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The Influence of Open Access on Advanced Placement Achievement

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The Influence of Open Access on Advanced Placement Achievement

by

Shanna Howell

Submitted in Partial Fulfillment of the Requirements for the degree of
Doctor of Education
College of Education and Human Services

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APPROVAL FOR SUCCESSFUL DEFENSE

Shanna Howell has successfully defended and made the required modifications to the text of the doctoral dissertation for the Ed.D. during this Spring Semester 2019.

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The mentor and any other committee members who wish to review revisions will sign and date this document only when revisions have been completed. Please return this form to the Office of Graduate Studies, where it will be placed in the candidate's file and submit a copy with your final dissertation to be bound as page number two.
Abstract

Preparing students for higher education is a primary aim of K-12 education. However, some high school graduates do not meet college readiness benchmarks and must take remedial noncredit courses in college (Adams, 2013; Butrymowicz, 2017). One of the strongest predictors of student success in college is rich and rigorous high school curriculum (Adelman, 1999; Adelman, 2006). The Advanced Placement (AP) program offers high school students college-level courses that can earn them college credits from participating institutions (Kolluri, 2018; Rothschild, 1999). College Board research overwhelmingly has indicated that the AP program is beneficial for students (Casserly, 1986; Dodd et al., 2002; Eimers & Mullen, 2003; Hargrove et al., 2008; Santoli, 2002; Warne, 2017). Independent research has not been as prevalent or as positive about the impact of the AP program (Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009; Sadler & Tai, 2007). However, benefits are only available to high school students who have access to AP courses. The College Board’s 2002 Equity Policy Statement emphasizes expanding the AP program and removing barriers to students’ access to AP courses (College Board, 2002).

This study sought to examine the influence of an open access policy on AP achievement within a regional public high school district in central New Jersey. Prior to the 2012–2013 school year, students in this district were required to meet enrollment criteria to enroll in an AP course. These criteria included a minimum grade of A- in a regular course or a minimum grade of B- in an honors course in the previous year course in that subject area. In September of 2012, the district removed the enrollment criteria as a barrier to AP enrollment. This study analyzed the AP exam scores of students in six high schools in a regional high school district for AP Calculus AB, AP English Language and Composition,
AP Physics 1, and AP United States History. The dependent variables in this study are student scores on AP exams. The independent variables are the designation of students as “traditional” or “nontraditional” students as defined by the qualifying criteria. The control variables are grade point average (GPA), PSAT/NMSQT score, socioeconomic status (SES), and prior AP experience. Findings indicate that traditional students scored statistically significantly higher on the AP Calculus, AP English Language and Composition, and AP United States History exams but not on the AP Physics 1 exam. However, the designation of student type was not a statistically significant predictor of AP exam performance when controlling for GPA, PSAT/NMSQT score, SES, and prior AP experience.
Dedication

To my mom and brothers: thank you for inspiring me to seek opportunities.

To my friends who are family: thank you for providing the conditions that helped me to embrace opportunities.

To every teacher and educational leader: thank you for providing opportunities that give all students the promise of a successful future.
Acknowledgments

I am deeply grateful to the individuals who supported me on this adventure. My mentor, Dr. Gutmore, showed me patience and encouragement that kept me on the journey. From my first class in the Seton Hall Educational Leadership doctoral program to the final submission of my dissertation, Dr. Gutmore has continuously demonstrated to me why simplicity is the ultimate sophistication.

Dr. Tienken has been an inspiration in my educational journey since 2006. In my tenure as a Scarlet Knight, he taught me how to be a teacher of teachers and maintain an idealism focused on progress. At Seton Hall University, Dr. Tienken further developed my philosophy as an educational leader—to be kind, listen and make others shine. His relentless focus on our most important stakeholders, our students, has inspired my north star. Grazie!

Dr. Graber models a commitment to supporting practitioners and developing school leaders. His dedication to educational leadership is inspiring and sets an example for us all.

I also greatly appreciate the leadership of the district that inspired this journey—for embracing equity and opportunity for all students and implementing practices that ensure all students can achieve their highest potential.
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CHAPTER I: Introduction to the Study

This research is organized into five chapters. Chapter I provides background information; a statement of the problem; the study’s purpose; the research questions; the study’s significance; limitations and delimitations; and definitions of the study’s terms. Chapter II focuses on relevant literature about the Advanced Placement (AP) program, including its influence on student achievement and college admissions, enrollment policies, and open access. Chapter III explains the data collection methods, the rationale for using the selected data, the research questions, the population under study, and the data analysis methods. Chapter IV presents the data analysis and interpretations of the findings. Chapter V further elaborates on the data analysis and includes conclusions, implications for policy and practice, and recommendations for future research.

The AP program of the College Board (the nonprofit examination board that administers the AP program) began in the 1950s. It offers high school students the opportunity to enroll in courses equivalent to entry-level college courses (Santoli, 2002). Its original intent was to allow select high school students to earn college credit by passing standardized end-of-course exams (Rothschild, 1999). In Four Decades of the Advanced Placement Program, Rothschild (1999) cited a committee report published by the original founders of the program. This foundational document provides insight into the origins of the AP program and includes references to “superior” students. Dudley (1958), an early director of the AP program, summarized the program’s philosophy this way:

The basic philosophy of the Advanced Placement Program is simply that all students are not created equal. The more mature level of study and discussion and examination demanded in
Advanced Placement classes provides the stimulus our superior students need if they are to receive the education best suited to their high potential (p. 1).

Over half a century later, the AP program has evolved and expanded; however, some fundamental characteristics of the program remain the same—high school students take “college-level” courses in their high schools and can take the College Board AP Exam to demonstrate mastery and earn college credits or advancement. AP courses conform to the required course description, including enumerated content and the academic skills required in a college-level course. At completion of the course, students can take the standardized exam that measures the identified college-level knowledge and skills. Interest in the AP program has grown as the value of a postsecondary education has become increasingly more important. Indeed, by 2025, 60% of new jobs will require a postsecondary credential (Lumina Foundation, 2016).

The goals of the AP program have evolved. In the College Board’s 10th Annual Report to the Nation (2014), the program’s objectives were outlined as follows:

The Advanced Placement Program—the collaborative community of AP teachers and students, states, districts, schools, colleges, and universities committed to the daily work of developing college-level knowledge and skills has grown significantly in the past 10 years. This expansion is built on the deep conviction that all students who are academically prepared—no matter their location, background, or socioeconomic status—deserve the opportunity to access the rigor and benefits of AP. (p. 5)

Currently, there are 38 AP courses created collaboratively with college and high school faculty. More than 90% of 4-year colleges and universities in the United States offer students introductory course credit, advanced placement, or both based on a successful score
of 3 or higher on the AP exam, which is scored on a scale of 1 to 5, with 1 being the lowest and 5 the highest and equivalent to the top A-level work in the corresponding college course. The decision to award credit is made by the college or university (College Board, 2018a). The College Board reported that of the 1,380 institutions they surveyed, 68% offer credit for a score of 3 or higher, 30% offer credit for a score of 4 or higher, and 2% offer credit for a score of 5 only. Eight schools do not accept AP course credit, including Brown and Dartmouth (Adams, 2014).

Proponents of the AP program have identified several advantages of taking AP courses, including possible college credit, higher college GPA, and the increased likelihood of finishing college in 4 years (Dodd, Fitzpatrick, De Ayala, & Jennings, 2002; Hargrove, Godin, & Dodd, 2008). Proponents believe that more challenging high school courses can better prepare students for the rigors of college and that college dropout rates are lower among AP students (Santoli, 2002). In addition to the benefits of college credit or advancement, by the 1980s, a significant number of universities had begun using enrollment in AP courses as one aspect of admission criteria (Klopfenstein & Thomas, 2009). This contributed to an increase in interest and enrollment in AP courses because the impact of an AP course on a student’s transcript was a factor in enrollment decisions, irrespective of the score on the AP exam.

The College Board or collaborates of the College Board (e.g., ETS) sponsor most of the research on the AP program. Hence, limited independent research exists; however, what little research there is in this area has explored the influence of the AP program on student success in college by using various measures of student success (Warne, 2017). The College Board has encouraged open access to AP courses and increased enrollment of
underrepresented subgroups, and the program is marketed to any student “willing to do the work” (Manzo, 2005, p. 11). However, few research studies have explored the influence of access policies on enrollment and achievement in AP classes. Because schools make decisions on enrollment criteria, they could benefit from research that identifies the impact of these decisions on student achievement.

In 2008, Miron conducted research at a suburban high school in New Jersey that “relaxed” admission criteria for enrollment in select AP courses. Miron determined that even a 20% increase in student enrollment between 2006 and 2007 did not “compromise student achievement as measured by AP scores. This is true even if you remove preexisting individual differences among the students such as GPA, AP experience and PSAT scores” (2008, p. 95). Although Miron’s research did not examine a pure open enrollment policy, just a modified admission policy that included individuals identified as “fringe” students, it demonstrated that opening access, albeit limited access, did not cause “harm” to overall student achievement (Miron, 2008).

**Statement of the Problem**

Research exists on the influence of the AP program—including enrollment in AP courses and achievement on the AP exam—on student success in higher education (Casserly, 1986; Hargrove et al., 2008; Santoli, 2002; Thompson & Rust, 2007; Willingham & Morris, 1986). In the 10th Annual AP Report to the Nation, the College Board (2014) demonstrated that expansion efforts in the last decade have resulted in significant increases in the number of students with access to AP opportunities. For example, between 2003 and 2013, the number of AP exams increased from 1,238,511 to 3,153,014. The College Board
has maintained that there are still academically capable students who do not participate in the AP program. Many districts across the country have responded to this research by expanding their AP programs, specifically opening access in varying ways to provide more equitable access. Still, many high school students do not have the opportunity to participate in the AP program despite having the academic potential to succeed. The influence of an open access policy, specifically on nontraditional students, has yet to be determined; however, several districts have policies that limit nontraditional students’ participation. According to the College Board, in 2011, fewer than 38% of students with the potential to succeed on an AP exam took one (College Board, 2012).

Prior to open access policies, many districts established criteria that limited course access based on defined criteria. These criteria included course grades, assessment scores, GPA, and teacher recommendations. The transition to less restrictive enrollment policies for advanced coursework is consistent with shifts in K–12 education to eliminate tracking and academic levels in favor of more heterogeneous classroom environments.

Still, limited quantitative research exists on the influence of open enrollment on student achievement, particularly for students who did not meet prior enrollment criteria. The College Board has encouraged open enrollment practices, and many districts continue to remove barriers to enrollment. The growth in the number of students enrolled in AP courses has raised concerns regarding a diminished or “watered down” program (Banchero, 2011; Mollison, 2006). Expanding the AP program requires a significant commitment of time and resources although the literature on the efficacy of the AP program lacks consistent findings. An examination of the influence of open access policies on student achievement could
contribute to the literature and help improve programs for all students, ensuring college and career readiness.

**Purpose of the Study**

The purpose for the current study was to explain the influence of an open access policy for AP course enrollment on academic achievement as measured by scores on the College Board AP exams, specifically Calculus AB, English Language and Composition, Physics 1, and United States History. The current study analyzed a suburban public regional high school district that receives almost 11,000 students from seven K–8 districts and eight municipalities. Students are from a wide range of socioeconomic backgrounds. The racial make-up of the student population includes 76% white, 9% Asian, 9% Hispanic, 4% black, and 2% multiracial (New Jersey Department of Education, 2017). Academically, over 90% of students in the district pursue a 2- or 4-year degree; a large number attend the most competitive colleges in the nation. Standardized test scores (e.g., SAT, ACT) consistently exceed state and national averages, and all six high schools boast a variety of national, state, and local accolades and honors.

Prior to the 2012–2013 school year, students within the district were required to meet specified admission criteria for enrollment in an AP course; these admission criteria included a combination of a teacher recommendation and a specific grade requirement (minimum A- in an academic course, minimum B- in an honors course). In September 2012, the district removed all barriers to enrollment except for prerequisite courses, for example, United States History I, prior to enrolling in AP United States History. This was a significant change. Overall, the enrollment in AP courses increased with the inclusion of nontraditional
students. For the present study, a traditional student is defined as a student who achieved a minimum grade of an A- in an academic course or a minimum grade of a B- in an honors course preceding enrollment in an AP course. A nontraditional student is defined as a student who achieved a grade below an A- in an academic course or a grade below a B- in an honors course in the course preceding the AP course.

In some districts, students are required to take the AP exam as a condition of enrolling in the AP course. In the district studied, taking the AP exam is voluntary although there are incentives for taking the exam. If students take the AP exam and maintain an overall A- average in the course, they are exempt from the final course exam at the conclusion of the school year, regardless of the score they achieve on the AP exam. There is also a fee to take the exam ($93 in 2017) that is not paid by the student. However, federal, state, and district financial support, including fee waivers, is provided for identified students.

According to the College Board, the stated benefits of the AP program—including preparation for higher education and advantages in the college admissions process—require educators to assess pathways for all students to access these opportunities. School districts grapple between maintaining defined criteria for AP course enrollment to “safeguard” student success, but this comes at the risk of denying a potentially qualified student an opportunity. Structural barriers within a school system, including tracking and limiting access to selected students through overt measures or subtle biases, can further widen barriers and increase gaps in academic opportunities. The tracking of students into certain course progressions is often the result of the decisions made very early on in a student’s academic career. As a result, students may not have all available opportunities, including the opportunity to take an AP course, in their later high school years. Opportunity gaps
invariably lead to achievement gaps, and these gaps are significant for several reasons. AP course enrollment can influence admission decisions or scholarship opportunities and lower the cost of higher education or the time to degree completion. These gaps may restrict access to the AP program to qualified students with challenging learning opportunities that have long-lasting impacts. If school districts eliminate systemic and structural barriers, it may be possible to close these gaps.

**Research Questions and Hypotheses**

The current study was guided by the following overarching questions:

**Research Question 1**: What is the relationship between the type of student (traditional versus nontraditional) and student achievement as measured by AP exam scores?

**Null Hypothesis 1**: There is no statistically significant difference between the type of student (traditional versus nontraditional) and achievement on the AP exam as measured by AP exam scores.

**Research Question 2**: What is the relationship between the type of student (traditional versus nontraditional) and student achievement as measured by AP exam scores when controlling for GPA, PSAT/NMSQT, student SES, and prior AP experience?

**Null Hypothesis 2a**: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP Calculus AB exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

**Null Hypothesis 2b**: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP English Language and Composition exam score
when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

**Null Hypothesis 2c:** There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP Physics 1 exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

**Null Hypothesis 2d:** There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP United States History exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

**Independent Variables**

For the current study, the independent variables include the type of student, which is defined by district enrollment criteria prior to open access; traditional student and nontraditional student; and specific student control variables: 2015-2016 GPA, most recent PSAT/NMSQT score, and student SES, defined here by free and reduced lunch status and student prior year AP experience.

**Dependent Variables**

The dependent variables were student scores on the specified AP exams, Calculus AB, English Language and Composition, Physics 1, and United States History. AP exam scores are primarily used to predict student readiness for placement into higher-level college courses. AP exam scores are reported on a 5-point scale, with 1 being the equivalent of “no recommendation” and 5 being the equivalent of “extremely well qualified.” A minimum score of 3 is considered “passing” and the equivalent for placement into higher-level college
courses. Individual universities and colleges establish criteria for AP credit acceptance. A variety of studies and empirical data have been used to support the validity of AP exam scores in course placement decisions.

**Significance of the Study**

College enrollment and completion is a de facto requirement for young adults in today’s globally competitive world. AP courses have long stood as a mechanism for high-achieving students to challenge themselves academically and distinguish themselves in the college admissions process. Preparing students for higher education is a primary aim of K–12 education. Indeed, one of the strongest predictors of student success in college is a rich and rigorous course of study in high school (Adelman, 1999; Adelman, 2006). The AP program offers college-level course work to high school students, providing them with an opportunity to earn college credits from participating institutions (Rothschild, 1999). College Board research overwhelmingly has indicated that the AP program is beneficial for students (Casserly, 1986; Dodd et al., 2002; Eimers & Mullen, 2003; Hargrove et al., 2008; Santoli, 2002; Warne, 2017). Independent research has not been as prevalent or as positive about the impact of the AP program (Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009; Sadler & Tai, 2007). Still, the benefits of the AP program are only available if students have access to AP courses in high school. Many districts across the country have both formal and tacit policies that create barriers to enrollment in AP courses. In this vein, the National Research Council reviewed over 100 high school curriculum guides and reported that the enrollment criteria for AP courses ranged from open access to prerequisite criteria, including minimum PSAT/NMSQT scores, minimum prior year grades, teacher
recommendations, and subjective criteria, including motivation and study habits (National Research Council, 2002). Prior student academic success and course taking are two of the more common prerequisite criteria. Districts have the autonomy to create their own enrollment criteria and policies (Cassity, 2013). Therefore, there are widely divergent policies across the country, ranging from open access to strict gatekeeping (Flores & Gomez, 2011; Zinith, 2016). Currently, approximately 35% of high schools that offer AP courses have an open access policy that permits students to enroll in AP courses without meeting established criteria (Farkas & Duffett, 2009); however, these are local decisions, and little research has been conducted to identify the trends or influences of specific policies. The expansion of open access policies and practices has highlighted an area of research that can identify if there is a significant difference between traditional AP students and nontraditional AP students. Changing access policies has been shown to expand the number of students enrolled in AP courses (Farkas & Duffett, 2009). During this expansion, there has been a decline in the percentage of students passing AP exams, from 64.3% in 2001 to 59.8% in 2011 (Warne, Larsen, Anderson, & Odasso, 2015). Hence, stakeholders have questioned the effectiveness of open access if fewer students are achieving passing scores on AP exams. In line with this, some selective universities do not award course credit unless the student achieves a score of 4 or 5 (Farkas & Duffett, 2009; Lichten, 2010). The current study is designed to examine the influence of open access on nontraditional students’ academic achievement as measured by AP exam scores. The literature has indicated there is a gap regarding the influence of open access on student achievement.

The present research contributes to the limited body of knowledge on open access policies for AP courses. Districts can draw from the current research when considering if
open access policies are appropriate for their schools and students. Because of the lack of quantitative, explanatory literature on this topic, school leaders and policy makers have trouble determining research-based policy decisions that have proven to positively impact student achievement. Therefore, the current study aimed to strengthen the validity of the research using quantitative research.

The results from a similar study found that relaxing admission criteria to include “fringe students” did not affect overall student achievement negatively, as measured by AP exam scores from 2006 to 2007, when controlling for preexisting differences in students (Miron, 2008). Fringe students had statistically significant lower AP exam scores than regularly admitted students. However, Miron still noted that “further relaxation of admission criteria is warranted” and that “increasing AP enrollment has not led to ‘doomsday’ and should be further encouraged” (2008, p. 107). Miron’s research included a smaller overall sample size and analyzed the achievement for all AP courses and exams cumulatively from 2006 to 2007. The current research disaggregates achievement by individual tests and is narrowed to four selected AP courses: Calculus AB, English Language and Composition, Physics 1, and United States History. Additionally, the present research includes all nontraditional students enrolled in the AP course, while Miron’s research included only “fringe” students, who were selected by AP teachers and identified as slightly less qualified than traditional students. Miron (2008) admittedly noted that the increase of students was not uniform and that not all staff members agreed with the change in philosophy that impacted the inclusion of “fringe” students. Hence, the current study furthers the analysis by including six high schools and an open access policy that is not predicated on staff identification of “fringe” students.
The nontraditional students included in the current study were permitted to take the AP course as a result of the change in policy. These students would have previously been denied the opportunity to enroll in the course because of their prior year’s course grade. The present study is also significant because it controls for confounding variables, including GPA, PSAT/NMSQT score, student SES, and prior AP experience. Specifically, the hope here is to increase our understanding of the influence of open access policies on student achievement and improve academic outcomes for all students.

Limitations and Delimitations

There are limitations inherent in the scope of the current study and to the ability to generalize findings to the greater educational community. The design of the current study is a limitation in and of itself because it is correlational in nature and cannot determine causation. Very few studies related to this topic are experimental because pure experimental studies are difficult to conduct within education. Therefore, although studies can identify relationships, causation cannot be determined. The current study only includes subjects who met the following criteria: took AP Calculus AB, AP English Language and Composition, AP Physics 1, or AP United States History in the 2016-2017 school year and received a valid score for the AP exam in the AP course for which they were enrolled. The use of students within the same regional high school district helped to control for several potential variables, including divergence in curriculum and course expectations. Another limitation of the study is the utilization of one public school district in a suburban area that is not reflective of all demographic subsets represented in other school districts throughout New
Jersey or the United States. Hence, the results may not be generalizable to other areas of the country.

The use of only four AP courses is a limitation as well. These four courses were selected because they are the most highly enrolled within the district for the 2016–2017 school year (See Table 1). Calculus AB, English Language and Composition, and United States History are also the most popular courses and tests nationwide (Warne et al., 2015). It is important to review data by discipline because research disaggregated by discipline has varying outcomes when compared with the overall outcomes for all AP students (Casserly, 1986; Dodd et al., 2002; Morgan & Klaric, 2007; Morgan & Ramist, 1998).
Table 1

*FRHSD Advanced Placement Enrollment Data, 2016–2017*

<table>
<thead>
<tr>
<th>AP Course</th>
<th>Number of students enrolled in course</th>
<th>Number of AP Exams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art History</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Music Theory</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Studio Art 2D</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>Studio Art Drawing</td>
<td>N/A</td>
<td>5</td>
</tr>
<tr>
<td>English Language and Composition</td>
<td>528</td>
<td>541</td>
</tr>
<tr>
<td>English Literature and Composition</td>
<td>478</td>
<td>281</td>
</tr>
<tr>
<td>Comparative Government and Politics</td>
<td>30</td>
<td>27</td>
</tr>
<tr>
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<td>Spanish Language</td>
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</tr>
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*(Freehold Regional High School District, 2017a)*

The data used in the study came from one point in time: the 2016–2017 school year.

The 2016–2017 school year was selected because it had been 4 years since the open access policy had been implemented. In this time, there had been additional mechanisms to enroll
students in AP courses, including targeting students identified as having “AP potential” by using the College Board AP Potential tool, offering an AP summer bridge program, and strategically assigning staff to teach AP courses.

Another limitation of the current study is the use of eligibility for free and reduced lunch as an indicator of SES. This indicator may not be as accurate of overall student or community SES, particularly considering that here, it is the sole indicator.

The perceptions and practices related to the AP program in this school district are not consistent with those of all districts. The current study provides insights into the outcomes associated with open access, including the differences in outcomes for traditional and nontraditional students. However, limitations pertaining to the role of the researcher include researcher beliefs about student enrollment—specifically that all students should have access to advanced coursework. The researcher is also an employee of the district being studied, which always has the potential to introduce bias.

**Definition of Terms**

The following are terms, along with their definitions, that are commonly used in the current paper:

**Achievement gap**: The disparity in academic performance between specific groups of students, specifically students from low-income families and families that are more affluent. The achievement gap is present in standardized test scores, academic success as measured by course grades, course selection, college acceptance, college completion rates, and dropout rates.
**Advanced Placement (AP):** Defined by the College Board (Rothschild, 1999) as a cooperative endeavor between colleges and high schools that gives students the chance to take college-level work in high school and earn college credit and placement.

**Advanced Placement (AP) course:** College-level course taught in a high school setting that uses a standardized course syllabus aligned with the AP exam. As of 2017, there are 38 AP courses in multiple subject areas (College Board, 2018b).

**Advanced Placement (AP) exam:** Standardized exams that accompany each AP course. A student can elect to take the AP exam to receive college credit or advanced placement, as determined by the requirements established by the individual college or university.

**Advanced Placement (AP) policies:** The degree to which the opportunity to take AP courses is open to all high school students in a school or district, regardless of other variables, including course placement in a prior high school year, grade in a prior course, or standardized test score.

**AP Potential:** A web-based tool established by the College Board that links PSAT/NMSQT scores to success in AP courses to help identify potential students for designated AP courses.

**College Board:** A nonprofit organization that since 1955 has continued to develop and maintain the AP program; support high schools, colleges, and universities; and coordinate the administration of annual AP examinations.

**Elementary and Secondary Education Act (ESEA):** ESEA was authorized in 1965 as a component of the “War on Poverty.” The act establishes high standards and accountability for all subgroups and requires equal access to education. The law provides federally funded education programs administered by the states. In 2002, the federal government amended ESEA, and it became known as the “No Child Left Behind Act” (NCLB).
**Dual enrollment**: Enrollment of a high school student in a postsecondary course at a higher education institution concurrently. Students may earn both high school credit and college credit depending on the articulation agreement between the district and college.

**Equity statement**: A statement drafted in 2002 by the College Board to promote the inclusion of all students into AP courses, regardless of ethnicity, race, gender, or socioeconomic background.

**International Baccalaureate (IB)**: An international acceleration program that includes both a curriculum and examination system that focuses on the global skills needed to participate in educational and employment opportunities. The IB program is a 2-year comprehensive curriculum. Successful IB students earn an IB diploma and may be granted advanced standing at universities.

**Nontraditional student**: A student who achieved less than a grade of A- in an academic course or a grade of B- in an honors course in the course preceding the AP course. The preceding course grade is the enrollment criterion for an AP class.

**Open access/open access**: A school or district policy that allows students to enroll in a course without prerequisite requirements. Students are not required to meet additional criteria for enrollment, for example, a minimum grade in a prior year’s course, teacher recommendation, application, assessment, or minimum GPA.

**Socioeconomic status (SES)**: A combination of social and economic factors that are used as an indicator of household income and opportunity. The National Assessment of Educational Progress (NAEP) uses eligibility for the Department of Agriculture’s National School Lunch Program as a measure of SES (National Assessment of Educational Progress, 2018).
**Student achievement**: For the purpose of the current study, student achievement is defined by scores on the AP exam. AP exam scores range from 1 to 5, as follows: 1: no recommendation; 2: possibly qualified; 3: qualified; 4: well qualified; and 5: extremely well qualified. A higher score indicates greater mastery of the knowledge and skills tested on the AP exam.

**Traditional student**: A student who achieved a minimum grade of an A- in an academic course or a minimum grade of a B- in an honors course preceding enrollment in an AP course. The preceding course grade is the enrollment criterion for an AP class.
CHAPTER II: Review of Literature

This literature review includes research that is relevant to the problem statement, important background on the history and expansion of the AP program, the AP Equity Policy Statement, policies on student enrollment in AP courses, including open access policies, and research on the stated benefits of the AP program. The literature includes peer-reviewed research published by the College Board and independent researchers, government and research reports, regularly cited seminal works, and relevant dissertations.

Options for Advanced Study in High School

As the global economy expands, there is increasing pressure to effectively prepare future generations to succeed in this increasingly competitive environment. This pressure extends to providing a quality education. Hence, the high school experience must be appropriately challenging in preparation for college and career; this includes ensuring that high school students have an opportunity to engage in advanced college-level course work. Research has demonstrated that a challenging high school curriculum leads to higher 4-year college graduation rates, and the rigor of a student’s high school curriculum is more powerful than any other factor in predicting college success (Adelman, 1999, 2006). There are a variety of advanced programs and advanced courses available for high school students, including AP courses, dual enrollment courses, and international baccalaureate (IB) courses. However, the AP program is the single largest program that offers college-level coursework completed in high school that is eligible for college credit (Waits, Setzer, & Lewis, 2005). Approximately half of all high schools that offer AP or dual enrollment courses offer both, while 20% offer dual enrollment courses exclusively and 16% offer AP courses only (Wyatt,
Patterson, & Di Giacomo, 2015). Not all opportunities are available to all students in all high schools. Some schools do not have the available resources or staff to offer multiple options. Some communities may also prefer one option over another. In schools that do offer advanced programs, there may be specified criteria for enrollment, including minimum GPA requirements or a teacher recommendation; these restrictions limit opportunities for students who do not meet the criteria.

Dual enrollment programs enroll students in postsecondary coursework at approved higher education institutions while the students are still in high school. Dual enrollment programs are expanding. In the 2010–2011 school year, more than 1.4 million high school students took courses offered by a college or university for credit through dual enrollment (Marken, Gray, & Lewis, 2013). Research has indicated that participation in dual enrollment courses has multiple positive outcomes, including better grades in high school, increased enrollment in college following high school, higher rates of persistence in college, greater credit accumulation, and increased rates of credential attainment (An, 2013; Karp, Calcagno, Hughes, Bailey, & Jeong, 2007). Dual enrollment programs also provide support for the transition between secondary education and higher education because they allow students to experience a college course and accumulate college credit while in high school (An, 2013).

There are often obstacles to implementing dual enrollment programs. First, dual enrollment programs require an articulation agreement between the high school and community college and often require the student to take the courses on the community college’s campus. To address this obstacle, community colleges increasingly offer “on-site” dual enrollment programs; these programs offer community college courses taught by an approved high school teacher at the high school. In this type of program, the student is
responsible for university tuition (typically at a reduced rate), and university credit is dependent on a specified passing grade in the class. Dual enrollment programs are decentralized and are offered at various colleges in different capacities; hence, there is not a consolidated source for data. Even absent uniform practices and data, dual enrollment research has demonstrated positive results for students, including a higher likelihood of enrolling in a 4-year college and higher college graduation rates (Wyatt et al., 2015).

Controlling for high school grades, race/ethnicity, and parental education, research supported by the College Board compared postsecondary outcomes between students enrolled in a dual enrollment course and students enrolled in an AP course who took the corresponding AP exam (Wyatt et al., 2015). AP students who scored a 3 or higher on at least one AP exam had more positive outcomes than dual enrollment students on identified outcomes, including 4-year college enrollment, 4-year GPA, persistence to the fourth year of college, and graduation in 4 or 6 years. Students scoring below a 3 on an AP exam had lower 4-year college enrollment rates, lower graduation rates, and a lower 4-year GPA than students enrolled in dual enrollment programs affiliated with a 4-year college (Wyatt et al., 2015). One potential advantage of a dual enrollment program is the opportunity for college credit without the requirement of a specific exam score. However, the credits may not be transferrable to other postsecondary institutions.

The IB Diploma Programme (DP) was developed in the 1960s to provide an international standard of education for children of diplomats stationed outside of the United States. European educators were seeking an international high school program and college entrance examinations that colleges and universities would accept worldwide (International Baccalaureate Organization [IBO], 2018a). According to its mission, the IBO (2018a) “aims
to develop inquiring, knowledgeable, and caring young people who help to create a better and more peaceful world through intellectual understanding and respect” (p. 1). The IB program differs from the AP program in several areas. The IB DP is internationally based, and its primary curricular mission is to develop global citizens. IB courses are taken in 11th and 12th grades. To earn an IB diploma, students complete six courses in five or six subject areas, a theory of knowledge course, an extended essay, and a required community service component: creativity, action, service (CAS). Students select one course from each of the subject areas to gain comprehensive knowledge in languages, social studies, experimental sciences, and mathematics. The sixth subject can be fine arts or a second course from the other core subject areas. The CAS is designed to encourage the development of a well-rounded student and requires IB students to participate in community service activities. The IB program is illustrated through a hexagonal image that shows the three core elements in the center surrounded by the core subject areas.
Figure 1. IB Diploma Program course of study (International Baccalaureate Organization [IBO], 2018b)

A growing number of school districts are implementing the IB DP. The global and comprehensive nature of the program is appealing to districts that want to support the development of “open-mindedness, inquiry skills, and reflectiveness,” which are identified skills in the IB learner profile (IB) (International Baccalaureate Organization, 2017). A summary of the research on the perspectives of university admissions noted that competitive
colleges and universities “perceive the IB DP as a rigorous college preparation program” (Culross & Tarver, 2011, p. 241). Research comparing college retention and graduation rates for IB students with the U.S. national average demonstrated that first-year retention rates of IB students was 98% compared with the U.S. national average of 75%. The 4-year graduation rate was 74% compared with the national average of 38%. The study included a sample of 8,679 students and was sponsored by the International Baccalaureate Global Research Unit (Halic, 2013).

Although the AP program includes courses and tests in discrete subject areas, the IB program is a comprehensive program of study, including the attainment of an IB “diploma” if all elements are satisfactorily completed and if the minimum levels of performance are achieved on the internal and external assessments. The IB program is significantly smaller than the AP one. As of February 2018, there were 3,182 schools offering the IB DP (IBO, 2018b). The process to become an authorized IB school is multipart and financially cost prohibitive for some school districts. The authorization process generally takes 2 years and includes an extensive application, site visits, consultancy, required off-site professional development for all participating staff members, and standardized curriculum development. As of 2018, annual school fees were $11,600. This authorization is required to offer IB courses, award IB certificates, or award the IB diploma (International Baccalaureate Organization [IBO], 2018b). In contrast, the College Board does not require schools to undergo a formal authorization process or specified professional development to offer AP courses.

Both the IB DP and AP programs focus on college readiness and are recognized by higher education institutions. In 2017, the College Board added the AP Capstone Program,
perhaps in response to the growth of the IB program. This program mirrors many components of the IB program, specifically the awarding of a “diploma” if the student achieves a passing score on two new AP exams—AP Research and AP Seminar—and four additional AP exams (College Board, 2018c).

**College Board Advanced Placement Program**

Sponsored by the College Board, the AP program began in the 1950s. The Ford Foundation created the Fund for the Advancement of Education in response to a post-WWII demand for a better-educated populace. The fund sponsored two studies that both recommended collaboration between secondary schools and colleges regarding the development of college-level course work that could be completed in high school (Rothschild, 1999). Educators from three preparatory schools—Andover, Exeter, and Lawrenceville—and three universities—Harvard, Princeton, and Yale—met together to identify options for improvements to secondary education in preparation for higher education (Rothschild, 1999).

The president of Kenyon College spearheaded the parallel project, which was also sponsored by the Fund for the Advancement of Education, the School and College Study of Admission with Advanced Standing. The plan brought together representatives from the Educational Testing Service (ETS), high school teachers, and university professors. The Committee on Admission with Advanced Standing developed high school courses that college faculty would accept for “advanced standing,” even though they were taught in high school. The first advanced courses began in 1952 and were followed by the associated exams in 1954. The original intent was to provide opportunities for “superior” high school
students to earn college credit and to enroll in a curriculum that was equivalent to an entry-level college course (Santoli, 2002; Rothschild, 1999). The program was designed for a specific type of student: “…largely male, largely students from private prep schools and elite public high schools, and probably mostly Protestant” (Mollison, 2006, p. 34).

Ability grouping was the dominant educational belief in the 1950s. William Cornog, who led the Committee on Admission with Advanced Standing, believed that the AP program was for the “able student” (Cornog, 1957). According to Cornog (1957), the “able” student was the “gifted” student who required advanced coursework at a “pace appropriate to their ability” (p. 49). Educational initiatives and reforms focused on “sorting and separating” to place superior students on one path and less able students on another path. The second director of the AP program summarized the early philosophy of AP as follows: “…all students are not created equal” (Dudley, 1958, p. 1). Originally, the AP program was patently focused on the “best and the brightest” students and less focused on access (Schneider, 2009).

The AP program sought to provide educational opportunities that could challenge America’s brightest students. National security was also a driving factor for the increased interest in advanced opportunities for select students. The post-Sputnik age created growing concern that the United States could not compete with the scientific and intellectual ability of the Soviet Union. Although these concerns were misguided, they were leveraged as a national crisis that prompted educational reforms (Tienken & Orlich, 2013).

The college performance of AP students in these early cohorts proved to be very positive. In 1954, 32% of the students who took an AP course finished in the top one-sixth of their class at the end of their freshman year (Rothschild, 1999). By the late 1960s,
approximately 14% of high schools in the United States offered AP courses and AP exams (Schneider, 2009).

In the 1970s and 1980s, the number of students taking AP exams rose. Both the number of schools offering AP courses and the number of students taking AP courses and their corresponding exams continued to rise as schools identified the program with student success and advancement. Education reformers recognized the value of the AP program as a lever to move “underserved” students into higher education (Schneider, 2009, p. 8).

By the fourth decade after its creation, half of all public high schools in the nation were participating in the AP program. This was the result of multiple factors: the pervasive understanding that AP courses permit high school students to earn college credit; the signifying status of AP course enrollment as a symbol of a rigorous high school curriculum; and the impact of AP courses in the admissions process (Judson & Hobson, 2015). During this time, the College Board added additional AP courses and more aggressively marketed the AP program. The number of students completing an AP exam doubled between 1986 and 1994, jumping from 231,000 students to 458,945. Although this was a significant increase, it was a small percentage of total high school students and contained an even smaller fraction of minority students (Rothschild, 1999).

The AP program continued to grow into the 1990s. Federal, state, and local economic support encouraged this growth. The federal government began subsidizing AP exam fees for identified students. In 1998 and 1999, the federal government spent close to $2.7M to subsidize the cost of AP examinations and encourage greater participation (Schneider, 2009). In 2001, the No Child Left Behind Act allocated grant money to expand the AP program (U.S. Department of Education, 2001). Several states offered
reimbursement for the AP exam test fee and provided funding for teacher professional
development to improve instruction. Federal and state governments also encouraged
enrollment in AP courses through legislation (Schneider, 2009). The motivation to enroll a
greater number of students in AP courses was predicated on a belief that enrollment in an
AP course was an indicator of college preparedness, even if this was not true for all AP
students.

AP participation also expanded at this time because of the inclusion of AP data as a
component of state accountability metrics. In Florida, schools were assigned a grade (A–F);
300 of the 1600 total points were based on advanced coursework participation, including AP
coursework. Texas, Indiana, Idaho, Georgia, New Mexico, Oklahoma, and Nevada also
included AP participation and achievement statistics in their high school accountability
frameworks (Schneider, 2009). Currently, the New Jersey Department of Education
publishes annual school performance reports for each public school district. The school
performance reports are designed to share district and school information and include AP
participation and performance as an indicator of academic achievement. These data are used
as a metric of “college and career readiness” and specifically include the percentage of
students in the school who are enrolled in at least one AP/IB course in English, math, social
studies, or science (New Jersey Department of Education, 2016).

AP has become the “status symbol” for a rigorous academic high school program
(Schneider, 2009). Colleges and universities recognize students who succeed in AP courses
by awarding college credit, advanced placement, or both (College Board, 2018a). Most
colleges acknowledge AP courses as equivalent to entry-level college courses, so most high
schools throughout the country offer AP courses. The AP program has expanded to include a
broad range of students; indeed, there is greater diversity in the “typical” AP student (Rothschild, 1999, p. 198). This growth has provoked a “tug-of-war between those struggling to secure equity for all and those intent on securing a measure of distinction for some” (Schneider, 2009, p. 813).

Currently, there are 38 AP courses offered by the College Board, and these are created collaboratively with college and high school faculty. The most recent additions include two algebra-based Physics courses in 2014–2015 and a Computer Science Principles course in 2016–2017. Table 2 identifies the courses and exams offered by the College Board (College Board, 2018b).
Table 2

**Advanced Placement Courses and Exams**

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<th>Arts</th>
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<th>Mathematics</th>
<th>Sciences</th>
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<th>AP Capstone</th>
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<td>Comparative Government and Politics</td>
<td>Calculus AB</td>
<td>Biology</td>
<td>Chinese Language and Culture</td>
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<td>Music Theory</td>
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<td>Calculus BC</td>
<td>Chemistry</td>
<td>French Language and Culture</td>
<td>AP Seminar</td>
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<td>Human Geography</td>
<td>Computer Science A</td>
<td>Environmental Science</td>
<td>German Language and Culture</td>
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<td>Macroeconomics</td>
<td>Principles of Computer Science</td>
<td>Physics 1: Algebra-based</td>
<td>Japanese Language and Culture</td>
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<td>Statistics</td>
<td>Physics 2: Algebra-based</td>
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<td>World History</td>
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</table>

(College Board *The 10th Annual AP Report to the Nation*, 2014)

Most AP exams include two components—an objective multiple-choice section and a subjective essay-based section. The College Board does not require students to take the AP exam, but locally, districts may require students to take the assessment. The national examinations are administered in May, regardless of the school calendar. According to the 2014 College Board *AP Report to the Nation*, AP exam grades of 5 are equivalent to the top A-level work in the corresponding college course. AP exam grades of 4 are equivalent to
work representing midlevel A to midlevel B performance in equivalent college courses, and AP exam grades of 3 are equivalent to a range of work representing midlevel B to midlevel C performance in equivalent college courses. These scores are considered “passing” scores and are worthy of credit in the equivalent college course (College Board, 2014). Independent research, though, has questioned this correlation and the value of a passing score on the AP exam, specifically noting that although there may be benefits, those benefits are not uniform (Klopfenstein & Thomas, 2009; Sadler & Tai, 2007). In House Bill 1333, the College Board recently supported legislation to require public college and university systems to award credit for AP scores of a 3 or higher. At least 20 individual states require postsecondary institutions to award credit for AP courses in some capacity (Gewertz, 2017).

Annual rankings produced by *Newsweek*, the *Washington Post*, and *U.S. News and World Report* use statistics on AP participation and performance as a criterion to rank American high schools (Matthews, 2016a). The “Challenge Index,” which was created by Jay Matthews in 1998 and published annually by *Newsweek*, is a popular metric used to rank schools. The Challenge Index uses the following index formula: the number of AP exams given at a school each year divided by the number of seniors who graduate. Regardless of the criticisms of these rankings to accurately assess the quality of a high school, the rankings are publicized and used by schools, towns, and communities as an indicator of school quality (Tierney, 2013).

In 2007, the College Board created an “equity and excellence” metric, which is described in the 6th *Annual AP Report to the Nation* (College Board, 2010). This metric is the percentage of a school’s graduating class that earns a passing score of 3 or higher on at least one AP exam. The metric encourages both enrollment in AP courses and a passing
score on the AP exam. The average equity and excellence rating in 2015 was 22.4% (Matthews, 2016b), and the metric is increasingly used in state accountability frameworks (e.g., Florida Department of Education) or in news magazines as one aspect of school rankings.

Over the last 20 years, the College Board has emphasized a philosophy of open access to AP courses. Indeed, the College Board regularly publicizes the benefits of AP courses and the opportunities these courses provide students. These efforts have facilitated the program’s expansion. The creation of the Equity Policy Statement—which broadcasts the philosophy of the College Board, stating that schools should consider any student for enrollment in an AP course if the student expresses a desire to study college-level coursework—was also a catalyst for expansion. This is a significant shift from the original philosophy of the AP program that was elitist and limited to the “ablest” students (Cornog, 1957). This growth has included nontraditional students, students with lower GPAs, and students from underrepresented minority subgroups.

In 2007, because of the significant growth of the AP program, the College Board announced it would require an audit of all AP course syllabi. The purpose of the audit was to ensure the AP course was the equivalent of a college-level course with college-level coursework. The process included a review of the course syllabus for each AP class. Following the first audit, the College Board noted that over two-thirds of the course syllabi submitted were immediately approved. The high passage rate was described by College Board officials as proof that AP courses met the expectations of first-year, college-level courses and that college admissions officers could be assured that AP courses had been examined by college
faculty (Cech, 2007). The audit encouraged colleges and universities to continue to accept passing scores on the AP exam for college credit.

Although the audit ensured that courses approved by the College Board met the required content expectations and “what” content was taught, the audit did not include a review of “how” the content was taught or the quality of the instruction. The College Board continues to require districts to complete the audit process annually, and this includes the submission of the course syllabi and information on the resources available to the teacher. The audit does not assess the quality of the course, teacher expertise, or overall outcomes for students, however. Even so, the audit provides an added measure of accountability.

**Advanced Placement Program and Student Success in College**

The literature on the influence of the AP program on student success in college is mixed. Although studies have consistently pointed to positive outcomes for AP students (Eimers & Mullen, 2003; Klopfenstein & Thomas, 2009; Hargrove et al., 2008), it is unknown if this relationship is causal. Most research on the impact of the AP program has been tied to student success in college (Dougherty, Mellor, & Jian, 2006; Hargrove et al., 2008). Proponents believe that AP students fare better than non-AP students in several key areas—GPA, retention, graduation, and time to degree attainment (Challenge Success, 2013).

Over the past five decades, the AP program has become a household name and an indicator of academic achievement. This foundational assumption has been supported by a significant number of research studies, many of which have been commissioned, published, or supported by the College Board (Chajewski, Mattern, & Shaw, 2011; Flowers, 2008;
Sadler & Tai, 2007). There is an inherent conflict of interest in research supported by the College Board. A notation is included about these studies in each report: “Researchers are encouraged to freely express their professional judgment. Therefore, points of view or opinions stated in College Board reports do not necessarily represent official College Board position or policy” (The College Board, 2017, p. 2). Independent empirical research is not as pervasive, though. College Board publications consistently report positive outcomes for AP students, but this organization clearly has a stake in promoting the AP program; an increase in AP students may mean an increase in revenue. Studies sponsored by the College Board include research on the benefits and outcomes of the program, college completion rates for AP students, the validity of AP test scores, and AP test construction. These studies by the College Board have been vast in number: dating from 1997 to 2017, there are over 160 research studies and reports available on the College Board website (College Board, 2017).

One of the first systematic analyses of the performance of AP students in college was conducted in 1967. Using college grades in courses related to the students’ AP subject and their performance in those courses, Burnham and Hewitt (1971) found that AP students were generally a superior group of students prior to college entry and performed better than non-AP students in college courses. However, there were limitations to the study, including a noted small sample size (Burnham & Hewitt, 1971).

A more extensive study was conducted in 1978. The study included 344 AP freshmen at Indiana University and compared these students with an equal number of non-AP freshmen. The study matched the groups by gender and SAT score. Three measures of academic progress were compared: hours completed per semester, proportion of courses taken at the junior level or above, and cumulative GPA. In all three indicators, AP students
performed better than non-AP students (Chamberlain, Pugh, & Schellhammer, 1978). Although this study used matched pairs to control for some variables, more recent methodological advancements, specifically a propensity score analysis, allow researchers to control for a greater number of covariates (Warne, 2017).

In 1986, Casserly demonstrated that AP students performed better than other students in the field of their qualifying AP exam. This research, supported by the College Board, was one of the first studies to include qualitative and quantitative data to examine the validity of AP exam scores as indicators of students’ readiness to take advanced courses in college. Casserly (1986) examined college course grades to show that AP students had better grades in their upper-level courses than non-AP students and were appropriately prepared to be in an advanced course as a result of their qualifying AP exam score.

Larger studies began in the 1990s. Morgan and Ramist (1998) found that AP students received higher grades in college than non-AP students; the study included 27,268 students from 20 colleges and universities who completed at least one AP exam with a score of 3 or higher. Students who placed into these classes based on their AP scores were compared with students who took the introductory course while in college. The study included an analysis of 25 AP courses and concluded that students who placed into advanced college courses based on passing AP scores of a 3, 4, or 5 were more successful in college-level courses when compared with students who took the introductory course while in college (Morgan & Ramist, 1998). The authors also noted that students who scored a 5 on the AP exam had higher course grade averages than non-AP students. Morgan and Ramist ‘s study has been one of the most often-cited studies of AP students’ success in college.

However, the study had two stated limitations. Although the overall sample size was large,
the conclusions for some AP exams were based on sample sizes of 10 or less. The study also used simple comparisons of AP students and non-AP students and controlled for very few or no confounding variables.

In 2003, Eimers and Mullen found that students who earned AP credits had higher first-year college retention rates. Eimers and Mullen (2003) studied 7,913 freshmen enrolled in the University of Missouri. The authors compared the first-year GPA and first-year retention of students who received AP credit and those who did not. Academic ability was held constant by using ACT scores and class rank. When holding academic ability constant, students with AP credit had slightly higher GPAs (3.18 compared with 2.97) and higher retention rates (87% compared with 76%; Eimers & Mullen, 2003).

In 2006, Dougherty et al. studied the relationship between participation in AP courses and college graduation rates; controlling for high school demographics, they compared the graduation rates of AP and non-AP students. The research included 67,412 Texas high school students who enrolled in a Texas college within 1 year following high school graduation. The study showed that students who earned a 3 or better on an AP exam were more likely to graduate from college within 5 years, even when controlling for other individual or high school variables (Dougherty et al., 2006). Dougherty et al. (2006) also included AP students who participated in the course but did not pass the exam in the analysis. Although these students did better than their non-AP peers did, they were not as successful as the AP students who passed the exam. The study concluded that participation in an AP course can be beneficial; however, success in an AP course, as measured by the score on the AP exam, has even greater implications for academic outcomes.
In 2007, Morgan and Klaric expanded on the research conducted by Morgan and Ramist (1998). Morgan and Klaric (2007) used a larger sample size and controlled for additional variables—specifically, SAT scores. The research, sponsored by the College Board, reinforced the connection between higher scores on the AP exam and higher grades in the equivalent college-level course. Students with AP exam scores of 3, 4, or 5 had higher grades in the corresponding college course than non-AP students, even when controlling for SAT scores. The research also noted that AP students scoring a 3 on the exam did not significantly outperform non-AP students when measuring semester grades in biology, specifically. This study had the advantage of almost 10 years of additional research and included a total of 72,457 students attending 27 colleges from the incoming class of 1994. However, the study did not use a controlled experimental design, making it impossible to determine causality (Morgan & Klaric, 2007).

In 2008, Hargrove et al. conducted a study sponsored by the College Board that included over 300,000 students. The study analyzed graduation rates, GPAs, and earned credits. Ethnicity, gender, and the type of AP and non-AP experience were included as the independent variables. The study also added a control for SES by subdividing students within SAT categories using free and reduced lunch status participation. Five cohorts of students from a Texas public high school from 1998–2002 were included, totaling over 300,000 students. Student performance measures included first- and fourth-year college GPAs, first- and fourth-year credit hours earned, and 4-year graduation status. The outcomes were compared across three types of students: (1) students who took the AP course only; (2) students who took the AP exam only; and (3) students who took both the AP course and the AP exam. Within each cohort year and each exam cohort, students in the AP and non-AP
groups were matched based on ability and SES. The outcomes demonstrated strong benefits for students who participated in the AP course and took the corresponding AP exam, even when scoring a 2 on the exam. The college outcomes included higher GPAs, more credit hours earned, and higher 4-year graduation rates (Hargrove et al., 2008). This was the first large-scale study that compared AP and non-AP students with specific subgroups of AP students determined by their earned AP score. This research validated both participation in the AP course and taking the AP exam. Of note, those students with the highest score on the AP exam also graduated at the highest rates. Additionally, even students who scored a 2—a score not typically high enough to earn college credit—were still more likely to have better college performance and a 4-year graduation rate than students who did not take an AP course. Even when the students were matched using SAT score intervals and SES status, the students who took both an AP course and the corresponding AP exam outperformed students who took the AP course only, dual enrollment only, or no AP course on multiple college outcomes, including 4-year graduation rates. Studies that have applied controls for academic achievement, student ability, student-level characteristics, and school-level characteristics have found that only taking an AP course is not a strong predictor for college performance—achievement on the AP exam is a superior predictor (Dodd et al., 2002; Dougherty et al., 2006; Geiser & Santelices, 2004).

Between 2009 and 2013, several studies supported by the College Board showed positive academic outcomes for AP students. In 2009, Mattern, Shaw, and Xiong demonstrated that students who scored at least a 3 on the identified exams (Biology, Calculus AB, English Language and Composition, and U.S. History) had higher first-year GPAs in college and higher second-year retention rates. In 2011, Chajewski et al. conducted
research on the relationship between AP exam participation and enrollment in a 4-year college; their research demonstrated a 171% increase in the odds of attending a 4-year postsecondary institution for AP students (Chajewski et al., 2011). Included in this research was a meta-analysis of educational research related to the AP program that showed a “…link between AP participation and college success” (Chajewski et al., 2011, p. 16). In 2013, Mattern, Marini, and Shaw conducted research that indicated that students who took one or more AP exams, regardless of their score on the exam, were more likely to graduate from college in 4 years compared with non-AP students when controlling for prior academic achievement, demographic variables, and school-level variables. Also, when controlling for the relevant variables, students who earned higher scores on AP exams had an increased likelihood of graduating in 4 years compared with students who earned lower scores (Mattern et al., 2013).

Most recently, Warne (2017) published a comprehensive review of research on the AP program. According to Warne (2017), the College Board supports and authors a large proportion of research on AP. Warne (2017) summarized the various College Board studies that used nonexperimental group comparisons of AP students and non-AP students. The studies supported several claims: AP students attend college at higher rates, earn higher grades in college, are less likely to drop out of college, graduate from college at higher rates than non-AP students, and are more likely to major in a field related to their AP courses than non-AP students (Warne, 2017).

Various independent studies have concluded there are benefits for AP students when compared with non-AP students, including that AP students have higher college GPAs (Ackerman, Kanfer, & Calderwood, 2013), higher college graduation rates (Ackerman, et
al., 2013), and higher rates of obtaining advanced degrees (Flowers, 2008). A limited number of independent studies and studies supported by the College Board include controls for numerous confounding variables.

In 2007, independent research conducted by Sadler and Tai questioned the value of AP coursework when it comes to studies that may not have had adequate controls and failed to account for other factors including family, community, and student characteristics. Sadler and Tai (2007) used survey data from 8,594 students in 55 randomly chosen colleges and universities and found that passing the AP science exam (biology, chemistry, or physics) was correlated with higher science grades but not enough to assume prior mastery. Sadler and Tai (2007) noted that the advantages perceived to be associated with taking an AP course or an AP exam may have been inherent in the background of AP students. Specifically, “…about half of the advantage attributed to AP experience can be accounted for by variables representing the academic abilities and experiences possessed by AP students prior to, or independent of, their AP course experiences” (Sadler & Tai, 2007, p. 17). Sadler and Tai (2007) acknowledged that AP courses may have some value to students, but the authors lacked the required evidence to support many of the claims that AP courses were the equivalent of introductory college science courses.

In 2009, independent researchers Klopfenstein and Thomas examined the extent to which AP course taking predicts early college grades and retention. The sample included 28,000 students from 31 4-year Texas universities. In the first analysis of the data, a limited number of control variables were included. The results identified AP course completion as a statistically significant variable for college GPA and retention. After controlling for student-level variables (SAT scores, high school GPA), non-school-level variables (family
background characteristics, parent education levels, family income), and school-level
variables (percentage of students eligible for free or reduced lunch), AP course completion
was not found to be as closely correlated to first semester college grades or college retention
(Klopfenstein & Thomas, 2009). Klopfenstein and Thomas noted that taking AP courses
“may be predictive of college success…but casts doubt on the notion that AP participation
imparts a positive causal impact on college performance for the typical student”
(Klopfenstein & Thomas, 2009, p. 887). Klopfenstein summarized the research in a 2017
New York Times Magazine article on the expansion of AP courses, stating the following:
Too often, research confuses correlation with causation; highly motivated students tend to
take more AP classes, and they also tend to do better in college and graduate on time. But
once all the variables, like parental education and income, are stripped away, there is no
indication that those who take APs do better in college. If you don’t control for all the
factors, AP looks good. If you do, AP is not so positive. (Tugend, 2017, para. 24)

In 2010, Clark, Scafidi, and Swinton studied specific outcomes on the statewide
economics end-of-course test (EOCT) for students who took AP Macroeconomics and AP
Microeconomics compared with students who did not, here controlling for prior
achievement. The study included various groups of students in Georgia and used 2 years of
data on all high school students who took Georgia’s required economic course and the high-
stakes, statewide EOCT. They found that AP students performed significantly better than the
non-AP students and concluded that the AP curriculum was better preparation for students
than the non-AP economics curriculum used in Georgia. Their conclusions demonstrated
that denying access to these AP courses was denying students the opportunity for increased
student achievement on Georgia’s EOCT in economics (Clark et al., 2010).
In 2013, Ackerman et al. studied the patterns of AP exam completion and AP exam scores on the indicators of postsecondary achievement using a sample of 26,693 students. After high school GPA, the AP exam score was determined to be the best predictor of academic success (2013).

Recent independent research has included additional control variables to more accurately determine the influence of AP courses. In 2015, Warne, Larsen, Anderson, and Odasso conducted the largest non College Board study using a sample of 45,558 students from the Utah public schools’ 2010 graduating class. This study controlled for 71 confounding variables and included four distinct groups: (1) students who never took an AP English course; (2) students enrolled in an AP English course who never took the AP exam; (3) students enrolled in an AP English course who took the AP English exam but did not earn a passing score (score of 1 or 2); and (4) students enrolled in an AP English course who passed the AP English exam (score of 3, 4, or 5). Warne et al. (2015) used ACT scores to measure academic achievement and demonstrated that when the covariates were not controlled for, the effect sizes measuring the impact were between 6.21% and 12.04%. After controlling for the covariates, there was a reduction in effect sizes from 1.72% to 5.92%. The reduction in the effect sizes further demonstrated that the confounding variables may have a significant impact on academic achievement. The sample size included every public school cohort member in the state of Utah for 2 consecutive years and students who had never participated in the AP program as a large control group. Although the research could not confirm that participation in the AP program was correlated with higher ACT scores, no other study has been able to control for as many confounding variables. Despite the
reduction in effect size when controlling for the covariates, there were noteworthy positive effects attributed to the AP program. Overall the researchers claimed the following:

…strong empirical evidence that participation in AP English and AP calculus courses is not beneficial to students who merely enroll in the courses, has some benefits to students who take the AP exam but do not pass it, and is most beneficial to those students who take and pass the exam. (Warne et al., 2015, p. 414)

Ultimately, Warne et al. (2015) agreed with the research of Dougherty et al. (2006) and other studies sponsored by the College Board: to reap the benefits of the AP program, it is important for students to take and pass the exam as opposed to simply taking the course.

However, research on the AP program and college success has been inconsistent. The research has not pointed to disadvantages for AP students; however, some of the positive outcomes may be inflated. Inconsistent conclusions about the impact of the AP program may also be because of inconsistent experiences in the individual courses, which can vary in design from school to school and teacher to teacher. Many questions are still unexplored, including the academic benefits for nontraditional AP students previously excluded from enrolling in an AP class, a group that has been absent from early research.

Advanced Placement Program and College Admission

The original intent of the AP program was to provide students with an opportunity for college credit or advanced placement in college; this was predicated on the idea that the student would take the AP course and subsequent exam to show the student has earned enough knowledge in the course to receive college credit. Merely enrolling in the AP course may not have the same academic benefits as passing the AP exam (Dougherty & Mellor,
The College Board does not mandate that students take the associated AP exam for the course in which they are enrolled, though.

By the mid-1980s, there was an increased emphasis on AP as a factor in the college admissions process. Willingham and Morris (1986) showed that a transcript that included AP courses was weighed more heavily in the admissions process compared with a transcript that did not include AP courses. Enrolling in advanced coursework began to serve as both an opportunity for a high-level curriculum and an opportunity to earn a mark of distinction on one’s high school transcript. Particularly for highly selective colleges and universities, a growing need to create distinctions among candidates prompted the use of AP courses as a variable for college admissions (Geiser & Santelices, 2004; Santoli, 2002).

The National Association of College Admission Counseling (NACAC) surveys over 2,000 4-year institutions to produce an annual report called the “State of College Admissions.” This report outlines the key trends and factors that influence admissions decisions. According to survey data, the top factors in college admissions decisions are “grades in college preparatory courses, strength of curriculum, admission test scores (such as ACT or SAT), and overall grades” (Clinedinst, Koranteng, & Nicola, 2015, p. 4). Additionally, the survey includes “evolving academic factors,” including AP, IB, and SAT II examinations (Clinedinst et al., 2015, p. 16). The NACAC noted that a student’s strength of curriculum, including grades in college preparatory courses, are strong indicators of student success in college and impact admissions decisions. Subject test scores (AP, IB) were noted as adding further depth to an applicant and as being used to provide greater information when comparing candidates of similar quality and academic qualifications (Clinedinst et al., 2015).
Colleges often cite a holistic approach to the admissions process, one that considers a student’s high school course schedule, including the degree of rigor of the courses. Geiser and Santelices (2004) conducted an email survey of admissions officers at 18 Association of American Universities (AAU) institutions to identify the impact of AP and honors courses in admissions decisions at selective colleges and universities; they discovered that almost all selective colleges and universities “give special consideration” to AP courses. Some schools consider the number of AP courses in their holistic review of the applicant, while others use a quantitative approach and assign extra points for AP and/or IB courses (Geiser & Santelices, 2004). In 1982, the University of California instituted a policy of awarding bonus points to AP and honors courses taken in the last 2 years of high school as part of their admission criteria. Schools within the University of California rank the number of AP courses and student performance in them as the fourth criterion used to assess student admission (Klopfenstein, 2004). A large percentage of colleges, including all colleges that use what is called the “Common Application,” specifically request information on the number of AP courses a student has access to within his or her school and how many AP courses the student elected to take over the course of his or her high school career. This information is used by colleges to determine if the applicant is taking the most challenging courses available.

Research has demonstrated that taking AP course and AP exams is a stronger predictor of success than taking the AP courses only (Dougherty & Mellor, 2009; Dougherty et al., 2006; Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009; Warne et al., 2015). However, a student who does not take the AP exam can include the AP course on his or her transcript, which can positively influence admissions decisions. Geiser and Santelices
(2004) looked closely at the differences between taking the AP exam and enrollment in an AP course; they stated that the policy of awarding “bonus points” for AP courses had little effect on college outcomes and was not statistically significant for predicting college outcomes. Their study included a sample of 81,445 freshmen entering University of California campuses between 1998 and 2001. Geiser and Santelices (2004) discovered that merely taking AP courses had little predictive value for college success; they revealed that high school GPA was the strongest predictor of student grades and persistence in college. The number of AP or honors courses had no significantly predictive weight when controlling for academic and socioeconomic factors. The authors did concede that performance on AP exams, especially scores of 3 or higher on the AP exam, is strongly related to college performance. However, they pointed out that many students who take an AP course do not take the associated AP exam and “merely taking the AP or other honors level courses in high school is not a valid indicator of the likelihood that students will perform well in college” (Geiser & Santelices, 2004, p. 2). Interestingly, in 2005, the College Board published a response to Geiser and Santelices’ research. The response listed specific reasons for why Geiser and Santelices’ claims were invalid and contrary to other research that demonstrated the importance of academic rigor in predicting college success. In addition, the College Board criticized Geiser and Santelices for not providing enough information for other researchers to replicate the study (Camara & Michaelides, 2005). Indeed, this exchange highlights the complexities of the research surrounding AP.

Klopfenstein and Thomas (2009) researched the extent to which taking an AP course predicts college grades and retention; their research raised questions for college admissions offices that had previously preferred students with AP coursework on their transcripts.
Klopfenstein and Thomas (2009) controlled for a broad range of student, school, and curricular variables and found that only taking an AP course, compared with taking the AP course and the AP exam, does not reliably predict first semester college grades or retention regarding the student’s second year. They concurred with Geiser and Santelices and concluded the following: “Once other rigorous high school courses and demographic and school characteristics are considered, however, students typically do well in college regardless of their AP experience” (Klopfenstein & Thomas, 2009, p. 887).

Although Klopfenstein and Thomas (2009) questioned the value of the AP course alone as a factor in admissions decisions, they did recognize the value of open access and greater consideration for students who were encouraged to enroll. Klopfenstein and Thomas were cited in a news magazine article that clarified their research outcomes:

While we are strongly in favor of open access to AP and do not wish our results to be interpreted as justification for excluding traditionally underrepresented students from AP classes, it is equally unfair to misplace underprepared students in AP classes when they would be better served in other rigorous courses. (Hart, 2011, para. 2).

Although the intent of the AP program is to support students in earning college credits, many students now use it as a mechanism to create a competitive college transcript (Santoli, 2002). The AP program has a pervasive role in the college admissions process, as evidenced by the over 3,000 U.S. colleges and universities that accept AP scores for credit and/or placement purposes or consider AP course enrollment in the admissions process (College Board, 2018a). Hence, schools that restrict access to participation in the AP program may be denying students an important advantage in the admissions process.

**Expansion of the AP Program: AP Equity Policy Statement**
Originally, the focus of the AP program was on “superior students,” or primarily white students from large schools with highly educated parents (Rothschild, 1999). This began to change as early as the 1980s. The College Board and governmental leadership advocated for broadening access to the AP program (Rothschild, 1999). Table 3 highlights the incremental growth of the AP program from its inception to 2016.

Table 3

**AP Program Participation in 5-Year Increments from 1955–2015**

<table>
<thead>
<tr>
<th>Year</th>
<th>Schools</th>
<th>Students</th>
<th>Exams</th>
<th>Colleges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955–56</td>
<td>104</td>
<td>1,229</td>
<td>2,199</td>
<td>130</td>
</tr>
<tr>
<td>1960–61</td>
<td>1,126</td>
<td>13,283</td>
<td>17,603</td>
<td>617</td>
</tr>
<tr>
<td>1965–66</td>
<td>2,518</td>
<td>38,178</td>
<td>50,104</td>
<td>1,076</td>
</tr>
<tr>
<td>1970–71</td>
<td>3,342</td>
<td>57,850</td>
<td>74,409</td>
<td>1,382</td>
</tr>
<tr>
<td>1975–76</td>
<td>3,937</td>
<td>75,651</td>
<td>98,898</td>
<td>1,580</td>
</tr>
<tr>
<td>1980–81</td>
<td>5,253</td>
<td>133,702</td>
<td>178,159</td>
<td>1,955</td>
</tr>
<tr>
<td>1985–86</td>
<td>7,021</td>
<td>231,378</td>
<td>319,224</td>
<td>2,125</td>
</tr>
<tr>
<td>1990–91</td>
<td>9,786</td>
<td>359,120</td>
<td>535,186</td>
<td>2,587</td>
</tr>
<tr>
<td>1995–96</td>
<td>11,712</td>
<td>537,428</td>
<td>843,423</td>
<td>2,895</td>
</tr>
<tr>
<td>2000–01</td>
<td>13,680</td>
<td>844,741</td>
<td>1,414,387</td>
<td>3,199</td>
</tr>
<tr>
<td>2005–06</td>
<td>16,000</td>
<td>1,339,282</td>
<td>2,312,611</td>
<td>3,638</td>
</tr>
<tr>
<td>2009–10</td>
<td>17,861</td>
<td>1,845,006</td>
<td>3,213,225</td>
<td>3,855</td>
</tr>
<tr>
<td>2015–16</td>
<td>21,953</td>
<td>2,611,172</td>
<td>4,704,980</td>
<td>4,199</td>
</tr>
</tbody>
</table>

(College Board *The 10th Annual AP Report to the Nation*, 2014)

The democratization of the AP program over the last 50 years is highlighted by the figures in Table 3. The program has expanded from providing advanced coursework to only “elite” students to providing opportunities for millions of students from every demographic subgroup, albeit not equally. The College Board has advocated for open access to AP courses for motivated students and has recommended that AP students reflect the diversity of a school’s student body, including minority and low-income students. Nationally, many high schools are expanding their AP programs, and the College Board is expanding their AP resources (College Board, 2014). As the College Board offers additional AP courses that appeal to a wider audience, the expectation is that participation will continue to grow. For
example, in the 2016–2017 academic year, AP Computer Science Principles was offered for the first time (College Board, 2018b), and over 90 colleges and universities have agreed to award college credit for passing scores on the AP Computer Science Principles exam.

The growing demand to ensure high school students are “college and career ready” has led to increased funding sources for the AP program. In 2017, Congress funded a $400 million Title IV, Part A block grant that gave allocations to states and districts for use in a variety of areas related to expanding or improving the AP program, for example, to offset the costs of the exams for low-income students, to increase student access to AP courses, or to fund professional development for AP teachers (College Board, 2018d). The U.S. Department of Education provides financial support through the appropriation of money to fund, support, and subsidize the AP program (United States Department of Education, 2011). According to the Education Commission of the States (2016), many states incentivize AP access in some capacity, for example, by using AP participation as an accountability metric and subsidizing AP exam fees and professional development for teachers (Zinith, 2016). Some states have seen significant growth because of state legislation. In 1999, a California ruling—Daniel et al. v. State of California—ruled that districts that did not offer AP courses were denying equal educational opportunities. This led to legislation that increased AP access in California (Rehm, 2014). In 2000, the U.S. Secretary of Education Richard Riley announced an initiative to offer at least 10 AP courses in every high school in the United States (Lichten, 2010).

Expanded access has widened the aims of the AP program. In a 2017 New York Times Magazine article, Chester E. Finn, former assistant secretary of education, summarized the AP program’s evolving purpose: “AP is now being asked to serve multiple
purposes in society. What started as a program for accelerating the education of gifted students is now being used as a means of broadening access to challenging material” (Tugend, 2017). This expansion includes students of varying academic abilities and demographic characteristics. The students who were the intended beneficiaries of open enrollment are often the students with limited skills or exposure to advanced coursework and who experience the biggest challenges within the AP course. The College Board has directed expansion efforts toward underrepresented minorities and low-income students not enrolled in AP courses. Schools serving low-income and minority students have generally offered fewer AP courses than schools serving high-income students (Dougherty et al., 2006). The same is true of rural and urban areas compared with suburban areas. Schools in suburban areas have offered more AP courses overall (Gagnon & Mattingly, 2015). Even schools within a close proximity can offer vastly different AP course opportunities. In the district analyzed in the current study, the number of AP courses offered ranged from 18 to 21. However, in a district less than 20 miles away, there are only three AP courses offered. In line with this, Burney (2010) studied the influence of the number of AP course offerings in high schools and found that the number of AP course offerings contributed to the explanation for the variance in high achievement in all students in the school; these discrepancies in opportunities are also noted in schools with high minority populations or high percentages of students on free/reduced price lunch; low-SES students are less likely to attend a postsecondary institution than higher SES students (Burney, 2010).

The College Board encourages school districts to implement open access policies that do not limit enrollment based on GPA, class rank, or teacher recommendation. The College Board’s equity policy statement is indicative of this philosophy:
The College Board strongly encourages educators to make equitable access a guiding principle for their AP programs by giving all willing and academically prepared students the opportunity to participate in AP. We encourage the elimination of barriers that restrict access to AP for students from ethnic, racial and socioeconomic groups that have been traditionally underserved. Schools should make every effort to ensure their AP classes reflect the diversity of their student population. The College Board also believes that all students should have access to academically challenging course work before they enroll in AP classes, which can prepare them for AP success. It is only through a commitment to equitable preparation and access that true equity and excellence can be achieved. (College Board, 2002, p. 2)

The College Board also assigns an “equity and excellence” score to schools and districts based on the percentage of graduates that earn a 3, 4, or 5 on an AP exam. This metric is used to encourage participation and assist schools in identifying subgroup populations not well represented.

Minority subgroups are disproportionately enrolled in AP courses. Klopfenstein (2004) noted that economically disadvantaged students enroll in AP courses at half the rate of white students who are not economically disadvantaged. In 2013, Theokas and Saaris reviewed College Board data on AP students and found that middle- and high-income students are three times more likely to enroll in AP courses as low-income students. However, a higher number of low-SES students has been participating in AP courses, from 75,000 in 2004 to 150,000 in 2009 (Wyatt & Mattern, 2011). A report sponsored by the College Board compared the college outcomes of low-SES students who took an AP exam (with a fee reduction) and students who did not take an AP exam. The report found that the
low-SES students had higher 4-year college enrollment rates, higher GPAs, and higher retention rates, even when the students were matched for ethnicity, parental education, or high school performance measures. The results also indicated that even low-SES students who scored a 2 on the AP exam and would not typically earn college credit were more likely to experience positive outcomes—including higher 4-year college enrollment rates, higher GPA, and higher retention rates—compared with students who did not take an AP course (Wyatt & Mattern, 2011). The study cited several limitations, including its descriptive nature, which lacked statistical controls and the inclusion of all students who took an AP exam, even if they did not take the AP course. The authors also found that Asian students participate at twice the national average and black students participate at half the national average. These statistics indicate that although access has opened, there continues to be a gap in minority subgroup participation.

In 2015, Judson and Hobson conducted an exploratory study to examine the overall trends in growth and student achievement within the AP program. Overall, they found that there has been “steady and extensive growth of AP participation, particularly among underclassmen and some minority groups” (Judson & Hobson, 2015, p. 59). During the 16-year period studied (1997–2012), the largest percentage of growth of AP exams was for 9th graders—4952%—compared with 12th graders—211%. Although growth was found to be steady, overall achievement, as measured by pass rates, had declined over the period studied; specifically, there was a twofold increase in the number of scores of a 1 on an exam. The percent of students obtaining a score of 3 or better decreased between 1992 (65.5%) and 2012 (59.2%; Judson & Hobson, 2015, p. 67). An explanation for the decline is that lower exam performance is indicative of increased enrollment of unprepared students. However,
this may also be indicative of a shifting philosophy in the value of the AP experience—
shifting from a focus on earning a passing score to experiencing college-level work and
building confidence.

The expansion is divisive. AP “purists” believe that enrollment in an AP course
should be limited to the most academically advanced, while a growing population of
“progressives” believe that AP courses should be open to all students. Proponents of open
access believe that the “AP experience” is enough of a reason to encourage all students to
take an AP course, regardless of their scores on the AP exam. Education writer Jay
Matthews of the Washington Post, a vocal advocate of expanding AP access, has stated that
he believes that even if students do not perform well on the AP exam, they are still better
prepared for college-level work if they take an AP course (Matthews, 2012).

Colleges and universities are increasingly selective in awarding credit for AP scores
because of the greater number of students enrolled in AP courses and taking AP exams. The
AP audit provides colleges and universities with increased confidence that courses
designated as “AP” are as equally challenging as college-level courses (College Board,
2018e).

**Policies on Student Enrollment in Advanced Placement Courses**

Districts have varied policies and procedures regarding student access to AP courses.
Other than school size and location, access to AP courses is largely influenced by school
policies on AP course offerings and AP enrollment, specifically who is eligible for
enrollment and how those students are identified; indeed, districts and schools have the
autonomy to establish criteria and policies for enrollment in an AP course. These policies
are not standardized or imposed by the College Board (Cassity, 2013). Therefore, there are widely divergent policies across the country and even within the same state. Policies range from open access to strict gatekeeping that restricts enrollment in an AP course to select students. However, approximately 35% of high schools that offer AP courses have an open access policy that permits students to enroll in AP courses without meeting established criteria (Farkas & Duffett, 2009). There are two predominant enrollment models in the United States: open enrollment, which permits any student to enroll in an AP class, and closed enrollment, which restricts access based on established criteria (Flores & Gomez, 2011). Research on both approaches has not identified a definitive “best” approach (Flores & Gomez, 2011; Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009; Rothschild, 1999). Prior to the publication of the College Board’s equity statement and the establishment of the “equity and excellence” metric, many schools limited student access to AP courses. AP courses were reserved for only the most “qualified” students, and enrollment was modest. “Roadblocks” included required teacher recommendations, minimum grades in prior courses, minimum standardized test scores, and local admission assessments. Schools that permitted exceptions to these criteria required parental waivers that often declared that the school did not recommend the course selection and was not responsible for student difficulty or failure.

The AP program was initially created for elite students (Schneider, 2009). This structure was supported by overarching beliefs supportive of tracking. The term tracking, also known as ability grouping, refers to an educational practice used by schools as early as the 1930s. Oakes and Guiton (1995) have written about the impact of tracking on student achievement for over three decades and defined “tracking” as the practice of grouping
students by ability into courses with differentiated curricula: high-, middle-, or low-level courses (Oakes & Guiton, 1995; Oakes, 2005). These courses are related to a “track” designated as early as elementary school (Futtrell & Gomez, 2008). Students are assigned a particular track based on numerous factors — standardized test scores, teacher recommendation, the prior year’s grades, or perceived ability or IQ. Oakes and Guiton (1995) found that high school policies and practices often reinforce inequitable course enrollment in advanced coursework, particularly along the lines of race, ethnicity, and class. Case studies of three high schools highlighted the influence of school policies that directed underrepresented students away from challenging coursework (Oakes & Guiton, 1995).

However, the advocates for tracking believe its intended purpose is to increase student achievement by reducing the disparities between students within the classroom (Loveless, 2013; Oakes, 2005; Slavin, 1987). They defend tracking based on the following assumptions: students learn better with students of a similar ability; a homogeneous classroom is easier for effective teaching; and low-achieving students develop higher self-esteem when they are not exposed to high-achieving students (Oakes, 2005). Proponents of the system believe tracking is a fair practice that is based on objective data but give little consideration to students who may be denied access to advanced tracks, including AP, which can impact future outcomes (Burris & Garrity, 2008). Much of the research on tracking includes some benefits for high-achieving students. However, minority students and low-SES students are more often placed into “lower” tracks that include less academically challenging courses and little opportunity for growth (Oakes, 2005).

The critics of tracking believe that heterogeneous classes benefit all students; stronger students benefit from peer tutoring, and lower ability students are positively
influenced in a heterogeneous environment. Students in heterogeneous groupings grow more in challenging courses, regardless of their abilities at the beginning of the class (Hallinan, 2004).

In secondary schools that use tracking, it may be difficult for students to move between tracks (Oakes, 2005). In many districts, AP courses are largely restricted to students in designated “high” tracks. Parents and teachers often resist the efforts made to alter this system. Some parents of students in high tracks believe that a heterogeneous environment diverts attention away from low-ability students. Many teachers have a similar mindset and believe challenging courses, including AP, should only be available to high-ability students. These teachers have stated that they need to slow down the pace of instruction to meet the needs of all students when the environment is not tracked (Farkas & Duffett, 2009).

In line with the idea of tracking, systemic barriers limit access to AP courses for traditionally underrepresented students (Theokas & Saaris, 2013). Additional barriers also include a lack of knowledge about the advantages of AP courses, a lack of awareness about the prerequisites required to be academically prepared, or a preference of receiving higher grades compared with being academically challenged. Most high schools in America currently offer at least a limited number of AP courses; therefore, the opportunity gap is largely the result of enrollment restrictions as opposed to schools not offering AP courses (Theokas & Saaris, 2013).

In the last decade, there has been a growing trend in increasing access to AP and advanced course work (e.g., honors courses, IB courses), particularly for various subgroups and “middle” students who often perform adequately but may not have met previous enrollment criteria (Winebrenner, 2006). Indeed, the College Board’s equity policy
statement encourages the elimination of any barriers that restrict access to AP courses (College Board, 2002). Many school districts have eliminated enrollment criteria or relaxed enrollment policies. The National Governors Association initiated the “AP Expansion Project” in Maine, Wisconsin, Alabama, Kentucky, Georgia, and Nevada with the goal of ensuring AP courses were available to “nontraditional” students and to support those students once they have been enrolled. The advancement via individual determination (AVID) program is a strong example of this philosophy. AVID is a nonprofit program that supports schools in shifting to a student-centered approach to close the opportunity gap and ensure all students are prepared to pursue individual goals (AVID Center, 2018). The AVID program recruits “average” students with the goal of enrolling them in at least one AP course during their high school careers. AVID provides educator resources and professional development to increase teacher effectiveness and encourage student success in challenging courses.

Opening access provides opportunities for a greater number of students to challenge themselves in an AP course and ensures that minority subgroups are not denied educational opportunities because of systemic barriers. However, there are concerns about the impact of expansion. Critics of open enrollment policies have cited concerns about underprepared or unqualified students taking AP courses (Sadler & Tai, 2007). Critics believe that open enrollment leads to a greater percentage of students scoring a 1 or 2 on the AP exam, which compromises their eligibility for college credit or advancement. Sadler and Tai (2007) posited that scoring a 1 on the AP exam was not beneficial for the student in any capacity and possibly meant a wasted year for the student because he or she was not appropriately placed in a lower-level course. While the percentage of graduating high school students
scoring at least a 3 on an AP exam has increased from 12% in 2003 to 15% in 2008, the mean score declined from 2.96 to 2.85 (Farkas & Duffett, 2009). Critics also have claimed that open enrollment could mean that gifted students will not receive the necessary focus and attention. In a more heterogeneous environment, unskilled teachers may not differentiate between low- and high-ability students and hence may only focus on the less-prepared students in the class (Thompson & Rust, 2007).

Open enrollment policies are not always popular among teachers. Following years of exclusivity, many teachers speculate that open access means a “watering down” of the curriculum to accommodate students who previously did not have permission to enroll (Farkas & Duffett, 2009). A study sponsored by the Thomas B. Fordham Institute sought to explore the impact of the rapid democratization of AP on its quality, specifically regarding the education of top students. The study included a national survey of 1,024 randomly selected public school teachers who were currently teaching at least one AP course. The focus of the study included two basic research themes, “1. What explains the growth in the AP Program? 2. What impact has this growth had?” (Duffett & Frakas, 2009).

Only 38% of the teachers felt that any student who wanted to take an AP course should be permitted. “A little more gatekeeping please” was the majority response from the teachers surveyed. Of the teachers surveyed, 52% stated that they felt that the AP students who are now enrolling are unprepared for the rigor and demands of the AP program (Farkas & Duffett, 2009). The study concluded that most teachers “believe that the program’s quality is holding up in the face of tremendous expansion, they also see troubling signs in their
classrooms from students who overestimate their abilities and parents who are overeager to see their kids in AP courses” (Farkas & Duffett, 2009, p. vi).

If schools adopt open access policies, support and “bridges” for nontraditional students are important. Support in this sense would include pre-AP coursework that models the AP program’s rigor and challenge, study skills courses, tutoring, summer or after-school “boot camps” that address the necessary skills, and content and mentoring programs that work directly with students (Freehold Regional High School District, 2017b).

Summary

Since its inception in the 1950s, the growth of the College Board’s AP program is indicative of a philosophical shift toward access and opportunity. This includes nontraditional students who may not have previously been eligible to take an AP course because of prerequisite criteria. Subsequently, there are concerns about the diminishing quality and rigor of the AP program.

The literature on the AP program is inconclusive concerning the impact of open access. Advocates for open access believe that advanced programs—specifically AP—are important to ensure equity and opportunity for underserved populations. Enrollment in an AP course, irrespective of the students’ scores on the AP exam, is still beneficial (Flores & Gomez, 2011). Contradicting this sentiment is a belief that the growth of the AP program is potentially harmful for those students who are underprepared and, hence, who would not benefit from enrollment in an AP course.
CHAPTER III: Research Methodology

The purpose for the current study was to explain the influence of an open access policy on student achievement as measured by AP exam scores. The present study compared the relationship of the type of student—traditional versus nontraditional—with student achievement while controlling for student-level variables. The results from previous studies have indicated that AP students outperform their peers who do not have AP experience in various measures of college success, are more likely to enroll in college, and are more likely to complete college in 4 years (Dougherty et al., 2006; Eimers & Mullen, 2003; Hargrove et al., 2008; Mattern et al., 2013; Mattern et al., 2009; Morgan & Klaric, 2007; Morgan & Ramist, 1998). The current study adds to the existing literature, providing district administrators and policy makers with evidence related to AP enrollment policies. This is important because a growing number of secondary schools are considering modifications to enrollment policies or have already modified their enrollment policies. Indeed, there has been a significant increase in the number of students taking AP courses over the last 15 years nationally, specifically in the last 5 years in the studied school district. Prior to a policy change in the studied district, only high-achieving students with a history of high grades and advanced coursework were permitted to enroll in AP courses.

The current study utilized secondary data and was a nonexperimental, correlational, explanatory study with quantitative design methods, hence indicating that the researcher did not manipulate the existing data; instead, the researcher evaluated the information within the context that it exists. A quantitative methodology identifies the factors that influence specific outcomes (Creswell, 2009). Nonexperimental quantitative research is important in education because it is often not possible to conduct an experiment or quasi-experiment.
because variables cannot be manipulated. A correlational research design was used; therefore, the results do not indicate causality among the variables, only a possible relationship.

This chapter presents the methodology and procedures utilized to conduct the current study. The following sections are included: (a) Population and Sample (including a description of the AP program within the district); (b) Research Design; (c) Research Questions and Hypotheses; (d) Data Collection; (e) Instrumentation; (f) Protection of Subjects; (g) Procedures; (h) Data Analysis Plan; and (i) Summary. In the study, t-tests and a multiple linear regression analysis are used to analyze the results for each exam: Calculus AB, English Language and Composition, Physics 1, and United States History. Independent sample t-tests were conducted to compare the mean scores of traditional students with nontraditional students. A multiple linear regression was used to explain the relationship of the predictive variables as they relate to the dependent variable—student achievement, which was measured by AP exam scores. The predictive variables included the designation of traditional AP students and nontraditional AP students. The control variables included the following: 2015–2016 GPA, PSAT/NMSQT score, SES, as designated by free/reduced lunch status, and prior AP experience, as indicated by enrollment in an AP course in the prior year.

Population and Sample

The Freehold Regional High School District is in western Monmouth County in New Jersey and covers over 200 square miles. It serves eight municipalities and seven elementary districts. Total district enrollment has declined over the last 5 years from 12,020 students in
2010–2011 to 11,126 students in 2016–2017 (New Jersey Department of Education [NJDOE], 2017). Each of the six high schools implements the same curriculum for their core courses. District wide, the ethnic make-up includes 9% Asian, 4% black or African American, 9% Hispanic or Latino, 2% multiracial, and 76% white (New Jersey Department of Education [NJDOE], 2017). The percentage of students designated as free/reduced lunch status varies in each school, ranging from 4%–27%. The district includes two of the wealthiest communities in the state—Colts Neck and Marlboro—as measured by average income. Students consistently score well on standardized assessments, and the district celebrates significant academic achievements. Over 90% of the students pursue higher education, including at some of the most prestigious colleges in the nation. College acceptances regularly include Ivy League schools and top-tier programs. AP achievement is a source of pride in the district.

The sample for the current research included students enrolled in the designated AP courses who took the designated AP exam. Not all the students enrolled in the selected AP courses in the 2016–2017 school year met the requirements for inclusion in the present study because they did not take the associated AP exam; here, the district does not require students to take the AP exam if they are enrolled in the AP course. The students included in the sample met the following criteria:

A. Enrolled in one of the designated Freehold Regional High School District AP courses (Calculus AB, English Language and Composition, Physics 1, or United States History) in the 2016–2017 school year

B. Had a valid PSAT/NMSQT score

C. Had a valid 2015–2016 GPA
D. Had a valid AP exam score on the designated AP exam

The number of students that had complete data for each AP exam included the following:

A. AP Calculus AB \((n = 486)\)

B. AP English Language and Culture \((n = 532)\)

C. AP Physics 1 \((n = 421)\)

D. AP United States History \((n = 852)\)

To ensure the appropriate sample size power, an a priori calculation was conducted using the work of Green (1991), as cited in the work of Field (2009). Green recommends a minimum sample size of \(50 + 8k\), where \(k\) is the number of predictors. Using five predictors, a sample size of 90 is necessary \((50 + 40 = 90)\). To test the individual predictors Green suggests a minimum sample size of \(104 + k\). Using the example of five predictors a minimum sample size of 109 is necessary \((104 + 5 = 109)\) (p. 222). The samples for each AP exam studied exceeded the minimum sample size (Green, 1991).

**History of AP in the District**

The district has offered AP courses for several decades. In June of 2011, a new superintendent initiated an analysis of the enrollment barriers and tracking within the district. The creation of action plans that were focused on eliminating lower-level courses and removing the barriers to higher-level courses (e.g., AP) were a product of the analysis. One of the reasons for this initiative was to reduce any academic disparities among the students coming from the seven elementary school districts sending students to the high schools, which would also address disparities in students’ race, SES, and ethnicity. By the winter of 2012, significant changes were in motion. Specifically, an open access policy was
initiated—students were permitted to enroll in an AP course without a teacher recommendation or prerequisite grade in the prior year’s course. With the transition to an open access policy, the number of students participating in the AP program and the number of AP exams has grown significantly, as indicated in Table 4. All six high schools offer approximately 20 AP courses each year. Enrollment dictates the offering of courses each year.

Table 4

<table>
<thead>
<tr>
<th>District Advanced Placement Program Data, 2010–2011 to 2016–2017</th>
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<tbody>
<tr>
<td>Year</td>
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<tr>
<td>------</td>
</tr>
<tr>
<td>2010–2011</td>
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<td>2011–2012</td>
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<td>2012–2013</td>
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<td>2013–2014</td>
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<td>2014–2015</td>
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<tr>
<td>2015–2016</td>
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<tr>
<td>2016–2017</td>
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</tbody>
</table>

(Freehold Regional High School District, 2017a)

Prior to open access enrollment policy

Prior to a shift in the policy regarding which students were eligible to take an AP course, students were required to have a minimum grade in the prior year’s course, and waivers were not permitted. These criteria were published in the course guide each year and were known to all academic supervisors who were responsible for coordinating student placement into specific courses and responding to the subsequent communication from parents requesting placement into AP. Acceptance into an AP course was considered “elite” and reserved for only the most well-prepared and academically motivated students, per the prior year’s course grades and teacher recommendations. It is significant to understand these
barriers because this was a component of the culture within the district surrounding AP courses. The shift in the College Board philosophy toward equity and access did not fully permeate through the district until there was a leadership change in June of 2011.

**After open access enrollment policy**

In November of 2011, the district’s AP task force was established to identify additional students who could be successful in AP courses. The task force identified specific reasons students would choose to take an AP course, including the following:

An opportunity to experience the academic rigor of college, embrace what it means and what it takes to be “college-ready,” foster self-motivation, build confidence, responsibility, and self-reliance, be competitive in the college admissions process, favorably impact college admissions decisions and be a part of the “college-going” culture in the high school.

(Freehold Regional High School District, 2011, p. 1)

In December 2011, the AP task force made recommendations to the superintendent to increase enrollment and provide academic support for success. These recommendations included the implementation of an AP summer bridge program, the development of staff capacity through College Board–sponsored professional development conferences and workshops, a commitment to reduce the average class size in AP courses, and the creation of an AP teacher mentor program. The AP summer bridge program was primarily for students aspiring to take an AP class for the first time in the upcoming school year. The program was created to provide students with the foundational skills and content knowledge to feel more confident before entering into an AP course. The district then established annual goals to encourage students to enroll in advanced courses, which could include AP courses. Specific structural changes included direct outreach to nontraditional students, who were identified
by various means, including a review of their grades in the prior year’s course, PSAT/NMSQT scores, and the College Board’s AP Potential Tool. The strategies and implementation timelines varied across schools; however, all the schools engaged in a more systematic identification of potential AP students.

In January of 2012, beginning with course registrations for the 2012–2013 school year, the admission criteria for AP course enrollment changed. Teacher recommendations were still utilized; however, students could not be prohibited from enrolling in an AP course based on their grades from a prior year’s course or the lack of a teacher recommendation. Waivers were no longer necessary. Students had the opportunity to take an AP course if they were interested and, ideally, academically prepared.

Additional incentives were created to encourage enrollment in an AP course. In 2014, beginning with the class of 2017, the GPA weight for an AP course was increased. Additional quality points were assigned to AP courses compared with honors courses and academic courses. Also, in 2014, students who took an AP course and the AP exam were exempt from taking the final exam of that AP course (Freehold Regional High School District, 2015). This was another incentive to encourage AP students to participate in the course. From 2011 to 2016, the number of AP exams given in the district increased from 2,802 to 5,482 (College Board, 2016a).

**Research Design**

The research design of the current study was a nonexperimental, correlational, and explanatory study with quantitative design methods. An experimental design was not possible because it is not possible to manipulate which students will take an AP course or AP exam and which students will not. When important variables of interest are not
manipulable, “nonexperimental research is frequently an important and appropriate mode of research in education” (Johnson, 2001, p. 3). The dependent variables in the present study were student scores on the designated AP exams in the 2016–2017 school year, including Calculus AB, English Language and Composition, Physics 1, and United States History. The independent variables were the designation of traditional and nontraditional students. This identification was determined by the enrollment criteria prior to the implementation of the open access policy; this includes the prior year grade criteria, minimum of an A- in an academic course or a minimum of a B- in an honors course. Four covariates were examined: GPA, PSAT/NMSQT score, SES as designated by free/reduced lunch status, and prior AP experience as indicated by enrollment in an AP course in the prior school year. All six schools included in the current study calculate GPA as an indicator of student academic progress (Freehold Regional High School District, 2015).

Table 5

*FRHSD Grade Point Average Formula*

<table>
<thead>
<tr>
<th>Grade</th>
<th>Regular</th>
<th>Honors</th>
<th>Advanced Placement</th>
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<tbody>
<tr>
<td>A+</td>
<td>4.6</td>
<td>5.6</td>
<td>6.1</td>
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<tr>
<td>A</td>
<td>4.3</td>
<td>5.3</td>
<td>5.8</td>
</tr>
<tr>
<td>A-</td>
<td>4.0</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>B+</td>
<td>3.6</td>
<td>4.6</td>
<td>5.1</td>
</tr>
<tr>
<td>B</td>
<td>3.3</td>
<td>4.3</td>
<td>4.8</td>
</tr>
<tr>
<td>B-</td>
<td>3.0</td>
<td>4.0</td>
<td>4.5</td>
</tr>
<tr>
<td>C+</td>
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<td>3.6</td>
<td>4.1</td>
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<tr>
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<td>2.3</td>
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<td>2.6</td>
<td>3.1</td>
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<tr>
<td>D</td>
<td>1.3</td>
<td>2.3</td>
<td>2.8</td>
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<tr>
<td>E</td>
<td>0</td>
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<td>0</td>
</tr>
</tbody>
</table>

(Freehold Regional High School District, 2015)
Per the FRHSD Student Family Handbook, “quality points are computed by assigning a numerical value to each grade which is multiplied by the total number of credits assigned to the course” (Freehold Regional High School District, 2015, p. 24).

The PSAT/NMSQT is a nationally administered standardized assessment produced by the College Board and is primarily used to prepare students for the SAT and to identify students who qualify as National Merit Scholars. The PSAT/NMSQT test consists of three sections: reading, writing, and mathematics. The raw scores for reading and writing and mathematics are converted to section scores using a scale of 160–760, with combined scores ranging from 320–1520 (College Board, 2019a). Prior AP experience was identified as participation in an AP course in any subject in the prior school year. SES was identified using the free/reduced lunch status, as noted in the student management system for the 2016–2017 school year. Each of these covariates have the potential of impacting the dependent variable. Controlling for the effects of these covariates can better identify the relationship between the dependent and independent variables.

The analyses were conducted in two phases: (1) determination of the differences in the mean AP score between traditional and nontraditional students and (2) determination of the influence of academic factors in explaining student achievement as measured by scores on the AP exam. A multiple linear regression was used here. This method is typically used to explain and maximize prediction. According to Field (2009), “regression analysis enables us to predict future outcomes based on values of predictive variables” (p. 221). In addition, a multiple regression model was used to specify which variables influenced student achievement and allowed for the statistical control of extraneous variables to make comparisons. Prior to using multiple linear regression procedures, independent sample t-
tests were conducted to compare the mean scores of traditional students with the scores of nontraditional students on the AP exam. The means were examined for each group of students and by each designated course.

Multiple linear regression tests were run to test each hypothesis. The researcher was able to distinguish between the significance and strength of the variables by performing simultaneous multiple regressions for each AP exam. The level of significance was set at \( p < 0.05 \), which is the customary level for significance. To check the statistical significance and relative importance of each predictive variable, the unstandardized coefficient beta weights and the standard beta weights of each predictive variable were examined. The \( R^2 \) was also used to examine the relationships between the predictive variables and dependent variables.

**Research Questions and Hypotheses**

The current study was guided by the following overarching questions:

**Research Question 1**: What is the relationship between the type of student (traditional versus nontraditional) and student achievement as measured by AP exam scores?

**Null Hypothesis 1**: There is no statistically significant difference between the type of student (traditional versus nontraditional) and achievement on the AP exam as measured by AP exam scores.

**Research Question 2**: What is the relationship between the type of student (traditional versus nontraditional) and student achievement as measured by AP exam scores when controlling for GPA, PSAT/NMSQT, student SES, and prior AP experience?
Null Hypothesis 2a: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP Calculus AB exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

Null Hypothesis 2b: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP English Language and Composition exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

Null Hypothesis 2c: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP Physics 1 exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

Null Hypothesis 2d: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP United States History exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

Data Collection

The current study includes all students enrolled in the designated AP courses in the district during the 2016–2017 school year who took the associated AP exam. Student-level data were acquired, compiled, and analyzed using district data stored in the district student data management system (Genesis) and from data provided annually by the College Board. The school district’s student management system provided all the demographic data,
including course enrollments, 2015–2016 GPAs, most current PSAT/NMSQT scores, SES, and prior AP experience.

Data for the dependent variables—2016–2017 AP exam scores for Calculus AB, English Language and Composition, Physics 1, and United States History—were collected from the district student data management system. These data are provided annually by the College Board in the form of student-level, school-level, and district-level data. District summary reports included the student scores on all AP exams. The AP scores for each student were exported into the student management system to maintain a comprehensive file of student achievement data. The data were downloaded directly from the student management system and exported into an Excel spreadsheet for analysis. The clean data were in the correct format to be imported into the Statistical Package for Social Science (SPSS) statistical software.

Data to determine the independent variables—traditional AP students and nontraditional AP students—were obtained from the district student management system. The data were exported into an Excel spreadsheet for analysis. Students were identified as traditional or nontraditional utilizing district criteria from 2011, which was prior to open access. In addition, 2015–2016 GPAs, most current PSAT/NMSQT scores, prior AP experience status, and SES were exported from the district student management system and included on the spreadsheet.

Permission was granted from the superintendent to use all the requested resources in the school district. Confidentially and anonymity were guaranteed through the utilization of nonidentifying student numbers.

Instrumentation
The current study focused specifically on four AP courses: Calculus AB, English Language and Composition, Physics 1, and United States History. Hence, it is important to disaggregate data on each course because the outcomes are different for each course. These courses were the most widely enrolled in the district in the 2016–2017 school year.

AP exams are standardized instruments designed collaboratively by selected teams of college faculty and high school AP teachers. The design process includes extensive review, analysis, piloting, and revision to ensure the tests provide an appropriate measure of a student’s preparedness for advanced placement upon college entrance. Each AP exam uses a score-setting process that involves psychometric analyses of the results in a specific year and then compares the performance of the students enrolled in comparable college-level courses to ensure alignment to college-level standards. Composite score points are set to ensure that a score of 5 is equivalent to the average score of college students achieving a grade of A in the course (College Board, 2016b).

The Calculus AB exam includes a multiple-choice section with 45 questions and a free-response section with six questions that measure the student’s understanding of the foundational concepts of calculus, including limits, derivatives, integrals, and the fundamental theorem of calculus. The mathematical practices for AP Calculus are embedded in the course curriculum and assessed by the exam. Multiple-choice questions are machine scored; the free-response questions are scored by college faculty and expert AP teachers from across the country. Scores on the free-response section are weighted and combined with the results of the multiple-choice section to create a raw score that is converted into a composite score of 1 to 5.
The AP English Language and Composition course was aligned with an introductory college-level rhetoric and writing curriculum. Forty-five percent of the exam includes 52–55 multiple-choice questions on students’ skills in rhetorical analysis of prose passages. The average score for the computer-graded multiple-choice section consists of the total correct answers, which makes up the raw score. The exam also includes three essay prompts that measured rhetorical analysis, argumentation, and synthesis of information from multiple sources to support the student’s argument. AP readers manually grade the free-response answers against an established rubric, providing a possible score of 9 points per question. The grading rubric is comprehensive and provides acceptable answers for each component of the question to ensure consistency. The multiple-choice and free-response scores are combined to create the composite score, which proportionally is weighted to each section and is then converted to a score of 1 to 5.

The AP Physics 1 exam includes two sections: 50 multiple-choice questions that represents the knowledge and science practices for the course and five questions in the free-response section that include an experimental design prompt and qualitative/quantitative translation and short-answer part. Each section is 50% of the total score. The average score for the computer-graded multiple-choice section consists of the total correct answers out of 50, which is the raw score. AP readers manually grade the free-response answers against an established rubric, providing a total score of 7 points per question on three of the questions and 12 points per question on two of the questions, specifically experimental design and quantitative/qualitative translation. The grading rubric is comprehensive and provides acceptable answers for each component of the question to ensure consistency. The multiple-
choice and free-response scores are combined to create the composite score, which proportionally is weighted to each section and is then converted to a score of 1 to 5.

The AP United States History exam consists of 55 multiple-choice questions that require students to respond to a primary or secondary source and that assess students’ ability to reason about the source material and combine it with their knowledge of course content. This section is worth 40% of the exam score. The exam also includes short-answer questions that assess the practice of analyzing secondary sources and the skill of causation or comparison. The questions require students to analyze historians’ interpretations, historical sources, and other propositions about history. This section is worth 20% of the exam score. The exam also includes one document-based question that is worth 25% of the exam score and a long essay question worth 15% of the exam score, here requiring students to develop an argument and utilize primary source documents to support the argument. The free-response questions are scored by college faculty and expert AP teachers by using established rubrics and scoring standards. Scores on the free-response section are weighted and combined with the results of the multiple-choice section before being converted into a score of 1 to 5.

**Protection of the Subjects**

The data utilized for the current study were codified private information, so it was not possible to ascertain the identity of any individual student. All information gathered was deidentified to protect the subjects. The study did not provide any identifiable information or characteristics for specific students or schools.

**Data Analysis Plan**
The research design of the current study utilized existing observed data. The study did not use human subjects; therefore, permission was not necessary from the institutional review board (IRB). Each exam’s data were retained as an individual data set in Excel and uploaded into the SPSS software program. Descriptive statistics were used to provide the mean and standard deviation for each variable. Prior to using the regression analysis, the data were analyzed using independent sample t-tests to compare the mean scores of traditional and nontraditional students for each exam. A multiple linear regression analysis was used to perform the analysis of the data. A multiple regression analysis was conducted for each AP exam. To ensure the appropriate sample size power, an a priori calculation was conducted using the work of Green (1991), as cited in the work of Field (2009). The samples for each AP exam studied exceeded the minimum sample size.

Using a regression analysis permitted the statistical control of covariates. Four covariates were used: GPA, PSAT/NMSQT score, SES, and prior year AP experience. PSAT scores were selected instead of SAT scores because students take the PSAT in 10th and 11th grades during the school day and at the expense of the school district. Therefore, most students had a valid PSAT/NMSQT score. The research questions were studied using descriptive and correlational analyses to discover the significance of the predictor variables on the dependent variable.

The statistical output was analyzed to determine which variables, if any, created multicollinearity issues; this was done by analyzing the variance inflation factors (VIF) levels. The data were also analyzed for skewness to measure the degree to which most of the scores in a frequency distribution are located at one end of the scale of measurement (Hinkle, Weirisma, & Jurs, 2003). Analyses of skewness and histograms were created for this
process. Histograms and scatterplots of the data were completed, including multicollinearity statistics and simultaneous regression analyses using all the variables. The scatterplots were analyzed and examined to see if a linear line of strength was present. The scatterplots exhibited a linear line of strength, indicating a relationship between the independent and dependent variables. Following an evaluation of the normality, multiple regression models that included all the independent variables were conducted for each of the AP exams. A correlation coefficient matrix was created to identify the variables that were statistically significant.

**Summary**

Chapter III provided a description of the research methodology, including the population and sample, research design, data collection methods, instrumentation, and data analysis plan. The current study was conducted to explain the influence of an open access policy on student achievement because there is significant pressure to ensure students are college and career ready. Indeed, district leaders have a responsibility to judiciously allocate district resources to meet this challenge. The data related to the current study can support decision making in pursuit of opportunities that ensure student achievement. The results of the data analysis will be presented in Chapter IV.
CHAPTER IV: Analysis of the Data and Findings

The purpose of the present study was to explore the influence of an open access policy on academic achievement, as measured by scores on the College Board’s AP exams for Calculus AB, English Language and Composition, Physics 1, and United States History. The AP program is a hallmark of college preparatory education in America. The stated benefits of the AP program included advantages in the college admissions process and preparation for higher education and require educators to assess pathways for all students to access these opportunities (Ackerman et al., 2013; Clinedinst et al., 2015; Hargrove et al., 2008; Eimers & Mullen, 2003; Mattern et al., 2009; Mattern et al., 2013; Morgan & Klaric, 2007; Santoli, 2002; Warne et al., 2015; Warne, 2017). School districts grapple with maintaining specific criteria for enrollment to safeguard student success but at the cost of potentially denying a qualified student an opportunity because of established criteria that do not accurately measure student potential for success. The current study explored the influence of an open access policy, in which more students are eligible to enroll in AP courses, on student achievement. Structural barriers within a school system, including denying students access to AP courses, can increase gaps in academic opportunity. Providing access to AP courses for all students is a structural barrier that can be changed. The results from the current study can be used by educators, district, school administrators, and policy makers to guide decisions about AP enrollment policies and initiatives. Information from the current study will support district and school leaders in their ongoing efforts to ensure college and career readiness for all students.

This chapter presents the results of the statistical analysis discussed in Chapter III. The results are derived from a range of descriptive statistics, t-tests, and multiple regression
analyses. The dependent variables are students’ performance on the designated AP exams, which were obtained from the student information system and provided by the College Board. The independent variable is the designation of students as “traditional” or “nontraditional.” The control variables include GPA, PSAT/NMSQT score, SES, and prior AP experience. The sample includes all students enrolled in the designated AP courses during the 2016–2017 school year who took the related AP exam.

This chapter includes a review of the research questions and null hypotheses that guided the current research study. Each research question and hypothesis is presented with the corresponding results. Relevant conclusions are supported with data tables and written analyses. From these findings, recommendations are made for policy, practice, and future research.

Procedure

The research design of the current study was a nonexperimental, quantitative, and explanatory study with quantitative design methods. This correlational study only collected data from one point in time. To determine which student variables had a statistically significant relationship on student achievement, as measured by the AP exam, a multiple regression analysis was used. Scatterplots of the residuals were constructed to test assumptions. Prior to performing the analysis, the multicollinearity—a statistics phenomenon where two or more predictor variables in a multiple regression model are highly correlated (Field, 2009)—was also examined because it is important in a multiple regression analysis to ensure that the assumption of no multicollinearity has been met.
For this specific study, all student data that met the inclusion criteria were collected and entered into an Excel file, where the data were properly labeled and coded. The Excel file was then loaded into SPSS to obtain descriptive information and analytical results. The following procedure was followed for each AP exam to determine the significant independent variables and the relative predictive strength. First, a multiple regression included all five independent variables at one time. The purpose was to determine which of the variables was a statistically significant predictor. Next, prior to completing the analysis, it was determined if the sample size had adequate power to run the analysis, per the guidelines posited by Field (2009). All the variables were entered into the multiple regression analysis to determine the significance of each independent variable. The intent was to determine if student type had a statistically significant impact on student achievement, as measured by scores on the AP exam.

**Research Questions and Null Hypotheses**

SPSS was used to answer the following research questions:

**Research Question 1:** What is the relationship between the type of student (traditional versus nontraditional) and student achievement as measured by AP exam scores?

**Null Hypothesis 1:** There is no statistically significant difference between the type of student (traditional versus nontraditional) and achievement on the AP exam as measured by AP exam scores.

**Research Question 2:** What is the relationship between the type of student (traditional versus nontraditional) and student achievement as measured by AP exam scores when controlling for GPA, PSAT/NMSQT, student SES, and prior AP experience?
Null Hypothesis 2a: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP Calculus AB exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

Null Hypothesis 2b: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP English Language and Composition exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

Null Hypothesis 2c: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP Physics 1 exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

Null Hypothesis 2d: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP United States History exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

Descriptive Statistics

The research population included students who were enrolled in the identified AP courses and who took the associated AP exam in the 2016–2017 school year. Table 6 includes the descriptive statistics for the demographics for AP Calculus AB. The total number of students defined as traditional was 416 (85.6%). The total number of students defined as nontraditional was 70 (14.4%). White students comprised 69.8% of the sample;
50.8% of the students were male, 96.7% were not low SES, and 76.3% had prior AP experience.

Table 6

*Descriptive Statistics for the Demographics AP Calculus AB Exam*

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
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</tr>
<tr>
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<td>70</td>
<td>14.4</td>
</tr>
<tr>
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<td>85.6</td>
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<td><strong>Gender</strong></td>
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<tr>
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<td>49.2</td>
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<tr>
<td>Male</td>
<td>247</td>
<td>50.8</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
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<td></td>
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<tr>
<td>Asian</td>
<td>114</td>
<td>23.5</td>
</tr>
<tr>
<td>Black</td>
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<td>2.5</td>
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<tr>
<td>Hispanic</td>
<td>17</td>
<td>3.5</td>
</tr>
<tr>
<td>Multirace</td>
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</tr>
<tr>
<td>Pacific Islander</td>
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<td>0.2</td>
</tr>
<tr>
<td>White</td>
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<td>69.8</td>
</tr>
<tr>
<td><strong>Low SES</strong></td>
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<td></td>
</tr>
<tr>
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<td>440</td>
<td>96.7</td>
</tr>
<tr>
<td>Yes</td>
<td>46</td>
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<td><strong>Prior AP Experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>115</td>
<td>23.7</td>
</tr>
<tr>
<td>Yes</td>
<td>371</td>
<td>76.3</td>
</tr>
</tbody>
</table>

N = 486

Table 7 provides the descriptive statistics for the academic performance for AP Calculus AB. The mean AP Calculus AB exam score for all students in the sample was 3.84, with a range from 1 to 5. The mean 2016–2017 GPA for all students in the sample was 4.83.

The mean GPA for traditional students was 4.93, and the mean GPA for nontraditional students was 4.23. The mean PSAT score was 1263.25, with a range from 890 to 1500. The
mean PSAT score for traditional students was 1270, and the mean PSAT score for nontraditional students was 1223.

Table 7

*Descriptive Statistics for Academic Performance for AP Calculus AB Exam*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>16–17 AP Calculus AB Exam Score</td>
<td>3.84</td>
<td>1.12</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Most Recent PSAT Score</td>
<td>1263.25</td>
<td>117.93</td>
<td>890</td>
<td>1500</td>
</tr>
<tr>
<td>16–17 GPA</td>
<td>4.83</td>
<td>0.4776</td>
<td>2.97</td>
<td>5.89</td>
</tr>
</tbody>
</table>

N = 486

Table 8 includes the descriptive statistics for the demographics for AP English Language and Composition. The total number of students defined as traditional was 514 (96.6%). The total number of students defined as nontraditional was 18 (3.4%). White students comprised 72% of the sample, 63.9% of the students were female, 96.6% were not low SES, and 22.2% had prior AP experience.
Table 8

*Descriptive Statistics for the Demographics for AP English Language and Composition Exam*

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>18</td>
<td>3.4</td>
</tr>
<tr>
<td>Yes</td>
<td>514</td>
<td>96.6</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
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<td></td>
</tr>
<tr>
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<td>340</td>
<td>63.9</td>
</tr>
<tr>
<td>Male</td>
<td>192</td>
<td>36.1</td>
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<tr>
<td><strong>Ethnicity</strong></td>
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<td>Asian</td>
<td>92</td>
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<tr>
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<td>16</td>
<td>3.0</td>
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<tr>
<td>Hispanic</td>
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<td>5.3</td>
</tr>
<tr>
<td>Indian American</td>
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<td>0.2</td>
</tr>
<tr>
<td>Multirace</td>
<td>10</td>
<td>1.9</td>
</tr>
<tr>
<td>Pacific Islander</td>
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<td>0.4</td>
</tr>
<tr>
<td>White</td>
<td>383</td>
<td>72.0</td>
</tr>
<tr>
<td><strong>Low SES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>514</td>
<td>96.6</td>
</tr>
<tr>
<td>Yes</td>
<td>18</td>
<td>3.4</td>
</tr>
<tr>
<td><strong>Prior AP Experience</strong></td>
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<td></td>
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<td>No</td>
<td>414</td>
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<tr>
<td>Yes</td>
<td>118</td>
<td>22.2</td>
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N = 532

Table 9 provides the descriptive statistics for academic performance for AP English Language and Composition. The mean AP English Language exam score was 3.49, with a range from 1 to 5. The mean GPA for 2016–2017 was 3.49. The mean GPA for traditional students was 4.72, and the mean GPA for nontraditional students was 3.88. The mean PSAT score was 1233.7, with a range from 730 to 1510. The mean PSAT score for traditional students was 1236, and the mean PSAT score for nontraditional students was 1076.
Table 9

*Descriptive Statistics for Academic Performance for AP English Language and Composition Exam*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>English Score 16–17</td>
<td>3.49</td>
<td>0.979</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Most Recent PSAT</td>
<td>1233.70</td>
<td>136.21</td>
<td>730</td>
<td>1510</td>
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<tr>
<td>16–17 GPA</td>
<td>4.71</td>
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</table>

N = 532

Table 10 includes the descriptive statistics for the demographics for AP Physics 1. The total number of students defined as traditional was 386 (91.7%). The total number of students defined as nontraditional was 35 (8.3%). White students comprised 69.8% of the total sample, 51.8% of the students were male, 96.2% were not low SES, and 18.5% had prior AP experience.
Table 10

*Descriptive Statistics for the Demographics for AP Physics 1 Exam*

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
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<td>8.3</td>
</tr>
<tr>
<td>Yes</td>
<td>386</td>
<td>91.7</td>
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<tr>
<td>Gender</td>
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<td>Female</td>
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<tr>
<td>Male</td>
<td>218</td>
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<td>Ethnicity</td>
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<tr>
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<td>Pacific Islander</td>
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<td>White</td>
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<td>404</td>
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<td>Yes</td>
<td>17</td>
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<td>Prior AP Experience</td>
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<tr>
<td>No</td>
<td>343</td>
<td>81.5</td>
</tr>
<tr>
<td>Yes</td>
<td>78</td>
<td>18.5</td>
</tr>
</tbody>
</table>

N=421

Table 11 provides the descriptive statistics for academic performance for AP Physics 1. The mean AP Physics 1 exam score was 2.33, with a range from 1 to 5. The mean GPA for 2016-2017 was 4.72. The mean GPA for traditional students was 4.78, and the mean GPA for nontraditional students was 4.08. The mean PSAT score was 1240, with a range from 890 to 1510. The mean PSAT score for traditional students was 1246, and the mean PSAT score for nontraditional students was 1176.
Table 11

Descriptive Statistics for Academic Performance for AP Physics 1 Exam

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
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<th>Minimum</th>
<th>Maximum</th>
</tr>
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<tr>
<td>1617 AP Physics 1</td>
<td>2.33</td>
<td>1.00</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Most Recent PSAT</td>
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<td>124.62</td>
<td>890</td>
<td>1510</td>
</tr>
<tr>
<td>16–17 GPA</td>
<td>4.72</td>
<td>0.47</td>
<td>2.76</td>
<td>5.89</td>
</tr>
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</table>

N = 421

Table 12 includes the descriptive statistics for the demographics for AP United States History. The total number of students defined as traditional was 773 (90.7%). The total number of students defined as nontraditional was 79 (9.3%). White students comprised 75% of the sample, 56.3% of the students were female, 95.8% were not low SES, and 8.6% had prior AP experience.
Table 12

Descriptive Statistics for Demographics for AP United States History Exam

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</table>

N = 852

Table 13 provides the descriptive statistics for academic performance for AP United States History. The mean AP United States History exam score was 2.72, with a range from 1 to 5. The mean GPA for 2016–2017 was 4.43. The mean GPA for traditional students was 4.49, and the mean GPA for nontraditional students was 3.63. The mean PSAT score was 1163, with a range of 730 to 1510. The mean PSAT score for traditional students was 1172, and the mean PSAT score for nontraditional students was 1042.
Table 13

*Descriptive Statistics for Academic Performance for AP United States History Exam*

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1617 AP Test US History</td>
<td>2.72</td>
<td>1.203</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Most Recent PSAT</td>
<td>1163.70</td>
<td>137.400</td>
<td>730</td>
<td>1510</td>
</tr>
<tr>
<td>16–17 GPA</td>
<td>4.43</td>
<td>0.56</td>
<td>2.28</td>
<td>5.89</td>
</tr>
</tbody>
</table>

N = 852

The greatest percentage of nontraditional students were enrolled in AP Calculus AB. The smallest percentage of nontraditional students were enrolled in AP English Language and Composition. The overwhelming majority of students enrolled in all AP classes were white, followed by Asian and Hispanic students, respectively. The male-to-female ratio in each class was relatively even, except for AP English Language and Composition, which had a larger majority of females enrolled in the class.

**Analysis and Results**

The results of the hypothesis testing are presented below. Here, t-tests were used for continuous dependent variables. AP exam score achievement is measured on a continuous scale. The independent variable is student type: traditional or nontraditional. The t-tests were used to determine a difference in the mean scores between traditional and nontraditional students. The null hypothesis stated that there was no statistically significant difference in mean achievement scores between traditional and nontraditional students.

**Research Question 1**: What is the relationship between the type of student (traditional versus nontraditional) and student achievement as measured by AP exam scores?
**Null Hypothesis 1:** There is no statistically significant difference between the type of student (traditional versus nontraditional) and achievement on the AP exam as measured by AP exam scores.

As shown in Table 14, an independent t-test was used to assess whether the means of the two study groups were statistically different from one another for the AP Calculus AB exam. The results indicate there was a statistically significant difference, with traditional students having a mean score of 3.94 (SD = 1.09) when compared with nontraditional students (M = 3.23, SD = 1.09; $t(484) = -5.051, p < .001$). The null hypothesis was rejected. Traditional students statistically significantly outperformed the nontraditional students on the AP Calculus AB exam.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nontraditional</td>
<td>70</td>
<td>3.23</td>
<td>1.09</td>
<td>-5.051</td>
<td>484</td>
<td>0.000</td>
</tr>
<tr>
<td>Traditional</td>
<td>416</td>
<td>3.94</td>
<td>1.09</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 15, an independent t-test was used to assess whether the means of the two study groups were statistically different from one another for the AP English Language and Composition exam. The results indicate there was a significant difference, with traditional students having a mean score of 3.52 (SD = .98) compared with nontraditional students (M = 2.78, SD = .81; $t(530) = -3.18, p = .002$). The null hypothesis was rejected. The traditional students significantly outperformed the nontraditional students on the AP English Language and Composition exam.
Table 15

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nontraditional</td>
<td>18</td>
<td>2.78</td>
<td>0.81</td>
<td>-3.18</td>
<td>530</td>
<td>0.002</td>
</tr>
<tr>
<td>Traditional</td>
<td>514</td>
<td>3.52</td>
<td>0.98</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 16, for the AP Physics 1 exam, an independent t-test was used to assess whether the means of the two study groups were statistically different from one another. The results indicate there was not a significant difference, with traditional students having a mean score of 2.36 (SD = 1.01) compared with nontraditional students (M = 2.03, SD = .75; t(419) = -1.88, p = .061). Therefore, we failed to reject the null hypothesis. Here, traditional students did not significantly outperform nontraditional students on the AP Physics 1 exam.

Table 16

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nontraditional</td>
<td>35</td>
<td>2.03</td>
<td>0.75</td>
<td>-1.88</td>
<td>419</td>
<td>.061</td>
</tr>
<tr>
<td>Traditional</td>
<td>386</td>
<td>2.36</td>
<td>1.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 17, an independent t-test was used to assess whether the means of the two study groups were statistically different from one another for the AP United States History exam. The results indicate there was a significant difference, with traditional students having a mean score of 2.78 (SD = 1.21) compared with nontraditional students.
(M=2.10, SD=.98; *t*(850) = -4.84, *p* < .001). The null hypothesis was rejected. The traditional students significantly outperformed nontraditional students on the AP United States History exam.

**Table 17**

*T-test Comparing Traditional and Nontraditional Students’ AP United States History Exam Scores*

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th><em>t</em></th>
<th><em>df</em></th>
<th><em>p</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nontraditional</td>
<td>79</td>
<td>2.10</td>
<td>.98</td>
<td>-4.84</td>
<td>850</td>
<td>0.000</td>
</tr>
<tr>
<td>Traditional</td>
<td>773</td>
<td>2.78</td>
<td>1.21</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Research Question 2**: What is the relationship between the type of student (traditional versus nontraditional) and student achievement as measured by AP exam scores when controlling for GPA, PSAT/NMSQT, student SES, and prior AP experience?

The second phase of the data analysis consisted of performing a multiple regression analysis to determine whether the type of student had a statistically significant influence on student achievement, as measured by AP exam scores, after adjusting for the correlates of GPA, PSAT/NMSQT score, SES, and prior AP experience. The goal of this analysis was to determine the amount of influence type of student, GPA, PSAT/NMSAQT, SES, and prior AP experience had on student achievement on the AP exam. A multiple regression model was required because it was necessary to treat the covariates as separate predictors when measuring the effect of type of academic achievement (Field, 2009). A multiple regression analysis was conducted for each AP exam. The statistical output was analyzed to determine which variables, if any, created multicollinearity issues, which was done by analyzing the
VIF levels. The data were also analyzed for skewness to measure the degree to which most of the scores in a frequency distribution would be located at one end of the scale of measurement (Hinkle et al., 2003). Analyses of the skewness and histograms were created for this process. Following an evaluation of the normality, multiple regression models that included all the independent variables were conducted for each of the AP exams. A correlation coefficient matrix was created to identify the variables that were statistically significant.

**Null Hypothesis 2a:** There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP Calculus AB exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

As displayed in Table 18, the Pearson correlations were calculated among the five predictive variables. At the bivariate level, the type of student (traditional) GPA, PSAT, and prior AP experience are significantly correlated with AP Calculus AB exam scores. The Pearson correlation coefficient \( r \) ranges from -1 to 1, and the closer the \( r \) value is to 1 or -1, the stronger the correlation is. Thus, as seen by the \( r \) values for type of student, GPA, PSAT, and prior AP experience, the data show that there was a positive correlation between those variables and the AP Calculus AB exam scores. None of the correlations was above .7, indicating a lack of multicollinearity. SES was not significantly correlated with AP Calculus AB exam scores. To further test this assumption, an examination of the collinearity statistics revealed that there were no variables in this model with a significant VIF (i.e., VIF greater than 2); the VIFs were under 10. This indicated none of the independent variables included in the final regression model had any significant collinearity with one another.
### Table 18

**Correlation Matrix for AP Calculus AB Variables**

<table>
<thead>
<tr>
<th></th>
<th>16–17 AP Exam Calculus</th>
<th>SES Status</th>
<th>Traditional GPA</th>
<th>Most Recent PSAT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SES Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>-0.066</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\text{Si}$</td>
<td>0.145</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Traditional</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>0.224**</td>
<td>-0.121**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\text{Si}$</td>
<td>0.000</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td><strong>16–17 GPA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>0.340**</td>
<td>-0.098*</td>
<td>0.513**</td>
</tr>
<tr>
<td></td>
<td>$\text{Si}$</td>
<td>0.000</td>
<td>0.031</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Most Recent PSAT/NMSQT Score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>0.401**</td>
<td>-0.082</td>
<td>0.141**</td>
</tr>
<tr>
<td></td>
<td>$\text{Si}$</td>
<td>0.000</td>
<td>0.069</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>Prior AP Experience</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>0.097*</td>
<td>-0.033</td>
<td>0.116*</td>
</tr>
<tr>
<td></td>
<td>$\text{Si}$</td>
<td>0.032</td>
<td>0.469</td>
<td>0.010</td>
</tr>
</tbody>
</table>

$N = 486$

*p < .05, **p < .01, ***p < .001
The skewness and kurtosis were checked in the test scores, and both were within the normal range (skewness = -.075; kurtosis = 1.17). The residuals were checked and were normal, as can be seen in Figure 2. The histogram is a bar-type graph for quantitative data and was developed from the dependent variable student achievement and the five predictive variables. The common boundaries between the adjacent bars emphasize the continuity of the data, the same as with the continuous variables (Witte & Witte, 2007, p. 39). The residual statistics delineated in the histogram (Figure 2) and the p-plot (Figure 3) display a bell-shaped distribution, which is a requirement for the validity of the regression model.

Figure 2. Histogram of the dependent variables for AP Calculus AB exam
Figure 3 shows the p-plot of residuals of the AP Calculus AB exam scores. The linear relationship shows that the closer the predictive variables are, the stronger the relationship will be with student achievement.

Table 19 shows the results of the predictive variables in the multiple regression analysis. The R squared in a multiple regression represents the explained variance that can be contributed to all the predictors in a progression. The R squared gives the explanatory power. Here, the multiple correlation coefficient was $R^2 = .218$, which indicates that approximately 21.8% of the variance on the AP Calculus AB exam scores can be explained by the independent variables. The model was a statistically significant predictor of AP Calculus AB exam scores, $F (5, 480) = 26.80, p < .001$. 
As displayed in Table 19, only two variables in the model were statistically significant predictors: PSAT scores and GPA. As PSAT scores increase, AP Calculus AB exam scores increase ($B = .003, t(480) = 7.67, p < .001$). As 2016–2017 GPA increases, AP Calculus AB exam scores increase ($B = .47, t(480) = 4.04, p < .001$). The variable of type of student did not significantly affect student achievement on the AP Calculus AB exam scores.

Table 19

_Regression of Traditional, GPA, PSAT, SES, and Prior AP Experience on AP Calculus AB Exam Scores_

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>-2.59</td>
<td>0.60</td>
<td>***</td>
</tr>
<tr>
<td>Traditional</td>
<td>0.23</td>
<td>0.15</td>
<td>0.07</td>
</tr>
<tr>
<td>SES Status</td>
<td>-0.06</td>
<td>0.26</td>
<td>-0.01</td>
</tr>
<tr>
<td>Prior AP Experience</td>
<td>0.09</td>
<td>0.11</td>
<td>0.03</td>
</tr>
<tr>
<td>Most Recent PSAT/NMSQT Score</td>
<td>0.00</td>
<td>0.00</td>
<td>0.33 ***</td>
</tr>
<tr>
<td>16–17 GPA</td>
<td>0.47</td>
<td>0.12</td>
<td>0.20 ***</td>
</tr>
</tbody>
</table>

F 26.80 **
Df 5, 480
R$^2$ 0.218

N = 586
*p < .05,**p < .01,***p < .001

The null hypothesis cannot be rejected. The type of student had no statistically significant influence on student achievement as measured by the AP Calculus AB exam scores.
Null Hypothesis 2b: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP English Language and Composition exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

As displayed in Table 20, the Pearson correlations were calculated among the five predictive variables. At the bivariate level, type of student (traditional) GPA, PSAT, and prior AP experience were significantly correlated with AP English Language and Composition exam scores. SES was not significantly correlated with AP English Language and Composition exam scores. Thus, as seen by the r values for type of student, GPA, PSAT and prior AP experience, the data show that there was a positive correlation between those variables and the AP English Language and Composition exam scores. Additionally, none of the correlations was above .7, indicating a lack of multicollinearity. To further test this assumption, an examination of the collinearity statistics revealed that there were no variables with a significant variance inflation factor (i.e., a VIF greater than 2); the VIFs were under 10. This indicated none of the independent variables included in the final regression model had any significant collinearity with one another.
Table 20

<table>
<thead>
<tr>
<th>Correlation Matrix for the AP English Language and Composition Exam Scores Variables</th>
<th>16–17 AP Test English</th>
<th>SES Status</th>
<th>Traditional GPA</th>
<th>16–17 Most Recent PSAT/NMSQT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SES Status</td>
<td>$r$</td>
<td>–0.062</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.151</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional</td>
<td>$r$</td>
<td>0.137**</td>
<td>–0.022</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.002</td>
<td>0.605</td>
<td></td>
</tr>
<tr>
<td>16–17 GPA</td>
<td>$r$</td>
<td>0.433**</td>
<td>–0.045</td>
<td>0.258**</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.000</td>
<td>0.299</td>
<td>0.000</td>
</tr>
<tr>
<td>Most Recent PSAT/NMSQT Score</td>
<td>$r$</td>
<td>0.596**</td>
<td>–0.075</td>
<td>0.174**</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.000</td>
<td>0.086</td>
<td>0.000</td>
</tr>
<tr>
<td>Prior AP Experience</td>
<td>$r$</td>
<td>0.309**</td>
<td>–0.050</td>
<td>0.050</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.000</td>
<td>0.251</td>
<td>0.251</td>
</tr>
</tbody>
</table>

N= 532
*p<.05, **p<.01, ***p<.001
The skewness and kurtosis were checked for the variable and both were within the normal range (skewness = –.075, kurtosis = 1.17). The residuals were checked and were normal as can be seen in Figure 4. The residual statistics delineated in the histogram (Figure 4) and the P–Plot (Figure 5) displayed a bell–shaped distribution which is a requirement for the validity of the regression model.
Figure 5 shows the p-plot of residuals of AP English Language and Composition exam scores. The linear relationship shows that the closer the predictive variables are, the stronger the relationship will be with student achievement.

Table 21 shows the results of the predictive variables in the multiple regression analysis. The multiple correlation coefficient was $R^2 = .37$, which indicates that approximately 37% of the variance for the AP English Language and Composition exam scores can be explained by the independent variables. The model was a statistically significant predictor of AP English Language and Composition exam scores, $F (5, 526) =$
61.74, $p < .001$. As displayed in Table 21, three variables in the model were statistically significant predictors: prior AP experience, PSAT scores, and GPA. Those students with prior AP experience had higher scores than those without prior AP experience ($B = .20$, $t(526) = 2.22, p = .027$). As PSAT scores increase, AP English Language and Composition exam scores increase as well ($B = .004$, $t(526) = 10.98, p < .001$). As 16–17 GPA increases, AP English Language and Composition exam scores increase ($B = .19$, $t(526) = 2.16, p = .031$). The variable of type of student did not significantly affect student achievement on the AP English Language and Composition exam scores.

Table 21

Regression of Traditional, GPA, PSAT/NMSQT, SES, and Prior AP Experience on AP English Language and Composition Exam Scores

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>-1.99</td>
<td>0.39</td>
<td>***</td>
</tr>
<tr>
<td>Traditional</td>
<td>0.11</td>
<td>0.19</td>
<td>0.02</td>
</tr>
<tr>
<td>SES Status</td>
<td>-0.09</td>
<td>0.19</td>
<td>-0.02</td>
</tr>
<tr>
<td>Prior AP Experience</td>
<td>0.20</td>
<td>0.09</td>
<td>0.08 *</td>
</tr>
<tr>
<td>Most Recent PSAT/NMSQT Score</td>
<td>0.00</td>
<td>0.00</td>
<td>0.50 ***</td>
</tr>
<tr>
<td>16–17 GPA</td>
<td>0.19</td>
<td>0.09</td>
<td>0.10 *</td>
</tr>
</tbody>
</table>

F

61.74 ***

df

5, 526

R²

.370

N = 532

*p < .05, **p < .01, ***p < .001
The null hypothesis cannot be rejected. The type of student had no statistically significant influence on student achievement, as measured by AP English Language and Composition exam scores.

**Null Hypothesis 2c:** There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP Physics 1 exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.

As displayed in Table 22, the Pearson correlations were calculated for the five predictive variables. At the bivariate level, type of student (traditional) GPA, PSAT/NMSQT, and prior AP experience were significantly correlated with AP Physics 1 exam scores. SES was not significantly correlated with AP Physics 1 exam scores. Thus, as seen by the r values for type of student, GPA, PSAT/NMSQT, and prior AP experience, the data shows that there was a positive correlation between those variables and AP Physics 1 exam scores. Additionally, none of the correlations was above .7, indicating a lack of multicollinearity. To further test this assumption, an examination of the collinearity statistics revealed that there were no variables in this model with a significant variance inflation factor (i.e., a VIF greater than 2); the VIFs were under 10. This indicates that none of the independent variables included in the final regression model had any significant collinearity with the others.
Table 22

*Correlation Matrix for AP Physics 1 Exam Scores Variables*

<table>
<thead>
<tr>
<th></th>
<th>Physics Score 16–17</th>
<th>SES Status</th>
<th>Traditional 16–17 GPA</th>
<th>Most Recent PSAT/NMSQT Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>SES Status</td>
<td>r 0.009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td>0.855</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional</td>
<td>r 0.091 -0.030</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td>0.061 0.537</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16–17 GPA</td>
<td>r .286** 0.013 .414**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td>0.000 0.784 0.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most Recent PSAT/NMSQT Score</td>
<td>r .522** -0.093 .155** .475**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td>0.000 0.056 0.001 0.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior AP Experience</td>
<td>r .137** 0.033 -.233** 0.030 .112*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig.</td>
<td>0.005 0.498 0.000 0.537 0.022</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 4,921
*p < .05, **p < .01, ***p < .001
The skewness and kurtosis were checked for the variable, and both were within the normal range (skewness = -0.075; kurtosis = 1.17). The residuals were checked and were normal, as can be seen in Figure 6. The residual statistics delineated in the histogram (Figure 6) and the p-plot (Figure 7) displayed a bell-shaped distribution, which is a requirement for the validity of the regression model.
Figure 7 shows the p-plot of residuals of AP Physics 1 exam scores. The linear relationship shows that the closer the predictive variables are, the stronger the relationship will be with student achievement.

Table 23 shows the results of the predictive variables in the multiple regression analysis. The multiple correlation coefficient was $R^2 = .284$, which indicates that approximately 28% of the variance for the AP Physics 1 exam scores can be explained by the independent variables. The model was a statistically significant predictor of the AP Physics 1 exam score, $F (5, 415) = 32.86, p < .001$. As displayed in Table 23, one variable in
the model was a statistically significant predictor: PSAT/NMSQT scores. As PSAT/NMSQT scores increase, AP Physics 1 exam scores increased as well \((B = .0004, t(415) = 10.36, p < .001)\). The variable of type of student did not significantly affect student achievement on the AP Physics 1 exam scores.

Table 23

*Regression of Traditional, GPA, PSAT/NMSQT, SES, and Prior AP Experience on AP Physics 1 Exam Scores*

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>-3.10</td>
<td>0.49</td>
<td>***</td>
</tr>
<tr>
<td>Traditional</td>
<td>0.07</td>
<td>0.17</td>
<td>0.02</td>
</tr>
<tr>
<td>SES Status</td>
<td>0.27</td>
<td>0.22</td>
<td>0.05</td>
</tr>
<tr>
<td>16–17 GPA</td>
<td>0.08</td>
<td>0.11</td>
<td>0.04</td>
</tr>
<tr>
<td>Most Recent PSAT/NMSQT Score</td>
<td>0.00</td>
<td>0.00</td>
<td>0.50 ***</td>
</tr>
<tr>
<td>Prior AP Experience</td>
<td>0.21</td>
<td>0.11</td>
<td>0.08</td>
</tr>
</tbody>
</table>

\[F \quad 32.86 \quad ***\]
\[df \quad 5, 415\]
\[R^2 \quad .284\]

\(N = 421\)

\(*p < .05, **p < .01, ***p < .001\)

The null hypothesis cannot be rejected. The type of student had no statistically significant influence on student achievement, as measured by AP Physics 1 exam scores.

**Null Hypothesis 2d:** There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP United States History exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience.
As displayed in Table 24, the Pearson correlations were calculated for the five predictive variables. At the bivariate level, SES, type of student (traditional) GPA, PSAT/NMSQT, and prior AP experience were significantly correlated with AP United States History exam scores. Thus, as seen by the r values for type of student, GPA, PSAT/NMSQT, and prior AP experience, the data show that there was a positive correlation between those variables and AP United States History exam scores. As seen by the r values for SES, there was a negative correlation between SES and AP United States History exam scores. The AP United States History exam scores were the only scores where the SES variable was significant. Additionally, none of the correlations was above .7, indicating a lack of multicollinearity. To further test this assumption, an examination of the collinearity statistics revealed that there were no variables in this model with a significant VIF (i.e., a VIF greater than 2); the VIFs were under 10. This indicated none of the independent variables included in the final regression model had any significant collinearity with one another.
Table 24

_Correlation Matrix for AP United States History Exam Scores Variables_

<table>
<thead>
<tr>
<th></th>
<th>History Grade 16–17</th>
<th>SES Status</th>
<th>Traditional GPA</th>
<th>Most Recent PSAT/NMSQT Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>SES Status</td>
<td>r</td>
<td>-.082*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional</td>
<td>r</td>
<td>.164**</td>
<td>-.074*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.000</td>
<td>0.032</td>
<td></td>
</tr>
<tr>
<td>16–17 GPA</td>
<td>r</td>
<td>.462**</td>
<td>-0.042</td>
<td>.418**</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.000</td>
<td>0.218</td>
<td>0.000</td>
</tr>
<tr>
<td>Most Recent PSAT/NMSQT Score</td>
<td>r</td>
<td>.578**</td>
<td>-.071*</td>
<td>.258**</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.000</td>
<td>0.038</td>
<td>0.000</td>
</tr>
<tr>
<td>Prior AP Experience</td>
<td>r</td>
<td>.222**</td>
<td>-0.023</td>
<td>.083*</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.000</td>
<td>0.510</td>
<td>0.015</td>
</tr>
</tbody>
</table>

N = 852
*p < .05, **p < .01, ***p < .001
Figure 8. Histogram of the dependent variables for AP United States History exam scores

The skewness and kurtosis were checked for the variable, and both were within the normal range (skewness = -0.075; kurtosis = 1.17). The residuals were checked and were normal, as can be seen in Figure 8. The residual statistics delineated in the histogram (Figure 8) and the p-plot (Figure 9) displayed a bell-shaped distribution, which is a requirement for the validity of the regression model.
Figure 9. P-plot of residuals of the AP United States History exam scores

Figure 9 shows the p-plot of residuals of the AP United States History exam scores. The linear relationship shows that the closer the predictive variables are, the stronger the relationship will be with student achievement.

Table 25 shows the results of the predictive variables in the multiple regression analysis. The multiple correlation coefficient was $R^2 = .355$, which indicates that approximately 35.5% of the variance for the AP United States History exam scores can be explained by the independent variables. The model was a statistically significant predictor of AP United States History exam scores, $F (5, 846) = 93.12, p < .001$. Two variables in the
model were statistically significant predictors: PSAT/NMSQT scores and GPA. As PSAT/NMSQT scores increase, AP United States History exam scores increased as well \((B = .004, t(846) = 12.97 \ p < .001)\). As 16–17 GPA increases, AP United States History exam scores increased \((B = .392, t(846) = 4.89 \ p < .001)\). The variable of type of student did not significantly affect student achievement on the AP United States History exam scores.

Table 25

**Regression of Traditional, GPA, PSAT/NMSQT, SES, and Prior AP Experience on AP United States History Exam Scores**

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>-3.78</td>
<td>0.33</td>
<td>***</td>
</tr>
<tr>
<td>Traditional</td>
<td>-0.16</td>
<td>0.13</td>
<td>-0.04</td>
</tr>
<tr>
<td>SES Status</td>
<td>-0.26</td>
<td>0.17</td>
<td>-0.04</td>
</tr>
<tr>
<td>Prior AP Experience</td>
<td>-0.13</td>
<td>0.13</td>
<td>-0.03</td>
</tr>
<tr>
<td>Most Recent PSAT/NMSQT</td>
<td>0.00</td>
<td>0.00</td>
<td>0.48 ***</td>
</tr>
<tr>
<td>Score</td>
<td>0.39</td>
<td>0.08</td>
<td>0.18 ***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>df</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>93.12</td>
<td>5, 846</td>
<td>.355</td>
</tr>
</tbody>
</table>

\(N = 852\)

*p < .05, **p < .01, ***p < .001

The null hypothesis cannot be rejected. The type of student had no statistically significant influence on student achievement, as measured by AP United States History exam scores.
Summary

Chapter IV presented the results of the data analysis, including an overview of the data analysis procedures, histograms of the data, scatterplots of the data, and answers to the research questions. The results demonstrated that type of student did not have a statistically significant impact on student achievement, as measured by AP exam scores and when controlling for GPA, PSAT/NMSQT, SES, and prior AP experience. Hence, this chapter demonstrated how the predictive variables impacted the dependent variable. The outcomes related to this research will contribute to the literature regarding open access policies for AP courses and provide insights regarding enrollment policies and practices. Chapter V will provide an extended interpretation of the data, conclusions from the research study, and recommendations for policy, practice, and additional research.
CHAPTER V: Summary of the Findings and Conclusions

The AP program is the most popular and well-known advanced high school program in American high schools. The stated benefits of an AP program include advantages in the college admissions process (Ackerman et al., 2013; Clinedinst et al., 2015; Warne et al., 2015; Warne, 2017), higher scores on standardized assessments (Ewing, Camara & Millsap, 2006; Mattern et al., 2009), higher GPAs in college (Ackerman et al., 2013; Morgan & Klaric, 2007) and higher college graduation rates (Mattern et al., 2013). School districts determine enrollment criteria for advanced coursework at the local level. Consequently, all students may not have the opportunity to take an AP course. These structural barriers within a school system can create gaps in academic opportunity, which invariably lead to achievement gaps. If school districts eliminate structural barriers, it may be possible to close these gaps.

The current research was conducted to identify the influence of an open access policy for AP course enrollment on academic achievement, as measured by scores on College Board AP exams, specifically Calculus AB, English Language and Composition, Physics 1, and United States History. The insights gained from the current study may provide district–level and school–level leaders with information that can guide policy decisions for enrollment in advanced coursework. The statistical analysis of student data determined that student type—traditional versus nontraditional—was not a statistically significant predictor of student achievement on the AP exam. Specifically, the prior year’s course grade criterion, which was used to determine enrollment in an AP course prior to open access, was not a statistically significant predictor of student achievement. Instead, other student variables, including PSAT/NMSQT scores and GPA, were better indicators of
student success on the AP exam. These findings support the College Board’s AP Potential resource that utilizes PSAT/NMSQT scores as a mechanism to identify students who may be successful on an AP exam. The findings from the current study are consistent with the results reported in the literature, primarily from the College Board, which encourages AP course enrollment for a greater number of students, specifically nontraditional students and underrepresented populations (College Board, 2014; Kolluri, 2018; Theokas & Saaris, 2013).

**Purpose of the Study**

The purpose of the current nonexperimental, correlational, and explanatory study with quantitative design methods was to explain the influence of an open access policy on academic achievement, as measured by scores on College Board AP exams. The identified benefits of the AP program necessitate that educators assess pathways for all students to access these opportunities. Providing open access to AP courses for all students is an option for school districts that want to ensure equity and opportunity for all students. However, very few studies in the current body of literature address the influence of an open access policy on student achievement.

**Research Questions and Answers**

The dependent variables in the current study were student scores on the designated AP exams in the 2016–2017 school year. The independent variables were the designation of traditional and nontraditional students, as determined by the enrollment criteria prior to the implementation of open access in the district. Enrollment criteria included the student’s
grade in the prior year’s course, a minimum A- in an academic course or a minimum B- in an honors course. Four covariates were examined: GPA, PSAT/NMSQT score, student SES, as designated by free/reduced lunch status, and prior AP experience, as indicated by enrollment in an AP course in the prior year.

This study was guided by the following overarching research questions:

**Research Question 1:** What is the relationship between the type of student (traditional versus nontraditional) and student achievement as measured by AP exam scores?

**Research Question 2:** What is the relationship between the type of student (traditional versus nontraditional) and student achievement as measured by AP exam scores when controlling for GPA, PSAT/NMSQT, student SES, and prior AP experience?

For Research Question 1, the findings show that traditional students scored statically significantly higher than nontraditional students on three of the four AP exams studied. For AP Calculus AB, there was a statistically significant difference; traditional students had a mean score of 3.94 and nontraditional students had a mean score of 3.23. Although traditional students had a higher mean score, the mean score for nontraditional students is a passing score. For AP English, traditional students had mean score of 3.52 which was statistically significantly higher than the mean score of 2.78 for nontraditional students. For AP Physics 1, no statistically significant difference was found between the traditional students’ mean score of 2.36 and the nontraditional students’ mean score of 2.03. While traditional students had a higher mean score than nontraditional students the mean score for both students was below passing. Although the College Board does not officially equate a score of 1 or 2 as “not passing,” it is widely acknowledged that colleges do not award credit or advancement for an exam score less than 3. For the AP United States History exam, a
statistically significant difference was found in the students’ scores; traditional students had a mean score of 2.78 and nontraditional students had mean score of 2.10. Again, while traditional students had a higher mean score, the mean score for both traditional and nontraditional students was below passing.

Advocates of the AP program believe that enrollment in an AP course is beneficial, even if college credit is not awarded. Warne et al. (2015) and Hargrove et al. (2008) found that there were some limited benefits to students who take the AP exam and have a score a 1 or 2, although it was most advantageous to students who have a score of 3 or higher. Rodriguez, McKillip, and Niu (2012) demonstrated that early exam exposure, irrespective of exam success, is related to the probability that a student will take an AP exam at a later point in their high school career in school, which is an added benefit for the student’s overall academic achievement. This is especially true because students who take multiple AP courses have been found to be more likely to attend college, regardless of their score on the AP exam (McKillip & Cooney, 2012). Additionally, the other potential benefits of taking AP courses, not associated with a passing score on the exam, include increased student confidence, the opportunity to explore an academic interest in greater depth and greater exposure to college-level expectations (Fan, Zou, & Bahrman, 2016).

For Research Question 2, the findings show that the type of student (traditional versus nontraditional) did not have a statistically significant effect on student academic achievement, as measured by the scores on the AP exam. When controlling for additional variables—GPA, PSAT/NMSQT score, student SES, and prior AP experience—type of student was not a statistically significant variable.
**Null Hypothesis 2a:** There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP Calculus AB exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience. The null hypothesis cannot be rejected.

Based on the findings, for the AP Calculus AB exam, two variables were statistically significant predictors: PSAT/NMSQT score and GPA. Students with higher PSAT/NMSQT scores had higher AP Calculus AB exam scores, and students with higher GPAs had higher AP Calculus AB exam scores. Therefore, PSAT/NMSQT scores and GPA are better predictors of success on the AP Calculus AB exam. Type of student was not a statistically significant predictor.

**Null Hypothesis 2b:** There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP English Language and Composition exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience. The null hypothesis cannot be rejected.

Based on the findings for the AP English Language and Composition exam, three variables were statistically significant predictors: PSAT/NMSQT score, GPA, and prior AP experience. Students with higher PSAT/NMSQT scores had higher scores on the AP English Language and Composition exam. Students with higher GPAs had higher scores on the AP English Language and Composition exam. Also, students with prior AP experience had higher scores on the AP English Language and Composition exam. Therefore, PSAT/NMSQT, GPA, and prior AP experience are better predictors of success on the AP English Language and Composition exam. Type of student was not a statistically significant predictor.
Null Hypothesis 2c: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP Physics 1 exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience. The null hypothesis cannot be rejected.

Based on the findings for the AP Physics 1 exam, one variable was a statistically significant predictor: PSAT/NMSQT score. Students with higher PSAT/NMSQT scores had higher scores on the AP Physics 1 exam. Type of student was not a statistically significant predictor.

Null Hypothesis 2d: There is no statistically significant relationship in student type (traditional versus nontraditional) on the AP United States History exam score when controlling for individual differences among students, including GPA, PSAT/NMSQT score, student SES, and prior AP experience. The null hypothesis cannot be rejected.

Based on the findings for the AP United States History exam, two variables were statistically significant predictors: PSAT/NMSQT score and GPA. Students with higher PSAT/NMSQT scores had higher scores on the AP United States History exam. Students with higher GPAs had higher scores on the AP United States History exam. Therefore, PSAT/NMSQT scores and GPA were better predictors of success on the AP United States History exam. Type of student was not a statistically significant predictor.

The variables of PSAT/NMSQT score and GPA were the strongest predictors for student scores on the AP exams studied. Additionally, prior AP experience was a statistically significant predictor of success for the AP English Language and Composition exam. The findings related to PSAT/NMSQT scores are consistent with the College Board’s research and the College Board’s AP Potential resource (Ewing et al., 2006).
Type of student was not found to be a statistically significant predictor of student achievement on any of the AP exams studied, nor was SES. It is important to note that although SES has often been found to be a statistically significant predictor of student outcomes, the overall small number of students identified as low SES in the current study may have impacted the influence of SES (Sirin, 2005).

**Limitations and Delimitations of the Study**

The conclusions, findings, and recommendations of the current study should be understood within the context of the study’s limitations. The sample was limited to 11th- and 12th-grade students from one high school district in central New Jersey, a district that is neither ethnically nor socioeconomically diverse compared with state averages. This limitation is due in part to the small number of school districts that have open access to AP courses. In addition, the scope of the sample and percentage of nontraditional students was narrow. Nontraditional students were identified using enrollment criteria established prior to the transition to open access. This designation depended on individual teacher course grades. This is a highly subjective measure and another limitation. Therefore, it is difficult to extrapolate definitive results beyond this demographic. A larger sample size and the inclusion of additional AP exams would provide additional data that could reduce the limitations and strengthen the results.

The failure to capture all the variables that are known to be directly related to student achievement is another limitation of the present study. The conclusions drawn from the data should include stipulations when considering the impact of other school-level factors or family-level factors not included, for example, teacher experience and level of parental
education. Indeed, the lack of sufficient control variables can overestimate the positive impact of the AP program (Klopfenstein & Thomas, 2009; Warne, 2017).

Another limitation is the use of AP exam scores as the quantitative measure of student achievement; this measurement may not adequately capture the influence of open access for nontraditional students who would have been denied the opportunity to participate in advanced coursework prior to open access. For example, as noted in the literature review, participation in the AP program—irrespective of the score on the AP exam—can influence college admissions, success in college as measured by college GPA, and college graduation (Ackerman et al., 2013; Clinedinst et al., 2015; Hargrove et al., 2008; Eimers & Mullen, 2003; Flores & Gomez, 2011; Mattern et al., 2009; Mattern et al., 2013; Morgan & Klaric, 2007; Santoli, 2002; Warne et al., 2015).

Conclusions and Discussion

Research supported by the College Board overwhelmingly has indicated that the AP program is beneficial for students (Casserly, 1986; Dodd, 2002; Chajewski et al., 2011; Fitzpatrick et al., 2002; Eimers & Mullen, 2003; Hargrove et al., 2008; Santoli, 2002). Independent research has not been as prevalent or as positive about the influence of the AP program (Ackerman et al., 2013; Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009; Sadler & Tai, 2007). However, benefits are only available to high school students who have access to AP courses. Advocates for open access believe that opportunities for advanced coursework for all students ensures equity and opportunity, especially for underserved populations.
The number of students enrolled in AP courses and the number of students who take AP exams has increased significantly, especially in the last decade, as additional districts have begun to implement varying degrees of open access. The expansion of the AP program nationally has been accompanied by a decrease in the percentage of students passing AP exams, from 64.3% in 2001 to 59.8% in 2011 (College Board, 2012). Opponents of open access believe the lower passing rate is because of the inclusion of unqualified and unprepared students and that the potential benefits do not outweigh the negative effects of open access. These opponents also believe that open access is compromising the integrity of the courses, the experience of the course for qualified students, and the quality of instruction because of a heterogeneous class environment (Farkas & Duffett, 2009).

Results from a similar study found that relaxing admission criteria to include “fringe students” did not affect overall student achievement negatively, as measured by AP exam scores from 2006 to 2007, and when controlling for preexisting differences in students (Miron, 2008). Miron’s research included a smaller overall sample size and “fringe” students, who were defined as the following:

…students identified by the individual AP teacher as not having met the criteria for admission established and utilized over the past recent years. However, admission into the AP program has been granted for any of several possible reasons. Such factors include: (a) encouragement by school administrators; (b) directive from the building principal; or (c) special requests from parents. (Miron, 2008, p. 21)

The mean AP scores for regularly admitted students were statistically significantly higher than the fringe students; however, Miron noted that “This study has shown that students on the fringe can succeed in AP courses” (Miron, 2008, p. 131). The current research furthered
this analysis by including six high schools with an open access policy that is not predicated on staff identification of “fringe” students; instead open access allows for participation from all interested students.

**Findings Related to Other Research**

In reviewing the literature pertaining to the AP program, limited research has been conducted on the influence of open access on student achievement as measured by AP exam scores. Studies have not identified a definitive “best” approach regarding open access policies (Flores & Gomez, 2011; Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009; Rothschild, 1999). Existing available research is primarily qualitative (Mcalister, 2013). Open access to advanced coursework is not a pervasive approach in high schools. The district studied is one of few districts within suburban New Jersey that permits students to enroll in an AP course without meeting specific academic criteria.

The results of the current study revealed that GPA and PSAT/NMSQT scores are stronger predictors of student success on AP exams than the grades from a prior year’s course, something that previously could have excluded a student from enrolling in the AP course. Traditional students were found to perform better in AP courses than nontraditional students. However, when controlling for specific variables, the variable of student type was not a statistically significant predictor for student success on the AP exam. Therefore, although nontraditional students may not perform as well as traditional students on the exam, open access provides important opportunities that may benefit nontraditional students (Casserly, 1986; Dodd, 2002; Chajewski et al., 2011; Fitzpatrick et al., 2002; Eimers & Mullen, 2003; Hargrove et al., 2008; Santoli, 2002; Warne, et al., 2015).
The College Board has supported practices that remove barriers to AP courses, for example, prerequisite grade criteria for enrollment (College Board, 2002). Research supported by the College Board has demonstrated that PSAT/NMSQT scores were moderately to highly correlated with the scores on 29 AP exams (Ewing et al., 2006). To provide an objective means to identify those students who may be successful in an AP course and on an AP exam, the College Board AP Potential tool utilizes students PSAT/NMSQT scores to identify students who are likely to achieve a passing score on the AP exam. The current study provided additional evidence for using PSAT/NMSQT scores as a predictor of success on AP exams (Ewing et al., 2006). In all four of the AP exams studied, PSAT/NMSQT scores were a statistically significant predictor of success on the AP exam.

Motivated students who could be successful in an AP course should be identified and supported. On three of the AP exams studied, nontraditional students achieved a mean score below a 3. However, research from Hargrove et al. (2008) demonstrated strong benefits for students who participated in both the AP course and took the AP exam, even when scoring a 2 on the exam. Benefits included higher undergraduate GPAs, more credit hours earned, and higher 4-year college graduation rates (Hargrove et al., 2008). Research from Rodriguez et al. demonstrates taking AP courses—even without success on the AP exam—potentially provides noncognitive benefits, including the confidence to take additional AP courses (Rodriguez et al., 2012). Findings from the current study highlight the importance of student supports for all students, particularly nontraditional students, to ensure benefits for all students and maintain the integrity of the AP program.

**Recommendations and Implications for Policy**
The current study is not conclusive because of its limited scope and sample; it is merely one additional piece of information that can be considered when making decisions for students who do not have a seat at the policy table. The results of the current research can inform education policy makers and district and school leaders. The opportunity gap, which can lead to achievement gaps, often begins early in a student’s educational career. School leaders have the responsibility to close this gap. The outcomes from the current research demonstrate that in an open access environment, a greater number of students benefit from the opportunity to enroll in an AP course. Open access to AP courses for all students is a policy that can create opportunity (Theokas & Saaris, 2013). Open access may also mitigate earlier “tracking” decisions that limited student opportunities. However, simply increasing the number of AP courses or enrolling all students in AP courses without a systemic approach for student and teacher education and support is a hasty and short-sighted solution that is unlikely to lead to successful student outcomes. Instead, the creation of an academically preparatory pipeline to prepare nontraditional students and the development of concurrent support must be a component of this commitment.

The current research demonstrates the need for district policies and practices that remove the barriers to advanced coursework for all students. In an open access environment, district and school leaders should develop formal policies that operationalize the identification, recruitment, and enrollment of students into advanced coursework, including AP courses. As a component of increasing enrollment, alternative outcome measures should be identified and should include both increased academic achievement, as measured by AP exam scores, and alternative metrics related to the student experience, student confidence and persistence, the development of essential college and career readiness skills, or student
enrollment in future AP courses (Fan et al., 2016; Warne, 2017). Additional benefits—including advantages in the admissions process and student experience in an advanced college-level course—are significant. AP courses should deemphasize AP exam scores as the only barometer of student success. Genuine learning and an opportunity to explore a discipline in-depth to encourage a student’s interest or appreciation for the subject or for career possibilities are equally significant. The current paradigm for many students that enroll in AP courses is acquisition—gaining a college credit or a “bow” on the student transcript. This paradigm is often encouraged by the school culture. A shift in the culture from content acquisition to growth and meaningful real-world learning is important during this shift to open access.

The overarching beliefs of educational leaders regarding student ability and growth influence placement policies and subsequent outcomes for students. Prior to structural changes, the edification of all stakeholders is an important first step in ensuring that the conceptual barriers are removed and that the mission is understood. This requires significant education and communication. All stakeholders must understand the rationale for the change and the potential impact of the change on student individual goals and outcomes. Communication is important for all members of the school community, including students, parents, teachers, administrators, board of education members, and the community at large.

Communication to state agencies and professional associations is another policy recommendation. One of the primary goals of state policy making is to improve college and career readiness and the frequency of students who earn a postsecondary degree or industry credential. State policy makers may want to consider requiring school districts to provide opportunities to take advanced coursework (e.g., AP, IB, dual enrollment) for all students.
State professional agencies, including the New Jersey Principals and Supervisors Association (NJPSA) and the New Jersey Association of Superintendents (NJASA), can work on better articulating the need for access to advanced coursework for all students. The opportunity for advanced coursework should not be dependent on student zip code. Requiring districts to offer advanced coursework is insufficient if all students cannot access these opportunities. New Jersey currently reports AP and IB participation and performance data for schools and districts annually (New Jersey Department of Education, 2016).

However, this data is not disaggregated by subgroup; districts should collect and review this data by subgroup to better understand equity gaps.

Following staff education, structural changes could include eliminating lower-level courses that do not prepare students for more advanced coursework and monitoring all courses to ensure that even non-AP and nonhonors courses provide the same academic rigor and foundation for college and career readiness. The pipeline to advanced coursework should include multiple entry points. Early preparation for these courses should be a component of elementary and middle-level curricula.

Policy changes that open access to advanced coursework for all students may create dissonance in the school community (Farkas & Duffett, 2009). This dissonance must be directly confronted. A participation gap for various subgroups may continue, even with a stated open access policy, if teachers continue to reinforce the belief that AP courses are only for “select” students. Teachers and school counselors should be included in the development and implementation of formal processes and practices that identify, recruit, and enroll students into AP courses. This should be a consistent and uniform process, allowing for appropriate counseling that is specific to the individual goals of the student. Practices
related to recruitment and enrollment should be systematic, formalized, and consistently reviewed.

**Recommendations and Implications for Practice**

Based on the findings of the current study and the related literature, several recommendations and implications for practice can be made. In adopting an open access policy, schools should review best practices from schools that have already made similar transitions. School districts should conduct a comprehensive review of their AP programs and other existing college and career pathways. This program review includes an evaluation of each content area to identify opportunities and entry points to advanced coursework.

Student access and support are priorities in an open access environment, and this includes student identification and recruitment, curriculum development, teacher professional development, and the development of a culture and climate that is supportive of these opportunities. Performance gains should follow enrollment gains as student supports, professional development, and instructional modifications are implemented.

Outreach should be expanded to underrepresented students, specifically students not currently enrolled in honors or advanced courses, and should be focused on identifying the academic potential in students who may not have a proven academic record. AP information nights and information sessions with students currently enrolled in AP courses are effective in providing information and outreach. In addition, the advantages and expectations of the AP program should be communicated to students and parents; this is especially important for families that may not have previous knowledge or exposure to the AP program.
Another recommendation for practice is to systematically identify students who could be successful in advanced coursework, including AP courses. Districts should consider using their own measures, for example, a combination of standardized assessment data, teacher recommendation, and the prior year’s course grades. It should be clearly understood that these measures are being used to identify potential students as opposed to restricting enrollment to students who do not meet specified criteria. In addition to standardized assessment data that may be susceptible to biases impacting underrepresented subgroups, districts should consider alternative measures, for example, the Renzulli scale, which is used to gather learning characteristics of students from multiple, diverse areas (Renzulli, 2016). Overall, district and school leaders are responsible for removing roadblocks and obstacles to student access following policy changes. Unintended screening mechanisms or inherent biases regarding which students can be successful in an AP course may be present and must be confronted to ensure access for all students.

District and school leaders are tasked with evaluating new and existing programs to maximize district resources to increase student achievement. There are innumerable curricula packages, programs, and platforms with which to do this. Adding AP courses and resources is a significant investment. Although the College Board does not assess fees for participation in the AP program, curricular resources are a significant investment. The College Board provides curricular resources for AP courses and a pre-AP curriculum for schools and districts that are interested in adopting a preparatory curriculum (College Board, 2019b). These resources can provide curricular and instructional supports to ensure the delivery of a challenging curriculum. It is important to note that although the College Board conducts an audit of the AP course syllabus to ensure appropriate content and college-level
expectations, the curriculum is locally developed and implemented. Districts and teachers retain autonomy regarding “how” content is taught and assessed.

District and school leaders must ensure support systems are in place for students who are considering taking on the new challenge of AP courses. This could include the adoption of pre-AP courses, the AVID program, summer bridge programs, after-school tutoring, or dedicated study groups. This also would include frequent monitoring of progress to close gaps in the students’ academic skills. One of the most effective means for student success is the development of foundational academic skills.

Teacher support and professional development are essential. Teachers who are prepared and knowledgeable about the AP course framework and AP exam are better prepared to support students (Haycock, 1998). A commitment to ongoing, consistent, and comprehensive professional development is critical, particularly in maintaining quality and consistency across schools within one district or among the teachers within a school. The College Board’s AP workshops and summer institutes provide curricular and instructional resources, exam information, and scoring guidelines and opportunities that allow AP teachers to collaborate with one another. The 1-week AP Professional Development Institutes cost approximately $1,000 per teacher for registration. These costs must be included in an assessment of the overall benefits of the AP program for all students.

Additionally, teachers need professional development that is centered on instructional strategies for teaching in a heterogeneous classroom environment. Professional learning should include strategies to meet the needs of nontraditional students and advanced students; indeed, teachers need the skills and pedagogy to deliver instruction to a diverse group of learners, including those students who may not have the prerequisite skills or readiness of
other students in the class. If the AP program is going to effectively serve a range of student needs and abilities, the training for teachers must include scaffolding techniques and remediation and enrichment strategies. This professional development is essential for all teachers and must begin in earlier courses that are potential entry points for AP courses.

Another important implication for practice is an assessment of the necessary curricular and instructional modifications in both AP course curricula and prior course curricula to prepare all students for advanced coursework. Open access policies may necessitate modifications to earlier courses to prepare students for the challenges of advanced coursework. AP courses are one option for students within a broader program of studies. These courses should not be situated as an “escape” from general education classes that do not prepare students for college–level work and their future careers. All course curricula should include challenging expectations and real-world applications (College Board, 2019b).

**Recommendations and Implications for Future Research**

The findings from the present study support the need for additional research, specifically on the opportunities and outcomes for nontraditional students in open access. Additional research will enhance the literature and support informed decision–making by school and district leaders. A larger sample size is one recommendation for future research. The district used in the present study is located in suburban New Jersey and has a combined enrollment of approximately 10,500 students; the ethnic diversity of the student body is approximately 76% white, 10% Hispanic, 9% Asian, 4% black, 1% mixed, and 9% economically disadvantaged, as determined by those students who qualify for a free and
reduced lunch (New Jersey Department of Education [NJDOE], 2017). This is below the state average and not representative of the diversity of the state or other areas of the country. To validate the current study’s findings, a larger sample of students is recommended. Future research could examine additional school districts in New Jersey and across the country.

For the AP exams analyzed in the current study, the relatively small number of nontraditional students included in the sample created some issues when calculating the statistical significance of the differences in means. It is recommended that a larger sample include a greater number of nontraditional students to further validate the findings. To achieve this larger sample of nontraditional students, additional years of data and additional AP exams should be included. A replication of the current study that includes all AP exams would also provide additional information to determine the influence of open access pertaining to other AP courses, including AP courses that may not have a defined previous year’s course progression.

Future research could identify the influence of additional school-level variables (e.g., number of years of teacher experience, type of professional development, student supports, and student interventions), and additional student-level variables (e.g., highest degree of attainment by the students’ parents, percentage of students from low-income families). Warne (2017) identified a significant limitation in the independent research and the research supported by the College Board, which controlled for few or no confounding variables. When controlling for covariates, the impact of the AP program was shown to be not as significant (Warne, 2017; Warne et al., 2015).

Future research could be conducted to determine the influence of specific supports for nontraditional students, for example, AP summer bridge programs, tutoring, or online
support materials. The relationship between identified student supports and interventions and the influence on student achievement could guide school leaders in identifying the support necessary for increased student achievement in an open access environment.

Future research could include a comparison of access policies (e.g., total open access, limited access) and student outcomes. A review of these varying policies would contribute to the literature and support district and school leaders who are considering modifications.

Future research could include a longitudinal design to identify postsecondary outcomes for nontraditional students, including better performance in college, as measured by GPA (Geiser & Santelices, 2004; Mattern et al., 2009; Morgan & Klaric, 2007), higher likelihood of earning credits in college classes of the same subject matter as the AP exam (Dodd et al., 2002; Hargrove et al., 2008), and faster time to degree attainment (Adelman, 1999; Adelman, 2006; Dougherty et al., 2006).

Most of the research on the AP program has not been conclusive. Very few studies related to the topic have been experimental because pure experimental studies are difficult to conduct within the field of education. Therefore, although studies can identify relationships and correlation, causation cannot be determined. Future research could include qualitative studies that investigate the experiences of these students (Kolluri, 2018). Qualitative data from a range of student populations could better inform the resources and attributes that support student success. Finally, future research could include case studies of schools that have transitioned to open access policies and that have high rates of AP participation and high performance. Qualitative data that include stakeholder feedback, information on student supports, and information on teacher strategies and outcomes would contribute to the
literature. This kind of research could identify specific district, school, and teacher practices that influence student outcomes. As the AP program continues to expand, research with varying student populations and variables is an important addition to the literature.

Conclusion

The current study sought to understand the influence of open access on student achievement as measured by AP exam scores. Research on the AP program has primarily focused on the AP program’s influence on student achievement in college (Warne, 2017). A limited number of studies have focused on the enrollment of various subgroup populations and equity and access issues (Ackerman et al., 2013; Hallett & Venegas, 2011; Lichten, 2010), and limited research has been conducted on the influence of access policies on nontraditional students. The current study’s analysis revealed that the type of student—traditional versus nontraditional—was not a statistically significant predictor of student success on the studied AP exams. Also, there may be additional benefits for students who participate in the AP program that are not reflected in student AP exam scores, for example, experiencing a challenging college-level academic experience, the opportunity to explore a subject area in greater depth, increased skill development, and confidence and influence during the college admissions process. Schools must consider these benefits and the potential impact of a greater number of heterogeneous classroom settings in all courses. Therefore, districts with enrollment policies that deny students the opportunity to enroll in AP courses may be denying students an important educational opportunity. A district’s commitment to equity should be reflected in access policies and support structures that demand high expectations for all students. In line with this, the current study contains
several conclusions that contribute to the literature on access policies for advanced coursework and AP student participation and performance.

District and school leaders have the crucial responsibility to ensure equitable educational opportunities for all students, including AP courses and advanced coursework, mentorships, internships, dual enrollment, and workplace training. This is accomplished by exploring opportunities for all students to maximize their potential, providing all students with the most effective curriculum, instruction, and supports, and removing roadblocks that threaten these opportunities.
References


https://apstudent.collegeboard.org/apcourse

College Board. (2018c, April 2). *Advances in AP*. Retrieved from
https://advancesinap.collegeboard.org/ap-capstone/how-ap-capstone-works


https://apcentral.collegeboard.org/courses/ap-course-audit

College Board. (2019a, January 25). *Score structure*. Retrieved from


https://collegereadiness.collegeboard.org/psat-nmsqt-psat-10/scores/structure


outcomes in two states. Saint Paul, MN: The National Research Center for Career and Technical Education at the Southern Regional Education Board.


Mattern, K. D., Marini, J. P., & Shaw, E. J. (2013). *Are AP® students more likely to graduate from college on time?* New York, NY: The College Board.


