

GENDER DIFFERENCES IN ADVANCED PLACEMENT EXAM PERFORMANCE
FOR ASIAN STUDENTS: A MULTIYEAR NATIONWIDE ANALYSIS

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DEDICATION

I dedicate this dissertation to my parents, Zhonghou and Zhihua, who raised me with unconditional love and guided me in my early life. To my sister, Xiaoqing, who gave me incredible support as she cared for my eighty-year-old parents overseas, so I could focus on my dissertation to chase my academic goal without worrying about my parents' health, especially during the COVID 19 pandemic. To my son, Kai, who supported me on my continued quest to pursue my academic journey by offering understanding, patience, and sacrificing accompany time, so I could balance my career, school, and family life. Also, to my husband, Zhan, who brought me to the U. S., so I could have the opportunity to achieve my academic dream and start a new life, which is impossible in my hometown. All inspiration and motivation provided by them have been immeasurable, my sincerest thanks to all of you!

ABSTRACT

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Purpose

The purpose of this study was to analyze ethnic (i.e., Asian, White) and gender differences for Asian students in the overall advanced Placement (AP) exam performance from the 2002 through the 2019 school years. Specifically, first, the extent to which differences existed in ethnic (i.e., Asian, White) in the overall AP exams and the top five most frequently taken exams performance. Second, the extent to which differences existed in gender for Asian students in the overall AP exams and the top five most frequently taken AP exams performance. Finally, the trend analyses were conducted to identify the extent to which national trends were present in ethnic and in gender for Asian students in AP exam performance.

Method

A causal-comparative research design was used to compare the AP exam performance of Asian students and White students and of Asian females and Asian males. Archival data for the 2012 school year through the 2019 school years were downloaded from the College Board website. Pearson chi-square tests were then performed to determine whether statistically significant differences were present in overall AP exam performance as well as in the top five most frequently taken AP exams.

Findings

Based on the results of the comparisons of the eight years of overall AP exam performance, Asian students had higher overall average AP exam scores than did White students. Moreover, higher percentages of Asian students passed AP exams than White students. Although both Asian students and White students improved their AP exam performance over the eight school years of data that were analyzed, the gap wherein Asian students and White students increased over this time period. Within the Asian student group, Asian males consistently outperformed Asian females. In all analyses, statistically significant differences were present for all comparisons of overall AP exam performance between Asian students and White students and between Asian females and Asian males for each of the eight school years. Higher percentages of Asian students took AP STEM-related exams than did White students.

KEY WORDS: Advanced Placement, Top five most frequently taken exams, Asian students, White students, Female, Male, Gender differences

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CHAPTER I

Introduction

Educated citizens are critically important for the United States to maintain a world leader economically, politically, and militarily (Obama, 2011; Rostiashvili, 2012). Educating young Americans to gain necessary skills for the workforce and for responding to societal needs is one of the goals of higher education (Autor, 2014; Bamik, 2018; Fortino, 2012; Keniston, 1960; Trepanier, 2019). Researchers (Autor, 2014; Beede et al., 2011; London, 2006; Schudde & Bernell, 2019) have established that obtaining a postsecondary education leads to lower unemployment rates and lower public assistance needs. However, with the rising costs of higher education, college affordability prevents students from enrolling in college (Marcus, 2018; Nichols et al., 2019). Therefore, helping students to be well prepared with necessary skills for their future and making college affordable are top priorities for federal, state, and local communities (Friedman, 2018; Johnson, 2016; Nevin, 2019).

During the Obama administration, the Pell Grant, a federal grant which helps low-income students with access to postsecondary education and student loan repayment options were expanded based on income level. The focus of federal assistance shifted from advocating student enrollment to student completion and high-performing career college programs (U.S. Department of Education, 2015). In 2019, then-President Trump's administration released proposals to reform higher education principles pointing out that "Accelerate Program Completion – One of the most effective ways to reduce student debt is to help students complete their education more quickly" (The White House, Office of the Press Secretary, 2019, para. 9).

In an effort to assist students to shorten the path to complete a traditional 4-year college degree, many accelerated programs have been offered in high school. These programs provide opportunities for high school students to prepare for college study and possibly earn college credits (Bailey & Karp, 2003). Two popular accelerated programs are dual credit and AP (AP) programs. Both programs help high school students earn college credits by offering college-level classes while they are enrolled in high school. These courses are advanced and have a high level of content rigor. Differences between these two accelerated programs for high school students are how the college credits are earned. For the AP program, college credits are based on taking AP courses and passing AP exams with high scores, usually a 4 or a 5. Dual credits are earned by passing the course offered by a local college that has partnered with the high school, and these credits may only be accepted in local colleges (Gruman, 2013; Katrina, 2013; Speroni, 2011). Therefore, dual credits earned by a student in one state may not be accepted by colleges in other states (Education Commission of the States, 2020).

Although the AP program is more advanced than the dual credit program because the AP course credits earned may be accepted nationwide (Witte, 2016), inequitable access to AP exams continues to be present (Cisneros et al., 2014; Holmes et al., 2013; Kettler & Hurst, 2017) because of the expensive costs for each AP exam. In 2016, 41 states and the District of Columbia received \$28.4 million from the U.S. Department of Education grants to help low-income families with students with the cost of AP tests (U.S. Department of Education, 2016). With federal funding assistance, the number of students participating in at least one AP exam surged to a historical record high since 2016 to present (College Board Data, 2020a). According to the College Board's (2020a)

AP Report, more than five million exams have been taken by high school students, and almost three million high school students took at least one AP exam. Moreover, in a decade, AP exam participation has increased by more than 50% (College Board, 2020a). Of note to readers is that out of all students who took the AP exam, only one-third of the students earned a score of 3 or above on at least one AP test. A score of 3 is the minimal score that colleges accept for credit.

Statement of the Problem

The AP program is considered one of the most popular accelerated programs due to the possibility of course credits being accepted by highly selective universities if students earned high AP scores (Effective strategies for accelerated learning, 2012). Given the fact that almost 40% of 2019 high school seniors and a total of three million students participated in AP exams (College Board, 2020a), concerns exist because of the presence of ethnic/racial and gender differences in AP exam performance, AP course rigor, and the relationship between AP exam performance and college outcome (Bittman et al., 2017). According to census estimates, the Asian population is the fastest-growing group with a higher percentage of them having a bachelor's degree or higher in the United States (Budiman et al., 2019; López & Patten, 2017). On the 2019 AP exams compared to the 2018 AP exams the increasing percentage of the AP score of 3 and above, Asian students performed above the national average. White students were the only racial group in which the percentage of students who earned a score 3 and above which were lower than the national average. Among the other ethnic/racial groups, Asian students not only had the highest average scores in the most popular AP exams, but they also had the highest percentage of test-takers, taking into account the percentage of Asian

students in the test-taker population (College Board, 2020b). In addition, on STEM-related exams, male students outperformed female students (College Board, 2020b).

Along with the rapid gains in expanding AP courses and exams, many research studies have been conducted on AP exam performance in the past two decades (Bumpous, 2015; Clark et al., 2012; Shaw et al., 2013; Xu et al., 2019). In particular, the primary focus has been on closing the achievement gaps for Black students and Hispanic students as well as on gender differences in AP performance (Borg et al., 2010; Buford, 2012; Davis, 2013; Graefe & Ritchotte, 2019; Jara, 2013; Koch, 2012; Rodriguez & McGuire, 2018; Wilson, 2013). However, published research studies on Asian students' AP exam performance are limited and are more than 10 years old (Moore et al., 2009, 2010). In general, Asian American students are overlooked in published research studies, specifically, Asian students compared to other racial/ethnic groups as well as the achievement gap differences between Asian females and Asian males.

Purpose of the Study

The purpose of this study was to compare overall AP exam performance between Asian students and White students and between Asian females and Asian males in the United States for the 2012 school year through the 2019 school year. Another purpose of this study was to compare AP exam performance on the top five most popular AP exams between Asian students and White students and between Asian females and Asian males. Finally, analyses were conducted to determine the degree to which trends were present by race/ethnicity and by gender on AP exams for this 8-year study.

Significance of the Study

With more than 60 years of history on the AP program and exams that have been offered throughout this time, an abundance of studies have been conducted on AP exams performance, particularly, emphasis on the race/ethnicity, gender, and economic status achievement gaps (e.g., Beard et al., 2019; Holmes, 2013; Moore & Slate, 2008; Perry, 2020). The AP exam performance of students of color has been well documented (e.g., Barnes & Slate, 2014; Borg et al., 2010; Buford, 2012; Davis, 2013; Graefe & Ritchotte, 2019; Holmes et al., 2013; Jara, 2013; Jaschik, 2018; Koch, 2012; Rodriguez & McGuire, 2018; Wilson, 2013). Although Asian students have been outperforming other students on AP exams for decades (Jaschik, 2018; Moore & Slate, 2011), the lack of research and acknowledgment of academic performance including AP performance for Asian American students may place these students at a disadvantage when they face barriers while under the guise of the Model Minority Myth (Kao, 1995; Kiang et al., 2017; McGowan & Lingren, 2003).

Moore et al. (2009) analyzed enrollment percentages and compared the overall performance of Asian American students and White students on the 2008 AP exams. They documented higher percentages for scores of 5 for Asian students (20.34%) than for White students (14.45%) in the overall AP performance. Also, they analyzed the 18 most frequently enrolled AP courses and compared the exam scores of Asian students to White students. Their results were that in most, but not all cases, exam scores were statistically significantly higher for Asian students than for White students.

In a related study, Moore et al. (2010) examined the overall performance on AP exams for Asian students from 1997 to 2008. They established that “Asian American

students had statistically significant higher percentages of AP exam scores of 5 and 4 than did White students” (para. 1). In addition, differences in average AP exam scores between Asian American students and White students increased from 1997 to 2008. Earlier researchers did not analyze the differences of overall performance at a state level. Limited research exists for Asian students’ performance on AP exams and those studies are older than 10 years (Moore et al., 2009; Moore et al., 2010). Thus, a void exists in the current research regarding recent AP exam performance of Asian students compared to White students, recent AP exam performance of Asian males compared to Asian females, and the extent to which achievement gaps may be present. Therefore, current findings on AP exam performance of Asian students compared to White students, of Asian males compared to Asian females, and of the most frequently enrolled AP exams would add to the existing literature. The findings from this study may be used to provide evidence to support or create policies related to the rapidly growing number of Asian American students taking the AP exams.

Theoretical Framework

Critical Race Theory (CRT), Asian critical theory (AsianCrit), and the model minority myth along with cultural capital theory served as key theoretical frameworks in this research investigation for understanding how Asian students perform differently from White students on AP exams and how Asian females and males may perform differently on AP exams. In higher education, addressed in the CRT includes differences among racial student groups and their needs related to policies and programs (Ladson-Billings, 2014; Teranishi et al., 2009). Cultural capital theory is tied to educational success based on students’ social life (Becker, 1993; Becker & Luthar, 2002; Bourdieu, 1977; Jæger &

Møllegaard, 2017; Sullivan, 2001). Considering the inequitable social and cultural capital due to race and class background differences, Bourdieu (1977) posited that race and racism have shaped the individual's culture reproduction which influences the academic and social outcomes of the individual (Yosso, 2005).

Solorzano (1997) defined CRT as a framework that “seeks to identify, analyze, and transform those structural and cultural aspects of society that maintain the subordination and marginalization of People of Color” (p. 6). Using CRT framework, researchers have tried to demystify racial inequities and racial stereotypes. In 2013, Museus and Iftikar developed Asian critical theory (AsianCrit) framework, which is a branch that extended from CRT, by applying CRT to examining the effects of racial oppression of Asian Americans and their communities.

Asian Americans as an ethnic group are labeled as the Model Minority and are ascribed as educational and economically more successful than other minority groups, and the difficulties and failures they face are overlooked (Assalone & Fann, 2017; Brand, 1987; Chang, 2008). Moreover, the Model Minority stereotype posits that all Asian Americans are uniformly successful which resulted in missing the heterogeneity among different Asian-American groups (Assalone & Fann, 2017; Chang, 2008). As such, this Model Minority myth stereotype threat negatively affects the education of Asian American students.

According to Franklin (2002), cultural capital is “the sense of group consciousness and collective identity” that serves as a resource “aimed at the advancement of an entire group” (p. 177). In education, cultural capital theory was applied to explain the effect of cultural capital on academic performance, educational

outcomes, and social inequality. Some researchers have asserted that college success has been affected positively from cultural capital, and this positive effect depended on students' socioeconomic and race background (Bourdieu, 1984). Conversely, other researchers (e.g., Dumais, 2002) have reached contradictory conclusions for males and females on the influence of cultural capital on educational outcomes due to traditional gender stereotypes.

Research Questions

The following research questions were investigated in this study: (a) What is the difference in overall performance on AP exams between Asian students and White students in the United States for the 2012 school year through the 2019 school years?; (b) What is the difference in overall performance on AP exams between Asian females and Asian males in the United States for the 2012 school year through the 2019 school years?; (c) What is the difference in performance on the top five most popular AP exams between Asian students and White students in the United States for the 2012 school year through the 2019 school years?; and (d) What is the difference in performance on the top five most popular AP exams between Asian females and Asian males in the United States for the 2012 school year through the 2019 school years?; (e) What trends might be present in the AP exam performance of Asian students and White students over eight years of archival data analyzed?; and (f) What trends might be present in the AP exam performance of Asian females and Asian males over eight years of archival data examined?

Definition of Terms

The definition of terms used in this dissertation are listed below:

Achievement Gap

An achievement gap in this study refers to any disparity in the AP exam performance between different groups of students, such as Asian students and White students, and Asian females and Asian males.

Advanced Placement Program

The AP program is a high school program administered by the College Board in United States and Canada. Through the AP program, which offers 38 college-level subject courses from 7 academic areas, high school students can possibly earn college credits and be granted placement in college if they pass the AP exam with the required score (College Board, 2016).

Advanced Placement Course

The AP courses are high school advanced level courses designed and approved by College Board. The course subject contents are typically taught during the first academic year of college (College Board, 2016).

Advanced Placement Exams

The AP exams are nationwide exams administrated by College Board. They are designed to measure a student's level of mastery of the AP course work for high school students (College Board, n.d.-b). Most AP exams are 2-3 hours long and consist of multiple-choice questions and free-response questions, and students typically take the AP exams after they complete AP courses.

Advanced Placement Exam Score

According to the College Board, an AP exam score is graded on a scale of 1 to 5. Most universities consider score 3 as a “qualifying” score and grant AP credits or placement. Some high selective universities only accept AP scores for credit 4 and above (College Board, 2016, p. 22).

Asian

Asian in this study refers to a student’s self-reported ethnicity as one who has “origins in any of the original peoples of the Far East, Southeast Asia, or the Indian Subcontinent, including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam” on his/her AP exam online registration (National Center for Education Statistics, 2010).

College Board

The College Board (2016) is an American non-profit organization that funded in 1900 to expand access to higher education by developing and administering the standardized tests used in college admission and placement. This entity oversees the AP program. Consequently, the College Board (2016) developed the AP curriculum and designed the AP exams.

White

White in this study refers to a student’s self-reported race as “having origins in any of the original peoples of Europe, the Middle East, or North Africa” on his/her AP exam online registration (National Center for Education Statistics, 2010).

Literature Review Process

The process of literature review search started with searching keywords in the EBSCO Academic Search Complete database accessed via SHSU (Sam Houston State University) library system with articles from 2005 through 2020. Search strategies focused on identifying main terms on the core themes, reviewing the abstracts, refining the results, then locating the core articles.

In addition, ProQuest databases were also accessed via the SHSU library system to search recent dissertations on this study topic, and the same search strategies were used. Furthermore, due to a lack of published articles about Asian student academic performance in EBSCO, keywords searching in Google Scholar were used for this systematic review of the literature. Specifically, keyword searches for Asian student academic performance were as follows: *Asian students in Higher Education*; *Asian and Advanced Placement*; *Model Minority*; *Asian and academic performance*; *Asian gender and Advanced Placement*. All dissertations and articles were selected based on their relationship to the research questions, defined as published within the last 15 years (January 2005 to August 2020). During the review of literature, several core themes emerged, including (a) a historical overview of AP program; (b) current AP program and AP exams; (c) incentives for AP exam participation; (d) achievement gap; and (e) Asian students in higher education. In particular, the relevant current peer-reviewed articles on Asian student academic performance that were written between 2005 to 2020 were the emphasis of the literature review search process.

Delimitations

The College Board releases AP summary reports, score distribution, and exam volume data for each school year by course subjects and overall as well as by state or nationally. These archival reports and data can be retrieved from their website. The focus of this dissertation was on the extent to which differences were present in overall AP exam performance between Asian students and White students and between Asian females and Asian males. Another focus of this study was on the degree to which differences were present in exam performance on the top five most popular AP exams between Asian students and White students and between Asian females and Asian males. As such, other student racial/ethnic groups were not included in this study.

For this study, only AP exam data from the United States were downloaded from the College Board database. No state-level data were downloaded. As such, generalizations to any specific state will not be possible. Moreover, the data analyzed were for the 2012 school year through the 2019 school years.

Limitations

Limitations of a research design to a study come from two angles: threat to internal validity and threat to external validity (Campbell & Stanley, 1963; Cook & Campbell, 1979). As described by Onwuegbuzie (2003), the limitations identified in this study on the threat to internal validity include selection bias and mortality bias. Selection bias refers to any type of bias that occurs when a sample population is not randomly selected. Thus, the sample was not a true representation of the population at large. Not all high school students choose to take AP course subjects and AP exams, and students who enroll in AP course subjects have the option to select which AP exams they will

take. In this study, Asian students and White students who enrolled in AP courses but opted out of taking the AP exams were excluded. Therefore, the sample in this study was not randomized. An external threat present in this study was population validity, which refers to reasonably generalizing the findings from the sample to a larger population (Onwuegbuzie, 2003). Examined in this study were the AP exam scores of Asian students and White students for eight years.

Assumptions

The assumptions of this study were the following: (a) AP exam scores earned by Asian students and White students and stored in College Board database were accurate, reliable, and valid for each of the eight years; (b) students accurately reported their race/ethnicity and gender when they registered for the AP exams; and (c) missing data were excluded from analysis due to the small size of missing data compared with the total population.

Organization of the Study

This dissertation consists of five chapters. Chapter I includes the introduction, background of the study, statement of the problem, purpose of the study, educational significance of the study, theoretical framework, research questions, definition of terms, limitations, delimitations, assumptions, and a summary. Chapter II is the review of the literature relevant to (a) The history of AP, (b) AP and college admission and completion, (c) College credit and AP credit, (d) Gender achievement gap, (e) Asian students and Higher Education, (f) Asian students and AP exam performance, (g) theoretical Framework, and (h) Summary. Described in Chapter III were the research design and method, consisting of the identified population, data collection, procedures,

instrumentation, and data analysis. The results and findings of the chi-square analyses and the comparisons of AP exam performance between Asian students and White students and between females and males within Asian group over the eight school years from 2012 to 2019 for each year were presented in Chapter IV. Lastly, Chapter V contains the discussions of findings and implications for policy and practices, and suggestions for future research.

CHAPTER II

Review of the Literature

The objective of this literature review is to review systematically and to analyze the existing research regarding the AP exam performance of Asian students and White students and of Asian females and Asian males. An extensive literature review was conducted to identify articles related to AP program, AP exam performance, and Asian American students who would provide for a contextual understanding of the comparisons of AP exam performances by race/ethnicity and by gender.

Historical Overview of Advanced Placement

The idea of the AP program was launched in 1951 by the Ford Foundation in response to the need for a small elite program for the motivated and best students in private high schools (McCammon, 2020) in response to concerns that a gap between secondary and higher education prevents talented students from being a top success in the world because of the courses that have overlapping materials in high school and college (Rothschild, 1999). In 1953, a pilot program offered 11 AP course subjects (Stone, 2014) in seven schools first then later 10 schools joined the program. In 1954, the common AP exam was offered for the first time with 27 schools offering the exam (McCammon, 2020). The College Board took over the program's management in 1955. Then, in the 1960s and 1970s, the College Board promoted the program in many ways, including offering expensive courses to students from low-income families, providing funding to train AP teachers, creating an AP center in Virginia, and broadcasting the teaching film of the AP courses at New York City's public television station. As a result of doing so, the expansion of the program has changed dramatically (Klopfenstein & Thomas, 2009).

Then-President George W. Bush included expanding the AP for low-income schools as a new national goal through *No Child Left Behind* (U.S. Department of Education, 2005). Additionally, many incentive AP funds/grants have been allocated by the U.S. Department of Education in 2009, 2011, and 2014 and by state bills (e.g., North Carolina Senate Bill 388). Thereafter, AP subject courses have been continuously developed. Currently, 38 course subjects and exams are available, and the AP program has been expanded and as such is a standard feature of education in the nation's high schools.

The AP program is considered a connection between high school and college, and its curriculum and exams are developed by a team of educators, who are a diverse mix of college professors and high school teachers (College Board, n.d). Many researchers (e.g., Beard et al., 2019; Dougherty et al., 2006; Kaye, 2006) have asserted that the rigor of AP curricula aligns with college-level courses and provides high school students the opportunities to experience similar expectations to college coursework. In an attempt to understand the degree that AP courses contribute to the success of students in college, researchers (e.g., Beard et al., 2019; Cooney et al., 2013; Mattern et al., 2013) have investigated the relationship between AP credits earned in high school and college success, including the time to degree. These researchers have indicated that students who earned higher AP scores and more AP credits had a higher college graduation rate with a shorter time to degree. In addition, Warne (2017) concluded that the AP program could be most beneficial to students completing their college work if they passed the AP exams.

Even with the benefits of taking the AP course subjects, the equity gaps in taking the AP course subject exams as well as with the AP scores remain. According to the Higher Education Research Institute (2010), Asian-American students took far more AP

classes during high school than most other American students. For example, 33.8% of Asian American high school students took five to nine AP classes in comparison to 15.4% of White-Americans and 18.9% of Hispanic-Americans. In some areas, Asian American students' AP score higher than other student groups (College Board, 2020b).

Advanced Placement and College Admission and Completion

Comparing to regular high school classes, taking AP classes is more challenging because students are required to complete more intensive work to complete the rigorous AP courses and earn college credit and placement if the AP exam scores meet the college's minimum score standard. Therefore, the initial intent of establishing the AP program was not for students to stand out on their college applications but to allow high-achieving high school students to earn college credit while still in high school (Warne, 2017). Before 1980, students generally took AP courses and exams during their senior year. Therefore, the AP scores were impossible to be considered as one of the criteria of college admission due to the fact that the College Board released the AP scores in late spring, which was after the admissions process was completed (Geiser & Santelices, 2004).

Beginning in the 1980s, the role of the AP program expanded into the college admission process (Rothschild, 1999). The incentive of taking AP exams and self-reporting AP scores on student's college applications was that college admission committees considered AP courses and AP scores as one of the highly recognizable ways to make the applicants stand out (Hebel, 1999; Lord, 1999). As more and more high school students took AP courses and exams in their junior, sophomore, and even freshman year, AP scores began to be listed on applicant transcripts. In 2019, more than

50% of the total high school students who took at least one AP exam were students in their junior, sophomore, and freshman year.

Breland et al. (2002) published a report based on data drawn from a series of national surveys on the admission of professionals from more than 2,000 institutions conducted since 1979. The surveys listed various factors that had possibly contributed to admission decisions, including the number of AP courses completed, AP course grades, and AP exam scores. Survey results were that the overall mean importance of AP enrollment and course grade was 2.5, and AP exam scores had an average of 2.1 for private institutions. Breland et al. (2002) pointed out that AP enrollment and performance did not influence the decision of college admission historically, but they are considered for college admission in recent years.

In 2002, the National Research Council conducted another survey of 254 colleges and universities' deans of admission via phone and face-to-face interviews. Their results were that the AP program and high AP scores played an increasing and significant role in college admission. Specifically, highly selective 4-year institutions did consider the high AP test scores as evidence that indicated an applicant was well prepared for the college academics and more likely to succeed in college. Therefore, many institutions had an admission policy in place to award additional points to applicants who took AP courses and earned high AP exam scores (Camara & Michaelides, 2005; Hebel, 1999; Lord, 1999) and to identify qualified students (Camara & Michaelides, 2005). The College Board (n.d.) claimed that one of the reasons to give the special considerations in college admission was due to the positive relationship between high performance in AP courses/scores and student college success. However, Geiser and Santelices (2004)

stated that AP course performance had no statistically significant effect on predicting college outcomes, particularly on student GPA. According to them, special considerations were given to AP courses and AP scores in most 4-year institution's admission decisions, and the format and methodologies of special consideration given to AP courses and scores varied depending on the policies of the individual institution. Those special considerations included the number of AP courses listed on the applications, assigning extra points for the AP courses taken, and the actual AP high course grades. Therefore, they suggested that a need was present for postsecondary institutions to reconsider the use of AP exam performance as critical admission criteria.

In California two lawsuits were filed in 1999 against the AP factor consideration in college admission (Adelman, 1999; Hebel, 1999). The use of the AP factor in college admission processes was criticized as discriminatory because minority and students in poverty were not given equal rights for admission consideration due to the lack of AP courses offered in high schools which were disproportionate or to the unaffordable AP exam fee (Hebel, 1999). Following these lawsuits, millions of dollars have been invested to expand the AP program and to help disadvantaged students have accessibility to AP courses and AP exams. The U.S. Department of Education and many state legislatures provided financial assistance to waive the AP exam fee, to provide teacher training, and to establish AP courses in disadvantaged schools (Santoli, 2002).

Theoretically, successfully completed rigorous AP courses and the AP credits accepted by colleges would increase the chance of students being successful in college and reduce their time to degree (Evans, 2018). Although it depends on individual learners to determine if taking AP courses is an option for enhancing their postsecondary

success many researchers (e.g., Hargrove et al., 2008; Scott et al., 2010) have debated on the quality of the AP courses and if they have the same rigor as the college course. As such, an increased emphasis was placed on examining the relationship between AP courses and student college academic success. Many research studies (e.g., Beard et al., 2019; Cooney et al., 2013; Hargrove et al., 2008; Mattern et al., 2013) have been conducted to explore the strengths and weaknesses of the AP courses. Some researchers (e.g., Mattern et al., 2013; Warne, 2017) have documented the presence of statistically significant differences in student learning outcomes between students who took AP exams and students who did not take AP exams, specifically for students who earned high AP exam scores.

Smith et al. (2017) examined college graduation rate in relation to students' AP scores. Over 4.5 million students' AP scores were downloaded from the College Board database and student graduation data were downloaded from National Student Clearinghouse databases between 2004 and 2009. By implementing a regression discontinuity design, the researchers analyzed three sets of relationships referring to college application and college AP policies, AP scores and college admission, and AP scores and college completion. Results of their study were that a strong positive relationship existed between earning higher AP scores and college completion. Moreover, high AP exam scores were considered by most colleges in their admission decisions. Therefore, these researchers suggested that AP should be included in college admission to increase college graduation rates. Students who earned high AP scores should be awarded college credit and placement to reduce curricular repetition.

Morgan et al. (2018) analyzed the college academic outcomes of 1,464 students who participated in rigorous high school courses, including AP courses from 2009 to 2014. Morgan et al. (2018) reported that first-time college students with higher AP scores used them to their advantage on the college admission decision, and those students did perform well in college with higher persistence rates and higher graduation rates. Thus, the results of their study were that high AP scores were not only showing the importance of the study skills students had learned from the AP courses for successfully completing college-level works, but also, they were strengthening their high school transcript for college admission because of the extra weight given to AP grades when calculated in their high school GPA.

Beard et al. (2019) also confirmed that the AP course participation and exam performance had positive effects on first-year college performance and their four-year graduation rates. Beard et al. (2019) investigated over 400,000 student transcript records from approximately 100 four-year higher education institutions, their AP performance, and the number of AP exams they had taken. Beard et al. (2019) indicated that the more AP exams taken and the higher AP exam performance could increase the likelihood of the first-time students' on time receiving a Bachelor's degree.

Latino et al. (2020) examined Hispanic student participation in accelerated programs (i.e., AP courses and dual credit) in high school on their college performance. They selected 2,655 incoming first-time Hispanic students from a 4-year Hispanic-serving postsecondary institution and divided them into two groups: first-generation college student and non-first-generation college student. Based on the comparisons of these two groups' college performance, they determined that first-generation Hispanic

college students' first-year GPAs and one-year retention rates were statistically lower than non-first-generation Hispanic college students' first-year GPAs and one-year retention rates. Also, they established that Hispanic students who participated in accelerated programs during high school had statistically significantly higher first-year GPAs than Hispanic students who did not participate in these programs. Latino et al. (2020) recommended that policymakers and administrators should expand the accelerated programs in high schools and increase Hispanic student participation, particularly first-generation college student participation. Similarly, high school counselors and teachers should advise first-generation-college students that participating in the AP or dual credit program is an effective way for them to prepare themselves for college success while earning college credits in high school.

Although some researchers (Beard et al., 2019; Morgan et al., 2018) claimed that AP program participation and AP scores had positive effects on student college work, other researchers (Deaton, 2014; Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009; Sadler & Tai, 2007) argued that AP courses and AP scores did not contribute tremendously to first time freshmen college students' first or second semester GPAs, one-year persistence in college, or college success. Sadler and Tai (2007) noted factors that are difficult to measure accurately, such as personal characteristics, are related to student success in college. Klopfenstein and Thomas (2010) indicated in their study that "there is no evidence from methodologically rigorous studies that AP experience causes students to be successful in college" (p. 170). They reported that when compared to other high school rigorous courses, such as the honors program, the AP experiences did not have predictive power for student success in college.

Current AP Program and Exams

With more than 60 years of growth, the AP program has expanded from an original small elite program consisting of 11 subjects offered in 27 high schools to a well-known high school accelerated program. Today, the AP program consists of 38 AP courses and exams in three subject areas across the United States, Canada, and worldwide. According to the Education Commission of the States (n.d.), the AP program is required to be offered in all high schools or districts in eight states and the District of Columbia. Fourteen states require all high schools or districts to offer advanced coursework, and 28 states have no such policies regarding the AP program or advanced coursework. In the 2020-2021 school year, AP courses were offered in about 86% of U.S. high schools, and the average number of AP courses offered in a high school is eight (Belasco, 2020).

The AP exams are offered during the first weeks of May each year and are administered by the College Board. All students, regardless of whether they have taken AP courses or not, can take the AP exams with the exception of the portfolio for AP Studio Art exams and the foreign language listening test. The format for the 2-3 hour tests that can be taken by all students consists of multiple-choice and free-response questions. As the years have passed, the cost of the AP exam has increased. For the 2020-2021 school year, the AP exam fee was \$95 per exam at schools in the U.S. territories and Canada schools, \$125 per exam at schools outside the U.S. territories and Canada, and \$143 per exam for the AP Capstone™ (AP Seminar or AP Research). Financial aid is available for waiving the fee or for discounted fees.

According to the College Board AP annual program participation and 2019 performance data, high school participation in the AP program has increased by 22% from the 2012 to the 2019 school years. The number of participants in the AP program and those who have taken the AP exam have increased by 35% and 38%, respectively. In the 2018-2019 school year (College Board, 2019), the most popular AP exam taken was AP English Language & Composition (573,171), and the least popular AP exam taken was AP Japanese Language & Culture. Compared to the 2018-2019 school year, the highest percentage of AP exam participation increase was for Research (63%) followed by Seminar (40%). Considering the small volumes of exam participation for AP Research and AP Seminar, the only percentage with two digits increase for participation was AP Computer Science Principles. The AP Studio Art - Drawing had 91% of the exam scores at a 3 or higher, and the highest average scores among the 38 AP subject exams was Chinese Language & Culture (4.19) with 90% of the scores at a 3 or higher. In addition, Physics had the lowest average score (3.65) with only 45% of the scores at a 3 or higher, and Macroeconomics had the largest standard deviation on the AP exam scores.

Disparities in the numbers and percentages of AP exams taken by different ethnic/racial groups were especially striking. Of note is that almost half of the students who took AP exams in 2019 were White students, although overall AP exam participation increased in 2018, a decline was present in the number of exams taken by White students and an increase in the number of exams taken by Asian and Hispanic students. Among the different racial/ethnic groups, Asian students were the highest performing group, and Black students were the lowest performing group.

Similarly, disparities in the numbers and percentages of AP exams taken by males and females existed in 2019. Overall, males were performing better than females while the number of females who took the AP exams were higher than males. Asian males had the highest mean score of 3.41 followed by Asian females with a mean score of 3.27. White males and White females came in second followed by Hispanic males and females. Of note, in each racial/ethnic group, males performed higher than females.

Asian Americans in Education System

Having lived in the United States for more than a century, Asian Americans have become portrayed as the “ideal” racial minority due to their socioeconomic achievement through their hard work and educational attainment (Museus & Kiang, 2009). On average, the household incomes of Asian Americans were higher than other racial groups (Covarrubias & Liou, 2014). Historically, Asian Americans were oppressed racial minorities with higher poverty rates and faced language barriers, especially the anti-Asian hostility which spiked during the Chinese Exclusion Act (1882-1943) and the Asiatic Barred Zone Act 1917. The keys to Asian American success were known as education to being paramount in their families and their higher education achievement (Endo, 1980; Suzuki, 2002). As Endo (1980) pointed out,

Immigrant parents constantly prodded their children to get good grades and to strive for a college education as a means of bettering their situation. The emphasis on education is seen in the large numbers of Chinese and Japanese who went to college and of course, is reflected in the present high aggregate levels of education for these groups. (p. 371)

Prior to 1940, literature on Asian immigrants' educational experiences is limited (Paik et al., 2014) because most of the Asian immigrants came to the United States as laborers to earn an income and bring their earnings back to their native countries. Therefore, they did not come to the United States to pursue an education (Takaki, 1998). In the middle of the 19th Century during the California Gold Rush, the United States experienced the first significant wave of Asian immigration, primarily Chinese who worked as laborers in the gold mines and railroads. Next, large numbers of Japanese immigrants landed in Hawaii and soon after they migrated to the continental United States to fill the labor demand jobs in the gold mines during the late 1800s. Then, Koreans and Filipinos flocked to the United States (Okihiro, 2015; Takaki, 1998; Tamura, 2001). After that, the exclusion era began with the Chinese Exclusion Act passed in 1882, then it expanded to Asia expansion as a whole in the Asiatic Barred Zone Act of 1917, which prohibited virtually all immigration from Asia to the United States for nearly 65 years (Takaki 1998, pp. 44-45).

After World War II, the United States reopened its door to Asia. First, those exclusionary policies were phased out. Second, the immigration quotas for Asian countries increased. In addition, the updated immigration policies tended to be in favor of welcoming highly educated and skilled professional groups (Okihiro, 2015; Takaki, 1998). Along with these changes, not only the first-generation of Asian immigrants were growing fast in the United States but also the second-generation of Asian Americans spurred the Asian population growth during the past 50 years (Takaki, 1998). In 2016 Asian Americans represented about 6% of the total population (United States Census Bureau, 2016a).

In pace with the fast Asian American population growth, Asian American student enrollment surged as well. In 2016-17, 113 higher education institutions were identified as Asian American and Native American Pacific Islander-serving institutions. Within higher education, Asian Americans represented about 6% of the postsecondary student population (de Brey et al., 2019), and most Asian American students attended colleges in the following 10 states: California, New York, Texas, New Jersey, Illinois, Florida, Hawaii, Washington, Massachusetts, and Pennsylvania (Teranishi, 2010).

Although Asian Americans are well-known as a highly educated minority group, throughout history, they faced the challenges of exclusion and inequity that pertained to school policies. Asian American students struggled in various aspects of the United States educational system, particularly, the level of support and assistance Asian American students received was not the same as other students of color (Kerr, 1994). In 1970, Kinney Kinmon Lau and 12 non-English-speaking students representing 1,800 non-English speaking students filed a class-action suit in the federal district the San Francisco Board of Education in violation of the Fourteenth Amendment or the Civil Rights Act. The lawsuit alleged that the Board deprived their opportunity to study in public school because of failing to provide supplemental English language classes to non-English speakers. The Court determined to be in favor of the plaintiffs and ruled the Board to make corrections (Lau v. Nichols, 1974; Wang, 1975).

In 2007, Harper and Hurtado conducted campus racial climate research. They observed that the experience of Asian Americans was ignored from the campus racial climate research analyses, although Asian American students were included in the study. This neglect resulted in a lack of knowledge of Asian American student experiences,

which lead to a negative image of Asian Americans to frame a stereotype of being quiet and unsociable. Thus, compared to other minority groups of color, Asian American students were less likely to be chosen as roommates. Additionally, Asian American students felt excluded from college society as well. Ultimately, Asian Americans would be stereotyped as “competent but cold” (Berdahl & Min, 2012, p. 141), and educational decisions may have been influenced by these biases.

Further, Chang (2017) analyzed the problems Asian Americans encountered in education and related fields. He documented that even under the same Asian American category, issues of inequity in education persisted because of the large disparities among the subgroups of Asian Americans. These inequity issues can affect the educational achievement gap and identity politics. Also, Chang (2017) identified two dominant frames of Asian Americans, Oppressed Minority and Model Minority and addressed some “issues and pedagogies that can help move toward greater educational equity and social justice” (p. 24).

In addition to the inequity in educational exclusion, being well-behaved and recognized by society as a “Model Minority” stereotype, Asian Americans are expected to be academically excellent. However, the immense expectation of success internally and externally can cause students psychological distress and physiological stress (Museus, 2014; Wong et al., 2010). Contrary to other racial/ethnic groups, Asian culture believed that claiming mental illness was shamed and caused loss of face (Kramer et al., 2002). Therefore, Asian Americans were reluctant to seek institutional support and resources, academic, and non-academic advising, which reinforced the quiet Asian stereotype and added to their stress levels (Liu & Suyemoto, 2016). In 2012, Murphy-

Shigematsu et al. explored the causes of Asian American students' stress by using a participatory action approach. They discovered three stress narrative findings: (a) the demand of filial piety and the need to be successful for parents; (b) a sense of self; and (c) identity development.

Without a doubt, problems exist in all racial/ethnic groups in higher education. Endo (1980) examined some important problems among Asian American students. He described the challenges and barriers Asian American students faced were: (a) the lack of presentation and communication skills and weakness of mastering the English language; (b) stress resulting from achieving high academic success because of long hours of hard studies; (c) the voice of demand for being overlooked; and (d) tremendous diverse subgroups among Asian Americans. Additionally, Endo (1980) discussed two programs: "Asian American studies programs and Educational Opportunity Program (EOP)" (p. 376). The objective of the Asian American EOP program was to assist Asian American students to achieve their academic success by providing access, academic support, and financial aid. The objective of Asian American studies was to increase the communities' knowledge of Asian Americans by encouraging research and studies on topics of Asian American minority groups and individual students which resulted in the elimination of biases toward Asian Americans. In conclusion, Endo (1980) posited that the behavior of Asian Americans in higher education was misunderstood, and the complex nature of Asian Americans needed to be considered in the creation of new policies.

Despite all of the problems faced by Asian American students in higher education, a notable phenomenon was overrepresentation of Asian Americans students in some elite institutions which triggered a movement of removing Asian Americans from

underrepresented minority groups (Douglass, 1997; Lee, 2006). Lee (2006) investigated how Asian Americans have been removed from affirmative action protection by dissecting two racist projects. The two racist projects were yellow peril foreigner and the model minority. She asserted that racist projects played decisive roles in eliminating Asian American racial minority status. No matter if Asian Americans were depicted as *yellow peril foreigners* or de-minoritizing them as model minorities because of their overrepresentation in the higher education institutions, the two racist projects reinforced White dominance in higher education and rejected Asian Americans representation in higher education.

Asian Males (related to culture and education expectations)

It is well known that Asians are highly diverse in ethnicity, cultural background, and languages. However, Asian traditional cultures have many similarities. The most prominent aspect of traditional similarity is that Asian males have received the dominant support from their family, so the pressures from their family to achieve success in economic, social status, and academically were at high levels (Ballard, 1982). In addition, the Asian American males struggled with the conflicts between the traditional Asian male standard belief on family obligation first and the White Western male standard belief of advocating as an independent individual (Lazur & Majors, 1995).

Das and Kemp (1997) created a culture profile of South Asian American families by examining their mental health issues. The South Asian American referred to emigrants originally from the Indian subcontinent. They analyzed the process of identity formation of the first generation of South Asian Americans and their family structures. They established that South Asian males had authority and prestige in families and

society because they were raised in the belief that working, supporting their families, and filial piety were their obligations. The parents made the decisions for their children's future, including college and major selections, without or with little consultation of their children's opinions.

In another study, Wei et al. (2013) randomly selected 95 Asian American male college students from a Midwestern public university to complete an online survey. They analyzed the correlations among family support, self-esteem, and perceived racial discrimination by using a hierarchical regression model. They reported two major findings the family support that the American Asian male college students received had a high positive correlation to their self-esteem, and their perceived racial discrimination had no statistically significant effect on their self-esteem. Wei et al. (2013) suggested that counselors pay more attention to Asian American male students' self-esteem and analyze the level of family support they receive. However, contrary to the Western culture, filial piety is the core of traditional Asian culture, and a son has the responsibility of taking care of his elder parents. If family resources were limited, Asian females sacrificed their educational goals by working at an early age to financially support the male family members in pursuit of their educational goals. Therefore, balancing between the traditional Asian culture and Western culture was a challenge for the second generation of Asian Americans (Das & Kemp, 1997).

Park et al. (2009) reviewed the traditional Asian culture which is imparted from parents to young Asian Americans who were born or raised in the United States, particularly the influences from the first-generation immigrant parents with their upward mobility. They examined the family affection protected Asian American parent-child

relationship which affects the Asian values gap between the parents and their children. Based on their parent-child relationship survey, these researchers documented that the Asian values gap was significantly smaller for males compared to females. Compared to verbal affection, both male and female Asian college students reported that they received more supportive affection from their parents. Also, they noted that Asian American males were likely to adhere to traditional Asian culture values.

Given the strong family support Asian American male students received and the adherence in traditional Asian male culture of putting family obligation first, the high expectations were the most important driving components of academic achievement and socioeconomic status upward. In 2020, Warikoo et al. investigated the relationship between parental academic expectations and mental health outcomes of Asian American and White American families by surveying 1,700 students in a school district that had a high Asian population. They established that the factor driving student mental health outcomes was the parent-child relationship rather than parent expectation. Compared to Asian American female and White male counterparts, Asian American male students reported higher parental expectations. Those high expectations were more likely to cause problems in their parent-child relationship if the academic performance of their child did not meet their expectations. Furthermore, the poorer the parent-child relationships were, the more it negatively affected the academic performance of Asian American males. Warikoo et al. (2020) also documented that Asian American male students reported more anxiety and depression problems than was reported by their White male counterparts.

Similarly, another driving component of academic success from parents was the high pressure of winning the academic competitions, which is tied to Asian culture by

bringing family name prestige (Tao & Hong, 2014). Asian culture values academic achievements as gaining an honor to the family. The desire to win the academic competitions motivated Asian American students, particularly male students, to work diligently (Tao & Hong, 2014). In addition, the selection of college majors for Asian American students had largely been influenced by their parents' opinions. According to Song and Glick (2004), the Sciences, Technology, Engineering, and Mathematics (STEM) majors were always the top field of study for Asian American students for both females or males, and education and humanities were the least preferable selections, especially for Asian males. Over the past 40 years, the top three popular fields of study for Asian American students, including males and females, remained the same: science, engineering, and business. These findings were drawn from data analyses of the National Education Longitudinal Study of 1988. Song and Glick (2004) explored the factors that may influence the college majors that Asian American students applied for. They identified that parent immigration status and educational level played a role in making decisions on their college majors. With the hardship experiences of immigration and adherence to the Asian culture male standard of taking the lead of helping the family with socioeconomic upward, Asian parents preferred to choose lucrative majors for their sons with little or no consideration of their major interest.

Despite all the stress Asian American male students experienced, Asian American males were depicted as intelligent, emasculate, and nerds (Huynh & Woo, 2014). Wong et al. (2012) conducted a comprehensive study on the examinations of Asian American male's stereotypes based on 158 Asian American male college students' perceptions. Wong et al. (2012) identified seven stereotypes of Asian American males "(a)

interpersonal deficits, (b) intelligence, (c) intense diligence, (d) unflattering physical attributes, (e) physical ability distortions, (f) perpetual foreigner, and (g) sexual/romantic inadequacies” (p. 75). In addition, they concluded three cluster stereotypes: “Body-Mind Stereotypes, Nerd Stereotypes, and Outsider Stereotypes” (Wong et al., 2012, p. 75). In reviewing the seven stereotypes and three cluster stereotypes, the majority of those stereotypes were negative imaging and caused a deficit in their sense of belonging, which resulted in mental problems which prevented Asian Americans from achieving their academic dreams. Wong et al. (2012) analyzed the findings and recommended several practical implications for the clinicians to avoid inappropriate treatment to Asian American students who were at risk of potential psychological distress due to Asian American male stereotypes.

Together with higher academic expectation, pressure of culture conflicting between Western male standards and traditional Asian male standards, lack of sense of belonging in college life, and not being interested in their major of study, Asian American male students sometimes could not bear the burden of these stresses (Das & Kemp, 1997; Song & Glick, 2004; Warikoo et al., 2020). Therefore, Wei et al. (2013) suggested that high level of family support should be provided to Asian American male students who may have psychological distress. Further, Warikoo et al. (2020) advised Asian parents to make an effort to enhance their relationship with their sons instead of adding more pressure or stress. The negative effects from the higher expectations can possibly result in mental health issues.

Asian Females (related to culture and education expectations)

In general, Asian parents take pride in their Asian culture in terms of high value of academic success and high academic expectations of their children. However, gender differences existed in academic expectations, academic performance, and fields of study, and these differences aligned with the Asian traditional culture. In the traditional Asian culture, the decision-making process was dominated by males, and the role of females was to serve the male family members unconditionally as wife, mother, daughter, and sister (Pyke & Johnson, 2003). Although the traditional Asian culture had influences on the Asian American family structure, with more opportunities for education and economic opportunities available to Asian American female and the effect of feminist movement in the United States, the women's rights grew, which resulted in changing the traditional male head of household (Palley, 1994).

According to Park et al. (2009), Asian American females perceived a higher Asian value gap than Asian American males, and they were in favor of Western values of acting as individuals while confronting the intensity of cultural clashes with their parents. Rahman and Witenstein (2013) examined the patterns of culture conflicts based on the data collected from 95 college students (38 males, 57 females) who were 1.5 generation (were born in Asia and came to the United States at a young age) and the second generation of South Asian immigrants. The South Asian immigrants included people originally from the Indian subcontinent. Results of their study were Asian American females experienced high level of conflicts in both academic and sociocultural decisions while the conflicts for males were mainly in academic decision-making. Thus, Asian

American females reported more anxiety and depression symptoms (Warikoo et al., 2020).

Asian American females perceived few academic expectations from their parents in response to the traditional Asian culture that females have less obligation to support families because females were expected to receive a lower level of education attainment compared to Asian American males (Hall, 2009). In addition, females with high academic achievement would reduce their attractiveness for dating or marriage because males preferred to marry a female who had lower academic achievement than their own (Hall, 2009).

Hsin and Xie (2014) contended that “Asian-American girls are not significantly different from Asian-American boys in terms of achievement outcomes, cognitive ability, and academic effort” (p. 8408). They analyzed the academic advantage between Asian American students and White American students using mixed methods on two longitudinal cohort survey results. For more than three years their results were consistent, Asian American students outperformed White students. Hsin and Xie (2014) asserted that the academic achievement Asian American students performed mainly attributed to their hard work aligned with the Asian culture in beliefs of education as the only path to success.

However, Lee and Zhou (2017) debunked the claim that the Asian culture made a paramount contribution to Asian American’s academic achievement. They argued that the highly selected and educated Asian immigrants from Asian countries drove Asian American students to achieve their academic success. Thus, the credits for the academic achievement of Asian American students could appertain to the educated immigrant

parents' support, which resulted from the U. S. immigration law in favor of highly educated and highly skilled immigrants from Asia (Lee & Zhou, 2017).

Regardless of the role Asian culture played in Asian Americans' academic achievement, compared to Asian American males, Asian American females had more flexibility in their choice of study (Hall, 2009). Asian female students preferred to study lucrative majors that White females traditionally did not choose to study, such as engineering and science. This phenomenon was inconsistent with the gender roles of the Asian cultures (Leung et al., 1994), and one of the factors that might influence the likelihood of Asian American females' major choice of study was equal educational opportunities for females in the Western world (Song & Glick, 2004). In addition, Song and Glick (2004) identified that single-parent families, specifically single moms, had less influence on Asian American females' choice of study, and Asian females from lower-income and low expectation families had a higher possibility to enroll in the majors potentially having high financial return.

In addition, Asian American females had unique college experiences irrespective of the majors they studied. The negative stereotype of Asian American females, as being considered racially subordinated, cute, and small, was the major obstacle in their academic study and future occupations. Asian American females have had a long history fighting the additional barriers to advance their academic success and to secure a higher-ranking position in their future career (Liang & Peters-Hawkins, 2017). As indicated by Liang and Peters-Hawkins (2017), Asian American females "struggled with gender, racialethnic, and cultural discrimination" (p. 41).

Asian Student AP Performance

Given well-documented AP performance differences by gender and by ethnicity, the existing literature on comparisons of AP performance within Asian group by gender is scant or outdated for a decade (Moore et al., 2009; Moore et al., 2010; Willingham & Cole, 1997). The earliest study was on the assessment of AP performance by gender and ethnicity located was a study conducted by Willingham and Cole (1997). In this study, they revealed that Asian females performed much better than White females on AP exams based on analyses of the exam results from cohorts 1993 and 1994. They reported statistically significant differences in the average AP scores between Asian females and White females (Willingham & Cole, 1997).

In another study conducted by Moore and Slate (2011), they examined 14 years of AP exam scores from 1997 through 2000. Their result was that Asian males outperformed Asian females each year. Based on the College Board reports published on the College Board website, in general, over the past two decades, the total AP participation has increased dramatically, and more students received AP exam scores of 3 and above. Asian American students were outperforming other American students in terms of mean AP scores across all subjects and were overrepresented among AP exam takers (College Board, 2020b).

According to the National Center for Education Statistics (2016), Asian students earned AP/international baccalaureate (IB) credits which were 32 percentage points higher than White students based on a 2009 longitudinal study. Parents with more education and families with higher incomes contributed to Asian Americans' high performance on the AP exams. The same trend existed for the most recent AP exams

reported by the College Board (2020b) that Asian Americans had the highest average AP exam scores and had high participation rates. Even though the numbers and participation of AP classes for all non-Asian groups declined due to effects of the COVID-19 pandemic, the participation and attainment for Asian groups increased.

In addition, the high performance of Asian American students on the AP exams was present at the state level as well (College Board, 2020c). According to the North Carolina Center for Racial Equity in Education's report (Tripplett & Ford, 2019), they examined the percentage of earned AP exam scores of 3 and higher by race. Asian American students had more than twice the percentage of students who had these AP exam scores than Black and American Indian students.

Despite analyzing the overall AP exam performance, some researchers reviewed specific course subjects of AP exams. Venkateswaran (2004) examined the AP United States History exam performance. He scrutinized the outcomes of the exam's questions by gender and race including the student responses to the pre-exam questionnaires. Venkateswaran (2004) concluded that Asian American students had the highest performance on both the essay and multiple-choice sections, but there were no performance differences among the race groups in answering the questions related to chronological area. Havard and Howard (2019) analyzed the AP Computer Science A and Computer Science Principle. They revealed that Asian and White American students were more likely to take traditional AP Computer Science courses and were more likely to earn higher exam scores than other students.

Gender Achievement Gap

Gender differences have been studied extensively. Numerous researchers have reported gender achievement gaps in overall academic performance using a variety of academic tests and AP exam performance (Hemelt & Lenard, 2020; Moore & Slate, 2011; Reardon et al., 2018a; 2019; Zhao et al., 2021). Researchers (Curran & Kellogg, 2016; Gonzales et al., 2009; Legewie & DiPrete, 2014; Meinck & Brese, 2019; Moore & Slate, 2008; Reardon et al., 2018a) have addressed the gender achievement gaps from various perspectives and studies. Some researchers (Gonzales et al., 2009; Reardon et al., 2018b) focused on the gender differences in learning subjects, specifically mathematics and ELA. Gonzales et al. (2009) targeted learning outcomes in secondary education settings. Garibaldi (2014) examined some of the specific race groups in postsecondary education settings, and more researchers (Autor et al., 2019; Gevrek et al., 2020; Workman & Heyder, 2020) aimed to locate the factors that influenced the gender achievement gaps in their attempt to find ways to close the gaps.

The traditional stereotypes for the gender differences in academic studies were mathematics as masculine subject, thus males had higher scores and better learning outcomes in mathematics and mathematics-intensive related fields, such as STEM fields. In English Language Arts, females scored higher than males (Trusz, 2020; van der Vleuten et al., 2016). However, in the developed world, females had higher graduation rates in both high school and college than males (Autor & Wasserman, 2013), as well as higher GPAs than males (Lin, 2017; Voyer & Voyer, 2014). However, males had higher scores on state tests which consisted of primarily multiple-choice questions (Reardon et al., 2018a).

Curran and Kellogg (2016) investigated the gender differences in academic achievement at early grades in elementary schools. They identified the presence of statistically significant gender disparities in science achievement gaps by the ethnicity/race of Kindergarten and first grade students based on their analysis of the Early Childhood Longitudinal Study data. Gender achievement gaps in science began at the end of Kindergarten, and the gaps increased as students moved through first grade. Hispanic students had the largest gender achievement gap in science.

Reardon et al. (2018b) asserted that a gender achievement gap existed in the test scores from third through eighth grade in English language Arts. They analyzed accountability test data from the 2008-2009 through 2014-2015 school years from almost 10,000 school districts and established that females had higher English Language Arts test scores than males. They did not report any gender achievement gaps in mathematics in their study.

Voyers (2014) examined gender disparities in academic achievements through multilevel meta-analysis and mixed-effects meta-analysis to identify the presence of moderating factors, such as nationality, race, gender, and course subject. Based on the analyses of 369 samples in Grade 1 or later in elementary schools, females had a statistically significant advantage in overall schoolwork. Voyers confirmed that females had better performance on language courses and that the smallest difference in performance was in mathematics courses.

Similarly, numerous research studies have been conducted on gender differences in AP exams (Ackerman et al., 2013; Campbell et al., 2009). Both Ackerman et al. (2013) and Campbell et al. (2009) documented the presence of positive relationships

between AP exams and student college success. Males tended to outperform females in STEM related AP exams which positively predicted that the likelihood of males successfully completing their degree in STEM fields had higher possibilities than females (Ackerman et al., 2013; Campbell et al., 2009).

As the equity gaps in achievement between males and females persisted over the past 20 years, Meinck and Brese (2019) analyzed 1995 and 2015 data from the Trends in International Mathematics and Science Study database. They asserted that the trend of gender performance gaps in education is slowly closing, and no scientific evidence proved that males had genes that were superior to females in favor of mathematics and/or sciences. However, a phenomenon that more males studied and succeeded in both mathematics and science fields existed in their international study. Due to the need for more knowledge and understanding of the mechanisms causing the achievement gaps, they contended that further research is needed to learn more about the factors before making any recommendations for the policy (Meinck & Brese, 2019).

In a qualitative study of the barriers that first-year, community college students encountered, Heller and Cassady (2017) reported that females perceived more academic and non-academic barriers toward enrollment and college persistence than males. In more recent study, Gevrek et al. (2020) determined that males and females frequently viewed the number and type of barriers to postsecondary education differently.

Theoretical Frameworks

Four theoretical frameworks were used in this study are critical race theory, cultural capital theory, Asian critical theory, and model minority theory. Researchers have documented that Asian American students consistently have outperformed all other

race/ethnic students in academics (Hsin & Xie, 2014; Jaschik, 2018; Moore et al., 2010; Museus & Kiang, 2009), and Asian Americans have often been labeled as a “model minority” due to their higher educational attainment, higher household income, and an overrepresentation in professional and managerial occupations (Assalone & Fann, 2017; Brand, 1987; Chang, 2008). In addition, Asian females have typically received different expectations for academic success from their family and society because of the Asian cultural influence, in which females are expected to perform well – but not better than males (Hall, 2009). Thus, the motivation for achieving academic success as well as developing the learning process has typically been different between male and female. Critical race theory, extended to Asian critical theory and model minority theory, and cultural capital theory were used in this study as conceptual lenses to examine the differences in AP exam performance between Asian students and White students and between Asian females and Asian males in the United States.

Critical Race Theory

Over the past two decades, a prevalent framework that has guided research for examining race differences in academic outcome was critical race theory (CRT) (Dixon & Rousseau Anderson, 2018). The term "critical race theory " was proposed by the legal scholar Kimberlé Crenshaw in the late 1980s (Crenshaw, 1988). It was originally a challenge to the view that the United States had become a colorblind society in which people’s racial identity no longer had an influence on human society or economic status (Crenshaw, 1988). Only two decades after the emergence of the Civil Rights Movement, many politicians and institutions adopted Martin Luther King Jr.’s ambitious, blind language, that is, we should judge someone’s value based on the content of their

character rather than the color of their skin. In other words, we should ignore race (King, 1963). The more prominent aspect of the speech was the emphasis on discrimination in social and economic inequalities (Crenshaw, 1988; Ladson-Billings, 2014; Yosso, 2005).

Critical race theory was introduced into the educational settings by Ladson-Billings and Tate (1995) in response to the role of race and racism in academic fields for the examination and critique of racial disparities in educational attainment. It has been used to examine social and educational oppression and maltreatment, negative experiences, and social inequities; and to amplify the voice of those who speak out against racism and shape the structuring of institutional and social policies (Gillborn et al., 2018; Lynn & Dixson, 2013). As defined by Yosso (2005), critical race theory was a “theoretical and analytical framework that challenges the ways race and racism impact educational structures, practices, and discourses” (p. 74). It helped educators to understand and find new ways to eliminate educational achievement gaps for students of color through the critical analyses of racism (Yosso, 2005).

The genealogy of critical race theory covers multiple disciplines and philosophies. Explanatory bases of CRT vary among scholars, but commonly, five basic tenets of CRT include: (a) race and racism are inseparable, and racism is a common phenomenon based on the White racial notion; (b) we must challenge the traditional ideology of the role of dominant ethnic groups in the formation and maintenance of ethnic hierarchy, (c) we should commit to adjusting the institutional nature of racial inequality; (d) the intersectional perspective of race, class, and gender helps to understand the generation mechanism and consequences of racial inequality; and (e) a solution to the racial problem (Ladson-Billings, 2014; Solorzano, 2014). In higher education, the use of CRT’s five

tenets in analyzing the experiences of students marginalized by racial group identification has revealed the existence of education inequities and structural effect of racism (Ladson-Billings & Tate, 1995).

More than 20 years after the establishment of CRT was introduced in education by Ladson-Billings and Tate (1995), Dixson and Anderson (2018) reviewed the literature of CRT research and determined six CRT boundaries to delineate the prominent features of utilizing CRT in education. Through an overlay mapping the features of CRT used in education and legal studies, they identified the limitation of CRT praxis in education, which was the same as the limitation of CRT influences on American jurisprudence. Although CRT has achieved unexpected success as an intellectual movement, they recommended that the most important was to expand the influences of CRT on schools and community practices.

Asian Critical Theory (AsianCrit) and the Model Minority Myth

Asian critical theory was rooted and stemmed from CRT in an attempt to analyze and understand how race functions influence the lives of Asian Americans in the United States and to address the discrimination against them. Museus (2014) asserted that “this AsianCrit perspective can provide a useful tool for understanding and analyzing the conditions and experiences of Asian American people and communities in the United States” (Museus, 2014, p. 28). Extended from CRT’s five tenets, Museus and Iftikar (2013) identified seven tenets “Asianization; Transnational Context; (Re) Constructive History; Strategic (Anti) Essentialism; Intersectionality; Story, Theory, and Praxis; and Commitment to Social Justice” that formed the basis for the application of Asian critical theory to Asian Americans’ life in society (pp. 23-27). Through the seven tenets of

AsianCrit as applied to analyzing racism's influences on the life of Asian Americans in society, the scholars addressed the issues of racial inequality, oppression, and exclusion faced by Asian Americans (Museus & Iftikar, 2013).

Asian Americans were labeled as a model minority due to their relatively higher achievements in economic success and educational attainment. The assumptions of Asian Americans included expectations of quiet, hard-working students who are good in mathematics and STEM fields. Asian Americans confronted the bias and discrimination of seen through a model minority stereotype. The three stages of responding to oppression were "denial, affirmation, and liberation" (Museus & Iftikar, 2013, p. 1315). However, the problems with these three stages were the exclusion of Asians from the American identity (Chang, 2017).

Cultural Capital Theory

The concept of cultural capital was developed by Bourdieu in 1970s. Cultural capital can be thought of as a person's social assets. The three forms include: objectified state (including a person's property or economic worth), embodied state (or socialization into a culture and set of traditions), and institutionalized state (recognition of a person's value in society achieved by academic or professional credentials). The separation of the three forms implies the possibility of different capital conversions, and the transmission of cultural capital is highly concealed. Bourdieu asserted that the main mechanism for the self-replication of a social structure was the reproduction of cultural capital, and the accumulation of cultural capital was mainly completed through reproduction. In Bourdieu's view, the apparent equality and democracy of education conceal the inequality of cultural capital of social classes.

The cultural capital theory has been used to explain issues related to gender inequities. In his book, Bourdieu (1984) stated,

Sexual properties are as inseparable from class properties as the yellowness of lemon is from its acidity: a class is defined in an essential respect by the place and value it gives to the two sexes and to their socially constituted dispositions. This is why there are so many ways of realizing femininity as there are classes and class fractions, and the division of labor between the sexes takes quite different forms, both in practices and in representations., in the different social classes. (pp. 107-108)

Bourdieu (1984) explained that students earned higher grades because of their cultural capital. They attained academic credentials through their work after socialization into a society that values credentials and economic profit. He used the cultural capital concepts to analyze the subjects in the educational field and pointed out that the reproduction of society through cultural reproduction.

Dumais (2002) analyzed cultural capital activities by gender based on a survey questionnaire data from the National Education Longitudinal Study that included 24,599 eighth-grade White students. In addition to the survey questionnaire data, the variables included in her study were parent education level, family incomes, and parents' occupations. As a result, Dumais (2002) concluded that cultural capital did play a role in student educational outcomes, and it had a strong and positive effect on female students than on male students.

Cultural capital is important for women for two reasons: Women make use of the capital for acquiring husbands, and women play the key role of transmitting the

cultural capital to their children. Men are more inclined to use cultural capital for educational qualifications and for getting jobs. These different uses of cultural capital imply that social actions take place in different fields for men and women, with different forms of capital serving as currency. (Dumais, 2002, p. 47)

Summary

Provided in this chapter was a review of the existing research literature on the history of the AP programs and the current state of the AP programs, Asian students, and their performance in higher education and on AP exams. Described in the overview of AP history and current AP programs was the necessity for students to enroll in the AP programs and take the AP exams. Several researchers explained why participation in taking the AP exams has consistently and drastically increased in the past decade. In addition, the Asian culture that may influence Asian American students to outperform other race/ethnicity students were explained in this chapter. Furthermore, Asian American students' performance on the AP exams was examined through the lenses of critical race theory, Asian critical race, model minority myth, and cultural capital theory frameworks.

Two perspectives were examined in this study: across race/ethnicity (i.e., Asian students and White students), and within an ethnic group (i.e., Asian students) over an 8-year period. Data on two comparison groups were analyzed: overall average AP exam scores for White students compared to Asian students; overall average AP exam scores for Asian females compared to Asian males. Chapter Three includes the description of methodology that were used to answer the research questions.

CHAPTER III

Method

The current interest in taking AP course subjects and AP exams has been fueled by the growing demand for college affordability due to the possibility of earning college credit in high school which can result in shorter time to degree, student debt reduction, improve the chances to be accepted by high selective postsecondary institutions, and increase the likelihood of postsecondary success (Geiser & Santelices, 2004; Scott et al., 2010). According to the College Board (2020), Asian students had the highest AP course subject-taking rates and the highest average AP scores in most of the AP exams in recent years. In 2019, the AP exam participation rate was 76% for Asian students (i.e., school seniors), which was 5% higher than the second-highest rate of 71% for White students.

Ono and Pham (2009) analyzed the characteristics of Asian American students and established that Asian American students had higher graduation rates compared to other racial/ethnic groups. Moreover, Asian Americans enrolled in highly selective and elite universities with exceptional test scores because they highly valued education and attainment. However, the complexities of the Asian American racial group lead to the complicated nature of understanding them (Hirschman & Wong, 1986), and Asian gender differences in academic achievement exist. Therefore, it is necessary to compare AP performance of Asian students to the AP performance of White students and that of Asian students by gender to develop and create policies that benefit them.

The method and research design that were employed to address the research questions is presented in this chapter. Chapter III is organized into the following eight sections: (a) introduction, (b) research questions, (c) research design, (d) selection of

participations, (e) instrumentation, (f) procedures, (g) data analysis, and (h) a short summary.

Research Questions

In this study, the following research questions were addressed: (a) What is the difference in overall performance on AP exams between Asian students and White students in the United States?; (b) What is the difference in overall performance on AP exams between Asian females and Asian males in the United States?; (c) What is the difference in performance on the top five most popular AP exams between Asian students and White students in the United States?; (d) What is the difference in performance on the top five most popular AP exams between Asian females and Asian males in the United States?; (e) What trends might be present in the AP exam performance of Asian students and White students over eight years of archival data analyzed?; and (f) What trends might be present in the AP exam performance of Asian females and Asian males over eight years of archival data examined? The first four research questions were answered separately for each school year, from 2012 through 2019, whereas the last two research questions involved comparisons across all eight school years.

Research Design

The research design is a framework of research methods and objectives for the implementation of research that is chosen by the researcher (Creswell, 2014; Sileyew, 2019). A nonexperimental research design was present in this study (Creswell, 2014).

As defined by Kerlinger (1986),

Nonexperimental research is systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations

have already occurred or because they are inherently not manipulable. Inferences about relations among variables are made, without direct intervention, from concomitant variation of independent and dependent variables. (p. 348)

A nonexperimental research design permitted the examination of performance data for Asian students and White students, Asian students and for Asian females and Asian males, and the extent to which differences in performance exist across an 8-year period. Student race/ethnicity (i.e., Asian, White) was the categorical independent variable in this study in research questions a and c. Dependent variables in this study were the AP exam overall performance scores and the AP exam performance scores for the top five most popular AP exams. Using a quantitative approach for this study would allow for the generalization of accurate conclusions because of the use of a large sample size downloaded from the College Board national database (Creswell, 2014). Furthermore, the analysis of results by using a quantitative method was a more straightforward analysis with less error and subjectivity (Johnson & Christensen, 2014; Schweigert, 2017).

In this analysis, a causal-comparative research design was utilized to determine the extent to which differences in performance were present between Asian students and White students or between Asian females and Asian males, and if present, the extent to which the differences in performance changed across an 8-year period. According to Johnson and Christensen (2014), a causal-comparative design restricts the manipulation of the independent variables and randomization of participation. As described previously, AP exam taking was not randomly assigned, rather students self-selected to take AP course exams. Causal-comparative research is used, when “the researcher studies

the relationship between one or more categorical independent variables and one or more quantitative dependent variables (Johnson & Christensen, 2014, p. 96). As such, in this study, archival data were obtained from the College Board database based on student race/ethnicity, gender, and overall AP performance scores and performance scores for the top five most popular AP exams. Therefore, a nonexperimental quantitative design, specifically a causal-comparative design, was appropriate for this investigation.

Selection of Participations

Participants for this study were selected from the College Board database that contains AP examination information. Archival AP exam data for Asian students and White students and Asian females and Asian males residing in the United States between 2012 and 2019 were downloaded from the College Board website (<https://research.collegeboard.org/programs/ap/data/participation/ap-2020>), and present data were Excel files. Although archived data from the College Board can be retrieved back to 2000, only data from 2012 to 2019 were selected for this study because similar studies (Moore et al., 2010) had been conducted on the AP exam performance of Asian students and White students from 1997 to 2008.

For this study, overall performance on the AP exams for all 38 course subjects of Asian students and White students and of Asian females and Asian males was selected. Any racial/ethnic group other than Asian students and White students was excluded from this study. Also, a specific analysis of the performance on the AP exams for the top five most popular AP exams by Asian students and White students and by Asian females and Asian males occurred.

Instrumentation

Eight years of national archival data were downloaded from the College Board website to examine the extent to which differences existed in the performance on AP examinations nationwide by race/ethnicity (i.e., Asian students, White students) and by Asian student gender. Every year in the fall, the College Board publishes and releases the AP exam information for the May exam on its AP Program Participation and Performance Data website and the previous year's data were archived and added to the Archived AP Data website. Both AP Program Participation and Performance Data and Archived AP Data websites include excel files and PDF files for every year including summary reports, score distributions, exam volume reports, other supplemental information, and data. For this study, data for overall performance and for the top five most popular AP subject exams were downloaded for Asian students and White students and for Asian females and Asian males for each year of the study. Then, the overall performance on the AP exams nationwide for Asian was examined to compare with White students and to compare between Asian females and Asian males for each year. Also, the performance on the top five most popular AP subject exams in the United States was determined to compare Asian students and White students and to compare Asian females and Asian males for each year.

Score Reliability

Johnson and Christensen (2014) asserted that “reliability refers to the consistency or stability of a set of test scores. If a test or assessment procedure provides reliable scores, the scores will be similar on every occasion” (p. 240). It is critical to demonstrate that the scores used in educational research are reliable and consistent results can be

generated. In this study, the AP exam score reliability refers to the scores obtained from the College Board reflect an equivalent of content proficiency over time. That is, the AP examination scores should be generalizable from year to year.

Although the requirements for each AP course subject exam are different, the structure of exams remained largely the same from the 2012 through the 2019 school years across all subject exams. The exams consist of two sections, a multiple-choice section and a free-response section (College Board, n.d.-d), and the number of questions answered correctly by the exam taker is the raw score of this exam. Through a process of score adjudication based on the level of question difficulty, the raw score is converted to a scaled score reported on a scale of 1 to 5 (College Board, n.d.-e).

The reliability of the AP exam scores is measured by the reliability coefficient, the standard error of measurement, and the conditional standard of error of measurement (College Board, 2016), and the correlation coefficient is commonly used for calculating reliability (Johnson & Christensen, 2014). In this study, reliability coefficient alpha values were utilized in the determination of the reliability of the AP exam scores. According to Johnson and Christensen (2014), the coefficient alpha should be at or above .70 for research. Therefore, coefficient alpha values at or above .70 represent sufficient internal consistency of AP exam scores for this study.

Score Validity

In research studies, “reliability is a necessary but not sufficient condition for validity, which simply means that if you want validity, you must have reliability” (Johnson & Christensen, 2014, p. 240). “Validity is the extent to which the scores from a measure represent the variable they are intended to” (Price et al., 2015, p. 24). In

addition, score validity is defined as “The accuracy of the inferences, interpretations, or actions made on the basis of test scores, . . . When making inferences or taking some action on the basis of scores, we want our inferences to be accurate, and we want our actions to be appropriate.” (Johnson & Christensen, 2014, p. 248). The AP courses and exams are developed by committees consisting of college/university faculty and expert high school AP teachers to ensure the consistency and validity of the exam content and scores. Throughout the AP course subject and exam development processes, the learning objects are aligned with college course curriculum and feedback and input from educators and scholars are carefully considered to ensure the conformity with the specifications and integrity of the exam (College Board, n.d.-c). Therefore, the accuracy of the inferences delivered by the instrument will depend on the score validity (Adams & Lawrence, 2015; Johnson & Christensen, 2014). In this study, the AP exam scores were used to make accurate inferences about the examinees’ ability to master the content knowledge learned from the AP course subjects. Thus, the score must be both reliable and valid (College Board, 2016), and an assessment of the validity of the AP exam score is necessary for this research study.

The types of validity in quantitative research include content validity, construct validity, and criterion validity (Heale & Twycross, 2015). The validity concern with the AP exam score is content validity, which is how to align the course curriculum and the exam to ensure that the exam accurately integrated with the course content and how to align the AP course/exam to the corresponding college-level course work. To ensure alignment of the AP courses with the exams and also that the AP courses and exams meet the expectation of college level learning, the AP courses and exams are developed by

development committees comprised of an equal number of postsecondary institution faculty and expert high school teachers in the particular disciplines, and professional organizations. The processes of developing the AP course and exams are parallel. Course development committees determine the scope expectations of the course and curriculum with two to three years development cycle, and test development committees design the test questions annually.

Every year, new exams are created. After the AP course development committee carefully reviews every exam question to ensure alignment with the AP curriculum framework, then the final exams are implemented. In addition, the development committees regularly review the courses and exams paying careful attention to the feedback received from scholars to continually update the AP courses and exams considering alignment to the college level course requirements. Together, the course and exam development committees work throughout the year to ensure the exams reflect the level of student learning in alignment with college level course (College Board, n.d.-c). According to the College Board (2016b), AP exam scores are reported in a five-point scale, and the score should align with academic performance in corresponding college courses.

Procedures

After receiving committee approval for this proposal, the Institutional Review Board Human Subjects application was submitted to the Sam Houston State University Office of Research for approval. Upon obtaining Institutional Review Board from Sam Houston State University, relevant data from the College Board website were downloaded and analyzed.

Summary

The purpose of this study was to compare AP exam performance between Asian students and White students and between Asian females and Asian males in the United States. Eight years of national archival data related to the overall AP exam performance and to the top five most popular AP exams were investigated. Following statistical analyses of data for each of the eight years, the extent to which trends were present were determined.

CHAPTER IV

Presentation and Analysis of Data

The purpose of this study was to explore the degree to which differences were present in AP exam performance between Asian students and White students and between Asian females and Asian males. A nonexperimental, causal-comparative research design was used in this study. Pearson chi-square tests were performed to determine whether statistically significant differences were present in the average AP exam test score by gender for Asian students in overall performance as well as between Asian students and White students. The following data analysis and results are presented by the order of research questions that guided this investigation.

Results

To address the research questions previously delineated, Pearson chi-square procedures were used in this study. This inferential statistical procedure is viewed as the optimal statistical procedure (Adams & Lawrence, 2015) to use because both independent variables, student race/ethnicity and gender, were categorical variables, and the dependent variables were also categorical in nature. With the large national sample, the available sample size per cell was more than five. Accordingly, the assumptions for using a Pearson chi-square procedure were met.

Research Question 1

Addressed in the first research question was the extent to which overall AP exam scores differed between Asian students and White students for the 2012 school year through the 2019 school year. A total of 5,201,503 Asian students and 18,481,637 White students took AP exams during this 8-year period ($N = 23,683,140$). Across all the years,

the Pearson chi-square revealed a statistically significant difference between Asian students and White students in their AP exam performance, $\chi^2(4) = 209650.4, p < .001$, with a Cramer's V of .09. Using Cohen's (1988) criteria, the effect size was below small effect size. Asian students had a greater percentage of students who earned an AP exam score of 3 and higher than White students did, a difference of more than 5 percentage points. The percentage of Asian students who earned an AP score of 5 was almost 8 percentage points higher than the percentage of White students who earned an AP score of 5. Revealed in Table 1 are the percentages and frequencies of overall AP exam scores for Asian students and White students for the 2012 school year through the 2019 school year.

Table 1

Frequencies and Percentages of Overall AP Exam Scores for Asian Students and White Students for the 2012 Through the 2019 School Years

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	1,163,529	22.37	2,687,512	14.54
4	1,202,173	23.11	4,108,258	22.23
3	1,252,936	24.09	5,117,470	27.69
2	944,575	18.16	4,126,914	22.33
1	638,290	12.27	2,441,483	13.21

With respect to the numbers of students who took an AP exam in the 2012 school year, 514,330 Asian students and 2,024,479 White students took an AP exam in this year. Regarding their performance, the Pearson chi-square revealed the presence of a

statistically significant difference, $\chi^2(4) = 17689.65, p < .001$, with a Cramer's V of .08, below small effect size (Cohen, 1988). A higher percentage of Asian students obtained an AP exam score of 5, more than 7% more, than did White students. Table 2 contains the descriptive statistics for this analysis.

Table 2

Frequencies and Percentages of Overall AP Exam Scores for Asian Students and White Students for the 2012 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	120,807	23.49	325,401	16.07
4	115,403	22.44	455,408	22.50
3	115,428	22.44	529,943	26.18
2	87,832	17 .08	417,760	20.64
1	74,860	14.55	295,967	14.62

In the 2013 school year, a total of 571,724 Asian and 2,159,613 White students took an AP exam. A statistically significant difference was present in their AP exam performance, $\chi^2(4) = 16311.12, p < .001$, Cramer's V of .08, below small effect size (Cohen, 1988). A statistically significantly higher percentage of Asian students, more than 6% more, earned an AP exam score of 5 than was earned by White students. Delineated in Table 3 are the descriptive statistics for this school year.

Table 3

Frequencies and Percentages of Overall AP Exam Scores for Asian Students and White Students for the 2013 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	121,585	21.27	319,733	14.81
4	130,166	22.77	481,694	22.30
3	137,200	24.00	595,075	27.55
2	104,930	18.35	469,324	21.73
1	77,843	13.62	293,787	13.60

Regarding the 2014 school year, the Pearson chi-square procedure revealed the presence of a statistically significant difference in AP exam performance between Asian and White students, $\chi^2(4) = 20373.06$, $p < .001$, Cramer's V of .08, below small effect size (Cohen, 1988). A higher percentage of Asian students, almost 7% more, obtained an AP exam score of 5 than was obtained by White students. Table 4 contains the descriptive statistics for this analysis.

Table 4

Frequencies and Percentages of Overall AP Exam Scores for Asian Students and White Students for the 2014 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	131,897	21.66	328,443	14.55
4	138,470	22.74	507,090	22.47
3	147,159	24.17	624,066	27.65
2	110,918	18.21	494,524	21.91
1	80,509	13.22	302,541	13.41

With respect to the 2015 exam year, the difference between Asian students and White students on AP exam performance was statistically significant, $\chi^2(4) = 22869.82$, $p < .001$, Cramer's V of .09, below small effect size (Cohen, 1988). A higher percentage of Asian students obtained an AP exam score of 5 than did White students, more than 7% more. Delineated in Table 5 are the percentages and frequencies of the AP exam scores for Asian students and White students.

Table 5

Frequencies and Percentages of Overall AP Exam Scores for Asian Students and White Students for the 2015 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	135,115	20.76	322,271	13.65
4	146,877	22.57	515,904	21.86
3	160,453	24.65	664,487	28.15
2	118,652	18.23	518,947	21.98
1	89,801	13.80	338,927	14.36

Concerning the 2016 exam year, the difference between Asian students and White students on their AP exam performance was statistically significant, $\chi^2(4) = 26829.71$, $p < .001$, Cramer's V of .09, below small effect size (Cohen, 1988). A higher percentage of Asian students, almost 8% more, obtained an AP exam score of 5 than was obtained by White students. Revealed in Table 6 are the percentages and frequencies of the AP exam scores for Asian students and White students.

Table 6

Frequencies and Percentages of Overall AP Exam Scores for Asian Students and White Students for the 2016 School Year

Exam Score	Asian Students		White Students	
	<i>N</i>	%	<i>n</i>	%
5	146,617	22.62	349,383	14.68
4	147,682	22.78	523,014	21.97
3	154,400	23.82	651,553	27.38
2	118,722	18.32	538,212	22.61
1	80,737	12.46	317,889	13.36

With respect to the 2017 exam year, a statistically significant difference was present, $\chi^2(4) = 30989.44$, $p < .001$, Cramer's V of .10, small effect size (Cohen, 1988). Presented in Table 4.7 are the percentages and frequencies of AP exam scores for Asian students and White students for the 2017 school year. A higher percentage of Asian students, more than 8% more, obtained an AP exam score of 5 than was obtained by White students. Presented in Table 7 are the percentages and frequencies of AP exam scores for Asian students and White students for the 2017 school year.

Table 7

Frequencies and Percentages of Overall AP Exam Scores for Asian Students and White Students for the 2017 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	154,154	22.06	340,669	13.91
4	161,025	23.05	540,606	22.08
3	171,346	24.52	690,472	28.20
2	132,768	19.00	571,480	23.34
1	79,375	11.36	305,253	12.47

In the 2018 school year, a statistically significant difference was present, $\chi^2(4) = 36459.49$, $p < .001$, Cramer's V of .11, small effect size (Cohen, 1988). Asian students had a higher percentage, more than 8% more, who earned an AP score of 5 than was earned by White students. Delineated in Table 8 are the percentages and frequencies of the AP exam scores for Asian students and White students for the 2018 school year.

Table 8

Frequencies and Percentages of Overall AP Exam Scores for Asian Students and White Students for the 2018 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	171,759	23.18	355,412	14.55
4	176,686	23.85	545,386	22.32
3	178,382	24.08	679,984	27.83
2	135,175	18.25	564,881	23.12
1	78,823	10.64	297,654	12.18

In the 2019 exam year, the result was statistically significant, $\chi^2(4) = 43,587.44$, $p < .001$, Cramer's V of .12, small effect size (Cohen, 1988). A higher percentage of Asian students, more than 8% more, earned an AP exam score of 5 than was earned by White students. Delineated in Table 9 are the percentages and frequencies of AP exam scores for Asian students and White students.

Table 9

Frequencies and Percentages of Overall AP Exam Scores for Asian Students and White Students for the 2019 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	181,595	23.65	346,200	14.37
4	185,864	24.20	539,156	22.39
3	188,568	24.55	681,890	28.31
2	135,578	17.65	551,786	22.91
1	76,342	9.94	289,465	12.02

In summary, statistically significant differences were revealed in overall AP exam performance between Asian students and White students in all eight school years. The percentage point differences of students who earned an AP exam score of 3 or higher increased from 3.62% to 7.33% in the eight years. Established was that the percentages of Asian students who earned AP exam scores of 4 or 5 increased by almost 2%; however, the percentage of White students who earned AP exam scores of 4 or 5 decreased almost 2%.

Research Question 2

The focus of the second research question was on determining the extent to which overall AP exam scores differed between Asian females and Asian males for the 2012 school year through the 2019 school year. A statistically significant difference was revealed, $\chi^2(4) = 20055.03$, $p < .001$, Cramer's V of .06, below small effect size (Cohen, 1988). A higher percentage of Asian males had an AP exam score of 3 or higher than did

Asian females, almost 4% more. In particular, a higher percentage of Asian males, more than 6%, had AP exam scores of 4 and 5 than did Asian females. Contained in Table 10 are the percentages and frequencies of overall AP exam scores for Asian females and Asian males for the 2012 through the 2019 school years.

Table 10

Frequencies and Percentages of Overall AP Exam Scores for Asian Females and Asian Males for the 2012 Through the 2019 School Years

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	540,268	20.16	623,261	24.71
4	608,450	22.71	593,723	23.54
3	665,962	24.86	586,974	23.27
2	519,900	19.40	424,675	16.84
1	344,734	12.87	293,556	11.64

For the 2012 school year, 262,721 Asian females and 251,609 Asian males took AP exams. A statistically significant difference was revealed between Asian females and Asian males, $\chi^2(4) = 2762.03$, $p < .001$, Cramer's V of .07, below small effect size (Cohen, 1988). A higher percentage, more than 5% more, of Asian males had AP exam scores of 5 than did Asian females. Presented in Table 11 are the percentages and frequencies of the 2012 AP overall exam scores for Asian females and Asian males.

Table 11

Frequencies and Percentages of Overall AP Exam Scores for Asian Females and Asian Males for the 2012 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	54,920	20.90	65,887	26.19
4	57,406	21.85	57,997	23.05
3	60,821	23.15	54,607	21.70
2	48,179	18.34	48,179	15.76
1	41,395	15.76	41,395	13.30

In 2013, a statistically significant difference was present, $\chi^2(4) = 2736.75, p < .001$, with a Cramer's *V* of .07, below small effect size (Cohen, 1988). A higher percentage of Asian males, more than 4% more, had AP exam scores of 5 than did Asian females. Delineated in Table 12 are the percentages and frequencies of the AP exam scores for Asian females and males for the 2013 school year.

Table 12

Frequencies and Percentages of Overall AP Exam Scores for Asian Females and Asian Males for the 2013 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	55,092	18.90	66,493	23.72
4	64,563	22.15	65,603	23.41
3	72,209	24.78	64,991	23.19
2	57,748	19.82	47,182	16.83
1	41,820	14.35	36,023	12.85

With respect to the 2014 school year, the difference was statistically significant, $\chi^2(4) = 2419.13$, $p < .001$, Cramer's V of .06, below small effect size (Cohen, 1988). A higher percentage, almost 5% more, of Asian males had an AP exam score of 5 than Asian females. The frequencies and percentages of overall AP exam scores of Asian females and Asian males are presented in Table 13.

Table 13

Frequencies and Percentages of Overall AP Exam Scores for Asian Females and Asian Males for the 2014 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	61,402	19.46	70,495	24.02
4	70,484	22.34	67,986	23.17
3	78,619	24.92	68,540	23.36
2	61,623	19.53	49,295	16.80
1	43,365	13.75	37,144	12.66

For the 2015 school year, a statistically significant difference was present in overall AP exam performance between Asian females and Asian males, $\chi^2(4) = 1945.19$, $p < .001$, Cramer's V of .05, below small effect size (Cohen, 1988). A higher percentage, almost 4% more, of Asian male students obtained an AP exam score of 5 than was obtained by Asian females. Table 14 contains the descriptive statistics for this analysis.

Table 14

Frequencies and Percentages of Overall AP Exam Scores for Asian Females and Asian Males for the 2015 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	63,677	18.92	71,438	22.73
4	74,317	22.08	72,560	23.09
3	85,261	25.33	75,192	23.92
2	64,930	19.29	53,722	17.09
1	48,412	14.38	41,389	13.17

Concerning the 2016 school year, a statistically significant difference was present, $\chi^2(4) = 1647.59, p < .001$, Cramer's *V* of .05, below small effect size (Cohen, 1988). A higher percentage, more than 3% more, of Asian males earned an AP exam score of 5 than did Asian females. Table 15 contains the descriptive statistics for this school year.

Table 15

Frequencies and Percentages of Overall AP Exam Scores for Asian Females and Asian Males for the 2016 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	69,898	20.80	76,719	24.58
4	75,894	22.58	71,788	23.00
3	81,769	24.33	72,631	23.27
2	65,064	19.36	53,658	17.19
1	43,417	12.92	37,320	11.96

Regarding the 2017 school year, a statistically significant difference was yielded, $\chi^2(4) = 2724.34, p < .001$, Cramer's *V* of .06, below small effect size (Cohen, 1988). A higher percentage of Asian males earned an AP exam score of 5 than did Asian females, more than 4% more. Delineated in Table 16 are the descriptive statistics for this analysis.

Table 16

Frequencies and Percentages of Overall AP Exam Scores for Asian Females and Asian Males for the 2017 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	71,899	19.89	82,255	24.40
4	81,636	22.58	79,389	23.55
3	91,530	25.32	79,816	23.67
2	73,299	20.28	59,469	17.64
1	43,139	11.93	36,236	10.75

With respect to the 2018 school year, a statistically significant difference was present, $\chi^2(4) = 3008.87, p < .001$, Cramer's *V* of .06, below small effect size (Cohen, 1988). A higher percentage of Asian males, almost 5% more, earned an AP exam score of 5 than was earned by Asian females. Table 17 contains the descriptive statistics for this analysis.

Table 17

Frequencies and Percentages of Overall AP Exam Scores for Asian Females and Asian Males for the 2018 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	79,623	20.85	92,136	25.67
4	89,951	23.55	86,735	24.17
3	95,471	24.99	82,911	23.10
2	74,490	19.50	60,685	16.91
1	42,429	11.11	36,394	10.14

Regarding the 2019 school year, a statistically significant difference was yielded, $\chi^2(4) = 3118.41, p < .001$, Cramer's *V* of .06, below small effect size (Cohen, 1988). As revealed in Table 18, a substantially higher percentage of Asian males obtained an AP exam score of 5, almost 5% more, than was obtained by Asian females. Readers should note that a substantially higher percentage of females, more than 3% more, earned failing scores than was earned by Asian males.

Table 18

Frequencies and Percentages of Overall AP Exam Scores for Asian Females and Asian Males for the 2019 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	83,757	21.28	97,838	26.13
4	94,199	23.93	91,665	24.48
3	100,282	25.48	88,286	23.58
2	74,567	18.95	61,011	16.30
1	40,757	10.36	35,585	9.50

Research Question 3

Differences between Asian students and White students in their exam performance in the top five frequently taken AP exams were addressed in the third research question from the 2012 to the 2019 school years. Over the eight school years nationwide, the top five most frequently taken AP exams in order from the most to least frequently taken exams were English Language & Composition, U.S. History, English Literature & Composition, Government & Politics U.S., and Calculus AB.

A statistically significant difference was revealed, $\chi^2(4) = 48675.31, p < .001$, Cramer's *V* of .07, below small effect size (Cohen, 1988). Asian students had a higher percentage of students, more than 5% more, who earned an AP exam score of 5 than was earned by White students. Table 19 contains the descriptive statistics for this analysis.

Table 19

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Students and White Students for the 2012 Through the 2019 School Years

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	374,287	19.06	1,150,895	13.47
4	415,862	21.18	1,756,368	20.55
3	496,217	25.27	2,447,370	28.64
2	428,118	21.80	2,146,961	25.12
1	249,338	12.70	1,043,889	12.22

For the 2012 school year, a total of 1,963,807 Asian students and 8,545,483 White students took the top five most frequently taken AP exams. Delineated in Table 20 are the comparisons of mean scores between Asian students and White students arranged in order from the most to least frequently taken exams. English Language & Composition was the most frequently taken AP exam for both Asian and White students. Government & Politics U.S. was the only AP exam on which White students had a higher average exam score than Asian students.

Table 20

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Students and White Students for the 2012 School Year

AP Exams	Asian <i>M</i>	White <i>M</i>	<i>M</i> Difference
English Language & Composition	3.21	3.14	0.07
U.S. History	3.17	2.99	0.18
English Literature & Composition	3.03	3.02	0.01
Calculus AB	3.26	3.10	0.16
Government & Politics U.S.	2.85	2.93	-0.08

Concerning the 2012 school year, a statistically significant difference was present between Asian student and White student AP exam performance, $\chi^2(4) = 3935.12$, $p < .001$, Cramer's *V* of .05, below small effect size (Cohen, 1988). A higher percentage of Asian students, almost 5% more, earned an AP exam score of 5 than was earned by White students. Descriptive statistics for this analysis are revealed in Table 21.

Table 21

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Students and White Students for the 2012 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	41,128	19.31	148,222	14.70
4	45,941	21.57	220,539	21.88
3	52,297	24.55	281,768	27.95
2	45,631	21.42	240,212	23.83
1	28,031	13.16	117,247	11.63

In 2013, the top five most frequently taken AP exams were the same as in 2012. Presented in Table 22 are the mean score comparisons of the top five most popular AP exams for Asian students and White students. Compared to 2012, mean score differences were smallest for U.S. History (0.18 to 0.09) and Calculus AB (0.16 to 0.15). Differences, however, were larger for English Language and Composition (0.07 to 0.08) and English Literature and Composition (0.01 to 0.03). Again, AP Government & Politics U.S. was the only exam that White students had a higher average exam score than Asian students. Asian students had higher average AP exam scores than White students for the rest of the four AP exams.

Table 22

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Students and White Students for the 2013 School Year

AP Exams	Asian <i>M</i>	White <i>M</i>	<i>M</i> Difference
English Language & Composition	3.08	3.00	0.08
U.S. History	3.07	2.98	0.09
English Literature & Composition	3.06	3.03	0.03
Calculus AB	3.24	3.09	0.15
Government & Politics U.S.	2.83	2.89	-0.06

Regarding the 2013 school year, a statistically significant difference was revealed between Asian student and White student AP exam performance in the top five most frequently taken exams, $\chi^2(4) = 3787.33, p < .001$, Cramer's *V* of .05, below small effect size (Cohen, 1988). A higher percentage of Asian students, more than 4% more, earned an AP exam score of 5 than was earned by White students. Table 23 contains the descriptive statistics for this analysis.

Table 23

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Students and White Students for the 2013 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	41,381	17.79	145,619	13.76
4	49,093	21.10	223,085	21.09
3	58,476	25.13	302,402	28.58
2	51,955	22.33	260,289	24.60
1	31,748	13.65	126,581	11.96

In 2014, the top five most frequently taken AP exams were the same as in the previous two school years, and the order from the most taken to the least taken was the same as well. The mean score comparisons of the top five most popular AP exams for Asian students and White students for 2014 exam year are delineated in Table 24. White students had a higher average AP exam score for only Government & Politics U.S. whereas Asian students had higher average AP exam scores for the other four AP exams.

Table 24

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Students and White Students for the 2014 School Year

AP Exams	Asian <i>M</i>	White <i>M</i>	<i>M</i> Difference
English Language & Composition	3.12	3.02	0.10
U.S. History	3.13	2.96	0.17
English Literature & Composition	3.02	2.98	0.04
Calculus AB	3.25	3.07	0.18
Government & Politics U.S.	2.83	2.88	-0.05

A statistically significant difference was revealed in AP exam performance between Asian and White students in the 2014 school year, $\chi^2(4) = 5310.51, p < .001$, Cramer's *V* of .06, below small effect size (Cohen, 1988). A higher percentage of Asian students, more than 5% more, earned an AP exam score of 5 than was earned by White students. Delineated in Table 25 are the descriptive statistics for this analysis.

Table 25

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Students and White Students for the 2014 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	46,234	18.86	150,219	13.77
4	51,029	20.81	226,740	20.79
3	59,919	24.44	304,073	27.88
2	54,777	22.34	275,269	25.24
1	33,244	13.56	134,435	12.33

The top five most frequently taken AP exams for 2015 school year were the same as for the 2012, 2013, and 2014 school years. Again, the order of from the most to least frequently was the same as well. This year was the first time that Asian students had a higher average AP exam score for Government & Politics U.S., which resulted in Asian students having higher mean scores for all top five AP exams. Compared to 2014, the mean score differences increased for all exams except slightly decreased for Calculus AB by 0.18 to 0.15. Revealed in Table 26 are the descriptive statistics for this analysis.

Table 26

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Students and White Students for the 2015 School Year

AP Exams	Asian <i>M</i>	White <i>M</i>	<i>M</i> Difference
English Language & Composition	3.17	3.03	0.14
U.S. History	3.04	2.84	0.20
English Literature & Composition	3.08	3.02	0.06
Calculus AB	3.16	3.01	0.15
Government & Politics U.S.	2.80	2.78	0.02

With respect to the 2015 exam year, a statistically significant difference was present, $\chi^2(4) = 6000.41, p < .001$, Cramer's *V* of .07, below small effect size (Cohen, 1988). A higher percentage of Asian students, more than 5% more, earned an AP exam score of 5 than was earned by White students. Table 27 contains the descriptive statistics for this analysis.

Table 27

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian students and White Students for the 2015 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	44,715	17.91	138,279	12.62
4	52,329	20.96	225,492	20.58
3	63,329	25.36	316,791	28.91
2	53,023	21.24	265,764	24.25
1	36,275	14.53	149,463	13.64

In the 2016 exam year, the top five most frequently taken AP exams were the same as previous years from 2012 to 2015. However, the order was swapped between the top four and top five. Readers should note this swapped order that is present in Table 28 from top to bottom. Asian students had higher average AP exam scores in all five subject AP exams than White students. Compared to 2015, the mean score differences increased across all five exams.

Table 28

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Students and White Students for the 2016 School Year

AP Exams	Asian <i>M</i>	White <i>M</i>	<i>M</i> Difference
English Language & Composition	3.26	3.05	0.21
U.S. History	3.14	2.93	0.21
English Literature & Composition	3.10	2.99	0.11
Government & Politics U.S.	2.93	2.89	0.04
Calculus AB	3.34	3.10	0.24

With respect to the 2016 exam year, a statistically significant difference was yielded, $\chi^2(4) = 8026.97, p < .001$, Cramer's *V* of .08, below small effect size (Cohen, 1988). A higher percentage of Asian students, almost 7% more, earned an AP exam score of 5 than was earned by White students. Delineated in Table 29 are the descriptive statistics for this analysis.

Table 29

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Students and White Students for the 2016 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	51,191	21.34	158,008	14.55
4	50,094	20.88	220,529	20.30
3	58,405	24.35	304,205	28.00
2	48,690	20.30	262,955	24.21
1	31,500	13.13	140,621	12.94

With respect to the 2017 exam year, the top five most frequently taken AP exams as well as the order of from the most to least were the same as the 2016. As revealed in Table 30, Asian students had all higher means in all five subject AP exams than White students. Compared to 2016, mean score differences were slightly up and down but no substantial changes.

Table 30

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Students and White Students in the 2017 School Year

AP Exams	Asian <i>M</i>	White <i>M</i>	<i>M</i> Difference
English Language & Composition	3.17	3.02	0.15
U.S. History	3.10	2.88	0.22
English Literature & Composition	3.02	2.94	0.08
Government & Politics U.S.	2.88	2.82	0.06
Calculus AB	3.26	3.08	0.18

Concerning the 2017 exam year, a statistically significant difference was revealed, $\chi^2(4) = 6561.46, p < .001$, Cramer's *V* of .07, below small effect size (Cohen, 1988). A higher percentage of Asian students, more than 5% more, earned an AP exam score of 5 than was earned by White students. Table 31 contains the descriptive statistics for this analysis.

Table 31

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Students and White Students for the 2017 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	46,146	18.01	137,903	12.52
4	54,446	21.25	221,644	20.13
3	66,593	25.99	321,928	29.23
2	57,888	22.60	288,221	26.17
1	31,124	12.15	131,509	11.94

In the 2018 school year, Calculus AB was not in the top five most frequently taken AP exams, instead, Psychology was added. All other AP exams as well as the order of from most to least frequently taken exams were the same as in the 2017 exam year. Asian students had higher means in all five subject AP exams than White students. Compared to the 2017 exam year, all mean score differences were either the same or increased for all exams. Revealed in Table 32 are the descriptive statistics for this analysis.

Table 32

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Students and White Students for the 2018 School Year

AP Exams	Asian <i>M</i>	White <i>M</i>	<i>M</i> Difference
English Language & Composition	3.25	3.07	0.18
U.S. History	3.11	2.89	0.22
English Literature & Composition	2.94	2.81	0.13
Government & Politics U.S.	3.02	2.95	0.07
Psychology	3.58	3.32	0.26

For the 2018 exam year, a statistically significant difference was revealed, $\chi^2(4) = 9946.85$, $p < .001$, Cramer's V of .09, below small effect size (Cohen, 1988). A higher percentage of Asian students, more than 7% more, had AP exam scores of 5 than did White students. Delineated in Table 33 are descriptive statistics for this analysis for the 2018 school year.

Table 33

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Students and White Students for the 2018 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	56,094	21.33	149,441	14.03
4	60,058	22.84	231,751	21.76
3	63,497	24.15	293,937	27.60
2	54,034	20.55	263,157	24.71
1	29,251	11.12	126,829	11.91

Concerning the 2019 exam year, Psychology was replaced by World History from the top five most frequently taken AP exams and all other AP exams as well as the order of from most to least frequently taken were the same as in the 2018 exam year. As delineated in Table 34, again, Asian students had all higher means in all five subject AP exams than White students. Compared to 2018, the mean score differences increased across all five exams.

Table 34

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Students and White Students for the 2019 School Year

AP Exams	Asian <i>M</i>	White <i>M</i>	<i>M</i> Difference
English Language & Composition	3.24	3.02	0.22
U.S. History	3.21	2.93	0.28
English Literature & Composition	2.96	2.88	0.08
Government & Politics U.S.	3.14	2.95	0.19
World History	3.22	3.00	0.22

Regarding the 2019 exam year, a statistically significant difference was revealed, $\chi^2(4) = 10628.50, p < .001$, Cramer's *V* of .09, below small effect size (Cohen, 1988). A higher percentage of Asian students, almost 7% more, obtained an AP exam score of 5 than was obtained by White students. Contained in Table 35 are the descriptive statistics for this analysis for the 2019 school year.

Table 35

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Students and White Students for the 2019 School Year

Exam Score	Asian Students		White Students	
	<i>n</i>	%	<i>n</i>	%
5	51,352	19.10	122,793	12.20
4	63,150	23.49	215,214	21.39
3	69,710	25.93	291,335	28.95
2	59,598	22.17	269,480	26.78
1	25,053	9.32	107,397	10.67

In summary, Asian students had higher average AP exam scores than White students did in each school year for the top five most frequently taken AP exams. Statistically significant differences were present in each school year between Asian students and White students in their average AP exam performance. As presented in Table 36, the effect size values, Cramer's *V*s, increased from .05 to .09 over the eight school years.

Table 36

Comparisons of Effect Sizes and Cramer's Vs of the Top Five Most Frequently Taken AP Exam Performance for Asian Students and White Students for the 2012 Through the 2019 School Years

School Year	Cramer's V	Effect size range	Group with Higher AP Exam Score
2012	.05	Below small	Asian Students
2013	.05	Below small	Asian Students
2014	.06	Below small	Asian Students
2015	.07	Below small	Asian Students
2016	.08	Below small	Asian Students
2017	.07	Below small	Asian Students
2018	.09	Below small	Asian Students
2019	.09	Below small	Asian Students
Eight Year Overall	.07	Below Small	Asian Students

Research Question 4

Explored in the fourth research question was the extent to which Asian females and Asian males differed in their AP exam performance in the top five most frequently taken AP exams. The top five most frequently taken exams arranged in order from the most to least frequently taken exams were U.S. History, English Language & Composition, Calculus AB, English Literature & Composition, and Biology in the 2012 to the 2014 school years. In the 2015 to the 2017 school year, the top one and the second

swapped, English Language & Composition moved up from the second to the first while U.S. History moved down to the second from the first. In the 2018 school year, the fourth and the fifth swapped, Biology moved up from the fifth to the fourth while English Literature & Composition moved down to the fifth. In the 2019 school year, English Literature & Composition moved out of the top five most frequently taken exams, instead, World History has moved up from the out of the top five most frequently taken exams to the fifth. Compared to the nationwide top five AP exams presented in the research question three above, the differences across all eight years from 2012 to 2019 were that Biology was always included, and Government & Politics U.S. was always not included for Asian students.

Over the eight school years, a statistically significant difference was revealed, $\chi^2(4) = 4791.2, p < .001$, Cramer's V of .05, below small effect size (Cohen, 1988). A higher percentage of Asian males, more than 3% more, earned an AP exam score of 5 than was earned by Asian females. Revealed in Table 37 are the descriptive statistics for this analysis.

Table 37

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam scores for Asian Females and Asian Males for the 2012 Through the 2019 School Years

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	188,842	17.16	183,479	20.41
4	248,449	22.58	210,789	23.45
3	293,965	26.71	227,673	25.33
2	247,362	22.48	179,776	20.00
1	121,914	11.08	97,181	10.81

Contained in Table 38 are the top five most frequently taken AP exams by Asian students for the 2012 school year arranged in order from the most to least frequently taken exams. Except for English Literature & Composition, Asian males obtained higher average AP exam scores than were obtained by Asian females.

Table 38

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Females and Asian Males for the 2012 School Year

AP Exams	Female <i>M</i>	Male <i>M</i>	<i>M</i> Difference
U.S. History	3.09	3.25	-0.16
English Language & Composition	3.15	3.29	-0.14
Calculus AB	3.16	3.35	-0.19
English Literature & Composition	3.06	2.98	0.08
Biology	3.06	3.35	-0.29

In the 2012 school year, the result was statistically significant, $\chi^2(4) = 745.68, p < .001$, Cramer's *V* of .06, below small effect size (Cohen, 1988). A higher percentage of Asian males, more than 4% more, earned an AP exam score of 5 than was earned by Asian females. Descriptive statistics for this analysis are contained in Table 39.

Table 39

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Females and Asian Males for the 2012 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	23,081	19.55	23,728	23.94
4	25,540	21.64	22,043	22.24
3	27,591	23.38	21,806	22.01
2	24,394	20.67	18,489	18.66
1	17,427	14.76	13,028	13.15

In 2013, the top five most frequently taken AP exams were the same as in 2012. Presented in Table 40 are the mean score comparisons of the top five most popular AP exams for Asian females and Asian males. Compared to 2012, mean score differences were smaller for all top five AP exams between Asian females and Asian males. Again, Asian females had a higher average AP exam score than Asian males did for English Literature & Composition. Asian males continued to have higher average AP exam scores for the other AP exams in the top five.

Table 40

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Females and Asian Males for the 2013 School Year

AP Exams	Female <i>M</i>	Male <i>M</i>	<i>M</i> Difference
U.S. History	2.99	3.16	-0.17
English Language & Composition	3.06	3.11	-0.05
Calculus AB	3.16	3.31	-0.15
English Literature & Composition	3.09	3.02	0.07
Biology	3.03	3.28	-0.25

With respect to the 2013 exam year, a statistically significant difference was revealed in AP exam performance between Asian females and Asian males, $\chi^2(4) = 648.67, p < .001$, Cramer's *V* of .05, below small effect size (Cohen, 1988). A higher percentage of Asian males, more than 3% more, earned an AP exam score of 5 than was earned by Asian females. Table 41 contains the descriptive statistics for this analysis.

Table 41

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Females and Asian Males for the 2013 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	20,042	15.51	20,234	18.61
4	28,574	22.11	25,688	23.62
3	35,223	27.26	28,070	25.81
2	30,411	23.53	22,609	20.79
1	14,971	11.59	12,141	11.16

In 2014, again, the top five most frequently taken AP exams were the same as in the previous two school years, and the order from the most taken to the least taken was the same as well. Based on the mean score comparisons of the top five most popular AP exams for Asian females and Asian males delineated in Table 42, Asian females had a higher average AP exam score in English Language & Composition than Asian males. Asian males had higher average AP exam scores for other four AP exams.

Table 42

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Females and Asian Males for the 2014 School Year

AP Exams	Female <i>M</i>	Male <i>M</i>	<i>M</i> Difference
U.S. History	3.05	3.22	-0.17
English Language & Composition	3.09	3.17	-0.08
Calculus AB	3.20	3.31	-0.11
English Literature & Composition	3.09	2.92	0.17
Biology	3.08	3.32	-0.24

A statistically significant difference was revealed in AP exam performance between Asian females and Asian males in the 2014 exam year, $\chi^2(4) = 587.59, p < .001$, Cramer's *V* of .05, below small effect size (Cohen, 1988). A higher percentage of Asian males, more than 3% more, earned an AP exam score of 5 than was earned by Asian females. Delineated in Table 43 are the descriptive statistics for this analysis.

Table 43

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Females and Asian Males for the 2014 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	22,983	16.72	22,119	19.85
4	30,876	22.46	25,869	23.22
3	36,029	26.20	27,751	24.91
2	31,986	23.26	22,957	20.60
1	15,618	11.36	12,723	11.42

Although the top five most frequently taken AP exams for the 2015 school year were the same as all previous years from 2012 to 2014, the order of from the most to least frequently taken AP exams was swapped between top one and top two. The most frequently taken exam was English Language & Composition instead of U.S. History that was different from the previous school years. Delineated in Table 44 is that Asian males had higher average AP exam score averages for four AP exams than did Asian females.

Table 44

Mean Score Comparisons of the Top Five Most Frequently AP Exams for Asian Females and Asian Males for the 2015 School Year

AP Exams	Female <i>M</i>	Male <i>M</i>	<i>M</i> Difference
English Language & Composition	3.16	3.17	-0.01
U.S. History	2.98	3.10	-0.12
Calculus AB	3.09	3.23	-0.14
English Literature & Composition	3.11	3.03	0.08
Biology	3.09	3.34	-0.25

Regarding the 2015 exam year, a statistically significant difference was presented, $\chi^2(4) = 390.47, p < .001$, Cramer's *V* of .04, below small effect size (Cohen, 1988). A higher percentage of Asian males, more than 2% more, earned an AP exam score of 5 than was earned by Asian females. Contained in Table 45 are the descriptive statistics for this analysis.

Table 45

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Females and Asian Males for the 2015 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	22,813	16.34	21,143	18.66
4	31,110	22.28	26,371	23.27
3	38,211	27.37	29,804	26.30
2	30,525	21.86	22,295	19.67
1	16,957	12.15	13,714	12.10

In the 2016 exam year, the top five most frequently taken AP exams as well as the order of from the most to least frequently taken AP exams were exactly the same as the 2015 exam year. Asian males had higher average AP exam scores in four of the five areas, with Asian females having a higher average AP exam score in English Literature & Composition. Table 46 contains the descriptive statistics for this analysis.

Table 46

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Females and Asian Males for the 2016 School Year

AP Exams	Female <i>M</i>	Male <i>M</i>	<i>M</i> Difference
English Language & Composition	3.24	3.29	-0.05
U.S. History	3.10	3.18	-0.08
Calculus AB	3.28	3.40	-0.12
English Literature & Composition	3.16	3.00	0.16
Biology	3.03	3.30	-0.27

With respect to the 2016 exam year, a statistically significant difference was present, $\chi^2(4) = 372.83, p < .001$, Cramer's *V* of .04, below small effect size (Cohen, 1988). A higher percentage of Asian males, more than 2% more, earned an AP exam score of 5 than was earned by Asian females. Table 47 contains the descriptive statistics for this analysis for the 2016 school year.

Table 47

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Females and Asian Males for the 2016 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	25,835	19.08	23,662	21.72
4	30,185	22.29	24,708	22.68
3	35,022	25.86	27,301	25.06
2	29,315	21.65	21,153	19.41
1	15,065	11.12	12,129	11.13

Concerning the 2017 exam year, the top five most frequently taken AP exams as well as the order of from the most to least were the same as the 2015 and 2016 exam year. As revealed in Table 48, Asian females had higher mean scores for both English Language & Composition and English Literature & Composition than did Asian males. Asian males had higher mean scores for the rest of the exams.

Table 48

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Females and Asian Males in the 2017 School Year

AP Exams	Female <i>M</i>	Male <i>M</i>	<i>M</i> Difference
English Language & Composition	3.18	3.16	0.02
U.S. History	3.05	3.16	-0.11
Calculus AB	3.19	3.33	-0.14
English Literature & Composition	3.06	2.97	0.09
Biology	3.09	3.36	-0.27

Concerning the 2017 exam year, a statistically significant difference was revealed, $\chi^2(4) = 514.65, p < .001$, Cramer's *V* of .04, below small effect size (Cohen, 1988). A higher percentage of Asian males, more than 2% more, earned an AP exam score of 5 than was earned by Asian females. Delineated in Table 49 are the descriptive statistics for the 2017 school year.

Table 49

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores by Asian Females and Asian Males for the 2017 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	23,211	16.08	21,847	18.88
4	32,740	22.68	27,147	23.46
3	40,261	27.89	30,619	26.46
2	33,920	23.50	24,485	21.16
1	14,211	9.85	11,613	10.04

In the 2018 exam year, the top five most frequently taken AP exams were the same as the 2017 exam year. However, the order of from the most to least frequently taken AP exams was swapped between the top four and the top five. Biology moved up from the top four to the top five, and English Literature & Composition was the only AP exam that Asian females had a higher average AP exam score than Asian males. Table 50 contains the descriptive statistics for this analysis.

Table 50

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Females and Asian Males for the 2018 School Year

AP Exams	Female <i>M</i>	Male <i>M</i>	<i>M</i> Difference
English Language & Composition	3.04	3.20	-0.16
U.S. History	3.23	3.27	-0.04
Calculus AB	3.24	3.37	-0.13
Biology	3.13	3.39	-0.26
English Literature & Composition	2.99	2.86	0.13

For the 2018 exam year, a statistically significant difference was revealed, $\chi^2(4) = 730.29, p < .001$, Cramer's *V* of .05, below small effect size (Cohen, 1988). A higher percentage of Asian males, more than 3% more, earned an AP exam score of 5 than was earned by Asian females. Contained in Table 51 are the descriptive statistics for this analysis for the 2018 school year.

Table 51

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Females and Asian Males for the 2018 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	24,666	16.65	24,085	20.33
4	33,597	22.68	27,327	23.06
3	40,932	27.64	30,599	25.82
2	34,337	23.18	24,724	20.87
1	14,576	9.84	11,753	9.92

In the 2019 exam year, four of the five AP exams noted in the previous year were in the top five. The one exception was that the AP English Literature & Composition exam was replaced by AP World History. The order from most to least frequently taken was the same as noted in the previous year. As delineated in Table 52, at the first time, Asian males had higher average AP exam scores than Asian females for all top five AP exams.

Table 52

Mean Score Comparisons of the Top Five Most Frequently Taken AP Exams for Asian Females and Asian Males in the 2019 School Year

AP Exams	Female <i>M</i>	Male <i>M</i>	<i>M</i> Difference
English Language & Composition	3.14	3.29	-0.15
U.S. History	3.23	3.25	-0.02
Calculus AB	3.31	3.42	-0.11
Biology	3.18	3.46	-0.28
World History	3.13	3.32	-0.19

Regarding the 2019 exam year, a statistically significant difference was revealed, $\chi^2(4) = 1043.15, p < .001$, Cramer's *V* of .06, below small effect size (Cohen, 1988). A higher percentage of Asian males, more than 4% more, earned an AP exam score of 5 than was earned by Asian females. Table 53 contains the descriptive statistics for this analysis.

Table 53

Frequencies and Percentages of the Top Five Most Frequently Taken AP Exam Scores for Asian Females and Asian Males for the 2019 School Year

Exam Score	Asian Females		Asian Males	
	<i>n</i>	%	<i>n</i>	%
5	51,352	17.67	122,793	21.65
4	63,150	24.16	215,214	25.69
3	69,710	27.44	291,335	25.76
2	59,598	21.90	269,480	18.73
1	25,053	8.83	107,397	8.18

In summary, the only AP subject exam among the top five most frequently taken AP exams that Asian females had higher mean scores than Asian males did was English Literature & Composition for each school year. Asian males had higher mean scores for the rest of AP exams for each exam year. However, English Literature & Composition was not included in the top five most frequently taken exams for Asian students for the 2019 school year. Instead, it was replaced by World History on which, Asian males obtained a higher average exam score than Asian females. In the 2019 school year, Asian males had higher average exam scores for all top five most frequently taken AP exams. In addition, statistically significant differences were revealed between Asian females and Asian males in AP exam performance in each of the eight years. As revealed in Table 54, the effect size values were fairly stable over the eight school years.

Table 54

Comparisons of Effect Sizes and Cramer's Vs of the Top Five Most Frequently Taken AP Exam Performance for Asian Females and Asian Males for the 2012 Through the 2019 School Years

School Year	Cramer's V	Effect size range	Group with Higher AP Exam Score
2012	.06	Below small	Asian males
2013	.05	Below small	Asian males
2014	.05	Below small	Asian males
2015	.04	Below small	Asian males
2016	.04	Below small	Asian males
2017	.04	Below small	Asian males
2018	.05	Below small	Asian males
2019	.06	Below small	Asian males
Eight Year Overall	.05	Below Small	Asian males

Research Question 5

The focus of the fifth research question was on determining the extent to which trends were present in the AP exam performance of Asian students and White students for the 2012 school year through the 2019 school year. Concerning AP exam participation, although the total number of students taking AP exams for both Asian and White students increased over the eight school years, the percentage increase for Asian students was much higher than for White students from 2012 to 2019 school years.

Compared to the total of 18.93% increase for White students from the 2012 through the 2019 school year, Asian students taking AP exams increased by 49.31%, more than a 30 percentage point difference. Except for the slightly decrease in the number of Asian students taking AP exams from 2015 to 2016, the differences in the percentage increase of students taking AP exams from the prior year for Asian students were all higher than for White students. Table 55 contains the descriptive statistics for these analyses.

Table 55

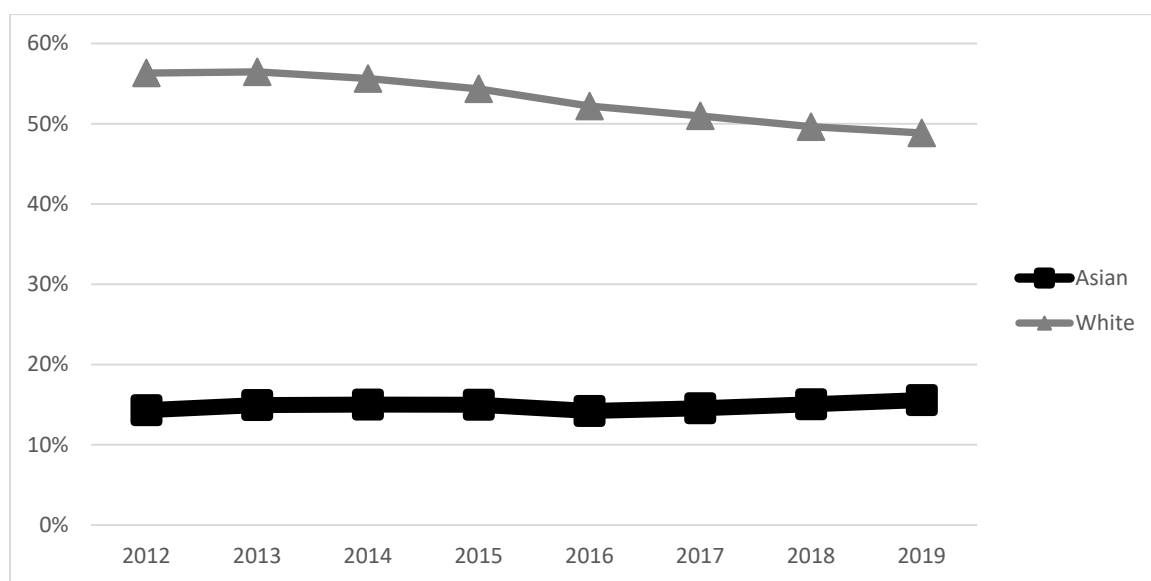
Comparisons of One Year Percentage Different of AP Exam Participation for Asian Students and White Students for the 2012 Through the 2019 School Years

School Year	Asian	White	One Year % Differences
2012 to 2013	11.16	6.68	4.48
2013 to 2014	6.51	4.49	2.02
2014 to 2015	6.89	4.60	2.29
2015 to 2016	-0.42	0.83	-1.25
2016 to 2017	7.79	2.88	4.92
2017 to 2018	6.03	-0.21	6.24
2018 to 2019	3.66	-1.43	5.09
2012 to 2019	49.31	18.97	30.34

Portrayed in Figure 1 are the comparisons of the percentages of Asian students and White students who took AP exams for the 2012 to the 2019 school years. The percentage of White students in total decreased from 56.32% to 48.85% whereas the percentage of Asian students slightly increased by 1.27%.

Figure 1

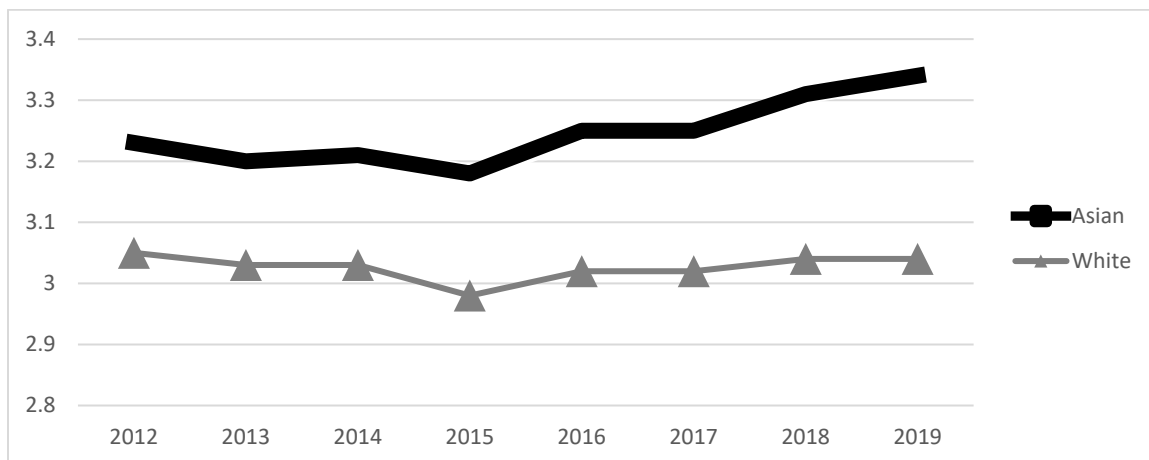
Comparisons of the Percentages of Students Who Took AP Exams in Total Between Asian Students and White Students for the 2012 to the 2019 School Years



With respect to trends in mean score differences between Asian students and White students, Asian students had higher average AP scores in all school years, regardless of whether or not it was for all AP exams or any of the top five most frequently taken exams. Of note is that the gaps of mean scores between Asian students and White students increased over the eight years of data that were analyzed herein. Exhibited in Figure 2 are the mean score comparisons between Asian students and White students over the eight school years.

Figure 2

Mean Score Comparisons of AP Exams for Asian Students and White Students for the 2012 Through the 2019 School Years



All comparisons of AP exam scores between Asian students and White students were statistically significant from the 2012 to the 2019 school years. As documented in Table 56, Asian students outperformed White students in each school year. The value of Cramer's V increased from .08 to .12 from 2012 to 2019. As such, this increase in the practical relevance of the results was indicative that the performance gap between Asian students and White students has increased over this eight-year time period.

Table 56

Effect Sizes and Cramer's Vs of Asian Students and White Students AP Exam

Performance Comparisons for the 2012 Through the 2019 School Years

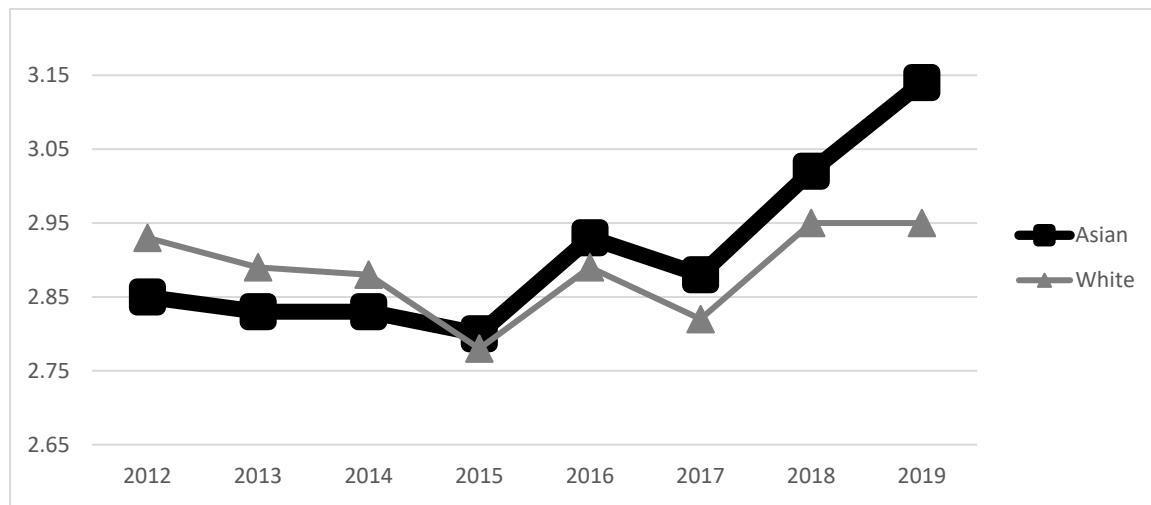
School Year	Cramer's V	Effect size range	Group with Higher AP Exam Score
2012	.08	Below small	Asian
2013	.08	Below small	Asian
2014	.08	Below small	Asian
2015	.09	Below small	Asian
2016	.09	Below small	Asian
2017	.10	Small	Asian
2018	.11	Small	Asian
2019	.12	Small	Asian
Eight Year Overall	.08	Below Small	Asian

Congruent with the results for the overall AP exam performance between Asian students and White students, each of the comparisons for the top five most frequently taken exams from the 2012 to the 2019 school year was statistically significant as well. Of note is that the effect size values increased from .05 to .09, also reflective that the AP exam performance gaps increased over time. The average AP exam score for Government & Politics U.S. for White students were higher than for Asian students from 2012 to 2015. However, starting from the 2016 school year, Asian students' average AP exam scores were higher than the average AP exam scores for White students. Shown in

Figure 3 is the trend for mean scores differences between Asian students and White students for AP Government & Politics U.S. over the eight school years.

Figure 3

Mean Score Comparisons of AP Government & Politics U.S. Exam Between Asian Students and White Students for the 2012 Through the 2019 School Years

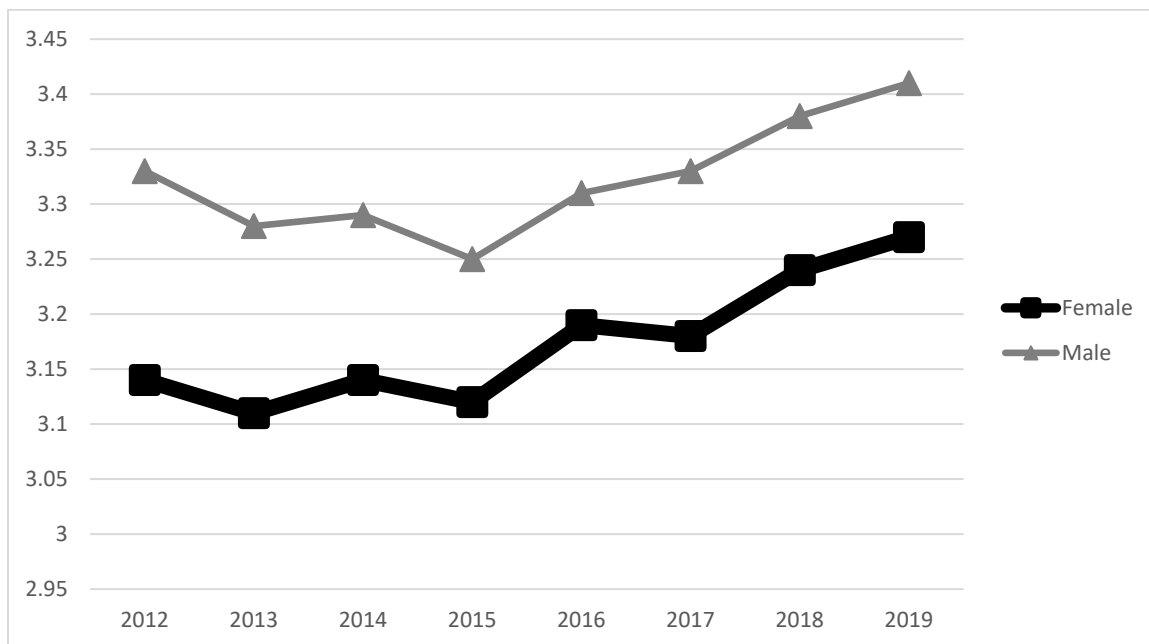


Research Question 6

The focus of this research question was to ascertain the degree to which trends were present in the AP exam performance of Asian females and Asian males for the 2012 through the 2019 school years. Over the eight school years, the total AP exam participation for both Asian females and males increased, by 49.80% and 48.80%, respectively. Portrayed in Figure 4 are the mean score comparisons between Asian females and Asian males. Clearly, Asian males had higher average AP exam scores in each school year than Asian females. Overall, across the eight school years, mean scores increased for both Asian females and males. The differences in mean scores between Asian females and males were fairly stable.

Figure 4

Mean Score Comparisons of AP Exams Between Asian Females and Asian Males for the 2012 Through the 2019 School Years



All comparisons of AP exam scores between Asian females and Asian males were statistically significant in each school year from 2012 to 2019. As presented in Table 57, the effect size values or degree of practical relevance were fairly stable between .05 to .07, indicative that the performance gap between Asian females and Asian males remained stable over time.

Table 57

Effect Sizes and Cramer's Vs of Asian Females and Asian Males AP Exam Performance Comparisons for the 2012 Through the 2019 School Years

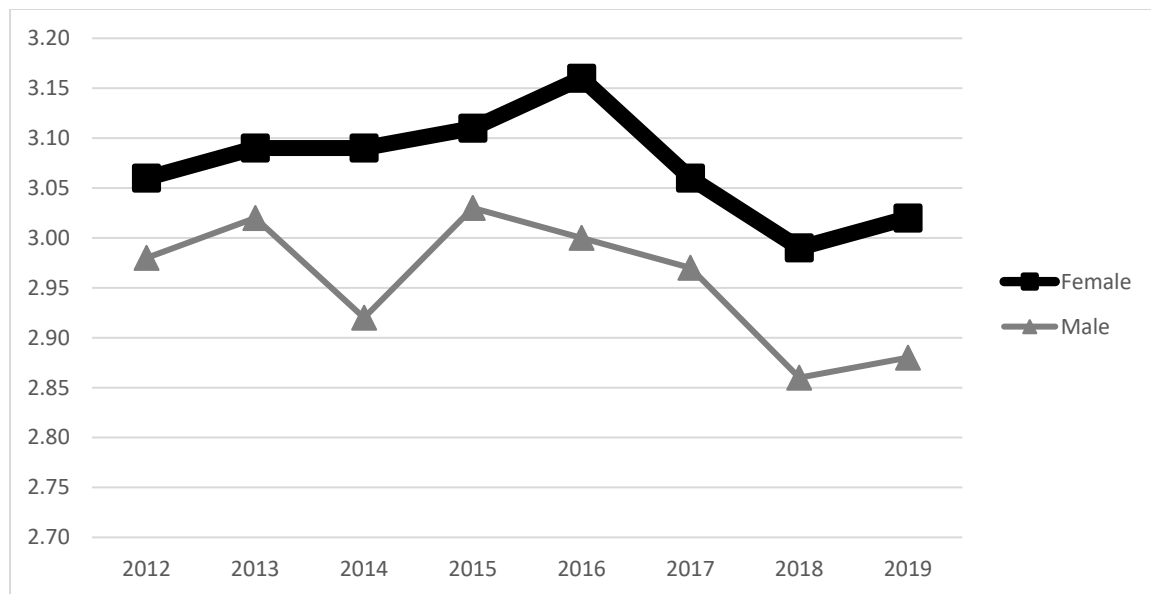
School Year	Cramer's V	Effect size range	Group with Higher AP Exam Score
2012	.07	Below small	Males
2013	.07	Below small	Males
2014	.06	Below small	Males
2015	.05	Below small	Males
2016	.05	Below small	Males
2017	.06	Below small	Males
2018	.06	Below small	Males
2019	.06	Below small	Males
Eight Year Overall	.06	Below Small	Males

Congruent with the results for the overall AP exam performance between Asian females and Asian males, each of the comparisons for the top five most frequently taken exams from the 2012 to the 2019 school year was statistically significant as well. Of note is that among the top five most frequently taken AP exams, AP English Literature & Composition was the only AP subject exam that Asian females had higher mean scores over the eight school years. However, the position of AP English Literature & Composition on the top five AP exams moved down from the top four to the top five in the 2018 school year. In the 2019, it was not included in the top five AP exams.

Presented in Figure 5 is the trend for mean scores differences between Asian females and Asian males for AP English Literature & Composition over the eight schoolyears.

Figure 5

Mean Score Comparisons for AP English Literature & Composition Exam for Asian Females and Asian Males for the 2012 Through the 2019 School Years



Summary of the Results

Examined in Chapter IV were student performance and trends between Asian students and White students and between Asian females and Asian males on the overall AP exams, as well as on the top five most frequently taken exams for the 2012 through the 2019 exam years. Participants in this study were Asian students and White students who had taken any AP exam during the 2012 through the 2019 school years. Exam scores and student participation were separated by ethnicity and by gender and were downloaded from the College Board website. Specifically, AP exam scores of 4 and 5 and AP exam scores of 1 and 2 were compared between different groups because scores of 4 and 5 can potentially transfer to college credit.

Regarding the first and three research questions, all of the comparisons of AP exam performance between Asian students and White students were statistically significant. Regardless of which AP exams were in the top five most frequently taken AP exams, Asian students had higher percentages who earned an AP exam score of 4 or 5 than was earned by White students. The AP Biology exam was always one of the top five most frequently taken exams for Asian students. In the most recent year, the AP Biology's position on the order of the top five moved up from fifth to fourth. White students were more likely taking Government & Politics U.S. exam.

Concerning research questions two and four, all of the comparisons of AP exam performance between Asian females and Asian males were statistically significant as well. In most instances, Asian males had higher average AP exam scores, although Asian females had a higher mean score of English & Language Composition than Asian males for a few years. The trend analyses were presented based on the results of research questions of five and six. In Chapter V, the findings and trends will be discussed. In addition, the discussion will include the study's relationship with theoretical frameworks. Policy and practice implications and recommendations for future research will be addressed as well.

CHAPTER V

Discussion, Implication, and Conclusion

As concluded by previous researchers (e.g., Moore et al., 2009), Asian students outperform White students in AP exams. Asian students, simply stated, have the best performance of any ethnic/racial group on AP exams. In addition, female students' academic performance historically was poor compared to their male peers (Moore & Slate, 2011; Reardon et al., 2018a). After 10 years of efforts, even with the policies of the No Child Left Behind Act and the Every Student Succeeds Act, ethnic/racial achievement gaps continue to exist and continue to increase in size.

The biggest challenge was on how to keep high-performing students moving forward while closing the achievement gaps (Hoffman & Mitchell, 2016). When the policymakers ignored the issues, such as stress and mental health issues, but focused on the academic achievement only for the high performance groups, academic success would not be sustainable (Wong et al., 2010). The primary goal of this research study was to investigate the degree to which differences were present in AP exam performance between Asian students and White students and between Asian females and Asian males.

Discussion

In this multiyear study, a quantitative causal-comparative research method was used to investigate the degree to which differences were present in overall AP exam performance between Asian students and White students and between Asian females and Asian males in AP exams for eight school years from the 2012 to 2019. The first four research questions were examined repeatedly for each of the eight years, including the comparisons of overall AP exam performance as well as the top five most frequently

taken AP exams performance between Asian students and White students and between Asian females and Asian males. Subsequently, trends were identified based on the results presented from the research question one to four, and these determined trends provided answers to the research question five and six.

Summary of Overall AP Performance between Asian Students and White Students

In the first research question, overall AP exam performance was examined for Asian students and White students for each of the 2012 through the 2019 school years. Over the eight school years, the average AP exam score for Asian students increased by 0.12 whereas the average AP exam score decreased by 0.01 for White students. In the 2019 school year, the average AP exam score for Asian students reached the highest of 3.34 and in the 2015 school year the average AP exam score was at the lowest of 3.18. Overall, the average AP exam scores for White students were relatively unchanged with the highest of 3.05 in the 2012 school year and the lowest of 2.98 in 2015. In addition, the mean scores of AP exam for Asian students were higher than for White students for each of the school years. In the overall AP exam of the eight years, the gap between the average AP exam scores for Asian students and White students steadily increased from the 2012 to the 2019 school year. It was 0.18 in the 2012 and 0.30 in the 2019 school year. The largest gap was in the 2019 school year.

As previously discussed in Tables 1 through Table 10, statistically significant differences were revealed for all of the AP exam performance comparisons between Asian students and White students for each of the 2012 through the 2019 school year. Over this time period, the effect size values increased from below small to small. Asian students clearly outperformed White students on AP exams in all eight school years. Based on the consideration of potential college credit transferable and the AP exam score criteria defined

by the College Board (College Board, 2016, p. 22), Asian students had higher percentages of students who passed the AP exams than White students in each school year. The percentage point differences between Asian students and White students who obtained AP exam score of 5 increased from 7.4% to 9.4%, and the mean score differences increased 0.3 from the 2012 to the 2019 school year.

Summary of Overall AP Performance for Asian Females and Asian Males

Focused on the second research question was the degree to which AP exam performance differed between Asian females and for Asian males for the 2012 school year through the 2019 school year. As delineated in Tables 11 through 20 in Chapter IV, statistically significant differences were revealed for each school year. In almost all instances, Asian males outperformed Asian females on the AP exams.

As previous presented in Figure 3, Asian males had higher average AP exam scores for each school year. The average AP exam score increased over this 8-year time period for both Asian females and Asian males. The increase in the average AP exam score was slightly higher for Asian females, by 0.05 points, than for Asian males. The average AP exam score for both Asian females and for Asian males was the highest in the 2018 school year, 3.24 and 3.38 respectively. For Asian females, their lowest average AP exam score was 3.11 in the 2013 school year. For Asian males, their lowest average AP exam score was 3.25 in the 2015 school year.

Over the eight school years, the percentage of Asian females and Asian males who earned scores of 5 increased. The gaps between the percentages of Asian females and of Asian males who earned an AP exam score of 5 increased over time, by 0.5%. The percentages of Asian females and Asian males who earned an AP exam score of 1 decreased. The gaps between the percentages of Asian females and of Asian males who

earned an AP exam score of 1 decreased by 0.8% over time. As such, Asian females improved in their AP exam performance and decreased the gap in their AP exam performance from Asian males.

Summary of Overall AP Performance on the Top Five Most Frequently Taken Exams Between Asian Students and White Students

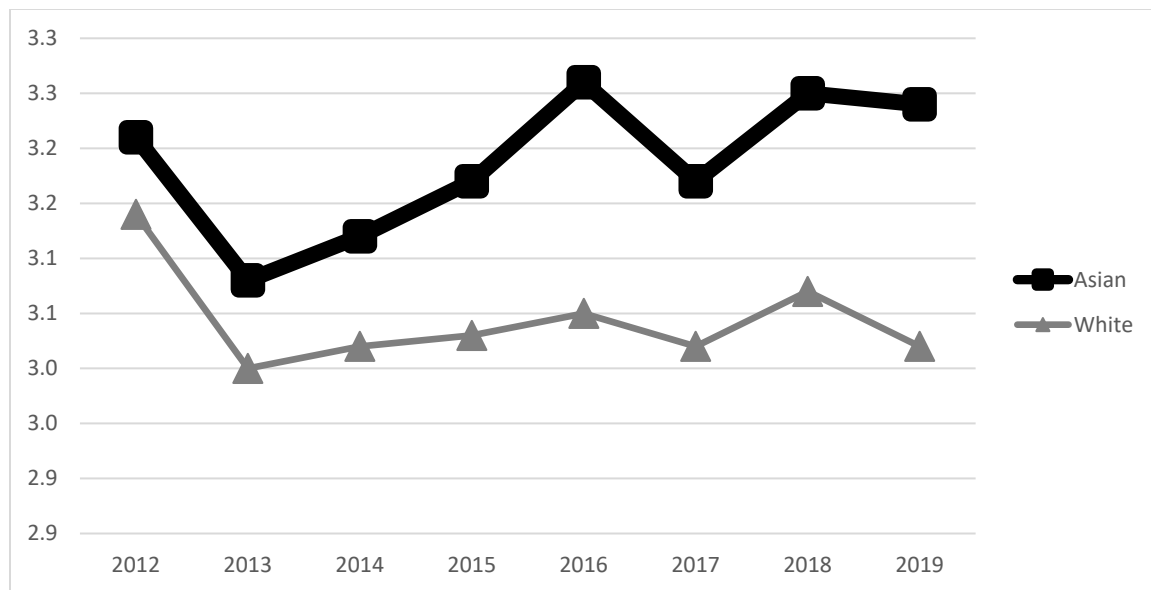
Addressed in the third research question was the comparisons of the AP exam performance between Asian students and White students in the top five most frequently taken exams from the 2012 through the 2019 school years. The top five most frequently taken exams arranged in order from the most to least frequently taken exams were English Language & Composition, U.S. History, English Literature & Composition, Calculus AB, and Government & Politics U.S. for the 2012 to the 2014 school years. Readers are directed to Chapter IV for the names of the top five most frequently taken AP exams and changes over the eight school years.

Over the eight school years, the average AP exam scores of Asian students were statistically significantly higher than the average AP exam scores of White students for each of the school years in each of the top frequently taken AP exams. One exception that was noted was for the AP Government & Politics U.S. in the 2012 to the 2015 school years where White students had higher average AP exam scores than Asian students. Readers can see the average AP exam score for Asian students increased from lower to higher than White students from the 2012 to the 2019 school years in Figure 4. In the overall AP exam of the eight years, the largest gap between the AP exam mean scores for Asian students and White students was AP U.S. History in the 2019 school year. The smallest gap was English Literature & Composition in the 2012 school year. Depicted in

Figure 6 are the mean score comparisons of AP English Language & Composition exams for Asian students and White students.

Figure 6

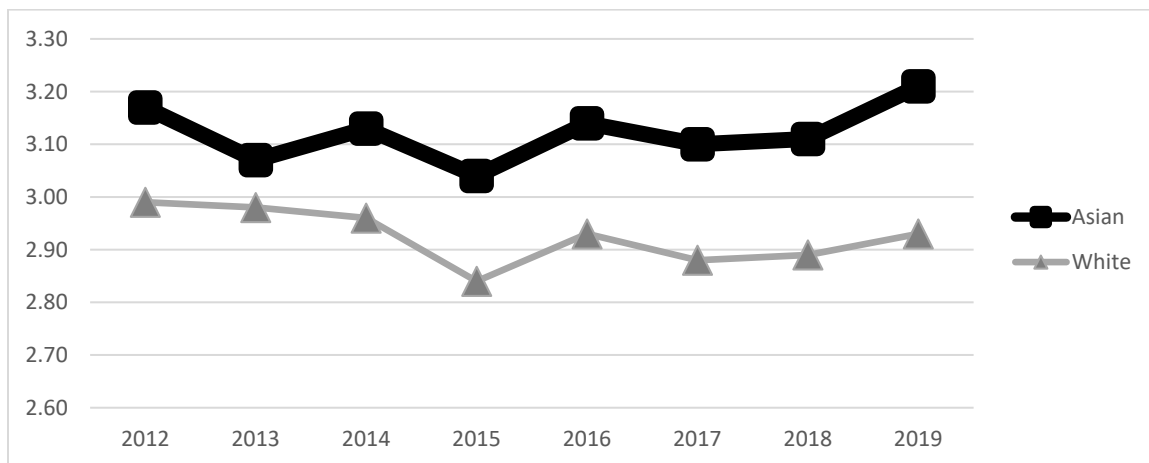
Mean Score Comparisons of AP English Language & Composition Exam Between Asian Students and White Students for the 2012 Through the 2019 School Years



Shown in Figure 7 are average AP exam scores on the AP U.S. History exam for Asian students and White students. Asian students consistently had higher average AP exam scores than White students. Moreover, the gaps in the average AP exam score for the U.S. History exam increased over time.

Figure 7

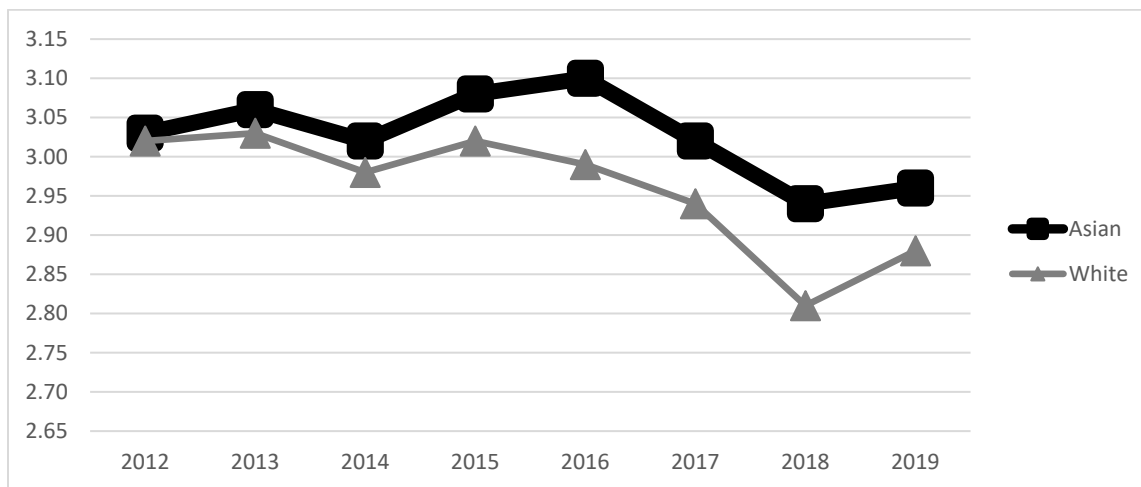
Mean Score Comparisons of AP U.S. History Exam Between Asian Students and White Students for the 2012 Through the 2019 School Years



Illustrated in Figure 8 are the average AP exam scores on the AP English Literature & Composition exam for Asian students and White students. Asian students consistently had a higher average AP exam score than White students. The gaps in performance on the AP English Literature & Composition exam between Asian students and White students increased over time.

Figure 8

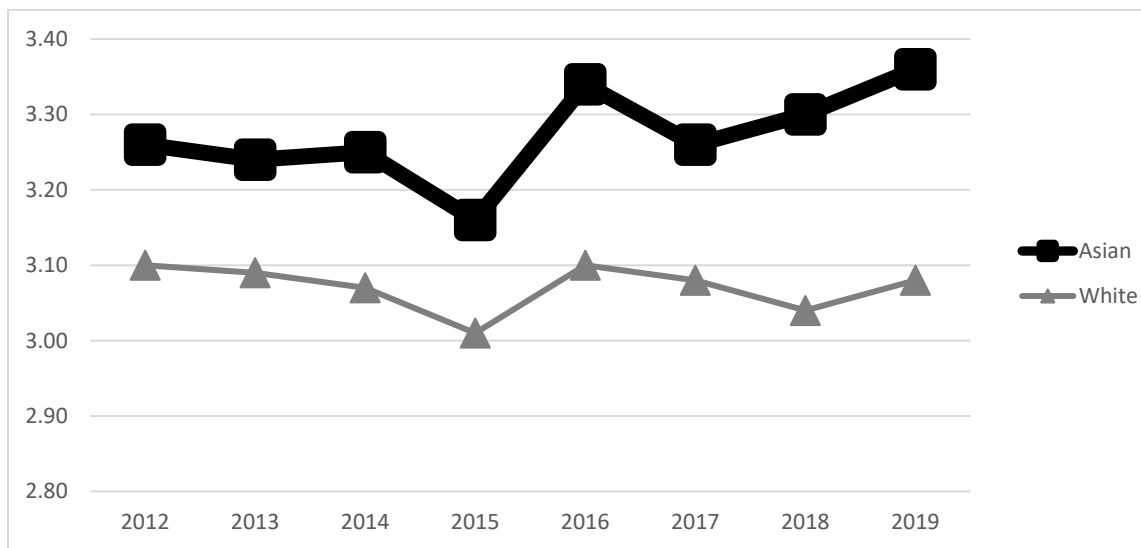
Mean Score Comparisons of AP English Literature & Composition Exam Between Asian Students and White Students for the 2012 Through the 2019 School Years



The average AP exam performance of Asian students and of White students on the Calculus AB exam is depicted in Figure 9. Asian students had higher average AP exam scores than did White students consistently. Over the eight years, the gaps in performance between Asian students and White students increased.

Figure 9

Mean Score Comparisons of AP Calculus AB Exam Between Asian Students and White Students for the 2012 Through the 2019 School Years



Regardless of which AP exam was included in the top five most frequently taken AP exams, statistically significant differences were revealed between Asian students and White students. In all instances, Asian students had better AP exam performance than White students. The effect size values increased over the eight years of data analyzed in this dissertation, indicating that the magnitude of the gap between the performance of Asian students and White students increased.

Summary of Overall AP Performance on the Top Five Most Frequently Taken Exams between Asian Females and Asian Males

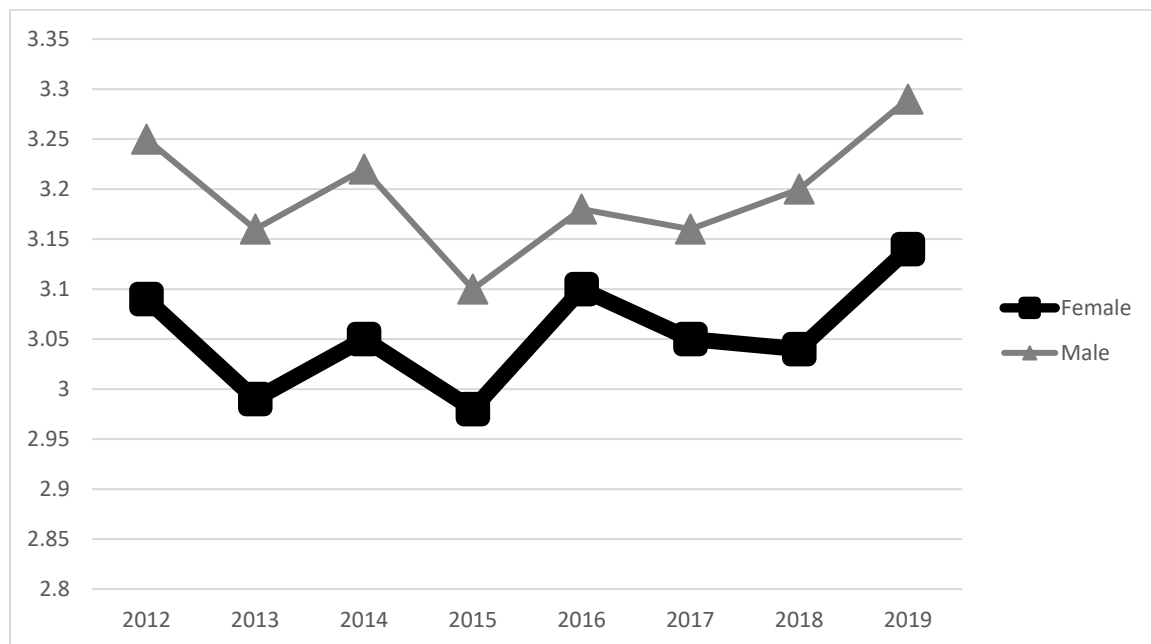
For the fourth research question, the focus was on the top five most frequently taken AP exams of Asian females and Asian males from the 2012 school year through the 2019 school year. The top five most frequently taken exams arranged in order from the most to least frequently taken exams were English Language & Composition, U.S. History, English Literature & Composition, Calculus AB, and Government & Politics

U.S. for the 2012 to the 2014 school years. Readers are directed to Chapter IV for the names of the top five most frequently taken AP exams and changes in them over the eight school years. As noted, Biology was included in the top five most frequently taken exams in each year of the eight years, which was different from the top five nationwide.

Over the eight school years, AP English Literature & Composition exam was the only AP exam on which average exam scores were higher for Asian females than for Asian males for each of the school years in each of the top frequently taken exams. In addition, in the 2017 school year, Asian females had a higher average AP exam score than Asian males on the AP English Language & Composition exam. Other than the above mentioned AP exams, Asian males had higher average exam scores than Asian females for each of the school years in each of the top four frequently taken exams. In the overall AP exam of the eight years, the largest gap between the AP exam mean scores for Asian students and White students was AP U.S. History in the 2019 school year, and the smallest gap was English Literature & Composition in the 2012 school year. Depicted in Figure 10 are the average AP exam score comparisons on the U.S. History exam between Asian females and Asian males for the 2012 school year through the 2019 school year.

Figure 10

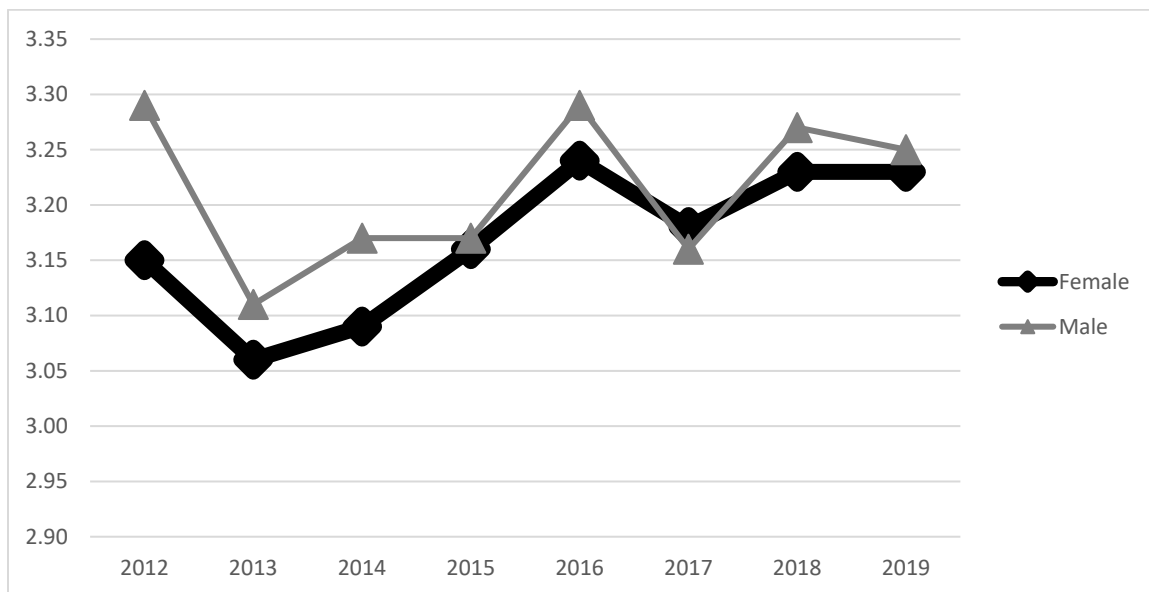
Mean Score Comparisons of AP U.S. History Exam Between Asian Females and Asian Males for the 2012 Through the 2019 School Years



Delimited in Figure 11 are the average exam score comparisons of the AP English Language & Composition exam between Asian females and Asian males for the 2012 through the 2019 school years. The gap between Asian females and males decreased from large to small. In 2017 school year, Asian females had a higher mean score compared to Asian males.

Figure 11

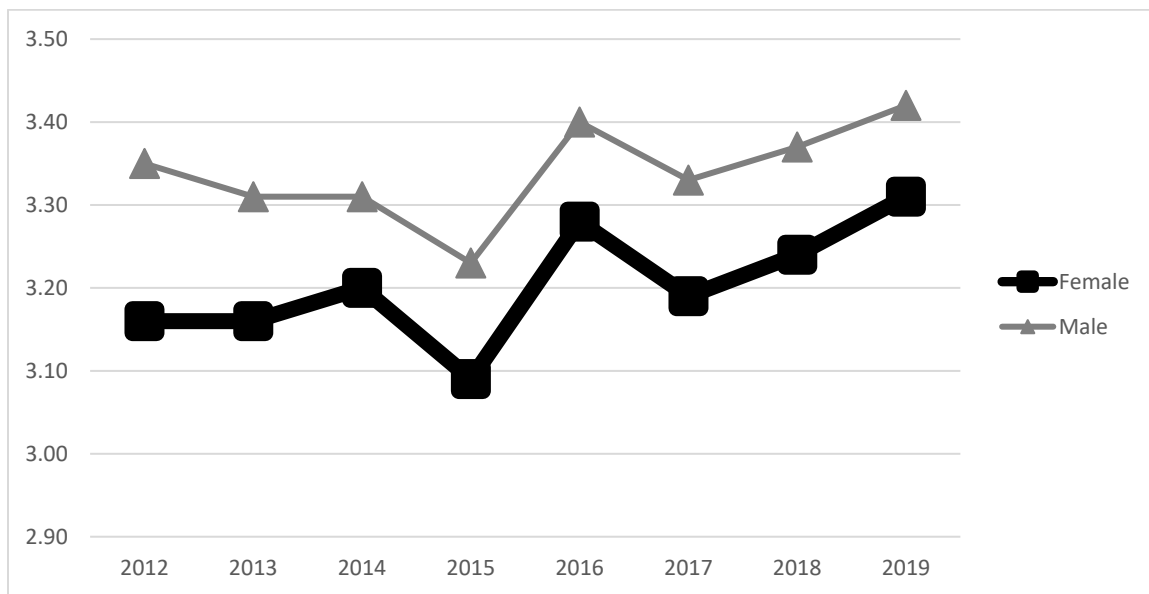
Mean Score Comparisons of AP English Language & Composition Exam Between Asian Females and Asian Males for the 2012 Through the 2019 School Years



Shown in Figure 12 are the average AP exam score comparisons of the Calculus AB exam between Asian females and Asian males for the 2012 school year through the 2019 school year. Average exam scores for both Asian females and males increased over the eight years. Readers should notice that the mean score differences between Asian females and Asian males were slightly closer.

Figure 12

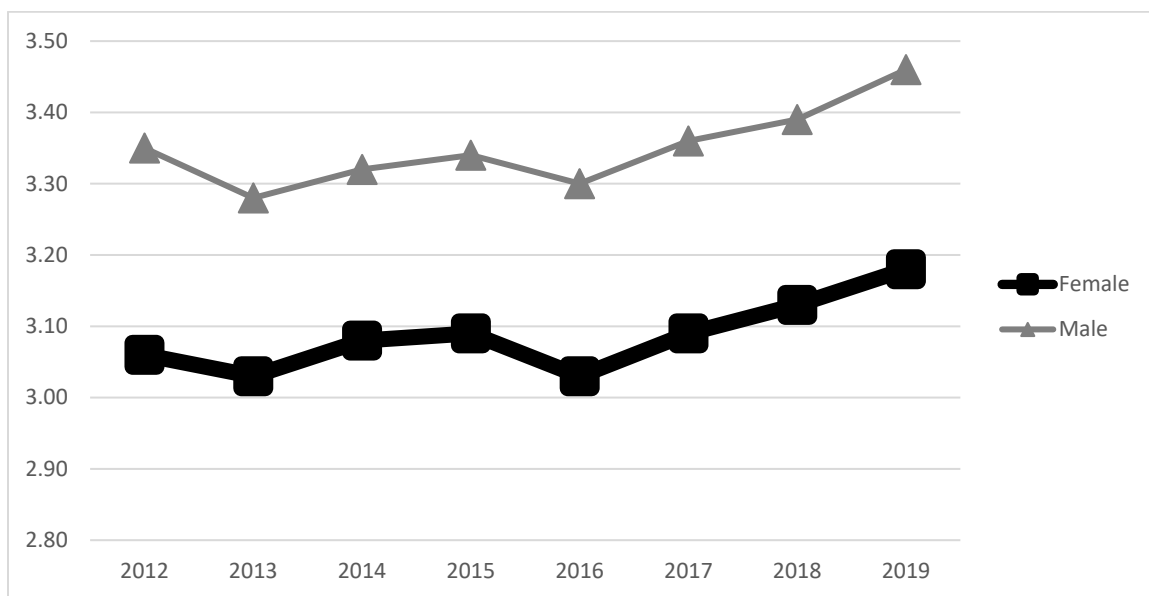
Mean Score Comparisons of AP Calculus AB Exam Between Asian Females and Asian Males for the 2012 Through the 2019 School Years



Average AP exam score comparisons of the Biology exam for Asian females and Asian males for the 2012 through the 2019 school years are depicted in Figure 13. Both groups, the average exam score increased in the last four school years. In addition, the gaps between Asian females and males remained constant over the eight years.

Figure 13

Mean Score Comparisons of AP Biology Exam Between Asian Females and Asian Males for the 2012 Through the 2019 School Years



Regardless of which AP exam was included in the top five most frequently taken AP exams, statistically significant differences were revealed for all comparisons of AP exam scores. In almost all instances, Asian males had higher average AP exam scores than Asian females in the top five most frequently taken exams.

Summary of the Trends for Asian Students and White Students in AP Exam

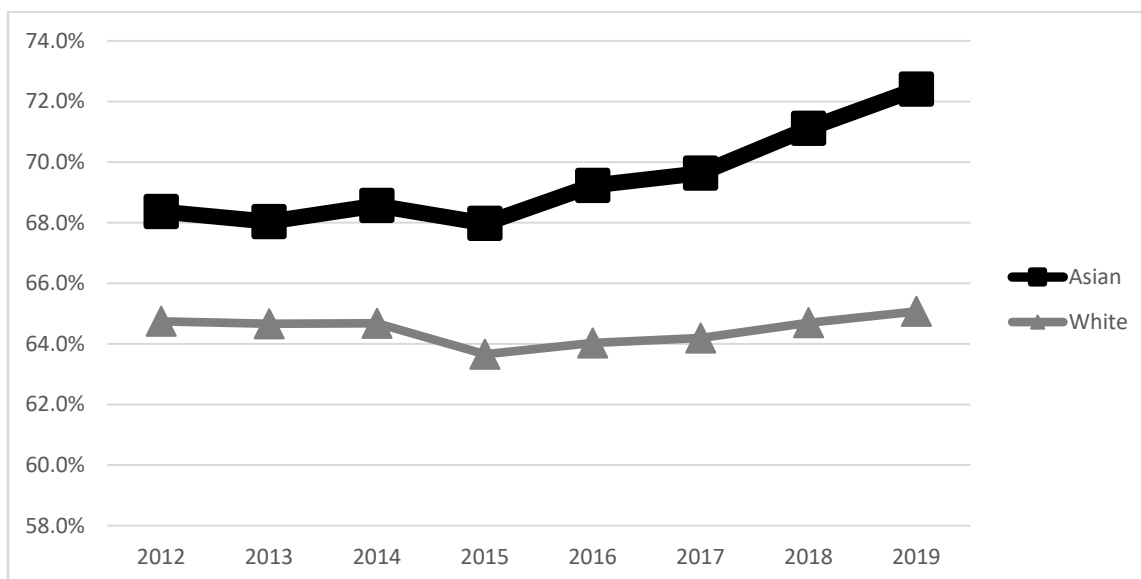
Performance

As presented in Figure 14, higher percentages of Asian students passed AP exams compared to White students for each year of the 2012 through the 2019 school years. In general, the percentage of Asian students who passed AP exams increased from the 2012 through the 2019 school years, whereas the percentage of White students who passed AP exams were fairly stable. As discussed in the previous sections, statistically significant differences were revealed for all comparisons of AP exam scores for all eight years.

Effect sizes increased from below small to small, which indicates that Asian students outperformed White students and that the gaps between Asian students and White students increased.

Figure 14

Comparisons of Percentage of Students Obtaining AP Exam Score of 3, 4, or 5 for Asian Students and White Students for the 2012 Through the 2019 School Years



Summary of the Trends for Asian Females and Asian Males in the AP Exam

Performance

Addressed in research question six was the extent to which trends were present in the AP exam performance of Asian females and Asian males over eight years of archival data. A notable difference from the nationwide top five most frequently taken exams was that two STEM (Science, Technology, Engineering, Mathematics) AP exams, Calculus AB and Biology, were always in the top five most frequently taken exams for Asian students. Biology AP exams moved from fifth to fourth. Only one STEM AP exam, Calculus AB, was in the nationwide top five most frequently taken exams from the 2012

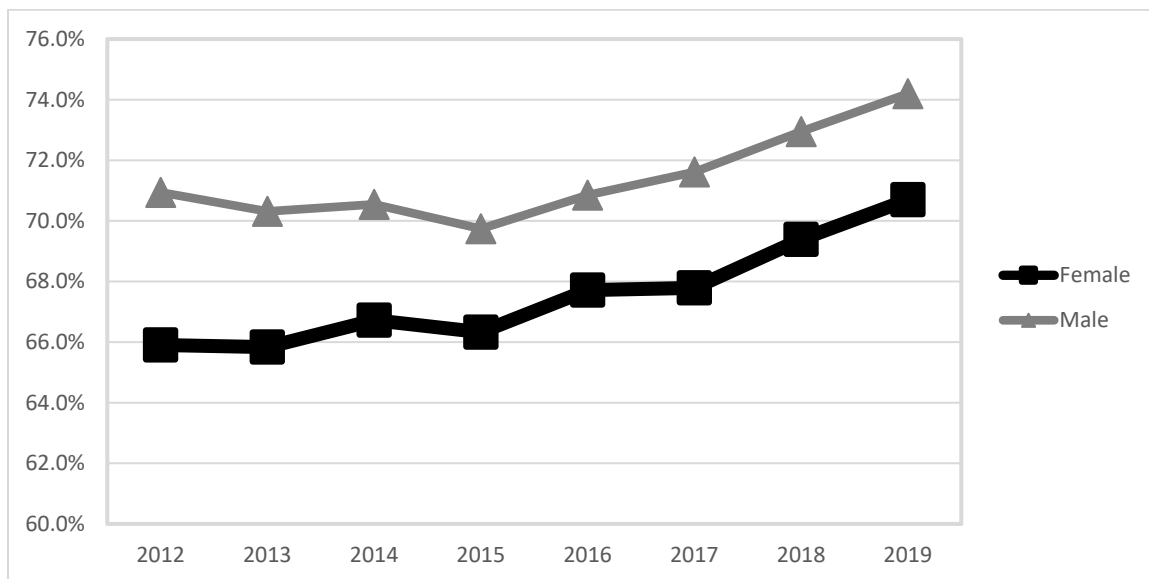
to the 2017 school years. No STEM subject AP exams were in the top five exams in the 2018 and the 2019 school years. As such, more Asian students took AP STEM-related exams than did White students.

Over the eight school years, a higher percentage of Asian males earned an AP exam score of 5 or 4 than was earned by Asian females. The large gap of the mean score differences in AP exams between Asian females and males were on the AP Biology and Calculus exams. However, in English Literature & Composition, one of the top five most frequently taken exams in the 2012 to 2017 school years, a higher percentage of Asian females obtained a score of 5 or 4 than males did, although English Literature & Composition moved out of the top five most frequently taken exams for Asian students after the 2017 school year. This pattern—in which Asian females earned a lower percentage of a score of 5 or 4 in overall AP exams, especially in STEM fields, Biology and Calculus AP exams, but a higher percentage of Asian females took AP exams—was observed across over the eight school years in each school year.

In Figure 15, higher percentages of Asian males passed the AP exams compared to Asian females for each year of the 2012 through the 2019 school years. The percentage points differences between Asian females and Asian males were slightly decreased. Thus, the gaps of overall mean scores of AP exams between Asian females and Asian males were slightly closing.

Figure 15

Comparisons of Percentage of Students Obtaining AP Exam Score of 3, 4, or 5 for Asian Females and Asian Males for the 2012 Through the 2019 School Years



As previously discussed, statistically significant differences were established for all comparisons of AP exam scores for all eight years Asian males outperformed Asian females in AP exams, especially in the STEM fields of AP exams, such as Biology and Calculus AB, certain subject AP exams, such as AP English Literature & Composition, Asian females did perform well compared to Asian males. In general, more Asian students took AP exams and the mean scores of AP exams increased across all subjects.

Relationship to Existing Research Literature

In the last two decades, AP courses and AP exams have become popular in high schools, with participation in both areas having increased rapidly. The main benefits of taking AP courses and AP exams include the opportunities to earn college credits for high school students while still in high school and enhancing their college applications if earned high AP scores. According to the College Board (2019) AP exam data released on its website, before the COVID pandemic, almost three million high school students took at least one AP exam in the 2019 school year. As such, it is necessary to analyze the relationship between AP courses and exam performance and academic success in college and to close equity gaps if they exist. Therefore, numerous studies have been conducted, and equity gaps, including ethnicity and gender, have been identified (e.g., Havard & Howard, 2019; Moore & Slate, 2011; 2019; Trusz, 2020; Venkateswaran, 2004; Willingham & Cole, 1997).

As presented in the results, findings in the current study were congruent with the results of previous studies (Moore et al., 2010; Moore et al., 2011; Morris & Slate, 2012). In particular, Moore et al. (2009) determined, after analyzing the AP exam score performance of Asian students for over 14 years that statistically significant differences were present. In their multiyear, statewide analysis, the performance of Asian girls on AP exams was consistently lower than the average AP exam performance of Asian boys. The findings of this study confirmed the achievement gaps by gender in AP exam performances. Of note, Asian females had higher average AP exam scores than Asian males did in the English Literature & Composition AP exam, one of the top five most frequently taken exam AP exams. This finding is congruent with previous studies in

which females performed better than males in fields related to language arts (Trusz, 2020; van der Vleuten et al., 2016).

In a related study, Moore et al. (2010) investigated overall scores in AP exams of Asian students compared to White students over 12 school years. In their study, statistically significant differences were present in each year. Asian students consistently outperformed White students. Gaps in the average AP exam scores between Asian students and White students increased over the 12 school years of data analyzed in the Moore et al. (2010) study. With respect to the findings delineated in this dissertation, Asian students consistently outperformed White students, as well as demonstrated an increase in the gap between them and White students in their average AP exam performance.

In summary, similar results reported in this study were congruent with the findings reported by Moore et al. (2009) and Moore and Slate (2008). Racial/ethnic and gender differences continue to be present in average AP exam scores. The findings of this study were also commensurate with previous researchers who established the presence of achievement gaps by ethnicity/race, gaps that increased over the eight years of data that were analyzed herein. Gaps in AP exam performance slightly decreased for Asian females and Asian males.

Relationship to Theoretical Frameworks

Four theories, including CRT, Asian critical theory (AsianCrit), the model minority, and cultural capital theory, were used in this dissertation as theoretical frameworks to examine AP exam performance inequities. As explained by Solorzano and Yosso (2011), CRT offers a basic theoretical foundation for reducing race or gender

bias opportunities by identifying the existence of racial inequalities. In higher education, CRT was used to reveal the existing educational inequities and systemic racism. Rooted in and stemmed from CRT, proponents of Asian critical theory and the model minority theory focus on analyzing anti-Asian and criticizing the view of Asian Americans as a model minority and defined a conceptual foundation on racism and Asian Americans (Chang, 2017). Labeled as a model minority, Asian Americans confront bias and discrimination due to economic success and educational attainment.

The findings in this dissertation revealed two trends on the comparisons of AP exam performance between Asian students and White students. First, Asian students performed statistically significantly better than White students did in AP exams. Second, higher percentages of Asian students took AP STEM-related exams than did White students. These results were consistent with the results of numerous previous researchers (e.g., Moore et al., 2009; Moore et al., 2010; Morris & Slate, 2012; Sakura-Lemessy et al., 2009), who revealed the presence of statistically significant differences in academic achievement by gender and Asian students outperformed White students in AP exams. The stereotype of Asian students as a model minority negatively influenced academic expectations of Asian students.

In addition, the cultural capital theory was used as a lens to understand the educational attainment differences in gender for Asian students. As the main source of cultural reproduction, education provides opportunities to individuals moving up their current social and economic class. However, the existing inequity in education is an obstacle to the mobility of social-economic classes (Bourdieu, 1977). The application of the cultural capital theory deduced that gender inequity in education exists as a result of

cultural reproduction carried from one generation to the next. Aligned with prior studies (Holmes et al., 2013; Moore et al., 2011), the findings of this study are supportive that cultural capital theory provides an appropriate basis for understanding educational equity (Mitchell et al., 2014; Moore et al., 2011). Asian males performed statistically significantly better than did Asian females, especially in the STEM fields. The only AP subject exam that Asian females outperformed Asian males was AP English Literature & Composite.

In summary, given the results of this study, disparate AP exam outcomes were discovered. The trend of gaps in AP exam performance between Asian females and Asian males tends to close in recent years, which would be efforts made by the policies and administrators. Although Asian students outperformed White students in AP exams presented in several previous studies and this dissertation, due to the lack of research on Asian students' academic and social behaviors, there is no sufficient compelling research evidence to spur action toward needed resolutions.

Implications for Policy and for Practice

The AP program and exams have been promoted by administrations since President Bush due to the fact that AP programs and exams were considered as strategies for helping students to shorten the path to complete a bachelor's degree and closing the academic gaps (Obama, 2011; U.S. Department of Education, 2005). However, after 10 years from the previous studies on the comparisons of AP exam performance between Asian students and White students (Moore et al., 2010) and between Asian females and Asian males (Moore et al., 2011), achievement gaps were still present in this study. Asian students outperformed White students and Asian males had higher AP mean scores

than Asian females. Subsequently, based upon these findings, several implications for policy and for practice can be recommended.

First, school leaders and policymakers should identify the common characteristics of better performance in the AP exams from Asian students and create new policies on stimulating those common characteristics to be implemented to other ethnic/racial groups. Through legislative mandates (e.g., funding and financial penalties) strategies geared toward closing the achievement gap. For example, if the better performance was due to the high participation of AP courses, consequently, the policy needs to provide incentive strategies to encourage students to take AP courses.

Second, Asians are the most diverse ethnic group and inequities in academic achievement persisted in subgroups of Asian Americans (Chang, 2017). Therefore, the better performance in AP exams for Asian students does not mean Asian students should be excluded from academic and emotional support. Policymakers and legislators should not overlook the needs of subgroups of Asian students, and policies in which Asian subgroups are emphasized, such as low-income students or students without having parents' support, should be established.

Also, Asian students are overrepresented and outperform other ethnic/racial groups of students on AP exams, based on the results of this study and other investigations. However, as being recognized as a “Model Minority” stereotype by society, Asian students are expected to earn over achievement scores. The immense expectation of success can cause students psychological distress and physiological stress (Museus, 2014; Wong et al., 2010). Policymakers and legislators are encouraged to look closely at the mental health needs of Asian students. Reviewing mental health issues for

Asian students and encouraging them to seek help from school counselors should be taken place. Especially, the suffering from high academic workload for Asian students should be examined. Better performance does not mean problem-free performance. Those high exam scores might be due to the overloaded hard work. In addition, effective strategies to increase the non-academic success of Asian students, such as leadership, should be taken place. More resources need to be devoted to the mental health for Asian students.

Recommendations for Future Research

Several suggestions for future research can be derived from the findings of this doctoral dissertation. First, achievement gaps were present in AP exams in this study. However, the factors that caused the differences were not analyzed because it was not an attempt for this study. Therefore, future researchers may conduct qualitative or mixed methods studies to investigate the potential cause of the differences that exist and reveal insight into factors that influence Asian students, especially Asian males earning high AP exam scores. For example, what factors might influence the most for these results? What were the motivations for Asian students to be willing to take AP exams and earned high scores?

In addition, as this study was based entirely on national archival data on AP exam performance, the extent to which the results of this dissertation would be generalizable to any particular state is not known. As such, researchers are encouraged to conduct specific state-level investigations. Specifically, future researchers are encouraged to conduct state-level investigations in the AP exam performance in California, New York, and Texas, because a large Asian population resides in those states. Discrepancies might

be observed in AP exam performance between states that have high percentage of Asian students and states that have low percentages of Asian students.

To supplement the findings of this study regarding the AP exam performance of female students and of male students, this study should be replicated to include the comparisons of AP performance in gender differences for other ethnicity groups. Did males within other ethnicity groups had statistically significant better performance than their female peers? Those performances were not analyzed in this investigation.

Finally, future researchers should extend this study by expanding the years of data analyzed. As the results discussed in the previous chapter, in general, both Asian and White students perform better in the most recent year of data analyzed than in the 2012 school year. As noted, COVID 19 has changed and is still changing the format of learning for students who take AP courses. Are similar performances present for Asian students following the COVID-10 pandemic and how will the trends that were documented be following the COVID 19 pandemic? Future research will need to be conducted especially for students who took AP courses fully online in the 2020 and 2021 school years.

Conclusion

In this multiyear, nationwide analysis, the ethnic (i.e., Asian, White) and gender disparities in AP exam performance for Asian students were analyzed for the 2012 through the 2019 school years. The top five most frequently taken AP exams were identified and analyzed for comparisons. Four research questions were repeated for the eight years, and national trends in overall AP exam performance were documented in this study.

Over the eight school years, all comparisons were statistically significant, indicating that Asian students had better overall AP exam performance than did White students. Moreover, Asian males outperformed Asian female. Effect sizes for the statistically significant differences between Asian students and White students in AP exam scores steadily increased from below small to small, whereas the effect sizes for Asian females and Asian males remained consistent.

In general, for the examinations of mean score differences over the eight years, although the increases of the mean scores were observed for both Asian students and White students, the achievement gap between Asian students and White students slightly increased in favor of Asians. While the gaps slightly decreased between Asian females and males. In addition, Asian students intended to take STEM AP exams. The largest gap between Asian students and White students in the top five most frequently taken exams performance was one of the STEM AP exams, AP Calculus AB, and the smallest gap was AP Government & Politics U.S.. As such, efforts to improve the disparities of ethnic (i.e., Asian, White) and gender in AP exam performance is needed.

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APPENDIX

IRB Approval

IRB-2021-187 - Initial: Exempt from IRB Review



do-not-reply@cayuse.com

Thu 7/1/2021 8:03 AM

To: Martinez-Garcia, Cynthia; Li, Xiaohong

Cc: Miles, Sharla



Date: Jul 1, 2021 10:02:54 AM CDT

TO: Xiaohong Li Cynthia Martinez-Garcia

FROM: SHSU IRB

PROJECT TITLE: Gender Differences in Advanced Placement Exam Performance for Asian Students: A Multiyear Nationwide Analysis

PROTOCOL #: IRB-2021-187

SUBMISSION TYPE: Initial

ACTION: Exempt

DECISION DATE: July 1, 2021

EXEMPT REVIEW CATEGORY: Category 4. Secondary research for which consent is not required: Secondary research uses of identifiable private information or identifiable biospecimens, if at least one of the following criteria is met:

- (i) The identifiable private information or identifiable biospecimens are publicly available;
- (ii) Information, which may include information about biospecimens, is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects, the investigator does not contact the subjects, and the investigator will not re-identify subjects;
- (iii) The research involves only information collection and analysis involving the investigator's use of identifiable health information when that use is regulated under 45 CFR parts 160 and 164, subparts A and E, for the purposes of "health care operations" or "research" as those terms are defined at 45 CFR 164.501 or for "public health activities and purposes" as described under 45 CFR 164.512(b); or
- (iv) The research is conducted by, or on behalf of, a Federal department or agency using government-generated or government-collected information obtained for nonresearch activities, if the research generates identifiable private information that is or will be maintained on information technology that is subject to and in compliance with section 208(b) of the E-Government Act of 2002, 44 U.S.C. 3501 note, if all of the identifiable private information collected, used, or generated as part of the activity will be maintained in systems of records subject to the Privacy Act of 1974, 5 U.S.C. 552a, and, if applicable, the information used in the research was collected subject to the Paperwork Reduction Act of 1995, 44 U.S.C. 3501 et seq.

OPPORTUNITY TO PROVIDE FEEDBACK: To access the survey, click [here](#). It only takes 10 minutes of your time and is voluntary. The results will be used internally to make improvements to the IRB application and/or process. Thank you for your time.

Greetings,

Thank you for your submission of Initial Review materials for this project. The Sam Houston State University (SHSU) IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will retain a copy of this correspondence within our records.

*** What should investigators do when considering changes to an exempt study that could make it nonexempt?**

It is the PI's responsibility to consult with the IRB whenever questions arise about whether planned changes to an exempt study might make that study nonexempt human subjects research.

In this case, please make available sufficient information to the IRB so it can make a correct determination.

If you have any questions, please contact the IRB Office at 936-294-4875 or irb@shsu.edu. Please include your project title and protocol number in all correspondence with this committee.

Sincerely,

Chase Young, Ph.D.

Chair, IRB

Hannah R. Gerber, Ph.D.

Co-Chair, IRB

VITA

Xiaohong Li

EDUCATION

Doctor of Education
Educational Leadership
Sam Houston State University, Huntsville, TX

Master of Science
Statistics
Sam Houston State University, Huntsville, TX

Master of Science
Land & Property Development
Texas A&M University, College Station, TX

Bachelor of Science
Urban Planning and Regional Studies
College of Arts and Science of Beijing Union University, Beijing, China

ACADEMIC EMPLOYMENT

July 2021-present	Taft College, West Kern Community College District Vice President of Information and Institutional Effectiveness
April 2020-June 2021	Taft College, West Kern Community College District Executive Director of Institutional Research & Planning Interim Executive Director of Information Technology Services
July 2019-June 2021	Taft College, West Kern Community College District Executive Director of Institutional Research & Planning
February 2018-June 2019	Sam Houston State University Director of Institutional Research
August 2015- February 2018	Sam Houston State University Assistant Director of Institutional Research
December 2009-August 2015	Sam Houston State University Senior Research Analyst at Institutional Research

June 2008- December 2009 Sam Houston State University
 Research Analyst II at Institutional Research

REFEREED PUBLICATIONS

Zientek, J., Albert, J., Manage, A., & Li, X. (2018). State-Mandated Policy: Effects on Enrollment at One University. *Journal of Developmental Education (JDE)*.

Jordan, J., Wilcox, R., Paitson, D., Parker, M., Li, X., & Onwuegbuzie, A. J. (2016). The role of doctoral studies on the relationships between select doctoral students and their partners: A collective case study. *The Qualitative Report*.

Jordan, J., Parker, M., Li, X., & Onwuegbuzie, A. J. (2015). Effect of study skills program participation on undergraduate student academic performance. *International Journal of Education*, 7(1), 247-265. doi:10.5296/ije.v7i1.6888

Li, X. (2016). Differences in student satisfaction as a function of instruction method. In L. Liu (Eds.), *Proceedings of the International Conference on Humanity and Social Science* (pp. 211-217). Singapore: World Scientific Publishing Co. Pte. Ltd. doi:10.1142/9789813208506_0031

Li, X., Holt, M., & Caso, R. (2008). *Applying Bayesian network to the examination of the student outcomes at Sam Houston State University*. In JSM Proceedings, Social Statistics Section. Denver, CO: American Statistical Association. 3602-3609.

PRESENTATIONS

Li, X. (March, 2017). *First-Year Experience Program for Female Students in STEM Majors*. Presented at the 2017 Annual Higher Learning Commission (HLC) Annual Conference. Chicago, IL.

Li, X. (April, 2016). *Differences in student satisfaction as a function of instruction method*. International conference on Humanity and Social Science, Xiamen, China.

Li, X. (March, 2013). *The examination of factors impacting Hispanic student college success*. Annual Conference of Texas Association of Institutional Research (TAIR), Galveston, TX.

Li, X., & Caso, R. (March, 2009). *Looking backwards for profiles of success*. Annual Conference of Texas Association of Institutional Research (TAIR), Lubbock, TX.