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by<br>Clara Cantu

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# ANALYZING TRENDS IN STUDENT PERFORMANCE ON THE STANFORD ACHIEVEMENT TEST, PRELIMINARY SAT/NATIONAL MERIT SCHOLARSHIP QUALIFYING TEST, AND ADVANCED PLACEMENT EXAMS 

An Abstract<br>of A Dissertation Presented to the<br>Faculty of the College of Education<br>University of Houston<br>In Partial Fulfillment<br>of the Requirement for the Degree<br>Doctor of Education

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#### Abstract

For the United States to prosper and compete in this new world of increased globalization, all students have to prepare themselves to be productive citizens and work toward receiving additional education past the secondary level. Private organizations such as the College Entrance Examination Board (a.k.a. College Board) have assisted in preparing students for a college education through rigorous coursework provided by the Advanced Placement Program (AP). The AP program gives students the opportunity to receive college level curriculum while still in high school.

With research indicating the linkage between the academic achievement of students who participate in rigorous college-level courses in high school and the completion of a college degree, there is increased pressure for high schools to provide college-level preparatory coursework for their students. The AP program is one of the methods used in high schools to prepare students for college.

Given the relationship between students' passing of AP exams and their college degree attainment, analyzing the characteristics of an AP student who is successful on the AP exams can provide valuable information on the level of preparation a student possesses before partaking in a given AP exam. Therefore, the purpose of this study was to use multiple data sources to analyze trends in student performance on Stanford Achievement test, Preliminary PSAT/National Merit Scholarship Qualifying (PSAT) test, and AP exams.


This study used archival student test data for approximately 12,000 students and discovered there is a positive and statistically significant relationship between Stanford Achievement Test and AP exam scores as well as reaffirmed an already examined positive relationship between PSAT and AP exam scores. In addition, this study provided expectancy tables, which indicates the percentage of students passing an AP exam at various test score levels on the Stanford Achievement Test and PSAT test. This information will prove useful to administrators for identifying students who should be strongly encouraged to enroll in AP courses.

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## CHAPTER ONE

## INTRODUCTION

## Introduction

For the United States to prosper and compete in this new world of increased globalization, all students have to prepare themselves to be productive citizens and work toward receiving additional education past the secondary level. Private organizations such as the College Entrance Examination Board (a.k.a. College Board) have assisted in preparing students for a college education through rigorous coursework provided by the Advanced Placement Program (AP) (College Board, 2004). The AP program gives students the opportunity to receive college level curriculum while still in high school.

With research indicating the linkage between the academic achievement of students who participate in rigorous college-level courses in high school and the completion of a college degree, there is increased pressure for high schools to provide college-level preparatory coursework for their students (Adelman, 1999 \& Adelman, 2006). The AP program is what is one of the methods used in high schools to prepare students for college (College Board, 2001).

AP students also have the option to take a standardized exam, which corresponds to each AP course, so that they may be eligible for college credit. A score of three or higher on a five-point scale is considered passing on an AP exam (Dougherty, Mellor, \& Jian, 2006). However, each college and university determines its own policy as to acceptable scores so as to grant college credit. For example, Harvard University only
accepts a score of five, which is the highest score on AP exams, for college credit (Harvard University, 2012). Whereas, University of Houston (UH) accepts a score of three on certain exams for college credit, such as in the UH course Political Science 1336 a score of three is acceptable for college credit (University of Houston, 2011). However, every university chooses if even to grant college credit, which includes Princeton University's policy to not grant credit for scoring a 5 on the AP English Language exam while accepting a score of 5 on the AP Macroeconomics exam (Princeton University, 2012). In the case of Stanford University, they do not grant credit for satisfying general education requirements except in foreign language (Stanford University, 2012). As for Rice University, they accept scores of 4 or 5 on AP exams for college credit, but still require additional testing as in the case of satisfying their English Composition college requirement (Rice University, 2012). While Yale University grants course credit for scoring 4 or 5 on certain AP exams, they use an acceleration approach so that students take more advanced coursework in the specific subject they are granted AP credit (Yale University, 2012). As for another state university, University of Texas accepts more AP exams for granting coursework credit then premier private universities, but in the case of this university most scores do need to be at least a score of 4 or 5 (University of Texas, 2012)

Additional research indicates that students who pass an AP exam in English, math, science, or social studies have a $64 \%$ probability of graduating from college compared to the $17 \%$ probability for students who do not take an AP course or pass an AP exam (Dougherty et al., 2006). Essentially, there is a correlation between whether a student passes an AP exam and whether he/she is more likely to complete a four year
degree (Dougherty et al., 2006). In the study by Dougherty, Mellor, \& Jian (2006), they examined the relationship between taking AP exams and college graduation by utilizing hierarchical linear modeling (hlm). This statistical model is a multiple linear regression model, which "creates a model for predicting values of an outcome variable from predictor variables, along with a way of explaining the variance in an outcome variable" (Abbott, 2011, p. 430). The next question becomes what academic indicators point to a student passing an AP exam.

The AP Program began in the 1950s for those students who were academically talented and could partake in college classes while in high school in order to have the ability to take more advanced coursework in college. However, throughout the decades, the scope of the AP program has changed. The College Board has evolved since its inception. At first, the AP Program was a response to the needs of graduates of Ivy League schools; but with studies that have concluded taking advanced level curriculum in high school leads to a higher correlation of students receiving a college degree, the AP Program is now seen as a gate opener to college degree attainment and no longer only for the elite few, who are academically talented. This essentially opens a door that anyone who can is prepared to learn college level material should partake in AP courses (College Board, 2001). Then, how do we determine who is prepared to learn AP material?

## Need for this Study

Given the relationship between students' passing of AP exams and their college degree attainment, analyzing the characteristics of an AP student who is successful on the AP exams can provide valuable information on the level of preparation a student
possesses before taking a given AP exam. To determine what information should be gathered to analyze these characteristics, it is important to consider previous studies that have examined relationships among various variables for students who pass AP exams.

Two studies were conducted, which essentially discovered the positive relationship between performance on the Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT) and passing an AP exam (Camara \& Millsap, 1998; Ewing, Camara, \& Millsap, 2006). With this information, the College Board created an online tool called AP Potential, which uses the expectancy tables in the Ewing, et al. (2006) study to identify students who would have the likelihood of passing an AP exam.

In this study, first it was determined where there was a high correlation between PSAT and AP scores. For example, AP English Language showed a high correlation when taking in consideration verbal and writing PSAT scores. Then, there was an expectancy table created with combined verbal and writing PSAT scores, which was meant to show the percentage of students receiving a score of 3 and 4 or higher. The table below is a recreation of the expectancy table for AP English Language. This table shows that $60.1 \%$ of students receiving a score of 105-101 combined verbal and writing score also received a score of 3 on the AP English Language Exam.

Table 1.1
AP English Language Examination Using PSAT/NMSQT Verbal and Writing Scores (Ewing, et al, 2006, pg. 20)

| PSAT/NMSQT <br> V+W Score | n | AP Grade $\geq 3$ <br> $\%$ | AP Grade $\geq 4$ <br> $\%$ |
| :---: | :---: | :---: | :---: |
| $160-156$ | 692 | 99.7 | 96.8 |
| $155-151$ | 1,316 | 99.8 | 95.6 |
| $150-146$ | 2,495 | 99.6 | 92.5 |
| $145-141$ | 3,996 | 99.5 | 90.7 |

140-136
6,147
98.9
84.5

Table 1.1 (continued)

| PSAT/NMSQT <br> V+W Score | n | AP Grade $\geq 3$ <br> $\%$ | AP Grade $\geq 4$ <br> $\%$ |
| :---: | :---: | :---: | :---: |
| $135-131$ | 9,274 | 98.3 | 77.6 |
| $130-126$ | 12,203 | 96.6 | 68.0 |
| $125-131$ | 15,280 | 94.5 | 57.2 |
| $120-116$ | 17,930 | 90.1 | 45.0 |
| $115-111$ | 20,126 | 82.9 | 32.2 |
| $110-106$ | 20,879 | 72.7 | 21.2 |
| $105-101$ | 20,372 | 60.1 | 12.2 |
| $100-96$ | 17,386 | 45.5 | 6.5 |
| $95-91$ | 14,141 | 30.1 | 2.8 |
| $90-86$ | 10,303 | 19.3 | 1.3 |

AP Potential was created to aid schools in identifying students who should be taking AP courses (College Board, 2011). The population encompassed in these studies included all subpopulations such as suburban, rural, and urban, however, reexamining the relationship between PSAT and AP student performance with a specific population of urban students will help determine if the relationship identified in previous studies will still be generalizable for high school students in a very large urban school district.

There are only studies correlating PSAT and AP scores, but there are other standardized exams like Stanford Achievement Tests, which could be researched to determine if there is a relationship present with AP scores as there is with PSAT and AP scores. It is important to determine if such a relationship exists, so as to build on the knowledge that exists concerning AP performance. If there is a proven relationship between Stanford Achievement and AP performance, then other descriptive statistics such as means can be given so as to provide information on student performance on both the Stanford Achievement Test and AP exams.

To protect the identity of the school district actually used in this study, this school district will be referred to as Southwest Independent School District (SISD). SISD was chosen for this study given that they administer the Stanford Achievement Test to each student every year and at every grade level. SISD is the one of the largest urban school districts in the country and in Texas, which allows for this study's results to be generalizable to other large urban school districts to expand upon research related to performance on Advanced Placement exams.

Currently, SISD utilizes AP Potential, which groups students into the likelihood they would pass a particular AP exam depending on their PSAT score. This AP Potential product is a free resource provided by the College Board. However, if there is a positive relationship between the Stanford Achievement Tests and AP student exam performance, SISD can choose to create its own expectancy tables that could help place students in AP and/or Pre-AP courses. As described earlier, expectancy tables provide a certain student's PSAT score and the corresponding percentage of students receiving a score of 3 or higher on the AP exams. This same idea may be used for the Stanford Achievement Tests if there is a high correlational relationship between Stanford Achievement Test and AP exams.

Currently, Texas Assessment of Knowledge and Skills (TAKS) vertical scores are being utilized to place students in the Pre-AP courses as indicated in the SISD Secondary Guidelines Advanced Academics section. However, Texas is moving towards End of Course Exams, and until those data are available to be analyzed, Stanford Achievement scores could be utilized as a tool for student AP/Pre-AP course placement if this study supports such an action and if approved by SISD central administration. Both of these
exams are standardized exams, but the content is derived from two different places.
TAKS is based on the Texas Essential Knowledge and Skills (TEKS), which are objectives given by grade level and subject, whereas, the Stanford Achievement Test is based on national standards and objectives (Malone, et. al., 2010).

## Statement of the Problem

There is little research on the academic preparation of students before students take AP exams, with the exception of research on PSAT student performance. However, it is important to note that the research on PSAT and the AP exams in the Camara and Millsap (1998) study and Ewing (2006) study examined students, who had higher student mean scores than the entire population of students taking the PSAT. Essentially, this means that a sample of better scoring students on the PSAT was used, which could inflate the results, thus pointing to a higher correlation between students' passing the AP exam and their PSAT scores. Given this information, reexamining the relationship with a specific population of students such as urban students could possibly strengthen or dilute the findings in previous studies.

In addition, other standardized exams should be examined alongside the PSAT to determine the characteristics of students passing AP exams, to inform school leadership of relationships that exist among the test scores that these students attain. The results of this study could, therefore, help schools develop interventions to improve their school's AP program. For example, this study could discover a high correlation between reading scores on Stanford Achievement Test and AP English Language exam performance. Then, school administrators could develop reading interventions at earlier grade levels to
improve their students AP program before actually taking the AP English Language course.

## Purpose of the Study

The purpose of this study was to use multiple data sources to analyze trends in student performance on the Stanford Achievement test, the PSAT test, and the AP exams. Given the relationship between students passing AP exams and college graduation (Dougherty, Mellor, \& Jian, 2006), more knowledge on AP student exam performance is needed. PSAT/NMSQT performance and AP exam performance has already been analyzed in previous studies (Camara \& Millsap, 1998 and Ewing, Camara, \& Millsap, 2006); however, this study seeks to add more knowledge around this topic by analyzing Stanford Achievement Test performance and AP student exam performance.

## Research Questions

As stated earlier, the purpose of this study was to use multiple data sources to analyze trends in student performance on the Stanford Achievement Test, the PSAT test, and the AP exams. Given this purpose, the study will address the following research questions:

Research Question One. What is the relationship between students' Stanford Achievement Test scores and their performance on AP Exams?

Research Question Two. What is the relationship between students' PSAT test scores and their performance on AP Exams?

## Hypotheses

The research questions posed in the previous section of this paper are the basis for the following research hypotheses.

Hypothesis One. There is a positive relationship between students' Stanford Achievement Test scores and their performance on AP Exams.

Hypothesis Two. There is a positive relationship between students' PSAT scores and their performance on AP Exams.

## Significance of the Study

This study will help school administrators determine what interventions are necessary to help promote the success of their students in the AP Program. In regards to SISD, their strategic plan has placed a strong emphasis on student achievement and ensuring students are prepared to succeed in college, as do many school districts. One of SISD's core initiatives is data driven accountability. This study aims to provide information for SISD that would expand the current knowledge base of characteristics associated with a student passing an AP exam by taking into consideration the student's PSAT test results and Stanford Achievement test results. Currently, SISD does not use the Stanford Achievement Test as an indicator for college preparation, because there is no research that supports that linkage. However, this study will explore whether, for this student sample, such a relationship exists between Stanford Achievement Test results and Advanced Placement exam performance. As a result, these findings may ultimately support SISD's strategic plan and data driven accountability core initiative.

Given the relationship of passing AP exams and college degree attainment, this study's analysis of the characteristics of an AP student who is successful on the AP exams can provide valuable information on the level of preparation a student possesses before taking a given AP exam. This information could have a positive impact on strategies to improve upon an effective teacher in the classroom and principal in every school, which are part of SISD's core initiatives. Determining whether the students are prepared for the AP coursework can help a school develop a strategy for helping improve their AP program. Additionally, this study will provide information gathered from analyzing student assessments data, which includes students' Stanford Achievement Test scores, PSAT Test scores, and their performance on AP exams. It is hoped that this information would be beneficial for school district administration in placement of students in AP courses.

## Definition of Terms

The following terms are discussed throughout this study; therefore definitions are provided for these terms.

Advanced Placement courses involve students taking college level coursework while still in high school. AP courses are taught by high school teachers, but use a course description agreed upon as satisfying college level curriculum (College Board, 2012c).

Advanced Placement exams involve students taking college level assessments while still in high school for which colleges may grant credit. AP exams are developed by high school and college teachers for which they determine the necessary information for certain introductory college courses (College Board, 2012c).

Advanced Placement exam scores is based on College Board's five point score reporting, which signifies a recommendation to universities and colleges on whether the student is qualified to receive college level credit (College Board, 2012c). The scores range from (1) no recommendation for college credit, (2) possibly qualified for college credit, (3) qualified for college credit, (4) well qualified for college credit, and (5) extremely well qualified for college credit (College Board, 2012c).

Passing Advanced Placement exams include students who scored of three or higher on AP Exams (Dougherty et al., 2006).

Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT) is an exam given to high school students that mimic SAT college entrance exam and is composed of Critical Reading, Writing, and Math scores (College Board, 2012b).

Stanford Achievement Test is an exam that can be given to students in the kindergarten to $12^{\text {th }}$ grade year, which uses national subject standards, and provides a basis for comparison to other students in the country as well as individual performance indicators for how well the student is achieving in reading, mathematics, spelling, language, science, social science, and listening (Harcourt Assessment, 2004).

## CHAPTER TWO

## REVIEW OF THE LITERATURE

The review of related literature in this chapter is organized by topics, which include research on the Advanced Placement (AP) Program, Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT/NMSQT), and Stanford Achievement Test. A review of the research linking PSAT/NMSQT and AP exam performance will be provided, since PSAT/NMSQT are used as a predictor for student AP exam performance.

## Review of Literature on the AP Program Historical Development

The Advanced Placement Program evolved from a need to accelerate students in college. The idea came about during in the 1950s when graduates from Harvard, Yale, and Princeton expressed their frustration with the redundancy of their courses covering information they learned in high school (Rothschild, 1999). For most of these students, their frustrations were not alleviated until their third year in college when they started taking more advanced college courses (Rothschild, 1999). Since this was during the time of the Cold War, it was imperative that students in the US education system be able to compete with students in the Soviet education system.

The Ford Foundation proposed a program that would allow high ability students an opportunity to attend college and complete their first two years of collegiate work at the University of Chicago in lieu of their last two years of high school (Rothschild, 1999). Many superintendents opposed this idea and preferred for these high ability students to
stay in high school and have them complete college level work with their high school teachers (Rothschild, 1999).

This formulation of the idea to provide college level work to high school students was the birth of the Advanced Placement Program. The AP Program included 27 schools and students were selected by I.Q. or recommendation by teacher. The first set of AP examinations proved that students learned sufficient college level curriculum while still in high school (Rothschild, 1999). These students in the first administration of AP exams attended 82 different colleges. The challenge for the AP Program was to convince these colleges to accept these exams and grant these students college credit.

The 1960s brought change to this country, and education was seen as more of a civil right. It was obvious that AP classes were for the few and the privileged, which brought about much of its criticism (Rothschild, 1999). There were few minority students in these AP courses. However in the 1970s and 1980s, there was a national movement to open access to all for AP classes regardless of background. The 1983 A Nation at Risk report highlighted the concern that classes in most secondary schools were mediocre, and that other countries were developing more technological innovations than the US (Commission on Excellence in Education, 1983). That report specifically mentioned the AP Program as a way to remedy the situation and it advocated for the expansion of this program. As a consequence, the AP Program saw a significant increase in the growth of participation. More courses were added during the 1980s. However, the AP program still had boundaries placed by teachers and/or counselors for enrollment, which limited minority participation (Rothschild, 1999).

In the 2000s, College Board had adopted a mantra of Equity and Excellence for underserved students who are from a minority and low socioeconomic background (College Board, 2001). As more and more students have the opportunity to take AP courses, there has been criticism that AP courses are losing their rigor. In "Access to Excellence," a report of the Commission on the Future of the AP Program, the authors wrote about the concern for the quality of AP courses as the number of students in AP courses had significantly increased in recent years (College Board, 2001).

The question started to arise on whether all the students in the AP program were really being exposed to college-level course work (Ewers, 2005). For this reason, the College Board had placed a trademark on the AP logo and required that each teacher who wishes to label a course AP submit the syllabus to the College Board for approval. This has become known as the AP Audit. In addition, the school administrator must also approve the syllabus and acknowledge to the College Board that each student will have access to college level textbooks.

In 2004, the Commission on the Future of the Advanced Placement Program released a report indicating several issues that could arise as the AP Program continues to grow and recommendations on how to address those issues. As a consequence, this report strengthened the moral imperative for educators to provide high quality education. If educators do not succeed in providing quality education, the Commission warns that this will lead to a decline in intellectual achievement and ultimately economic opportunity (College Board, 2001).

Building the AP Program would benefit the whole school by raising standards for a group of students. For example, teachers utilize higher level thinking strategies for
their AP students, which could also be used in their regular education classes. Also, there is a sense of pride students possess because they are attempting to learn harder curriculum than that of their peers, which is something all students could admire. These are a few examples of how an AP program could raise its standards. Teachers develop their own intellectual capacity by expanding their knowledge in their subject as they teach college level curriculum prescribed in the AP program (College Board, 2001). However, the Commission cautioned that as more schools feel the pressure to implement and/or increase their AP Program student participation, careful consideration to provide a concrete support system would ensure the success of this program within the schools (College Board, 2001).

The Commission explains that as AP is growing rapidly it is important to have quality control over the AP program. The emphasis on preparing and providing support for AP teachers is of vital importance. The Commission suggests that teachers are the heart of the AP program. There were over 100,000 AP teachers in the year 2000, and more than half indicated that they planned to retire by the year 2010 (College Board, 2001). The Commission also recommends that the AP Program reflect current college curriculum and that a strong relationship with the university professors guide this process.

In the $8^{\text {th }}$ Annual AP Report to the Nation provides the status the AP program for public school students in 2011. In this report, "903,630 U.S. public high school graduates took at least one AP exam, 128, 568 U.S. high school teachers taught an AP course, 21,328 AP Coordinators, counselors, and principals administered AP Exams or used AP data to shape their schools' programs, 5,808 college faculty participated in reviewing AP
teachers' syllabi, developing curricula, or scoring AP exams" (College Board, 2012a, p. 3). The AP program has expanded from 431,573 graduating seniors students taking at least one AP exams with 277,507 receiving a score of 3 or higher in 2001 to 903,630 graduating seniors students taking at least one AP exams with 540,619 receiving a score of 3 or higher in 2011 (College Board, 2012a). Not only AP exams have increased from 2001 to 2011, but also the number of students who receive a passing score of 3 or higher on the AP exams.

## Factors Relating to Students'AP Success

The AP program allows for student to take college level coursework in order to be better prepared for college. However, there are various aspects of an AP program that make it a successful experience for the students. This involves teachers, parents, and the school districts' commitment to the AP program.

Motivated teachers play a major role in whether or not an AP program will succeed. According to a study by Milewski and Gillie (2002), most teachers who teach AP courses either have a Bachelor's or Master's degree in that subject area. To extend their knowledge in their content area, these motivated teachers participate in training specifically designed for AP curriculum during the summer. These weeklong seminars give teachers a chance to learn from experienced teachers. "Summer Institutes provide an invaluable avenue for introducing new teachers to what is expected in AP, networking with other AP teachers obtaining new ideas, and brushing up on skills" (Klopfenstein, 2003, p. 44). Teachers who take these summer institute courses to prepare for their AP courses also teach regular curriculum courses. In essence, the strategies can be used for
both regular and advanced courses. Taking AP professional development helps these instructors become better teachers overall (College Board, 2005a).

According to a study by Patterson and Laitusis (2006), these summer institutes provide content knowledge for various AP subjects including teaching strategies. AP workshops on the other hand provide another avenue for teacher staff development in which teachers are given updated information on specific AP exams and any changes to the course description for that AP subject. In Patterson and Laitusis (2006) study, they included an analysis on which method of staff development increased student AP exam participation. They found that teachers taking AP workshops actually had a higher increase in students taking AP examination (Patterson \& Laitusis, 2006). Schools have developed innovative ways to improve their AP programs through vertical team planning amongst the major core academic areas, which have led to better working relationships amongst AP teachers (College Board, 2002).

Parents also play a vital role in students' academic success. Ndura, Robinson, and Ochs (2003) conducted a study in which they surveyed AP students and found that the most influential people in their lives were their parents, and not their peers as some might assume. Appealing to parents to make sure their children are ready to learn and ready to take on the challenges of an AP course is essential to the success of the student (Jehlen, 2003

## The Validity of the AP Exams

Some college professors did not support the idea of students who receive a score of 3 on the AP exam as being able to place out of introductory college courses (Morgan
\& Ramist, 1998). This is a valid concern not only for professors but also for other stakeholders including students, teachers, parents, and school administrators. Essentially, the question is whether passing an AP exam warrants a student not having to take introductory college courses in which the exam was given. To address this concern, researchers began to develop comparison groups of AP students and non-AP students in college to determine if this was a valid concern (Morgan \& Ramist, 1998).

This study collected data from students in 21 colleges and universities to determine the validity of AP exam grades for course placement. Comparison groups for students who took AP exams were created by matching similar students with entrance exams such as the SAT and ACT. College grades were investigated to determine how well students with AP credit performed compared to non-AP credit students. The study found that the students with AP scores of 3 performed as well as the students who did not have AP credit; however, as the scores increase to a value of 4 or 5 on the AP exam, the study showed that students performed better than their non-AP credit comparison group (Morgan \& Ramist, 1998).

Another similar study was conducted with students at the University of Texas (UT) in 1996-1999 in English, Calculus, and Biology (Dodd, Fitzpatrick, De Ayala, and Jennings, 2002). This study had included four comparison groups of students who received credit for introductory level courses in English, Calculus, and Biology. These participants were successful students on AP exams who received credit according to UT policy, non-successful students on AP exams who did not receive college credit, students with dual credit who took college courses in high school, and those students who actually took the introductory level college course. Using statistical analysis, which included
descriptive statistics and analysis of variance (ANOVA), the study concluded that students who pass the AP exam by receiving a score of 3 or better and place out of the corresponding introductory college course tend to perform as well or better in subsequent college courses in the same area of study than students who did not place out the same introductory college course (Dodd et al., 2002).

Most of these studies on AP student outcomes have focused on students who actually took the AP exam and who attained a score of at least 3 or higher. Additionally, a study by Dougherty, Mellor, and Jian (2006) attempted to compare student participation in AP courses and project if this made a difference in graduation rates. They found that indeed students were more likely to graduate in five years when having received at least a score of 3 in the areas of English, Math, Science, and Social Studies. There was some support for students who received a score of 1 or 2 on the AP exams, but Dougherty et al. (2006) explained at the very least students who enroll in AP courses self select in preparation for college. As a result, it can at least be inferred that motivation to succeed is one variable contributing to AP and then collegiate success.

When looking solely at student participation in AP courses in high school, a study tried to determine if students had a better experience in these AP courses than students who did not take AP courses (Thompson and Rust, 2007). Using a Likert scale questionnaire, high achieving students were asked to rate the experiences in AP course participation and students with non-AP experience but rather general education college introductory course experience. This study concluded that students with AP course participation experience did not rate their experience higher than those without this experience. This study conveys the idea that these AP courses may have not
demonstrated intense academic rigor. Unfortunately, this study included a fairly small group of 41 students who had at least a GPA of 3.00 in college. Therefore, its findings cannot be generalized to all students who have taken AP courses in high school.

However, it is difficult to compare AP student participation in courses and its effect on student outcomes in college because performance on the AP exams is a standardized process, but student participation in AP courses could substantially differ from classroom to classroom (Ewing, 2006). To control partially for this variability in course, the College Board instituted the so-called AP Audit, which requires that each teacher labeling a course as AP on a student's transcript adhere to the College Board course descriptions. Each AP course has a College Board course description, which includes a detailed outline of curricular requirements of the respective AP course. This course description is agreed to by a select group of college professors who serve on AP course development committees. Each course development committee has six or seven members for each AP course that is comprised of highly qualified college professors and secondary school teachers as determined by College Board (College Board, n.d.). They review the course descriptions and exam content for each AP course.

However, college faculty from Brigham Young University (BYU), the University of Maryland, and the University of Washington joined to conduct a study specifically on how students who received a 3 on AP English Language tended to perform in sophomore level humanities and history courses (Hansen, Reeve, Gonzalez, Sudweeks, Hatch, Esplin, \& Bradshaw, 2006). They were trying to determine if BYU's policy on granting credit for freshmen level English with a score of 3 on the AP exam was appropriate.

Hansen et al. explained more universities prefer for their students to take college writing in their freshmen year rather than accepting credit for the AP test. Hansen et al. cited references on how College Board is a business entity whose possible concern is to make profits from AP exams. This idea is somewhat supported by the secrecy of how AP exam scores are derived. Instead of a purely criterion reference exam, the AP exams have a portion of norming which adds to the criticism that as more students take AP exams, the score of 3 does not hold consistent for college level exemption (Hansen et al., 2006).

The study conducted by Hansen involved college writing prompts given to students in sophomore level humanities and history courses and a team of graders who were trained on a rubric for grading these writing samples. Statistical analysis was provided from the scores of these writing samples along with students who received a 3 on AP exams, students who took BYU freshmen writing course, and those who passed AP exam and took BYU freshmen writing course. The findings suggested that there was no statistically significant difference between students who had credit from AP English exam and those who took BYU freshmen writing course. This study's findings essentially support the previous study (Dodd et al., 2002) on how students compare to each other when students received credit from AP exams or taking the freshmen level courses.

Still there was continued speculation that a score of 3 on an AP exam still held its value when there has been a sharp increase in AP participation in the last decade. Therefore, another study was conducted to strengthen the research-supported idea that students who perform with at a score of 3 on the AP exam perform just as well as their
non-AP counterparts. Once again, a group of freshmen from the University of Texas were examined from the entering class of 1998-2001 (Keng \& Dodd, 2008). There were four groups examined which were students who passed AP, students who did not pass AP, students with no AP exams, and students receiving credit from college courses while concurrently enrolled in high school. The AP passing group and the AP no exams group was matched on the criteria of high school rank and SAT scores. The study examined 10 subject areas, which were AP Biology, AP Calculus AB, AP Calculus BC, AP Chemistry, AP Macroeconomics, AP English Language and Composition, AP English Literature and Composition, AP Government and Politics, AP US History, and AP Spanish Language. After statistical analysis using one-way multivariate analysis of variance was conducted, the study found that the students with a passing score of 3 or better on the AP exam consistently outperformed the other three groups in this study on most outcome measures. However, the students in the not passing AP exams group were shown to perform the poorest of the four groups. This study's researchers indicated that this group was matched with similar high school rank and SAT scores, but critics of the AP program may argue that these students were not in AP classes in high school that were rigorous to meet college standards. Therefore, there may be some cause for concern.

In Texas, there was an analysis to demonstrate the percentage of gender and ethnicity of students taking AP courses and their performance on AP exams (Moore and Slate, 2008). The study used data from the Academic Excellence Indicator System (AEIS), which is maintained online for each public school district in Texas on the Texas Education Agency (TEA) website. Ultimately, the study showed that there was more course enrollment by female students than male students in AP courses and a smaller
percentage of Hispanic and African American students as compared to white students. This study conducted a statistical analysis to compare the Hispanic and African American students' performance on AP exams, and determined that the Hispanic population is performing better on the AP exams. However, it must be noted that these comparisons were overall exam performances for Hispanic students, but the criticism for comparing Hispanic students' performances is inflated when AP Spanish Language was included.

## The Preliminary SAT

When discussing the Preliminary SAT test, it's important to start with the history of the SAT Reasoning Test. The SAT Reasoning Test (SAT) was formerly known as the Scholastic Aptitude Test and Test of Standard Written English until 1994. The first administration of the SAT exam was in 1926. The main contributor for the development of the SAT was Carl C. Brigham. The intent of the Scholastic Aptitude Test was meant to measure the aptitude of college studies, and it is not meant to measure intelligence according to the Mental Measurements Yearbook. In the beginning, there were two subsets of scores included in the Scholastic Aptitude Test, which consisted of verbal and math scores. The new SAT Reasoning Test also includes a writing score as well.

The range of scaled scores for the Math, Verbal, and Writing portions of the SAT are from 200-800 for each section. When combined high school GPA with Math and Verbal score of 1300 and higher, there is a high likelihood a student will graduate from college in four years (Burton \& Ramist, 2001).

Given the importance of the SATs, the College Board created a practice SAT exam to be taken as earlier as $8^{\text {th }}$ grade. The practice SAT exam also serves as an
opportunity to enter a competition based on the performance on this exam for a scholarship. The Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT/NMSQT) measures skills in three areas, which have been linked to success in college. This includes verbal reasoning, mathematics problem solving, and writing skills. The scores on each section of PSAT range from 20 to 80 . "It shares much of the SAT's statistical and content specifications, but the PSAT/NMSQT has a slightly lower overall difficulty than the SAT, contains fewer items, and does not cover content that would typically be found in a third-year college-preparatory math course" (Milewski \& Sawtell, 2006, p.1).

## PSAT and AP Tests

Increasing participation in the AP Program is a priority of the College Board in order to provide opportunity for more students to be exposed to college level curriculum, which will in essence prepare them to be successful in college (College Board, 2001). Online tools have been developed through the College Board to give schools a list of students who would have a certain percentage of potential success for passing various AP exams. This tool is called AP Potential. The purpose of this tool is to identify students who show potential for passing AP exams based on the Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT/NMSQT) taken as $10^{\text {th }}$ and $/$ or $11^{\text {th }}$ grade. The PSAT/NMSQT is comprised of a verbal, math, and written part of the exam.

Research studies have tested the validity of using PSAT/NMSQT to predict success on AP exams (Camara and Millsap, 1998). Most students who have a PSAT/NMSQT verbal score of 46-50 are predicted to pass the following AP exams: Art History, Biology, Calculus AB, Calculus BC, Chemistry, Comparative Government and

Politics, Computer Science A, Computer Science AB, English Language, English Literature, European History, French Language, French Literature, Latin Literature, Latin Vergil, Macroeconomics, Microeconomics, Music, Physics B, Physics C: Mechanic, Physics C: Electricity and Magnetism, Psychology, US Government and Politics, and US History (Camara and Millsap, 1998). Using the combined Math and Verbal score from PSAT/NMSQT expectancy tables were created from Camara and Millsap (1998) study and is the basis for AP potential online tool."The relationship between PSAT/NMSQT score and AP Examination grade is in fact stronger for minority groups than whites on 13 of 18 comparisons" (Camara \& Millsap, 1998, p. 17).

A later study would not find as strong of a relationship with only the PSAT/NMSQT verbal score (Ewing, Camara, Millsap, 2006). In the years between the two studies, the written portion of the PSAT/NMSQT was added along with a higher volume of students taking the PSAT/NMSQT. This may have contributed to slightly different findings in terms of the PSAT/NMSQT verbal score.

## The Stanford Achievement Test

The Stanford Achievement Test has been in existence as far back as 1923. This test consists of items that were chosen by reviewing national and state instructional standards, curriculum specific to the content tests, and standards outlined by various educational professional organizations (Harcourt Assessment, 2004). The Stanford Achievement Test is used in many urban districts to measure how well their students are performing on material in a given grade level. The Stanford Achievement Test allows districts to measure student performance with a national population and within particular
demographics. According to the Council on Greater City Schools (2001) report, Stanford Achievement Scores are used to demonstrate the achievement gap between white and non-white urban students.

The Stanford Achievement Test includes a multiple-choice assessment in reading, mathematics, spelling, language, science, social science, and listening. Since 1923, there have been 10 editions to the Stanford Achievement Test (Harcourt Assessment, 2004). "The decision to launch a new edition of a major test series is based on changes in schools' curricula, changes in national assessment trends and methods, and the need for updated testing materials, normative information, and interpretive materials" (Harcourt Assessment, 2004, p. 7). To begin the development of a new test edition for Stanford Achievement Test, major textbooks along with state curricula are utilized to gather necessary information for the new test framework. A blueprint is then created keeping in mind instructional standards discovered in the development process. Test questions are developed by experienced teachers and are reviewed by content experts (Harcourt Assessment, 2004). Before the new Stanford Achievement Test edition can be finalized, a national item tryout sample is conducted to test the new questions and feedback is gathered from teachers. In 1998, 1999, 2000, there were over 170,000 students in 42 states that were exposed to the new $10^{\text {th }}$ edition Stanford Achievement Test edition in the national item tryout program (Harcourt Assessment, 2004).

Of course, another issue involved in standardized exams is the existence of bias in test questions, which hinders students from a disadvantaged background. With this in mind, the Stanford Achievement Test developers seek to construct items, which eliminate
the need for cultural familiarity, while also having a bias review advisory panel consisting of members from diverse backgrounds (Harcourt Assessment, 2004).

The earlier editions of the Stanford Achievement Test consisted of questions in subtests that begin with easier questions but become increasingly harder as the test progresses. This posed as a problem for students becoming frustrated with the exam and essentially giving up on taking the entire test (Harcourt Assessment, 2004). Therefore, the $10^{\text {th }}$ edition of the Stanford Achievement Test was created to mix the difficulty of questions to protect from students quitting on taking the entire test.

## CHAPTER THREE

## METHODOLOGY

## Introduction

The purpose of this study was to use multiple data sources to analyze trends in student performance on the Stanford Achievement test, the PSAT test, and AP exams. Specifically, this section presents descriptions of: (1) the research design; (2) the sample; (3) the instruments; (4) the data collection procedures; and (5) the data analysis procedures utilized in the conduct of this study.

Given this purpose, the study addressed the following research questions:
Research Question One. What is the relationship between students' Stanford Achievement Test scores and their performance on AP Exams?

Research Question Two. What is the relationship between students' PSAT test scores and their performance on AP Exams?

## Research Design

A correlational design was used to test the hypothesis in this study. This research design was selected because this examined relationships among variables (standardized achievement scores and AP exam scores). To analyze trends of students' performance, who take AP exams, multiple data sources were analyzed, which include student PSAT scores, Stanford Achievement scores, and student performance on AP exams.

## Instrumentation

The dependent variable in this study is the AP scores, and the independent variables were the Stanford Achievement scores and PSAT scores. These three instruments were used in this study. However, the principal researcher did not administer these instruments, because they are given as part of a normal experience as a student in Southwest Independent School District (SISD); hence, data used in this study are archival in nature.

The first instrument used in this study is the AP exams. According to the 2012 AP Coordinator's Manual, these exams are comprised of a multiple-choice section and a free response section. The multiple-choice section includes a question stem and five answer choices. The length and the time for the multiple-choice section differ slightly, but it is roughly an hour long section depending on the exam. The free response section of the AP exams gives the student a question to answer and the student writes his/her own answer in the test booklet comprised of notebook paper. This section is roughly two hours long depending on the exam. The exams are securely packed and sent to the College Board for grading. The free response section is graded using a rubric, which is posted on the College Board Website. These exams are given to students who opt to take the AP exam that corresponds with their AP course. AP exams are given in May every year. The SISD schools are responsible for administering these exams.

The PSAT/NMSQT is a highly reliable exam yielding reliability coefficients of .86 in the verbal section, .89 in the math section, and .83 for the writing section (College Board, 2010). There is a critical reading section containing 48 questions, and math section containing 38 questions, and one 30 minute writing section containing 39
questions (College Board, 2011). "The PSAT/NMSQT scale of 20 to 80 is comparable to the SAT scale of 200 to 800 " for each critical reading, math, and writing section (College Board, 2011, p. 21). PSAT exams are given in October, and SISD schools are responsible for administering these exams.

The Stanford Achievement Test is based on national standards. These exams consist of multiple-choice items in Reading, Lexile Measure, Mathematics, Language, Spelling, Listening, Science, and Social Science. The Stanford Achievement Test has the Kuder-Richardson Formula 20 (KR-20) coefficients from 0.86 to 0.97 for composite scores, which means that the Stanford Achievement Tests are reliable instruments (Malone et al., 2010). Stanford Achievement Tests are given during the school year, and SISD schools are also responsible for administering these exams.

## The Sample

The sample for this study included approximately 12,000 students in SISD who took AP exams taken in May 2011. Research question one and two had a different sample population, which is detailed in Chapter 4 . These archival data did not have any student identifiers to protect the anonymity of the SISD students involved. The rationale for including this number of students is to ensure statistical power for the analyses in this correlational research design and to help improve the generalizability of this study's research findings to other similar populations of students.

## Data Collection Procedures

The researcher asked for permission to conduct research at SISD through the process in place and has received approval to conduct this research study. In addition, the
researcher submitted an application for research with the Committees for the Protection of Human at the University of Houston and received permission to conduct this study. The researcher received the data requested from the school district via the SISD Research Department in an electronic spreadsheet form. Specifically, the principal researcher gained access to AP scores, student PSAT scores, and Stanford Achievement Scores, demographic data for each student including race, ethnicity, free and/or reduced lunch status, and grade level of each student. All the data in this study was archival. No names or information that can link an individual student to personal information was reported to the researcher.

Two tables were provided to the researcher by SISD Research Department. The first table included AP student exam score, respective AP examination name, PSAT student raw and scaled scores in math, writing, critical reading, respective demographic data each student including race, ethnicity, free and/or reduced lunch status, and grade level of student for the 2010-2011 school year.

The second table included 2011 AP student exam score, respective AP examination name, Stanford Achievement Test student raw and scaled scores in reading, math, language, science, social studies, respective demographic data each student including race, ethnicity, free and/or reduced lunch status, and grade level of student for the 2010-2011 school year.

This data was password protected. However, this study did not include any student data that are identifiable to protect the anonymity of the SISD student participants. The data collected by this study will be destroyed three years after the study has been concluded. The data provided by SISD is used only for this research study.

## Data Analysis

The data received from SISD Research Department were imported into SPSS statistical software to compute means, standard deviations, and correlational data to test the hypotheses listed in this study. Pearson-product moment correlations were computed between AP scores and Stanford Achievement Scores as well as AP scores and PSAT Scores. This data analysis was meant to replicate the methods used in the Ewing et al. (2006) study conducted on the relationship between AP scores and PSAT scores.

In addition, if there are strong correlational relationships between AP scores and Stanford Achievement Scores, then an expectancy table was created, which includes students' scores ranging from high to low in group intervals and the percentage of students who score at the corresponding scores in the respective group intervals. These expectancy tables are another method used in the Ewing et al. (2006). Expectancy tables were created for PSAT scores with the data in this study if there is a demonstrated strong correlational relationship

## Limitations of the Study

The following are issues when reviewing the conclusions of this study. The study was conducted in an urban school district that services disadvantaged students; therefore, results found in this study may not be generalizable to other school districts.

## CHAPTER FOUR

## RESULTS

This study sought to answer the following research questions.
Research Question One: What is the relationship between students' Stanford Achievement Test scores and their performance on AP Exams?

Research Question Two: What is the relationship between students' Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT) scores and their performance on AP Exams?

Descriptive and correlational statistics were used to answer the above research questions. Sample sizes differ for each of the above research questions and are explained in this chapter.

## Research Question One

The Research Department from Southwest Independent School District (SISD) provided the principal research with an excel table that included Public Education Information Management System (PEIMS) information, Advanced Placement (AP) exams and scores information, and Stanford Achievement raw and scaled scores in Reading, Math, Language, Science, and Social Studies for 12,658 students. "The Public Education Information Management System (PEIMS) encompasses all data requested and received by TEA about public education, including student demographic and academic performance, personnel, financial, and organizational information" (Texas Education Agency, n.d., $\{3$ ).

Table 4.1 provides an explanation of the errors found in the data provided by SISD, which reduced the sample size used to address research question one. The original sample size of 12,658 students was reduced by 3,784 , which was the total number of errors in student records indicated in Table 4.1. This brings the sample size for research question one to 8,874 students.

Table 4.1

Frequency of Errors in Student Records for Research Question One

| Description of Error | f |
| :--- | :---: |
| Student Grade Level Missing | 5 |
| AP Score Missing for Students Taking 1 Exam | 16 |
| PEIMS Data Missing | 1 |
| All Stanford Achievement Scores Missing | 3583 |
| Partial Stanford Achievement Scores Missing | 173 |
| Duplicated Student Records | 6 |
| Total | 3784 |

Although there were 8,874 students in the sample size for research question one, some students took more than one AP exam. Research question one sought to determine the relationship between AP exams and Stanford Achievement Test scores; therefore, it was necessary to determine the total number of AP exams taken by the 8,874 students in order to further analyze the data for research question one. Once the principal researcher manipulated the data from SISD to represent AP exams, there were $12,905 \mathrm{AP}$ exams taken by 8,874 students. However, the principal researcher discovered that 40 AP exams
were missing scores for students taking more than one AP exam, which brought the total number of AP exams down to 12,865 taken by 8,874 students.

Table 4.2 shows the number of students who took a specific number of AP exams.
The majority of students took one AP exam ( $n=6244,48.5 \%$ ).

Table. 4.2

Quantity of AP Exams Taken by AP Students for Research Question One

| Quantity of AP Exams | f | $\%$ |
| :--- | :---: | :--- |
| 1 | 6244 | $48.5 \%$ |
| 2 | 3498 | $27.2 \%$ |
| 3 | 1740 | $13.5 \%$ |
| 4 | 728 | $5.7 \%$ |
| 5 | 390 | $3.0 \%$ |
| 6 | 180 | $1.4 \%$ |
| 7 | 56 | $0.4 \%$ |
| 9 | 9 | $0.1 \%$ |
| 10 | 20 | $0.2 \%$ |
| Total | 12865 | $100.0 \%$ |

Table 4.3 shows the specific title of AP exams and frequency taken by the 8,874 students for research question one. The largest number of AP exams taken was in AP World History ( $n=2854$ ).

Table. 4.3

Frequency of AP Exams for Research Question One

| Name of AP Exam | f |
| :---: | :---: |
| World History | 2854 |
| English Language | 2420 |
| Spanish Language | 2258 |
| United States History | 2143 |
| Human Geography | 1449 |
| Chemistry | 356 |
| Environmental Science | 185 |
| Biology | 174 |
| Psychology | 125 |
| Statistics | 112 |
| Physics B | 104 |
| Computer Science A | 86 |
| English Literature | 81 |
| Art History | 62 |
| European History | 54 |
| US Government | 51 |
| Spanish Literature | 49 |
| Chinese Language | 38 |
| Music Theory | 36 |

Table. 4.3 (continued)

| Name of AP Exam | f |
| :--- | :--- |
| Music Aural Subscore | 36 |
| Music Non-Aural Subscore | 36 |
| French Language | 31 |
| Calculus AB | 31 |
| Art: Studio Art-2-D Design Portfolio | 18 |
| Calculus BC | 18 |
| Calculus BC: AB Subscore | 18 |
| Art: Studio Art-Drawing Portfolio | 10 |
| German Language | 7 |
| Economics: Macroeconomics | 6 |
| Latin: Vergil | 5 |
| Physics C - Mechanics | 4 |
| Physics C - Electricity \& Magnetism | 3 |
| Economics: Microeconomics | 2 |
| Comparative Government | 2 |
| Japanese Language and Culture | 12865 |
| Total | 2 |

Since correlation coefficients were derived for each AP exam and Stanford Achievement Test scores, it was necessary to have at least 30 participants to further exam this correlational relationship (Gall, Gall, and Borg, 2007). Therefore, Art: Studio Art-2D Design Portfolio, Calculus BC, Calculus BC: AB Subscore, Art: Studio, Art-Drawing

Portfolio, German Language, Economics: Macroeconomics, Latin: Vergil, Physics C Mechanics, Physics C - Electricity \& Magnetism, Economics: Microeconomics, Government \& Politics: Comparative, and Japanese Language and Culture were not included in this study since the frequency of these respective AP exams was less than 30 . In addition, the data for AP Music Theory exam included the subscore for Aural and Non-Aural portion of the AP exam; however, for research question one only the total AP Music Theory exam need to be included. Given this information, there were a total of 166 AP exams not included in this study, which reduced the total number of AP exams to 12,669 for research question one. By reducing the total number of AP exams to 12,669 , this changed the sample size of students for research question one as well from 8,874 to 8,864 students.

Since the final sample size information was determined to be 8,864 students for research question one, below are the demographic data including grade level, gender, economically disadvantage status, and ethnicity.

Table 4.4 shows frequency of student taking AP exams by grade level in the sample population for research question one. The majority of AP exams were taken by $11^{\text {th }}$ grade students ( $n=3413,38.50 \%$ ) and $10^{\text {th }}$ grade students ( $n=3316,37.64 \%$ ). Students in the $12^{\text {th }}$ grade ( $n=4,0.05 \%$ ) were not substantially represented because $12^{\text {th }}$ graders were not given the Stanford Achievement Exam in 2010-2011 school year.

Table 4.4
Frequency and Percentage of AP Students Grade Level for Research Question One

| Grade Level | f | $\%$ |
| :--- | :---: | :---: |
| $8^{\text {th }}$ Grade | 297 | 3.35 |
| $9^{\text {th }}$ Grade | 1814 | 20.46 |
| $10^{\text {th }}$ Grade | 3336 | 37.64 |
| $11^{\text {th }}$ Grade | 3413 | 38.5 |
| $12^{\text {th }}$ Grade | 4 | 0.05 |
| Total | 8864 | 100 |

Table 4.5 shows the gender breakdown of students taking AP exams in the sample population for research question one. The majority of AP exams were taken by female students ( $n=4960,56 \%$ ).

Table 4.5
Frequency and Percentage of AP Students Gender for Research Question One

| Gender | f | $\%$ |
| :--- | :---: | :---: |
| Female | 4960 | 56 |
| Male | 3904 | 44 |
| Total | 8864 | 100 |

Table 4.6 shows the level of economic disadvantage breakdown for students taking AP exams in the sample population for research question one. The majority of AP exams were taken by economically disadvantaged students ( $n=5638,64 \%$ ).

Table 4.6
Frequency and Percentage of AP Students Economic Disadvantage Status for Research Question One

| Economic Disadvantage Status | f | $\%$ |
| :--- | :---: | :---: |
| Not Economically <br> Disadvantaged | 3226 | 36 |
| Eligible for Free Lunch | 3361 | 38 |
| Eligible for Reduce Price Meals | 833 | 9 |
| Other Economic Disadvantage | 1444 | 16 |
| Total | 8864 | 100 |

Table 4.7 shows the ethnic background for students taking AP exams in the sample population for research question one. The majority of AP exams were taken by Hispanic students ( $n=5032,56.8 \%$ ).

Table 4.7
Frequency and Percentage of AP Students Ethnicity for Research Question One

| Ethnicity | f | $\%$ |
| :--- | :---: | :---: |
| Asian | 532 | 6 |
| American Indian | 27 | 0.3 |
| African American | 1803 | 20.3 |
| Hispanic | 5032 | 56.8 |
| Pacific Islander | 25 | 0.3 |
| Two or More Ethnicities | 105 | 1.2 |
| White | 1340 | 15.1 |

Table 4.7 (continued)

| Ethnicity | f | $\%$ |
| :--- | :---: | :---: |
| Total | 8864 | 100 |

Although Stanford Achievement Test Total Subject Scaled Scores and Raw Scores were provided by SWISD, further examination of these scores result in the discovery of a problem when using raw scores. The Stanford Achievement Test is different for every grade level; therefore, the number of questions varies for each Stanford Achievement Test, which makes the raw maximum and minimum score different for every grade level. Some AP exams have more than one grade level represented within its participants, which is a problem if this study utilized raw scores to conduct correlation coefficients.

However, the Stanford Achievement Scaled Scores "system expresses student performance across all test levels of any given subtest [or total] on a single scale...Scaled scores are especially suitable for comparing student performance in a particular subject over time" (Harcourt Assessment, Inc., 2004, p. 34). Stanford Achievement Scaled Scores are converted from the raw score. Once this conversion occurs, the test level doesn't matter since a single scale occurs for every subtest and total score in a given subject area. Therefore, using Stanford Achievement Total Subject Scaled Scores is most appropriate given that grade level does not matter. Stanford Achievement Total Subject Scaled Scores are used in this study for Reading, Math, Language, Science, and Social Studies. Stanford Achievement Total Subject Scaled Scores combine results from subtests in each subject tested on the Stanford Achievement Test.

Research question one asks to examine the relationship between students' Stanford Achievement Test scores and their performance on AP Exams. The hypothesis for research question one suggests there are a positive relationship between students' Stanford Achievement Test scores and their performance on AP Exams. To determine whether a relationship exists, Pearson product moment correlation coefficients were calculated for each AP exam using the sample provided for SWISD. Pearson product moment correlation method was the appropriate statistical model given that both AP exams and Stanford Achievement Test Total Subject Scaled Scores are considered interval data, which is also requirement to perform Pearson product moment correlation coefficients (Ravid, 2011). Another study conducted by Ewing, Camara, Millsap (2006) examined PSAT scores and AP exam scores also used Pearson product moment correlation coefficients to test their hypothesis.

Table 4.8 shows the Pearson product moment correlation coefficients for each AP exam and Stanford Achievement Test Total Subject Scaled Scores. The AP exams appear grouped in subject areas. Each AP exam relationship was examined individually in the subsequent paragraphs to determine whether the hypothesis for research question one was upheld. Table 4.8 also indicates whether the relationship between each respective Stanford Achievement Test Total Subject and AP exam scores were statistically significant.

Table 4.8
Pearson Product Moment Correlation Coefficients for Stanford Achievement Total
Subject Scaled Scores and AP Exams

| AP Exam | Read Scaled Score | Math Scaled Score | Language Scaled Score | Science Scaled Score | Social Studies Scaled Score |
| :---: | :---: | :---: | :---: | :---: | :---: |
| English |  |  |  |  |  |
| English Language | .756** | .705** | .717** | .661** | .684** |
| English Literature | . $593 * *$ | . $377 * *$ | .433** | .256* | .311** |
| Fine Arts |  |  |  |  |  |
| Art History | .537** | .593** | .430** | .607** | .582** |
| Music Theory | .619** | . $545 * *$ | .487** | .475** | . 529 ** |
| Foreign Language |  |  |  |  |  |
| Chinese Language | 0.063 | 0.211 | 0.086 | 0.092 | 0.119 |
| French Language | .630** | .437* | .723** | .415* | .597** |
| Spanish Language | . 440 ** | .336** | .402** | .375** | .428** |
| Spanish Literature | . $379 * *$ | .418** | 0.276 | .357* | .318* |
| Math |  |  |  |  |  |
| Calculus AB | 0.329 | .685** | 0.325 | .478** | 0.142 |
| Computer Sci. | .496** | . 661 ** | . 520 ** | .557** | .580** |
| Statistics | .665** | .815** | .607** | .641** | .621** |
| Science |  |  |  |  |  |
| Biology | .676** | .713** | .690** | .666** | .618** |
| Chemistry | .706** | .840** | .733** | . 723 ** | .699** |
| Environmental Sci. | .694** | .690** | .590** | .656** | .659** |
| Physics | .682** | .817** | .695** | .761** | .661** |
| Social Studies |  |  |  |  |  |
| European History | .494** | .635** | .534** | . $513 * *$ | .595** |
| Human Geography | .603** | . 580 ** | .538** | . $578 * *$ | .598** |
| Psychology | .514** | .558** | .531** | .533** | .512** |
| US Government | .661** | .833** | .719** | .592** | .740** |
| US History | .686** | .702** | .673** | .653** | .694** |
| World History | .608** | . 620 ** | .569** | .652** | .646** |

Note. Sci. $=$ Science
*Correlation is significant at the 0.05 level (2-tailed). ${ }^{* *}$ Correlation is significant at the 0.01 level (2-tailed).

Table 4.9 describes the strength of the relationship by categorizing the Pearson product moment correlation coefficients as having a very high (. 80 to 1.00 ), high (. 60 to .80), moderate (. 40 to .60 ), low (. 20 to .40 ), and negligible to low (. 00 to .20 )
relationship, which follows the guidance provided in the book, "Practical Statistics for Educators" by Ravid (2011). The highest correlation coefficient for each AP exam is also indicated in Table 4.9.

Table 4.9 indicates the Stanford Achievement Test subject that used for an expectancy table, which was first introduced in Chapter One of this study. The purpose of the expectancy table was meant to emulate the study conducted by Ewing, Camara, Millsap (2006), which showed the percentage of students scoring 3 or higher at various exam achievement levels on the PSAT exam. A score of three or higher on a five-point scale is considered passing on an AP exam (Dougherty, Mellor, \& Jian, 2006). The purpose of creating such an expectancy table is for administrators to recruit students in respective AP courses by using data based on students who have been successful in passing the respective AP exams. Therefore, using the same idea presented in Ewing, Camara, Millsap (2006) for PSAT, Table 4.8 indicates the specific Stanford Achievement Test Total Subject Scaled Score used to create an expectancy table for school administrators based on a commonality that occurs within each AP subject exams correlation coefficients. The decision to use certain Stanford Achievement Test Total Subject Scaled Scores for AP exams expectancy tables is discussed in subsequent paragraphs following Table 4.9.

Table 4.9
Interpretation of Correlation Coefficients for Stanford Achievement Total Subject Scaled
Scores and AP Exams

| AP Exam | Read <br> Scaled Score | Math <br> Scaled <br> Score | Language Scaled Score | Science Scaled Score | Social Studies Scaled Score |
| :---: | :---: | :---: | :---: | :---: | :---: |
| English |  |  |  |  |  |
| English Language | $\mathrm{H}^{\mathrm{b}, \mathrm{c}}$ | H | H | H | H |
| English Literature | $\mathrm{M}^{\mathrm{b}, \mathrm{c}}$ | L | M | L | L |
| Fine Arts |  |  |  |  |  |
| Art History | $\mathrm{M}^{\text {c }}$ | M | M | $\mathrm{H}^{\text {b }}$ | M |
| Music Theory | $\mathrm{H}^{\mathrm{b}, \mathrm{c}}$ | M | M | M | M |
| Foreign Language |  |  |  |  |  |
| Chinese Language | $N L^{\text {a }}$ | $N L^{\text {a }}$ | NL ${ }^{\text {a }}$ | NL ${ }^{\text {a }}$ | $N L^{\text {a }}$ |
| French Language | H | M | $\mathrm{H}^{\text {b }}$ | M | M |
| Spanish Language | $\mathrm{M}^{\text {b }}$ | L | M | L | M |
| Spanish Literature | L | $M^{\text {b }}$ | NL ${ }^{\text {a }}$ | L | L |
| Math |  |  |  |  |  |
| Calculus AB | $N L^{\text {a }}$ | $\mathrm{H}^{\text {b,c }}$ | NL ${ }^{\text {a }}$ | M | NL ${ }^{\text {a }}$ |
| Computer Sci. | M | $\mathrm{H}^{\mathrm{b}, \mathrm{c}}$ | M | M | M |
| Statistics | H | $\mathrm{H}^{\mathrm{b}, \mathrm{c}}$ | H | H | H |
| Science |  |  |  |  |  |
| Biology | H | $\mathrm{H}^{\mathrm{b}, \mathrm{c}}$ | H | H | H |
| Chemistry | H | $\mathrm{VH}^{\text {b,c }}$ | H | H | H |
| Environmental Sci. | $\mathrm{H}^{\text {b }}$ | $\mathrm{H}^{\text {c }}$ | M | H | H |
| Physics | H | $\mathrm{VH}^{\text {b, }}$ | H | H | H |
| Social Studies |  |  |  |  |  |
| European History | M | $\mathrm{H}^{\text {b }}$ | M | M | $\mathrm{M}^{\text {c }}$ |
| Human Geography | $\mathrm{H}^{\text {b }}$ | M | M | M | $\mathrm{M}^{\text {c }}$ |
| Psychology | M | $\mathrm{M}^{\text {b }}$ | M | M | $\mathrm{M}^{\text {c }}$ |
| US Government | H | $\mathrm{VH}^{\text {b }}$ | H | M | $\mathrm{H}^{\text {c }}$ |
| US History | H | $\mathrm{H}^{\text {b }}$ | H | H | $\mathrm{H}^{\text {c }}$ |
| World History | H | H | M | H | $\mathrm{H}^{\mathrm{b}, \mathrm{c}}$ |

Note: Sci.=Science; VH=very high correlation coefficient; H=high correlation coefficient; $\mathrm{M}=$ moderate correlation coefficient; $\mathrm{L}=$ low correlation coefficient;
$\mathrm{NL}=$ negligible to low correlation coefficient.
${ }^{\text {a }}$ Not statistically significant and negligible to low correlation coefficient. ${ }^{\mathrm{b}}$ Highest correlation coefficient within each AP exam. ${ }^{\text {c }}$ Selected for expectancy table.

## AP English Subject Exams

The AP exams under the heading AP English subject exams are AP English Language and AP English Literature exams. Table 4.10 shows the descriptive statistics for the AP English subject exams. These descriptive statistics include number of participants, mean, median, mode, standard deviation, minimum score, and maximum score for AP English Language and English Literature exams. The purpose of this table is to display the descriptive statistics inclusive of the entire sample population for AP English Language and English Literature exams.

Table 4.10
Descriptive Statistics for AP English Language Subject Exams for Research Question One

| Descriptive <br> Statistics | AP <br> Exam Score | Reading Scaled Score | Math Scale Score | Language Scaled Score | Science Scaled Score | Social <br> Studies <br> Scaled <br> Score |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AP English Lang.$(n=2420)$ |  |  |  |  |  |  |
| Mean | 1.98 | 737.84 | 734.42 | 718.9 | 719.68 | 707.55 |
| Median | 2 | 735 | 726 | 717 | 716 | 706 |
| Mode | 1 | 768 | 708 | 721 | 712 | 698 |
| SD | 1.171 | 34.846 | 41.71 | 34.547 | 29.967 | 27.745 |
| Minimum | 1 | 643 | 582 | 616 | 607 | 600 |
| Maximum | 5 | 868 | 886 | 838 | 857 | 860 |
| AP English Lit.$(n=81)$ |  |  |  |  |  |  |
| Mean | 1.91 | 747.17 | 737.75 | 726.63 | 725.46 | 712.11 |
| Median | 2 | 744 | 735 | 721 | 721 | 709 |
| Mode | 2 | 768 | 745 | 717 | 712 | 709 |
| SD | 0.854 | 29.525 | 28.977 | 26.21 | 23.231 | 23.199 |
| Minimum | 1 | 688 | 685 | 666 | 685 | 666 |
| Maximum | 5 | 846 | 823 | 790 | 794 | 776 |

Note. $n=$ Number of students taking respective AP exams; SD=Standard Deviation;
Lang. $=$ Language; Lit. $=$ Literature.

For AP English Language exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.756, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.705, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.717, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.661, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.684, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP English Language exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP English Literature exam and Stanford Achievement Total Subject Scores correlation coefficients in Reading ( $\mathrm{r}=.593, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.377, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.433, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.256, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.311, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP English Language exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Scaled Scores in Reading, Math, Language, Science, and Social Studies.

If possible, it was important to determine a commonality that occurs between correlation coefficients for AP English Language and AP Literature exams, so that an expectancy table can be created utilizing one Stanford Achievement Test Total Subject Scaled Score, which will be useful to school administrators. The commonality chosen by the principal researcher was the Stanford Achievement Total Reading Scaled Score for the creation of an expectancy tables for AP English subject exams, because it has the highest Pearson product moment correlation coefficient as compared to the other Stanford Achievement Total Subject Scaled Scores correlation coefficients for AP English Language ( $\mathrm{r}=.756, \mathrm{p}<.01$ ) and AP English Literature ( $\mathrm{r}=.593$, $\mathrm{p}<.01$ ) exams.

An expectancy table would prove useful to educators who are trying to recruit students to take AP English Language courses, because it provides the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals. An administrator can look at Table 4.11 and select a Stanford Achievement Reading Scaled Score minimum score to focus their recruitment efforts on students who have proven to pass the AP English Language exam. If administrators want to be more inclusive in their recruitment efforts they may choose to recruit students with a minimum of Stanford Achievement Reading Scaled Score equaling 725, while only 15\% of students in Stanford Achievement Reading Scaled Scores range from 725-749 passed the AP English Language Exam. If administrators wants to be more exclusive in their recruitment efforts they may choose a to recruit students with a minimum of Stanford Achievement Reading Scaled Score equaling 775, while only $86 \%$ of students in Stanford Achievement Reading Scaled Scores range from 775-799 passed the AP English Language Exam.

Table 4.11 is an expectancy table for AP English Language, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.11
Stanford Achievement Total Reading Scaled Scores Expectancy Table for AP English

## Language Students

| Stanford Achievement <br> Reading Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $850-874$ | 7 | $100 \%$ |
| $825-849$ | 25 | $100 \%$ |
| $800-824$ | 94 | $90 \%$ |

Table 4.11 (continued)

| Stanford Achievement <br> Reading Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $775-799$ | 207 | $86 \%$ |
| $750-774$ | 485 | $56 \%$ |
| $725-749$ | 646 | $15 \%$ |
| $700-724$ | 691 | $1 \%$ |
| $675-699$ | 232 | $0 \%$ |
| $650-674$ | 30 | $0 \%$ |
| $625-649$ | 3 | $0 \%$ |

Note. $\mathrm{N}=$ Students taking AP English Language exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP English Language exam.

Table 4.12 is an expectancy table for AP English Literature, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.12
Stanford Achievement Total Reading Scaled Scores Expectancy Table for AP English

## Literature Students

| Stanford Achievement <br> Reading Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $825-849$ | 1 | $100 \%$ |
| $800-824$ | 2 | $100 \%$ |
| $775-799$ | 8 | $88 \%$ |
| $750-774$ | 24 | $25 \%$ |
| $725-749$ | 16 | $7 \%$ |
| $700-724$ | 2 | $6 \%$ |
| $675-699$ | $0 \%$ |  |
| Note. N= Students taking AP English Literature exam. AP Grade $\geq 3=$ Percentage of |  |  |
| students taking who scored a 3 or higher on AP English Literature exam. |  |  |

## AP Fine Arts Subject Exams

The AP exams under the heading AP Fine Arts subject exams are AP Art History and AP Music Theory exams. Table 4.13 shows the descriptive statistics for the AP Fine Arts subject exams. These descriptive statistics include number of participants, mean,
median, mode, standard deviation, minimum score, and maximum score for AP Art History and AP Music Theory exams. The purpose of this table is to display the descriptive statistics inclusive of the entire sample population for AP Art History and AP Music Theory exams.

Table 4.13
Descriptive Statistics for AP Fine Arts Subject Exams for Research Question One

| Descriptive <br> Statistics | AP Exam Score | Reading Scaled Score | Math Scale Score | Language Scaled Score | Science Scaled Score | Social <br> Studies <br> Scaled <br> Score |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Art History$(n=62)$ |  |  |  |  |  |  |
| Mean | 1.95 | 752.61 | 749.85 | 735.65 | 731.37 | 722.35 |
| Median | 1 | 748.5 | 741.5 | 735 | 730 | 724 |
| Mode | 1 | $773{ }^{\text {a }}$ | 766 | 755 | $716^{\text {a }}$ | $724^{\text {a }}$ |
| SD | 1.419 | 33.571 | 46.511 | 39.985 | 30.762 | 38.031 |
| Minimum | 1 | 662 | 688 | 626 | 681 | 615 |
| Maximum | 5 | 846 | 886 | 838 | 834 | 860 |
| Music Theory$(n=36)$ |  |  |  |  |  |  |
| Mean | 3.08 | 761.22 | 771.47 | 740.11 | 741.17 | 726.33 |
| Median | 3 | 768 | 772 | 744.5 | 742 | 725 |
| Mode | 5 | 821 | $770^{\text {a }}$ | $748^{\text {a }}$ | $742^{\text {a }}$ | $746^{\text {a }}$ |
| SD | 1.574 | 42.445 | 43.786 | 40.726 | 40.48 | 31.06 |
| Minimum | 1 | 643 | 692 | 639 | 635 | 666 |
| Maximum | 5 | 846 | 886 | 816 | 815 | 812 |

Note. $n=$ Number of students taking respective AP exams; SD=Standard Deviation. ${ }^{\mathrm{a}}$ Multiple modes exist. The smallest value is shown.

For AP Art History exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.537, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.593$, $\mathrm{p}<.01$ ), Language ( $\mathrm{r}=.430, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.607, \mathrm{p}<.01$ ), and Social Studies $(\mathrm{r}=.582, \mathrm{p}<.01)$, each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Art History exam in research question one can be accepted as having a positive
relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP Music Theory exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.619, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.545, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.487, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.475, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.529, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Music Theory exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

The commonality chosen by the principal researcher was Stanford Achievement Test Total Reading Scaled Score for the creation of an expectancy tables for AP Fine Arts subject exams was Stanford Achievement Test Total Reading Scaled Score, which took into consideration Stanford Achievement Test Total Reading Scaled correlation coefficients for AP Art History exam ( $\mathrm{r}=.537, \mathrm{p}<.01$ ) and for AP Music Theory exam $(\mathrm{r}=.619, \mathrm{p}<.01)$. Although the highest Pearson product moment correlation coefficient for AP Art History exam is Stanford Achievement Total Science Score ( $\mathrm{r}=.607, \mathrm{p}<.01$ ) as compared to the other Stanford Achievement Total Subject Scaled Scores for this AP exam, the highest Pearson product moment correlation coefficient for AP Music Theory exam is Stanford Achievement Total Reading Score ( $\mathrm{r}=.619, \mathrm{p}<.01$ ) as compared to the other Stanford Achievement Total Subject. Therefore, when comparing these two correlation coefficients, it shows a slightly stronger relationship in favor of Stanford Achievement Test Total Reading. Considering this comparison on the Stanford Achievement Test Total Reading Scaled Score correlation coefficients for AP Fine Arts
subject exams and that AP Art History exam ( $\mathrm{r}=.537, \mathrm{p}<.01$ ) has a moderate correlation coefficient, the principal researcher chose Stanford Achievement Total Reading Scaled Score for the creation of an expectancy table.

Table 4.14 is an expectancy table for AP Art History, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.14

Stanford Achievement Total Reading Scaled Scores Expectancy Table for AP Art History
Students

| Stanford Achievement <br> Reading Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $825-849$ | 1 | $100 \%$ |
| $800-824$ | 3 | $33 \%$ |
| $775-799$ | 11 | $64 \%$ |
| $750-774$ | 16 | $50 \%$ |
| $725-749$ | 19 | $5 \%$ |
| $700-724$ | 11 | $0 \%$ |
| $675-699$ | 0 | $0 \%$ |
| $650-674$ | 1 | $0 \%$ |

Note. $\mathrm{N}=$ Students taking AP Art History exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Art History exam.

Table 4.15 is an expectancy table for AP Music Theory, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.15
Stanford Achievement Total Reading Scaled Scores Expectancy Table for AP Music
Theory Students

| Stanford Achievement <br> Reading Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $825-849$ | 1 | $100 \%$ |
| $800-824$ | 3 | $33 \%$ |
| $775-799$ | 11 | $64 \%$ |
| $750-774$ | 16 | $50 \%$ |
| $725-749$ | 19 | $5 \%$ |
| $700-724$ | 11 | $0 \%$ |
| $675-699$ | 0 | $0 \%$ |
| $650-674$ | 1 | $0 \%$ |

Note. $\mathrm{N}=$ Students taking AP Music Theory exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Music Theory exam.

## AP Foreign Language Subject Exams

The AP exams under the heading AP Foreign Language subject exams are AP Chinese Language, AP French Language, AP Spanish Language and AP Spanish Literature exams. Table 4.16 shows the descriptive statistics for the AP Foreign Language subject exams. These descriptive statistics include number of participants, mean, median, mode, standard deviation, minimum score, and maximum score for AP Chinese Language, AP French Language, AP Spanish Language and AP Spanish Literature exams. The purpose of this table is to display the descriptive statistics inclusive of the entire sample population for AP Chinese Language, AP French Language, AP Spanish Language and AP Spanish Literature exams.

Table 4.16
Descriptive Statistics for AP Foreign Language Subject Exams for Research Question

One

| Descriptive <br> Statistics | AP <br> Exam <br> Score | Reading <br> Scaled <br> Score | Math Scale Score | Language Scaled Score | Science Scaled Score | Social <br> Studies <br> Scaled <br> Score |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Chinese Lang.$(n=38)$ |  |  |  |  |  |  |
| Mean | 4.11 | 738 | 778 | 723.5 | 734.61 | 718.89 |
| Median | 5 | 745.5 | 772.5 | 732.5 | 728 | 717 |
| Mode | 5 | 795 | 838 | $775^{\text {a }}$ | 794 | 762 |
| SD | 1.391 | 59.893 | 48.369 | 51.253 | 47.262 | 40.455 |
| Minimum | 1 | 605 | 678 | 617 | 625 | 642 |
| Maximum | 5 | 868 | 886 | 816 | 834 | 812 |
| French Lang.$(n=31)$ |  |  |  |  |  |  |
| Mean | 2.61 | 771.03 | 796.06 | 758.65 | 751.1 | 739.42 |
| Median | 2 | 768 | 805 | 760 | 753 | 746 |
| Mode | 1 | $768^{\text {a }}$ | 823 | 775 | 753 | 751 |
| SD | 1.585 | 31.308 | 41.672 | 29.918 | 26.337 | 29.808 |
| Minimum | 1 | 710 | 720 | 695 | 685 | 679 |
| Maximum | 5 | 821 | 886 | 816 | 809 | 814 |
| Spanish Lang.$(n=2258)$ |  |  |  |  |  |  |
| Mean | 2.79 | 702.54 | 717.59 | 689.34 | 697.71 | 688.89 |
| Median | 3 | 700 | 714 | 686 | 695.5 | 686 |
| Mode | 1 | 688 | 695 | 682 | 687 | 679 |
| SD | 1.362 | 35.342 | 35.426 | 35.426 | 29.669 | 27.104 |
| Minimum | 1 | 602 | 582 | 536 | 569 | 574 |
| Maximum | 5 | 868 | 886 | 838 | 857 | 860 |
| Spanish Lit.$(n=49)$ |  |  |  |  |  |  |
| Mean | 2.96 | 731.29 | 725.61 | 705 | 710.76 | 703.33 |
| Median | 3 | 732 | 714 | 705 | 712 | 702 |
| Mode | 3 | $704^{\text {a }}$ | 705 | $688^{\text {a }}$ | 732 | 691 |
| SD | 1.322 | 28.284 | 38.532 | 29.709 | 26.316 | 24.126 |
| Minimum | 1 | 683 | 657 | 630 | 653 | 655 |
| Maximum | 5 | 829 | 880 | 775 | 774 | 762 |

Note. $n=$ Number of students taking respective AP exams; SD=Standard Deviation; Lang. $=$ Language; Lit. $=$ Literature. ${ }^{\text {a }}$ Multiple modes exist. The smallest value is shown.

For AP Chinese Language exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.063$ ), Math ( $\mathrm{r}=.211$ ), Language ( $\mathrm{r}=. .086$ ), Science( $\mathrm{r}=.092$ ), and Social Studies ( $\mathrm{r}=.119$ ), each correlation is not statistically significant, which means that the hypothesis for AP Chinese Language exam in research question one is rejected and does not have a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP French Language exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.630, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.437, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.723, \mathrm{p}<.01$ ), Science $(\mathrm{r}=.415, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.597$, $\mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP French Language exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP Spanish Language exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.440, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.336, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.402, \mathrm{p}<.01$ ), Science $(\mathrm{r}=.375, \mathrm{p}<.01)$, and Social Studies $(\mathrm{r}=.428, \mathrm{p}<.01)$, each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Spanish Language exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP Spanish Literature exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.379, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.418, \mathrm{p}<.01$ ),

Language ( $\mathrm{r}=.276$ ), Science( $\mathrm{r}=.357, \mathrm{p}<.05$ ), and Social Studies ( $\mathrm{r}=.318, \mathrm{p}<.01$ ), correlation is statistically significant at the $\mathrm{p}<.01$ level for Reading, Math, and Social Studies and at $\mathrm{p}<.05$ for Science, which means that the hypothesis for AP Spanish Literature exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Science, and Social Studies since they are statistically significant at the respective $\mathrm{p}<.01$ and $\mathrm{p}<.05$ levels. For Stanford Achievement Test Total Language Score, the hypothesis for AP Spanish Literature exam in research question one is rejected and does not have a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Language.

If possible, it was important to determine a commonality that occurs between correlation coefficients for AP Chinese Language, AP French Language, AP Spanish Language, and AP Spanish Literature exams, so that an expectancy table can be created utilizing one Stanford Achievement Test Total Subject Scaled Score, which will be useful to administrators. However, no clear commonality occurred when utilizing Stanford Achievement Test. The first issue occurs with AP Chinese Language, which has no statistically significant correlation coefficient. In examining the other AP Foreign Language exams highest Pearson product moment correlation coefficient, AP French Language exam has its highest correlation with Stanford Achievement Total Language Score ( $\mathrm{r}=.723$, $\mathrm{p}<.01$ ), while AP Spanish Language has its highest correlation with Stanford Achievement Total Reading Score ( $\mathrm{r}=.440$, $\mathrm{p}<.01$ ). In addition, AP Spanish Literature has its highest correlation with Stanford Achievement Total Math Score $(\mathrm{r}=.418, \mathrm{p}<.01)$. The lack of being able to identify a single Stanford Achievement Test

Scaled Subject Score to create an expectancy table is consistent with findings in Ewing, Camara, Millsap (2006) study when they examined AP Foreign Language exams and PSAT scores. The reasoning given by researchers in the Ewing, Camara, Millsap (2006) study for not finding a clear relationship between AP Foreign Language exams and PSAT scores is that students were exposed to the other language at home or outside the classroom.

## AP Math Subject Exams

The AP exams under the heading AP Math subject exams are AP Calculus AB and AP Computer Science A, AP Statistics exams. Table 4.17 shows the descriptive statistics for the AP Math subject exams. These descriptive statistics include number of participants, mean, median, mode, standard deviation, minimum score, and maximum score for AP Calculus AB and AP Computer Science A, AP Statistics exams. The purpose of this table is to display the descriptive statistics inclusive of the entire sample population for AP Calculus AB and AP Computer Science A, AP Statistics exams.

Table 4.17
Descriptive Statistics for AP Math Subject Exams for Research Question One

|  |  |  |  |  |  | Social |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  | AP | Reading | Math | Language | Science | Studies |
| Descriptive | Exam | Scaled | Scale | Scaled | Scaled | Scaled |
| Statistics | Score | Score | Score | Score | Score | Score |
| Calculus AB |  |  |  |  |  |  |
| $(n=31)$ |  |  |  |  |  |  |
| Mean | 2.16 | 754.35 | 772.03 | 736.87 | 748.52 | 721.52 |
| Median | 1 | 758 | 766 | 739 | 742 | 724 |
| Mode | 1 | $747^{\mathrm{a}}$ | $766^{\text {a }}$ | 764 | $732^{\text {a }}$ | 732 |
| SD | 1.734 | 28.839 | 43.815 | 30.397 | 28.33 | 20.727 |
| Minimum | 1 | 680 | 667 | 669 | 696 | 661 |
| Maximum | 5 | 821 | 880 | 791 | 815 | 756 |

Table 4.17 (continued)

|  |  |  |  |  |  | Social |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| AP |  |  |  |  |  |  |
| Descriptive | Reading <br> Scam <br> Scaled | Math <br> Scale <br> Score | Language <br> Scaled <br> Score | Score | Scaled <br> Score | Studies <br> Scaled <br> Score |
| Statistics | Score |  |  |  |  |  |
| Computer Sci. |  |  |  |  |  |  |
| $(n=86)$ |  |  |  |  |  |  |
| Mean | 2.24 | 767.9 | 791 | 748.97 | 758.1 | 738.29 |
| Median | 1 | 768 | 793 | 755 | 759 | 741 |
| Mode | 1 | $768^{\mathrm{a}}$ | 812 | 775 | 782 | 762 |
| SD | 1.541 | 39.052 | 46.657 | 40.045 | 36.534 | 32.43 |
| Minimum | 1 | 684 | 699 | 669 | 685 | 655 |
| Maximum | 5 | 868 | 886 | 838 | 857 | 860 |
| Statistics |  |  |  |  |  |  |
| $(n=112)$ |  |  |  |  |  |  |
| Mean | 2.67 | 752.83 | 770.53 | 739.33 | 740.04 | 721.47 |
| Median | 2 | 754 | 762 | 735 | 732 | 720 |
| Mode | 1 | 754 | 886 | $721^{\text {a }}$ | $728^{\text {a }}$ | $706^{\mathrm{a}}$ |
| SD | 1.657 | 35.222 | 52.895 | 38.025 | 35.699 | 26.393 |
| Minimum | 1 | 686 | 692 | 672 | 668 | 670 |
| Maximum | 5 | 868 | 886 | 838 | 857 | 785 |

Note. $n=$ Number of students taking respective AP exams; SD=Standard Deviation; Sci. $=$ Science.
${ }^{\text {a }}$ Multiple modes exist. The smallest value is shown.
For AP Calculus AB exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.329$ ), Math ( $\mathrm{r}=.685, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.325$ ), Science $(\mathrm{r}=.478 \mathrm{p}<.01)$, and Social Studies ( $\mathrm{r}=.142$ ), which means that the hypothesis for AP Calculus AB exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Math and Science since they are statistically significant at the $\mathrm{p}<.01$ level. For Stanford Achievement Test Total Subject Scaled Scores in Reading, Language, and Social Studies, the hypothesis for AP Calculus AB exam in research question one is rejected and does not have a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Language, and Social Studies.

For Computer Science A exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.496, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.661, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.520, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.557, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.580, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Computer Science A exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP Statistics exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.665, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.815, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.607, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.641, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.621, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Statistics exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

The commonality chosen by the principal researcher is the Stanford Achievement Total Math Scaled Score for the creation of an expectancy tables for AP Math subject exams, because it has the highest Pearson product moment correlation coefficient as compared to the other Stanford Achievement Total Subject Scaled Scores correlation coefficients for AP Calculus AB (r=.685, $\mathrm{p}<.01$ ), AP Computer Science A ( $\mathrm{r}=.661$ $\mathrm{p}<.01$ ), and AP Statistics ( $\mathrm{r}=.815, \mathrm{p}<.01$ ) exams.

Table 4.18 is an expectancy table for AP Calculus AB, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.18
Stanford Achievement Total Math Scaled Scores Expectancy Table for AP Calculus AB Students

| Stanford Achievement Math <br> Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $875-899$ | 1 | $100 \%$ |
| $850-874$ | 2 | $100 \%$ |
| $825-849$ | 0 | $0 \%$ |
| $800-824$ | 2 | $50 \%$ |
| $775-799$ | 6 | $50 \%$ |
| $750-774$ | 11 | $18 \%$ |
| $725-749$ | 8 | $0 \%$ |
| $700-724$ | 0 | $0 \%$ |
| $675-699$ | 0 | $0 \%$ |
| $650-674$ | 1 | $0 \%$ |

Note. N= Students taking AP Calculus AB exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Calculus AB exam.

Table 4.19 is an expectancy table for AP Computer Science A, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.19
Stanford Achievement Math Scaled Scores Expectancy Table for AP Computer Science A
Students

| Stanford Achievement Math |  |  |
| :---: | :---: | :---: |
| Scaled Scores | N | AP Grade $\geq 3$ |
| 875-899 | 5 | 100\% |
| 850-874 | 4 | 100\% |
| 825-849 | 8 | 63\% |

Table 4.19 (continued)

| Stanford Achievement Math <br> Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $800-824$ | 20 | $65 \%$ |
| $775-799$ | 18 | $22 \%$ |
| $750-774$ | 16 | $6 \%$ |
| $725-749$ | 4 | $0 \%$ |
| $700-724$ | 10 | $0 \%$ |
| $675-699$ | 1 | $0 \%$ |

Note. $\mathrm{N}=$ Students taking AP Computer Science A exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Computer Science A exam.

Table 4.18 is an expectancy table for AP Statistics, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.20
Stanford Achievement Total Math Scaled Scores Expectancy Table for AP Statistics

## Students

| Stanford Achievement Math <br> Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $875-899$ | 8 | $100 \%$ |
| $850-874$ | 3 | $100 \%$ |
| $825-849$ | 5 | $100 \%$ |
| $800-824$ | 17 | $100 \%$ |
| $775-799$ | 12 | $67 \%$ |
| $750-774$ | 18 | $39 \%$ |
| $725-749$ | 22 | $23 \%$ |
| $700-724$ | 23 | $4 \%$ |
| $675-699$ | 4 | $0 \%$ |

Note. $\mathrm{N}=$ Students taking AP Statistics exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Statistics exam.

## AP Science Subject Exams

The AP exams under the heading AP Science subject exams are AP Biology and AP Chemistry, AP Environment Science, and AP Physics B exams. Table 4.21 shows the descriptive statistics for the AP Science subject exams. These descriptive statistics
include number of participants, mean, median, mode, standard deviation, minimum score, and maximum score for AP Biology and AP Chemistry, AP Environment Science, and AP Physics B exams. The purpose of this table is to display the descriptive statistics inclusive of the entire sample population for AP Biology and AP Chemistry, AP Environment Science, and AP Physics B exams.

Table 4.21
Descriptive Statistics for AP Science Subject Exams for Research Question One

|  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Descriptive Statistics | AP <br> Exam <br> Score | Reading <br> Scaled <br> Score | Math Scale Score | Language Scaled Score | Science Scaled Score | Social <br> Studies <br> Scaled <br> Score |
| Biology $(n=174)$ |  |  |  |  |  |  |
| Mean | 2.04 | 741.32 | 750.79 | 723.5 | 728.74 | 712.78 |
| Median | 1 | 737 | 745.5 | 719 | 727 | 713 |
| Mode | 1 | 726 | 796 | 705 | 737 | 698 |
| SD | 1.44 | 36.6 | 46.039 | 38.096 | 35.247 | 28.283 |
| Minimum | 1 | 646 | 657 | 617 | 635 | 642 |
| Maximum | 5 | 846 | 886 | 838 | 857 | 796 |
| Chemistry $(n=356)$ |  |  |  |  |  |  |
| Mean | 1.93 | 746.5 | 748.65 | 726.52 | 728.94 | 714.32 |
| Median | 1 | 741 | 735 | 721 | 724 | 713 |
| Mode | 1 | 786 | 823 | 764 | $759^{\text {a }}$ | 698 |
| SD | 1.424 | 43.005 | 56.446 | 42.61 | 38.852 | 34.12 |
| Minimum | 1 | 653 | 582 | 626 | 642 | 635 |
| Maximum | 5 | 868 | 886 | 838 | 857 | 860 |
| Environment $(n=185)$ |  |  |  |  |  |  |
| Mean | 2.29 | 745.63 | 749.04 | 724.54 | 727.51 | 714.04 |
| Median | 2 | 747 | 741 | 721 | 724 | 717 |
| Mode | 1 | 747 | 729 | $748^{\text {a }}$ | 732 | $695^{\text {a }}$ |
| SD | 1.336 | 29.93 | 41.636 | 28.51 | 27.178 | 24.649 |
| Minimum | 1 | 674 | 667 | 659 | 663 | 643 |
| Maximum | 5 | 821 | 886 | 816 | 834 | 776 |

Table 4.21 (continued)

|  |  |  |  |  |  | Social |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  | AP | Reading | Math | Language | Science | Studies |
| Descriptive | Exam | Scaled | Scale | Scaled | Scaled | Scaled |
| Statistics | Score | Score | Score | Score | Score | Score |
| Physics B |  |  |  |  |  |  |
| $(n=104)$ |  |  |  |  |  |  |
| Mean | 2.45 | 768.9 | 782.36 | 750.35 | 755.23 | 737.55 |
| Median | 2.5 | 768 | 787 | 748 | 753 | 737 |
| Mode | 1 | 821 | 863 | 790 | 782 | 756 |
| SD | 1.487 | 43.924 | 52.508 | 43.176 | 38.488 | 35.597 |
| Minimum | 1 | 678 | 685 | 642 | 672 | 661 |
| Maximum | 5 | 868 | 886 | 838 | 857 | 860 |

Note. $n=$ Number of students taking respective AP exams; SD=Standard Deviation. Sci=Science.
${ }^{\text {a }}$ Multiple modes exist. The smallest value is shown.
For AP Biology exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.676, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.713, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.690, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.666 \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.618, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Biology exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP Chemistry exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.706, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.840, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.733, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.723, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.699, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Chemistry exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP Environmental Science exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.694, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.690, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.590, \mathrm{p}<.01$ ), Science $(\mathrm{r}=.656, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.659, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Environmental Science exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP Physics B exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.682$, $\mathrm{p}<.01$ ), Math ( $\mathrm{r}=.817, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.695, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.761, \mathrm{p}<.01$ ), and Social Studies $(\mathrm{r}=.661, \mathrm{p}<.01)$, each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Physics B exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

The commonality chosen by the principal researcher was the Stanford Achievement Total Math Scaled Score for the creation of an expectancy tables for AP Science subject exams, because it has the highest Pearson Product Moment Correlation Coefficient as compared to the other Stanford Achievement Total Subject Scaled Scores correlation coefficients for AP Biology ( $\mathrm{r}=.713, \mathrm{p}<.01$ ), AP Chemistry ( $\mathrm{r}=.840 \mathrm{p}<.01$ ), AP Environmental Science ( $\mathrm{r}=.690$, $\mathrm{p}<.01$ ), and AP Physics B ( $\mathrm{r}=.817$, $\mathrm{p}<.01$ ) exams.

Table 4.22 is an expectancy table for AP Biology, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.22
Stanford Achievement Total Math Scaled Scores Expectancy Table for AP Biology
Students

| Stanford Achievement Math |  |  |
| :---: | :---: | :---: |
| Scaled Scores | N | AP Grade $\geq 3$ |
| $875-899$ | 2 | $100 \%$ |
| $850-874$ | 4 | $75 \%$ |
| $825-849$ | 4 | $100 \%$ |
| $800-824$ | 16 | $75 \%$ |
| $775-799$ | 22 | $77 \%$ |
| $750-774$ | 30 | $37 \%$ |
| $725-749$ | 39 | $15 \%$ |
| $700-724$ | 37 | $3 \%$ |
| $675-699$ | 13 | $0 \%$ |
| $650-674$ | 7 | $0 \%$ |

Note. N= Students taking AP Biology exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Biology exam.

Table 4.23 is an expectancy table for AP Chemistry, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.23
Stanford Achievement Total Math Scaled Scores Expectancy Table for AP Chemistry
Students

| Stanford Achievement Math <br> Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $875-899$ | 11 | $100 \%$ |
| $850-874$ | 8 | $100 \%$ |
| $825-849$ | 12 | $92 \%$ |
| $800-824$ | 44 | $84 \%$ |
| $775-799$ | 41 | $66 \%$ |
| $750-774$ | 33 | $30 \%$ |
| $725-749$ | 49 | $0 \%$ |
| $700-724$ | 84 | $0 \%$ |
| $675-699$ | 62 | $0 \%$ |

Table 4.23 (continued)

| Stanford Achievement Math <br> Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $650-674$ | 10 | $0 \%$ |
| $625-649$ | 0 | $0 \%$ |
| $600-624$ | 1 | $0 \%$ |
| $575-599$ | 1 | $0 \%$ |

Note. N= Students taking AP Chemistry exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Chemistry exam.

Table 4.24 is an expectancy table for AP Environmental Science, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.24
Stanford Achievement Total Math Scaled Scores Expectancy Table for AP Environmental
Science Students

| Stanford Achievement Math <br> Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $875-899$ | 1 | $100 \%$ |
| $850-874$ | 4 | $75 \%$ |
| $825-849$ | 1 | $100 \%$ |
| $800-824$ | 18 | $89 \%$ |
| $775-799$ | 22 | $73 \%$ |
| $750-774$ | 32 | $66 \%$ |
| $725-749$ | 47 | $23 \%$ |
| $700-724$ | 46 | $4 \%$ |
| $675-699$ | 11 | $0 \%$ |
| $650-674$ | 3 | $0 \%$ |

Note. N $=$ Students taking AP Environmental Science exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Environmental Science exam.

Table 4.25 is an expectancy table for AP Physics B, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.25
Stanford Achievement Total Math Scaled Scores Expectancy Table for AP Physics B

Students

| Stanford Achievement Math <br> Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $875-899$ | 4 | $100 \%$ |
| $850-874$ | 10 | $100 \%$ |
| $825-849$ | 7 | $100 \%$ |
| $800-824$ | 20 | $85 \%$ |
| $775-799$ | 16 | $75 \%$ |
| $750-774$ | 11 | $9 \%$ |
| $725-749$ | 19 | $0 \%$ |
| $700-724$ | 12 | $8 \%$ |
| $675-699$ | 5 | $0 \%$ |

Note. N $=$ Students taking AP Physics B exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Physics B exam.

## AP Social Studies Subject Exams

The AP exams under the heading AP Social Studies subject exams are AP European History, AP Human Geography, AP Psychology, AP US Government, AP US History, and AP World History exams. Table 4.26 shows the descriptive statistics for the AP Social Studies subject exams. These descriptive statistics include number of participants, mean, median, mode, standard deviation, minimum score, and maximum score for AP European History, AP Human Geography, AP Psychology, AP US Government, AP US History, and AP World History exams. The purpose of this table is to display the descriptive statistics inclusive of the entire sample population for AP European History, AP Human Geography, AP Psychology, AP US Government, AP US History, and AP World History exams.

Table 4.26
Descriptive Statistics for AP Social Studies Subject Exams for Research Question One

| Descriptive <br> Statistics | AP <br> Exam Score | Reading <br> Scaled <br> Score | Math Scale Score | Language Scaled Score | Science Scaled Score | Social <br> Studies <br> Scaled <br> Score |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Euro. History$(n=54)$ |  |  |  |  |  |  |
| Mean | 1.72 | 734.11 | 724.98 | 712.78 | 715.46 | 708.85 |
| Median | 1 | 732.5 | 717 | 707 | 712 | 709 |
| Mode | 1 | $737^{\text {a }}$ | $699{ }^{\text {a }}$ | 705 | 712a | 695 |
| SD | 1.054 | 32.149 | 34.526 | 30.863 | 23.502 | 31.719 |
| Minimum | 1 | 662 | 662 | 635 | 653 | 635 |
| Maximum | 5 | 821 | 838 | 790 | 782 | 785 |
| Human Geography$(n=1449)$ |  |  |  |  |  |  |
| Mean | 1.65 | 715.08 | 729.68 | 705.52 | 704.23 | 695.7 |
| Median | 1 | 715 | 728 | 704 | 704 | 696 |
| Mode | 1 | 710 | 708 | 704 | 704 | 692 |
| SD | 1.07 | 29.544 | 36.121 | 34.298 | 28.066 | 25.557 |
| Minimum | 1 | 610 | 619 | 586 | 531 | 574 |
| Maximum | 5 | 868 | 874 | 838 | 835 | 814 |
| Psychology$(n=125)$ |  |  |  |  |  |  |
| Mean | 3.1 | 756.94 | 756.1 | 740.32 | 734.86 | 720.02 |
| Median | 3 | 754 | 748 | 735 | 732 | 720 |
| Mode | 4 | 773 | 766 | 735 | 712 | 724 |
| SD | 1.413 | 30.909 | 43.508 | 31.323 | 32.422 | 25.347 |
| Minimum | 1 | 676 | 667 | 653 | 658 | 643 |
| Maximum | 5 | 846 | 886 | 838 | 857 | 796 |
| US Govt.$(n=51)$ |  |  |  |  |  |  |
| Mean | 1.67 | 740.02 | 742.59 | 721.22 | 723.98 | 713.08 |
| Median | 1 | 740 | 735 | 721 | 720 | 713 |
| Mode | 1 | 740 | 711 | 721 | 720 | $695^{\text {a }}$ |
| SD | 1.16 | 38.749 | 46.463 | 40.844 | 34.246 | 34.491 |
| Minimum | 1 | 662 | 662 | 630 | 648 | 626 |
| Maximum | 5 | 846 | 886 | 816 | 809 | 812 |

Table 4.26 (continued)

| Descriptive <br> Statistics | AP <br> Exam Score | Reading Scaled Score | Math <br> Scale <br> Score | Language Scaled Score | Science Scaled Score | Social <br> Studies <br> Scaled <br> Score |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| US History ( $n=2143$ ) |  |  |  |  |  |  |
| Mean | 1.79 | 10.99 | 735.71 | 719.2 | 720.94 | 709.65 |
| Median | 1 | 11 | 726 | 717 | 716 | 706 |
| Mode | 1 | 11 | 708 | 721 | 712 | 698 |
| SD | 1.225 | 0.096 | 42.532 | 35.733 | 30.782 | 28.172 |
| Minimum | 1 | 10 | 623 | 616 | 607 | 600 |
| Maximum | 5 | 11 | 886 | 838 | 857 | 860 |
| World History$(n=2854)$ |  |  |  |  |  |  |
| Mean | 1.68 | 719.64 | 735.36 | 704.34 | 712.39 | 700.88 |
| Median | 1 | 717 | 732 | 700 | 707 | 701 |
| Mode | 1 | 726 | 710 | 709 | 727 | 701 |
| SD | 1.073 | 29.67 | 38.319 | 33.121 | 32.746 | 25.917 |
| Minimum | 1 | 623 | 638 | 519 | 543 | 613 |
| Maximum | 5 | 852 | 880 | 823 | 838 | 826 |

Note. $n=$ Number of students taking respective AP exams; SD=Standard Deviation; Euro. $=$ European; Govt. $=$ Government.
${ }^{a}$ Multiple modes exist. The smallest value is shown.
For AP European History exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.494, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.635, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.534, \mathrm{p}<.01$ ), Science $(\mathrm{r}=.513 \mathrm{p}<.01)$, and Social Studies ( $\mathrm{r}=.595, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP European History exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP Human Geography exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.603$, $\mathrm{p}<.01$ ), Math ( $\mathrm{r}=.580$, $\mathrm{p}<.01$ ), Language ( $\mathrm{r}=.538, \mathrm{p}<.01$ ), Science ( $\mathrm{r}=.578, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.598, \mathrm{p}<.01$ ),
each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Human Geography exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP Psychology exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.514, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.558, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.531, \mathrm{p}<.01$ ), Science $(\mathrm{r}=.533, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.512, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Psychology exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP US Government exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.661, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.833, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.719, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.592, \mathrm{p}<.01$ ), and Social Studies $(\mathrm{r}=.740, \mathrm{p}<.01)$, each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP US Government exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP US History exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.686, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.702, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.673, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.653, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.694, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP US History exam in research question one can be accepted as having a positive
relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

For AP World History exam and Stanford Achievement Total Subject Scaled Scores correlation coefficients in Reading ( $\mathrm{r}=.608, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.620, \mathrm{p}<.01$ ), Language ( $\mathrm{r}=.569, \mathrm{p}<.01$ ), Science( $\mathrm{r}=.652, \mathrm{p}<.01$ ), and Social Studies ( $\mathrm{r}=.646, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP World History exam in research question one can be accepted as having a positive relationship for Stanford Achievement Test Total Subject Scaled Scores in Reading, Math, Language, Science, and Social Studies.

The commonality chosen by the principal researcher was the Stanford Achievement Total Social Studies Scaled Score for the creation of an expectancy tables for AP Social Studies subject exams. This was a difficult decision, because there seemed to be two commonalities when reviewing the correlation coefficients interpretation set forth in Table 4.8, which are Stanford Achievement Total Social Studies and Reading Scaled Scores. There are four high correlation coefficients for Stanford Achievement Total Reading Scaled Scores, which are in AP Human Geography ( $\mathrm{r}=.603$, $\mathrm{p}<.01$ ), AP US Government ( $\mathrm{r}=.661 \mathrm{p}<.01$ ), AP US History ( $\mathrm{r}=.686 \mathrm{p}<.01$ ), and AP World History ( $\mathrm{r}=.606, \mathrm{p}<.01$ ), while there are only three high correlation coefficients for Stanford Achievement Total Social Studies Scaled Scores, which are in AP US Government $(\mathrm{r}=.740 \mathrm{p}<.01)$, AP US History ( $\mathrm{r}=.694 \mathrm{p}<.01$ ), and AP World History ( $\mathrm{r}=.646, \mathrm{p}<.01$ ). However, when examining the AP European History correlation coefficients for Stanford Achievement Test Total Scaled Scores in Reading ( $\mathrm{r}=.494, \mathrm{p}<.01$ ) and Social Studies $(\mathrm{r}=.595, \mathrm{p}<.01)$, there is stronger relationship with the Stanford Achievement Test Total

Social Studies Scaled Score. In addition to identifying this stronger relationship, when examining AP US Government correlation coefficients for Stanford Achievement Test Total Scaled Scores in Reading ( $\mathrm{r}=.661, \mathrm{p}<.01$ ) and Social Studies $(\mathrm{r}=.740, \mathrm{p}<.01)$, there is stronger relationship with the Stanford Achievement Test Total Social Studies Scaled Score. With this comparison on the Stanford Achievement Test Total Reading and Social Studies Scaled Score correlation coefficients for AP Social Studies subject exams, the principal researcher chose Stanford Achievement Total Social Studies Scaled Score for the creation of an expectancy table taking into consideration correlation coefficients for AP European History ( $\mathrm{r}=.595, \mathrm{p}<.01$ ), AP Human Geography ( $\mathrm{r}=.598 \mathrm{p}<.01$ ), AP Psychology ( $\mathrm{r}=.512, \mathrm{p}<.01$ ), AP US Government $(\mathrm{r}=.740, \mathrm{p}<.01)$ exams, AP US History ( $\mathrm{r}=.694, \mathrm{p}<.01$ ) exams, and AP World History ( $\mathrm{r}=.646, \mathrm{p}<.01$ ) exams.

Table 4.27 is an expectancy table for AP European History, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.27
Stanford Achievement Total Social Studies Scaled Scores Expectancy Table for AP
European History Students

| Stanford Achievement <br> Social Studies Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $775-799$ | 1 | $100 \%$ |
| $750-774$ | 3 | $100 \%$ |
| $725-749$ | 10 | $50 \%$ |
| $700-724$ | 20 | $25 \%$ |
| $675-699$ | 14 | $7 \%$ |

Table 4.27 (continued)

| Stanford Achievement <br> Social Studies Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $650-674$ | 2 | $0 \%$ |
| $625-649$ | 4 | $0 \%$ |

Note. $\mathrm{N}=$ Students taking AP European History exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP European History exam.

Table 4.28 is an expectancy table for AP Human Geography, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.28
Stanford Achievement Total Social Studies Scaled Scores Expectancy Table for AP
Human Geography Students

| Stanford Achievement <br> Social Studies Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $800-824$ | 3 | $100 \%$ |
| $775-799$ | 1 | $100 \%$ |
| $750-774$ | 25 | $92 \%$ |
| $725-749$ | 149 | $66 \%$ |
| $700-724$ | 480 | $26 \%$ |
| $675-699$ | 505 | $4 \%$ |
| $650-674$ | 227 | $0 \%$ |
| $625-649$ | 53 | $0 \%$ |
| $600-624$ | 4 | $0 \%$ |
| $575-599$ | 1 | $0 \%$ |
| $550-574$ | 1 | $0 \%$ |
| Note. N= Students taking AP Human Geography exam. AP Grade $\geq 3=$ Percentage of |  |  |
| students taking who scored a 3 or higher on AP Human Geography exam. |  |  |

Table 4.29 is an expectancy table for AP Psychology, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.29
Stanford Achievement Total Social Studies Scaled Scores Expectancy Table for AP
Psychology Students

| Stanford Achievement <br> Social Studies Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $775-799$ | 2 | $100 \%$ |
| $750-774$ | 17 | $88 \%$ |
| $725-749$ | 23 | $87 \%$ |
| $700-724$ | 56 | $70 \%$ |
| $675-699$ | 25 | $44 \%$ |
| $650-674$ | 1 | $0 \%$ |
| $625-649$ | 1 | $0 \%$ |

Note. $\mathrm{N}=$ Students taking AP Psychology exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Psychology exam.

Table 4.30 is an expectancy table for AP US Government, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.30
Stanford Achievement Total Social Studies Scaled Scores Expectancy Table for AP US
Government Students

| Stanford Achievement <br> Social Studies Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $800-824$ | 1 | $100 \%$ |
| $775-799$ | 2 | $50 \%$ |
| $750-774$ | 4 | $100 \%$ |
| $725-749$ | 8 | $50 \%$ |
| $700-724$ | 16 | $6 \%$ |
| $675-699$ | 16 | $0 \%$ |
| $650-674$ | 3 | $0 \%$ |
| $625-649$ | 1 | $0 \%$ |

Note. N= Students taking AP US Government exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP US Government exam.

Table 4.31 is an expectancy table for AP US History, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.31
Stanford Achievement Total Social Studies Scaled Scores Expectancy Table for AP US
History Students

| Stanford Achievement <br> Social Studies Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $850-874$ | 2 | $100 \%$ |
| $825-849$ | 1 | $100 \%$ |
| $800-824$ | 5 | $100 \%$ |
| $775-799$ | 32 | $94 \%$ |
| $750-774$ | 152 | $80 \%$ |
| $725-749$ | 347 | $51 \%$ |
| $700-724$ | 751 | $15 \%$ |
| $675-699$ | 696 | $1 \%$ |
| $650-674$ | 133 | $0 \%$ |
| $625-649$ | 21 | $0 \%$ |
| $600-624$ | 3 | $0 \%$ |

Note. $\mathrm{N}=$ Students taking AP US History exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP US History exam.

Table 4.32 is an expectancy table for AP World History, which shows the percentage of students who passed the AP exam at various Stanford Achievement Test score intervals.

Table 4.32
Stanford Achievement Total Social Studies Scaled Scores Expectancy Table for AP World
History Students

| Stanford Achievement <br> Social Studies Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $825-849$ | 2 | $100 \%$ |
| $800-824$ | 3 | $100 \%$ |

Table 4.32 (continued)

| Stanford Achievement <br> Social Studies Scaled Scores | N | AP Grade $\geq 3$ |
| :---: | :---: | :---: |
| $775-799$ | 5 | $100 \%$ |
| $750-774$ | 101 | $90 \%$ |
| $725-749$ | 430 | $55 \%$ |
| $700-724$ | 917 | $19 \%$ |
| $675-699$ | 1024 | $2 \%$ |
| $650-674$ | 308 | $0 \%$ |
| $625-649$ | 58 | $0 \%$ |
| $600-624$ | 6 | $0 \%$ |

Note. N $=$ Students taking AP World History exam. AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP World History exam.

## Aggregate Stanford Achievement Test Expectancy Tables

In the previous section, expectancy tables were provided individually for each AP exam, where percentage of students who passed the AP exam at various Stanford Achievement Test score intervals was listed. However, Table 4.33, Table 4.34, and Table 4.35 are aggregate tables, which list all the percentage of students who passed the AP exams by respective Stanford Achievement Test Total Subject in Reading, Math, and Social Studies. These tables will proof useful for school administrators who would like to set a standard Stanford Achievement Test Total Subject Score of which they will focus their recruitment efforts for the respective AP courses.

Table 4.33
Aggregate Stanford Achievement Reading Scaled Scores Expectancy Table for AP

## English and Fine Arts Students

| AP Exam | Stanford Achievement Test Total Reading Scaled Scores |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & 650- \\ & 674 \end{aligned}$ | $\begin{aligned} & 675- \\ & 699 \end{aligned}$ | $\begin{aligned} & 700- \\ & 724 \end{aligned}$ | $\begin{aligned} & 725- \\ & 749 \end{aligned}$ | $\begin{aligned} & 750- \\ & 774 \end{aligned}$ | $\begin{aligned} & 775- \\ & 799 \end{aligned}$ | $\begin{aligned} & 800- \\ & 824 \end{aligned}$ | $\begin{aligned} & 825- \\ & 849 \end{aligned}$ | $\begin{aligned} & 850- \\ & 874 \end{aligned}$ | $\begin{aligned} & 875- \\ & 899 \end{aligned}$ |
| English |  |  |  |  |  |  |  |  |  |  |
| English Lang. | 0\% | 0\% | 1\% | 15\% | 56\% | 86\% | 90\% | 100\% | 100\% | N/A |
| English Lit. | N/A | 0\% | 6\% | 7\% | 25\% | 88\% | 100\% | 100\% | N/A | N/A |
| Fine Arts |  |  |  |  |  |  |  |  |  |  |
| Mus.Theory | N/A | 0\% | 100\% | 25\% | 64\% | 86\% | 100\% | 100\% | N/A | N/A |
| Art History | 0\% |  | 0\% | 5\% | 50\% | 64\% | 33\% | 100\% | N/A | N/A |

Note. N/A=None applicable due to no students scoring in respective Stanford Achievement Test intervals; Lang.=Language; Lit.=Literature; Mus.=Music.

Table 4.34
Aggregate Stanford Achievement Math Scaled Scores Expectancy Table for AP Math and Science Students

|  | Stanford Achievement Test Total Math Scaled Scores |  |  |  |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $650-$ | $675-$ | $700-$ | $725-$ | $750-$ | $775-$ | $800-$ | $825-$ | $850-$ | $875-$ |  |
| AP Exam | 674 | 699 | 724 | 749 | 774 | 799 | 824 | 849 | 874 | 899 |  |
| Math |  |  |  |  |  |  |  |  |  |  |  |
| Comp. Sci. A | N/A | $0 \%$ | $0 \%$ | $0 \%$ | $6 \%$ | $22 \%$ | $65 \%$ | $63 \%$ | $100 \%$ | $100 \%$ |  |
| Calculus AB | $0 \%$ | N/A | N/A | $0 \%$ | $18 \%$ | $50 \%$ | $50 \%$ | N/A | $100 \%$ | $100 \%$ |  |
| Statistics | N/A | $0 \%$ | $4 \%$ | $23 \%$ | $39 \%$ | $67 \%$ | $100 \%$ | $100 \%$ | $100 \%$ | $100 \%$ |  |
| Science |  |  |  |  |  |  |  |  |  |  |  |
| Chemistry | $0 \%$ | $0 \%$ | $0 \%$ | $0 \%$ | $30 \%$ | $66 \%$ | $84 \%$ | $92 \%$ | $100 \%$ | $100 \%$ |  |
| Env. Sci. | $0 \%$ | $0 \%$ | $4 \%$ | $23 \%$ | $66 \%$ | $73 \%$ | $89 \%$ | $100 \%$ | $75 \%$ | $100 \%$ |  |
| Physics B | N/A | $0 \%$ | $8 \%$ | $0 \%$ | $9 \%$ | $75 \%$ | $85 \%$ | $100 \%$ | $100 \%$ | $100 \%$ |  |
| Biology | $0 \%$ | $0 \%$ | $3 \%$ | $15 \%$ | $37 \%$ | $77 \%$ | $75 \%$ | $100 \%$ | $75 \%$ | $100 \%$ |  |

Note. N/A=None applicable due to no students scoring in respective Stanford Achievement Test intervals; Comp.=Computer; Sci.=Science; Env.=Environmental.

Table 4.35
Aggregate Stanford Achievement Social Studies Scaled Scores Expectancy Table for AP Social Studies Students

|  | Stanford Achievement Test Total Social Studies Scaled Scores |  |  |  |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $650-$ | $675-$ | $700-$ | $725-$ | $750-$ | $775-$ | $800-$ | $825-$ | $850-$ | $875-$ |  |
| AP Exam | 674 | 699 | 724 | 749 | 774 | 799 | 824 | 849 | 874 | 899 |  |
| Social Studies |  |  |  |  |  |  |  |  |  |  |  |
| Hum. Geog. | $0 \%$ | $4 \%$ | $26 \%$ | $66 \%$ | $92 \%$ | $100 \%$ | $100 \%$ | N/A | N/A | N/A |  |
| US Hist. | $0 \%$ | $1 \%$ | $15 \%$ | $51 \%$ | $80 \%$ | $94 \%$ | $100 \%$ | $100 \%$ | $100 \%$ | N/A |  |
| World Hist. | $0 \%$ | $2 \%$ | $19 \%$ | $55 \%$ | $90 \%$ | $100 \%$ | $100 \%$ | $100 \%$ | N/A | N/A |  |
| Euro. Hist. | $0 \%$ | $7 \%$ | $25 \%$ | $50 \%$ | $100 \%$ | $100 \%$ | N/A | N/A | N/A | N/A |  |
| Psychology | $0 \%$ | $44 \%$ | $70 \%$ | $87 \%$ | $88 \%$ | $100 \%$ | N/A | N/A | N/A | N/A |  |
| US Govt. | $0 \%$ | $0 \%$ | $6 \%$ | $50 \%$ | $100 \%$ | $50 \%$ | $100 \%$ | N/A | N/A | N/A |  |

Note. N/A=None applicable due to no students scoring in respective Stanford Achievement Test intervals; Hum.=Human; Hist.=History; Govt.=Government.

## Research Question Two

The Research Department from Southwest Independent School District (SISD) provided the principal research with an excel table that included Public Education Information Management System (PEIMS), Advanced Placement (AP) exams and scores information, and Preliminary raw and scaled scores in Reading, Math, Language, Science, and Social Studies for 12,655 students.

Table 4.36 provides an explanation of the errors found in the data provided by SISD, which reduced the sample size used to address research question two. The original sample size of 12,655 students was reduced by 7,551 , the total number of errors in student records indicated in Table 4.36, which equals to 5,104 students in the sample size for research question two.

Table 4.36
Frequency of Errors in Student Records for Research Question Two

| Description of Error | f |
| :--- | :---: |
| AP Score Missing for Students Taking 1 Exam | 10 |
| PEIMS Data Missing | 46 |
| All PSAT Scores Missing | 7473 |
| Partial Stanford Achievement Scores Missing | 15 |
| Duplicated Student Records | 7 |
| Total | 7551 |

Although there was 5,104 students in the sample size for research question two, some students took more than one AP exam. Research question two sought to determine the relationship between AP exams and PSAT scores; therefore, it was necessary to determine the total number of AP exams taken by the 5,104 students in order to further analyze the data for research question one. Once the principal researcher manipulated the data from SISD to represent AP exams, there were 5,692 AP exams taken by 5,104 students. However, the principal researcher discovered that 5 AP exams were missing scores for students taking more than one AP exam, which brought the total number of AP exams down to 5,687 taken by 5,104 students.

Table 4.37 shows the number of students who took a specific number of AP exams in the sample population for research question two. The majority of students took one AP exam ( $n=4567,89.48 \%)$.

Table. 4.37

Quantity of AP Exams Taken by AP Students for Research Question Two

| Quantity of AP Exams | f | $\%$ |
| :--- | :---: | :---: |
| 1 | 4567 | $89.48 \%$ |
| 2 | 502 | $9.84 \%$ |
| 3 | 27 | $0.53 \%$ |
| 4 | 6 | $0.12 \%$ |
| 5 | 1 | $0.02 \%$ |
| 6 | 1 | $0.02 \%$ |
| Total | 5104 | $100.0 \%$ |

Table 4.38 shows the specific title of AP exams and frequency taken by the 5,104 students for research question two. The largest number of AP exams taken was in AP World History ( $n=2666$ ).

Table. 4.38
Frequency of AP Exams for Research Question Two

| Name of AP Exam | f |
| :--- | :---: |
| World History | 2666 |
| Spanish Language | 1454 |
| Human Geography | 1341 |
| Biology | 73 |
| English Language | 27 |
| Environmental Science | 14 |
| Chemistry | 12 |
| Computer Science A | 11 |

Table. 4.38 (continued)

| Name of AP Exam | f |
| :--- | :--- |
| Chinese Language | 8 |
| French Language | 8 |
| Psychology | 8 |
| Spanish Literature | 8 |
| United States History | 6 |
| Art History | 6 |
| Music Theory | 6 |
| Music Aural Subscore | 6 |
| Music Non-Aural Subscore | 6 |
| Statistics | 6 |
| Art: Studio Art-Drawing Portfolio | 4 |
| Calculus AB | 4 |
| Physics B | 4 |
| European History | 2 |
| Art: Studio Art-2-D Design Portfolio | 3 |
| German Language | 1 |
| Economics: Microeconomics | 2 |
| Total | 287 |

Since correlation coefficients were derived for each AP exam and PSAT scores, it was suggested to have at least 30 participants to further exam this correlational
relationship (Gall, Gall, and Borg, 2007). Therefore, Environmental Science, Chemistry, Computer Science A, Chinese Language and Culture, French Language, Psychology, Spanish Literature, United States History, Art History, Music Theory, Music Aural Subscore, Music Non-Aural Subscore, Statistics, Art: Studio Art-Drawing Portfolio, Calculus AB, Physics B, European History, Art: Studio Art-2-D Design Portfolio, German Language, Economics: Microeconomics, English Literature was not included in this study since the frequency of these respective AP exams was less than 30 . However, AP English Language has a frequency of 27, which was close to the 30 participants suggested to have by Gall, Gall, and Borg (2007); therefore, the principal researcher included AP English Language in this study. Given this information, there were a total of 126 AP exams not included in this study, which reduced the total number of AP exams to 5,561 for research question two. By reducing the total number of AP exams to 5,561, this changed the sample size of students for research question two as well from 5,104 to 5,074 students.

Since the final sample size information was determined to be 5,074 students for research question two, below is the demographic data including grade level, gender, economically disadvantage status, and ethnicity.

Table 4.39 shows frequency of student taking AP exams by grade level in the sample population for research question one. The majority of AP exams were taken by $10^{\text {th }}$ grade students $(n=3072,61 \%)$. Students in the $12^{\text {th }}$ grade and $11^{\text {th }}$ grade were not substantially represented because $11^{\text {th }}$ and $12^{\text {th }}$ graders were not given the PSAT in 20102011 school year.

Table 4.39
Frequency and Percentage of AP Students Grade Level for Research Question Two

| Grade Level | f | $\%$ |
| :--- | :---: | :---: |
| $8^{\text {th }}$ Grade | 281 | 6 |
| $9^{\text {th }}$ Grade | 1721 | 34 |
| $10^{\text {th }}$ Grade | 3072 | 61 |
| Total | 5074 | 100 |

Table 4.40 shows the gender breakdown of students taking AP exams in the sample population for research question two. The majority of AP exams were taken by female students ( $n=2859,56 \%$ ).

Table 4.40
Frequency and Percentage of AP Students Gender for Research Question Two

| Gender | f | $\%$ |
| :--- | :---: | :---: |
| Female | 2859 | 56 |
| Male | 2215 | 44 |
| Total | 5074 | 100 |

Table 4.41 shows the level of economic disadvantage breakdown for students taking AP exams in the sample population for research question two. The majority of AP exams were taken by economically disadvantaged students ( $n=3186,63 \%$ ).

Table 4.41
Frequency and Percentage of AP Students Economic Disadvantage Status for Research Question Two

| Economic Disadvantage Status | f | $\%$ |
| :--- | :---: | :---: |
| Not Economically <br> Disadvantaged | 1888 | 37 |
| Eligible for Free Lunch | 1931 | 38 |
| Eligible for Reduce Price Meals | 475 | 9 |
| Other Economic Disadvantage | 780 | 15 |
| Total | 5074 | 100 |

Table 4.42 shows the ethnic background for students taking AP exams in the sample population for research question two. The majority of AP exams were taken by Hispanic students ( $n=2944,58 \%$ ).

Table 4.42

Frequency and Percentage of AP Students Ethnicity for Research Question One

| Ethnicity | f | $\%$ |
| :--- | :---: | :---: |
| Asian | 263 | 5.2 |
| American Indian | 14 | 0.3 |
| African American | 924 | 18.2 |
| Hispanic | 2944 | 58.0 |
| Pacific Islander | 13 | 0.3 |
| Two or More Ethnicities | 69 | 1.4 |

Table 4.42 (continued)

| Ethnicity | f | $\%$ |
| :--- | :---: | :---: |
| White | 847 | 16.7 |
| Total | 5074 | 100.0 |

Although PSAT Scores scaled scores and raw scores were provided by SWISD, research question two is based on a study conducted by Ewing et al. (2006), where they examined PSAT scores and AP exam scores by correlating verbal, math, and writing PSAT scores. In that study, the researchers used PSAT scaled scores. They also combined verbal and math, verbal and writing, math and writing, and verbal, math, and writing score, which created seven PSAT scores to correlate with AP exam scores (Ewing et al., 2006). Therefore, this study followed the same approach and used PSAT scaled scores in the previously stated seven combinations. However, the verbal portion of the PSAT exam is currently considered the critical reading portion of the PSAT exam, so the above seven combinations utilized PSAT critical reading scaled scores in this study.

Research question two asked to examine the relationship between students' PSAT scores and their performance on AP Exams. The hypothesis for research question two suggests there are a positive relationship between students' PSAT scores and their performance on AP Exams. To determine whether a relationship exists, Pearson product moment correlation coefficients were calculated for each AP exam using the sample provided for SWISD. Pearson product moment correlation method was the appropriate statistical model given that both AP exams and PSAT scaled scores are considered interval data, which is also a requirement to perform Pearson product moment correlation method (Ravid, 2011). Another study conducted by Ewing et al. (2006) examined PSAT
scores and AP exam scores also used Pearson product moment correlation coefficients to test their hypothesis.

Table 4.43 shows the Pearson product moment correlation coefficients for each AP exam and PSAT scores. The AP exams appear grouped in subject areas. Each AP exam relationship was examined individually in the subsequent paragraphs to determine whether the hypothesis for research question one was upheld. Table 4.43 also indicates whether the relationship between each respective PSAT and AP exam scores were statistically significant.

Table 4.43
Pearson Product Moment Correlation Coefficients for PSAT and AP Exams Scores

| AP Exam | CR | M | W | $\mathrm{CR}+\mathrm{M}$ | $\mathrm{CR}+\mathrm{W}$ | $\mathrm{M}+\mathrm{W}$ | $\mathrm{CR}+\mathrm{M}+\mathrm{W}$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| English |  |  |  |  |  |  |  |
| $\quad$ English Lang. | $.785^{* *}$ | $.734^{* *}$ | $.702^{* *}$ | $.839^{* *}$ | $.782^{* *}$ | $.764^{* *}$ | $.817^{* *}$ |
| Foreign Lang. |  |  |  |  |  |  |  |
| Spanish Lang. <br> Science | $.476^{* *}$ | $.419^{* *}$ | $.463^{* *}$ | $.499^{* *}$ | $.510^{* *}$ | $.489^{* *}$ | $.519^{* *}$ |
| $\quad$ Biology | $.624^{* *}$ | $.694^{* *}$ | $.658^{* *}$ | $.717^{* *}$ | $.671^{* *}$ | $.725^{* *}$ | $.723^{* *}$ |
| Social Studies |  |  |  |  |  |  |  |
| Human Geog. | $.636^{* *}$ | $.591^{* *}$ | $.605^{* *}$ | $.672^{* *}$ | $.656^{* *}$ | $.647^{* *}$ | $.677^{* *}$ |
| World History | $.679^{* *}$ | $.655^{* *}$ | $.653^{* *}$ | $.720^{* *}$ | $.701^{* *}$ | $.702^{* *}$ | $.725^{* *}$ |

Note. Lang. $=$ Language; Geog. $=$ Geography; CR=Critical Reading PSAT Scaled Score; M=Math PSAT Scaled Score; Writing=Writing PSAT Scaled Score;
CR $+\mathrm{M}=$ Combination of Critical Reading and Math PSAT Scaled Score;
$\mathrm{CR}+\mathrm{W}=$ Combination of Critical Reading and Writing PSAT Scaled Score; $\mathrm{M}+\mathrm{W}=$ Combination of Math and Writing PSAT Scaled Score; CR $+\mathrm{M}+\mathrm{W}=$ Combination of Critical Reading, Math, and Writing PSAT Scaled Score.
*Correlation is significant at the 0.05 level (2-tailed).
Table 4.44 describes the strength of the relationship by categorizing the Pearson product moment correlation coefficients as having a very high (. 80 to 1.00 ), high (. 60 to .80), moderate (. 40 to .60 ), low (. 20 to .40 ), and negligible to low (. 00 to .20 ) relationship, which follows the guidance provided in the book, "Practical Statistics for

Educators" by Ravid (2011). The highest correlation efficient for each AP exam is also indicated in Table 4.43.

Table 4.44 indicates the PSAT score combination used for an expectancy table, which was first introduced in Chapter One of this study. The purpose of the expectancy table was meant to emulate the study conducted by Ewing et al. (2006), which shows the percentage of students scoring 3 or higher at various exam achievement levels on the PSAT exam. A score of three or higher on a five-point scale is considered passing on an AP exam (Dougherty, Mellor, \& Jian, 2006). The purpose of creating such an expectancy table is to recruit students in respective AP courses by using data based on students who have successful in passing the respective AP exams. Therefore, using the same idea presented in Ewing et al. (2006) for PSAT, the Table 4.43 indicates the specific PSAT scaled score combination used to create an expectancy table for school administrators based on a highest correlation occurring within each AP subject exams correlation coefficients. The decision to use certain PSAT scaled score combinations for AP exams expectancy tables is discussed in subsequent paragraphs following Table 4.44.

Table 4.44
Interpretation of Correlation Coefficients for PSAT and AP Exams Scores

| AP Exam | CR | M | W | CR +M | $\mathrm{CR}+\mathrm{W}$ | $\mathrm{M}+\mathrm{W}$ | $\mathrm{CR}+\mathrm{M}+\mathrm{W}$ |
| :--- | :--- | :--- | :--- | :---: | :---: | :---: | :---: |
| English <br> English Lang. | H | H | H | $\mathrm{VH}^{\mathrm{ab}}$ | H | H | VH |
| Foreign Lang. <br> Spanish Lang. | M | M | M | M | M | M | $\mathrm{M}^{\mathrm{ab}}$ |
| Science <br> Biology | H | H | H | H | H | $\mathrm{H}^{\mathrm{ab}}$ | H |

Table 4.44 (continued)

| AP Exam | CR | M | W | CR+M | CR+W | M+W | CR+M+W |
| :--- | :--- | :--- | :--- | :---: | :---: | :---: | :---: |
| Social Studies |  |  |  |  |  |  |  |
| Human Geog. | H | M | H | H | H | H | $\mathrm{H}^{\text {ab }}$ |
| World History | H | H | H | H | H | H | H $^{\text {ab }}$ |

Note: Lang. $=$ Language; Geog. $=$ Geography; CR=Critical Reading PSAT Scaled Score;
M=Math PSAT Scaled Score; Writing=Writing PSAT Scaled Score;
$\mathrm{CR}+\mathrm{M}=$ Combination of Critical Reading and Math PSAT Scaled Score;
$\mathrm{CR}+\mathrm{W}=$ Combination of Critical Reading and Writing PSAT Scaled Score;
$\mathrm{M}+\mathrm{W}=$ Combination of Math and Writing PSAT Scaled Score; CR $+\mathrm{M}+\mathrm{W}=$ Combination of Critical Reading, Math, and Writing PSAT Scaled Score. VH=very high correlation coefficient; $\mathrm{H}=$ high correlation coefficient; $\mathrm{M}=$ moderate correlation coefficient; $\mathrm{L}=$ low correlation coefficient; $\mathrm{NL}=$ negligible to low correlation coefficient.
${ }^{\text {a }}$ Highest correlation coefficient within each AP exam. ${ }^{\mathrm{b}}$ Selected for expectancy table.

## AP English Subject Exam

The AP exam under the heading AP English subject exam is AP English
Language exam. Table 4.45 shows the descriptive statistics for the AP English Language exam. These descriptive statistics include number of participants, mean, median, mode, standard deviation, minimum score, and maximum score for AP English Language exam.

The purpose of this table is to display the descriptive statistics inclusive of the entire sample population for AP English Language exam.

Table 4.45
Descriptive Statistics for AP English Language Exam for Research Question Two

|  | AP |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Descriptive | Exam <br> Score | CR | M | W | $\mathrm{CR}+\mathrm{M}$ | $\mathrm{CR}+\mathrm{W}$ | $\mathrm{M}+\mathrm{W}$ | CR+M <br> +W |
| Statistics | Sco |  |  |  |  |  |  |  |
| English Lang. |  |  |  |  |  |  |  |  |
| $(n=27)$ |  |  |  |  |  |  |  |  |
| Mean | 2.63 | 54.15 | 52.33 | 52.96 | 106.48 | 107.11 | 105.3 | 159.44 |
| Median | 3 | 54 | 53 | 52 | 108 | 105 | 102 | 161 |
| Mode | 3 | 53 | 44 | $47^{\mathrm{a}}$ | $100^{\mathrm{a}}$ | 119 | $87^{\mathrm{a}}$ | $134^{\mathrm{a}}$ |
| SD | 1.043 | 9.222 | 10.619 | 8.693 | 17.928 | 17.066 | 18.187 | 25.885 |

Table 4.45 (continued)

|  | AP |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Descriptive <br> Exam | CR |  |  |  |  |  |  |  |
| Statistics | Score | CR | M | CR+M | CR+W | M+W | $+W$ |  |
| Minimum | 1 | 34 | 32 | 35 | 66 | 69 | 67 | 101 |
| Maximum | 5 | 73 | 80 | 69 | 151 | 142 | 149 | 220 |

Note. $n=$ Number of students taking respective AP exams; SD=Standard Deviation; Lang.=Language; CR=Critical Reading PSAT Scaled Score; M=Math PSAT Scaled Score; Writing=Writing PSAT Scaled Score; CR+M=Combination of Critical Reading and Math PSAT Scaled Score; CR $+\mathrm{W}=$ Combination of Critical Reading and Writing PSAT Scaled Score; M $+\mathrm{W}=$ Combination of Math and Writing PSAT Scaled Score; $\mathrm{CR}+\mathrm{M}+\mathrm{W}=$ Combination of Critical Reading, Math, and Writing PSAT Scaled Score. ${ }^{\mathrm{a}}$ Multiple modes exist. The smallest value is shown.

For the AP English Language exam and PSAT Scaled Scores correlation coefficients in Critical Reading ( $\mathrm{r}=.785, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.734$, $\mathrm{p}<.01$ ), Writing ( $\mathrm{r}=.702$, $\mathrm{p}<.01$ ), Critical Reading and Math ( $\mathrm{r}=.839, \mathrm{p}<.01$ ), Critical Reading and Writing ( $\mathrm{r}=.782$, $\mathrm{p}<.01$ ), Writing and Math ( $\mathrm{r}=.764, \mathrm{p}<.01$ ), and Critical Reading, Math, and Writing $(\mathrm{r}=.817, \mathrm{p}<.01)$, each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP English Language exam in research question two can be accepted as having a positive relationship for PSAT Scaled Scores.

The principal researcher chose to create an expectancy table for AP English Language using PSAT combined Critical Reading and Math scaled scores, because it has the highest Pearson Product Moment Correlation Coefficient as compared to the other PSAT Scaled Scores combination correlation coefficients for AP English Language $(\mathrm{r}=.839, \mathrm{p}<.01)$.

An expectancy table would prove useful to educators who are trying to recruit students to take AP English Language courses, because it provides the percentage of students who passed the AP exam at various PSAT score intervals. An administrator can
look at Table 4.46 and select a PSAT minimum score to focus their recruitment efforts on students who have proven to pass the AP English Language exam. If administrators want to be more inclusive in their recruitment efforts they may choose to recruit students with a minimum of PSAT combined Critical Reading and Math scaled score equaling 95, while only $25 \%$ of students in PSAT scores range from 95-91 passed the AP English Language Exam. If administrators wants to be more exclusive in their recruitment efforts they may choose a to recruit students with a minimum of PSAT combined Critical Reading and Math scaled score equaling 115, while only $75 \%$ of students in PSAT scores range from 115-111 passed the AP English Language Exam.

Table 4.46 is an expectancy table for AP English Language, which shows the percentage of students who passed the AP exam at various PSAT score intervals.

Table 4.46

PSAT Combined Critical Reading and Math Expectancy Table for AP English Language

## Students

| PSAT CR+M Scores | N | AP Grade $\geq 3$ |
| :--- | :--- | :---: |
| $160-156$ | 0 | $0 \%$ |
| $155-151$ | 1 | $100 \%$ |
| $150-146$ | 0 | $0 \%$ |
| $145-141$ | 0 | $0 \%$ |
| $140-136$ | 0 | $0 \%$ |
| $135-131$ | 1 | $100 \%$ |
| $130-126$ | 0 | $0 \%$ |
| $125-121$ | 4 | $100 \%$ |
| $120-116$ | 2 | $100 \%$ |
| $115-111$ | 4 | $75 \%$ |
| $110-106$ | 3 | $33 \%$ |
| $105-101$ | 1 | $100 \%$ |
| $100-96$ | 3 | $33 \%$ |
| $95-91$ | 4 | $25 \%$ |
| $90-86$ | 2 | $0 \%$ |

Table 4.46 (continued)

| PSAT CR+M Scores | N | AP Grade $\geq 3$ |
| :--- | :--- | :---: |
| $85-81$ | 0 | $0 \%$ |
| $80-76$ | 1 | $0 \%$ |
| $75-71$ | 0 | $0 \%$ |
| $70-66$ | 1 | $0 \%$ |
| $65-61$ | 0 | $0 \%$ |
| $60-56$ | 0 | $0 \%$ |
| $55-51$ | 0 | $0 \%$ |
| $50-46$ | 0 | $0 \%$ |
| $45-40$ | 0 | $0 \%$ |

Note. N= Students taking AP English Language exam; AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP English Language exam; $\mathrm{CR}+\mathrm{M}=$ Combination of Critical Reading and Math PSAT Scaled Score.

## AP Foreign Language Subject Exam

The AP exam under the heading AP Foreign Language subject exam is AP Spanish Language exam. Table 4.47 shows the descriptive statistics for the AP Spanish Language exam. These descriptive statistics include number of participants, mean, median, mode, standard deviation, minimum score, and maximum score for AP Spanish Language exam. The purpose of this table is to display the descriptive statistics inclusive of the entire sample population for AP Spanish Language exam.

Table 4.47
Descriptive Statistics for AP Spanish Language Exam

| Descriptive <br> Statistics | AP Exam | Score | CR | M | W | $\mathrm{CR}+\mathrm{M}$ | $\mathrm{CR}+\mathrm{W}$ | $\mathrm{M}+\mathrm{W}$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | | CR+M |
| :---: |
| +W |

Table 4.47 (continued)

|  |  |  |  |  |  |  |  | CR+ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Descriptive | AP Exam |  |  |  |  |  | M+ |  |
| Statistics | Score | CR | M | W | CR+M | CR+W | M+W | W |
| Minimum | 1 | 20 | 20 | 20 | 40 | 40 | 40 | 63 |
| Maximum | 5 | 77 | 80 | 80 | 145 | 153 | 152 | 225 |

Note. $n=$ Number of students taking respective AP exams; SD=Standard Deviation; Lang. $=$ Language; CR=Critical Reading PSAT Scaled Score; M=Math PSAT Scaled Score; Writing=Writing PSAT Scaled Score; CR+M=Combination of Critical Reading and Math PSAT Scaled Score; CR + W=Combination of Critical Reading and Writing PSAT Scaled Score; M $+\mathrm{W}=$ Combination of Math and Writing PSAT Scaled Score; $\mathrm{CR}+\mathrm{M}+\mathrm{W}=$ Combination of Critical Reading, Math, and Writing PSAT Scaled Score. ${ }^{\mathrm{a}}$ Multiple modes exist. The smallest value is shown.

For the AP Spanish Language exam and PSAT Scaled Scores correlation coefficients in Critical Reading ( $\mathrm{r}=.476, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.419, \mathrm{p}<.01$ ), Writing ( $\mathrm{r}=.463$, $\mathrm{p}<.01$ ), Critical Reading and Math ( $\mathrm{r}=.499, \mathrm{p}<.01$ ), Critical Reading and Writing ( $\mathrm{r}=.510$, $\mathrm{p}<.01$ ), Writing and Math ( $\mathrm{r}=.489, \mathrm{p}<.01$ ), and Critical Reading, Math, and Writing $(\mathrm{r}=.519, \mathrm{p}<.01)$, each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Spanish Language exam in research question two can be accepted as having a positive relationship for PSAT Scaled Scores.

The principal researcher chose to create an expectancy table for AP Spanish Language using PSAT combined Critical Reading, Math, and Writing scaled scores, because it has the highest Pearson product moment correlation coefficient as compared to the other PSAT Scaled Scores combination correlation coefficients for AP English Language ( $\mathrm{r}=.519, \mathrm{p}<.01$ ).

Table 4.48 is an expectancy table for AP Spanish Language, which shows the percentage of students who passed the AP exam at various PSAT score intervals.

Table 4.48
PSAT Combined Critical Reading, Math, and Writing Expectancy Table for AP Spanish

## Language Students

| PSAT CR+M+W | N |  |
| :--- | :---: | :---: |
| Scores | 0 | AP Grade $\geq 3$ |
| $240-231$ | 1 | $0 \%$ |
| $230-221$ | 3 | $100 \%$ |
| $220-211$ | 1 | $100 \%$ |
| $210-201$ | 3 | $0 \%$ |
| $200-191$ | 1 | $100 \%$ |
| $190-181$ | 11 | $100 \%$ |
| $180-171$ | 32 | $91 \%$ |
| $170-161$ | 59 | $84 \%$ |
| $160-151$ | 135 | $92 \%$ |
| $150-141$ | 193 | $80 \%$ |
| $140-131$ | 230 | $72 \%$ |
| $130-121$ | 266 | $66 \%$ |
| $120-111$ | 248 | $50 \%$ |
| $110-101$ | 162 | $36 \%$ |
| $100-91$ | 66 | $27 \%$ |
| $90-81$ | 36 | $32 \%$ |
| $80-71$ | 7 | $3 \%$ |
| $70-60$ |  | $14 \%$ |

Note. N= Students taking AP Spanish Language exam; AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Spanish Language exam; $\mathrm{CR}+\mathrm{M}+\mathrm{W}=$ Combination of Critical Reading, Math, and Writing PSAT Scaled Score.

## AP Science Subject Exam

The AP exam under the heading AP Science subject exam is AP Biology exam.
Table 4.49 shows the descriptive statistics for the AP Biology exam. These descriptive statistics include number of participants, mean, median, mode, standard deviation, minimum score, and maximum score for AP Biology exam. The purpose of this table is to display the descriptive statistics inclusive of the entire sample population for AP Biology exam.

Table 4.49
Descriptive Statistics for AP Biology Exam

| AP |  |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Descriptive | Exam |  |  |  |  | CR+M |  |  |
| Statistics | Score | CR | M | W | CR+M | CR+W | M+W | +W |
| Spanish Lang. <br> $(n=1454)$ |  |  |  |  |  |  |  |  |
| Mean | 2.69 | 38.86 | 41.69 | 39.22 | 80.55 | 78.08 | 80.91 | 119.77 |
| Median | 3 | 39 | 41 | 39 | 80 | 77 | 80 | 118 |
| Mode | 1 | 34 | 37 | 38 | 80 | 80 | 75 | $109^{\text {a }}$ |
| SD | 1.331 | 8.481 | 8.74 | 8.068 | 15.446 | 15.232 | 15.126 | 22.046 |
| Minimum | 1 | 20 | 20 | 20 | 40 | 40 | 40 | 63 |
| Maximum | 5 | 77 | 80 | 80 | 145 | 153 | 152 | 225 |

Note. $n=$ Number of students taking respective AP exams; SD=Standard Deviation; CR=Critical Reading PSAT Scaled Score; M=Math PSAT Scaled Score;
Writing=Writing PSAT Scaled Score; CR $+\mathrm{M}=$ Combination of Critical Reading and Math PSAT Scaled Score; CR+W=Combination of Critical Reading and Writing PSAT Scaled Score; $\mathrm{M}+\mathrm{W}=$ Combination of Math and Writing PSAT Scaled Score; $\mathrm{CR}+\mathrm{M}+\mathrm{W}=$ Combination of Critical Reading, Math, and Writing PSAT Scaled Score. ${ }^{\mathrm{a}}$ Multiple modes exist. The smallest value is shown.

For the AP Biology exam and PSAT Scaled Scores correlation coefficients in Critical Reading ( $\mathrm{r}=.624, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.694, \mathrm{p}<.01$ ), Writing ( $\mathrm{r}=.658$, $\mathrm{p}<.01$ ), Critical Reading and Math ( $\mathrm{r}=.717, \mathrm{p}<.01$ ), Critical Reading and Writing ( $\mathrm{r}=.671, \mathrm{p}<.01$ ), Writing and Math ( $\mathrm{r}=.725, \mathrm{p}<.01$ ), and Critical Reading, Math, and Writing ( $\mathrm{r}=.723, \mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Biology exam in research question two can be accepted as having a positive relationship for PSAT Scaled Scores.

The principal researcher chose to create an expectancy table for AP Biology using PSAT combined Math and Writing scaled scores, because it has the highest Pearson product moment correlation coefficient as compared to the other PSAT Scaled Scores combination correlation coefficients for AP Biology ( $\mathrm{r}=.725, \mathrm{p}<.01$ ).

Table 4.50 is an expectancy table for AP Biology, which shows the percentage of students who passed the AP exam at various PSAT score intervals.

Table 4.50
PSAT Combined Math and Writing Expectancy Table for AP Biology Students

| PSAT M+W Scores | N | AP Grade $\geq 3$ |
| :--- | :---: | :---: |
| $160-156$ | 0 | $0 \%$ |
| $155-151$ | 0 | $0 \%$ |
| $150-146$ | 1 | $100 \%$ |
| $145-141$ | 0 | $0 \%$ |
| $140-136$ | 2 | $100 \%$ |
| $135-131$ | 0 | $0 \%$ |
| $130-126$ | 5 | $60 \%$ |
| $125-121$ | 3 | $100 \%$ |
| $120-116$ | 2 | $50 \%$ |
| $115-111$ | 7 | $29 \%$ |
| $110-106$ | 4 | $50 \%$ |
| $105-101$ | 6 | $17 \%$ |
| $100-96$ | 5 | $0 \%$ |
| $95-91$ | 5 | $0 \%$ |
| $90-86$ | 10 | $0 \%$ |
| $85-81$ | 8 | $0 \%$ |
| $80-76$ | 9 | $0 \%$ |
| $75-71$ | 4 | $0 \%$ |
| $70-66$ | 1 | $0 \%$ |
| $65-61$ | 1 | $0 \%$ |
| $60-56$ | 0 | $0 \%$ |
| $55-51$ | 0 | $0 \%$ |
| $50-46$ | 0 | $0 \%$ |
| $45-40$ | 0 | $0 \%$ |

Note. N= Students taking AP Biology exam; AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Biology exam; $\mathrm{M}+\mathrm{W}=$ Combination of Math and Writing PSAT Scaled Score

## AP Social Studies Subject Exams

The AP exam under the heading AP Social Studies subject exam is AP Human Geography and AP World History exams. Table 4.51 shows the descriptive statistics for the AP Social Studies exams. These descriptive statistics include number of participants,
mean, median, mode, standard deviation, minimum score, and maximum score for AP Biology exam. The purpose of this table is to display the descriptive statistics inclusive of the entire sample population for AP Human Geography and AP World History.

Table 4.51
Descriptive Statistics for AP Social Studies Exams

| Descriptive <br> Statistics | AP Exam <br> Score | CR | M | W | $\mathrm{CR}+\mathrm{M}$ | $\mathrm{CR}+\mathrm{W}$ | $\mathrm{M}+\mathrm{W}$ | CR+M <br> +W |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Human Geography <br> $(n=1341)$ |  |  |  |  |  |  |  |  |
| Mean | 1.63 | 45.99 | 47.46 | 44.29 | 93.45 | 90.28 | 91.74 | 137.73 |
| Median | 1 | 45 | 47 | 44 | 92 | 89 | 91 | 137 |
| Mode | 1 | 48 | 47 | 44 | 89 | $86^{\mathrm{a}}$ | $82^{\mathrm{a}}$ | $128^{\mathrm{a}}$ |
| SD | 1.061 | 10.443 | 9.716 | 9.346 | 18.428 | 18.741 | 17.607 | 26.646 |
| Minimum | 1 | 20 | 20 | 20 | 40 | 40 | 40 | 60 |
| Maximum | 5 | 80 | 80 | 80 | 160 | 160 | 160 | 240 |
| World History |  |  |  |  |  |  |  |  |
| (n=2666) |  |  |  |  |  |  |  |  |
| Mean | 1.7 | 47.84 | 50.09 | 46.94 | 97.93 | 94.78 | 97.03 | 144.87 |
| Median | 1 | 47 | 49 | 46 | 96 | 92 | 95 | 142 |
| Mode | 1 | 48 | 47 | 44 | 90 | $86 a$ | 93 | 131 |
| SD | 1.083 | 10.75 | 10.823 | 10.4 | 19.976 | 20.091 | 19.784 | 29.21 |
| Minimum | 1 | 20 | 20 | 20 | 42 | 41 | 45 | 71 |
| Maximum | 5 | 80 | 80 | 80 | 160 | 160 | 160 | 236 |

Note. $n=$ Number of students taking respective AP exams; SD=Standard Deviation; CR=Critical Reading PSAT Scaled Score; M=Math PSAT Scaled Score; Writing $=$ Writing PSAT Scaled Score; $\mathrm{CR}+\mathrm{M}=$ Combination of Critical Reading and Math PSAT Scaled Score; CR $+\mathrm{W}=$ Combination of Critical Reading and Writing PSAT Scaled Score; $\mathrm{M}+\mathrm{W}=$ Combination of Math and Writing PSAT Scaled Score;
$\mathrm{CR}+\mathrm{M}+\mathrm{W}=$ Combination of Critical Reading, Math, and Writing PSAT Scaled Score.
${ }^{\mathrm{a}}$ Multiple modes exist. The smallest value is shown.

For the AP Human Geography exam and PSAT Scaled Scores correlation coefficients in Critical Reading ( $\mathrm{r}=.636, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.591, \mathrm{p}<.01$ ), Writing ( $\mathrm{r}=.605$, $\mathrm{p}<.01$ ), Critical Reading and Math ( $\mathrm{r}=.672, \mathrm{p}<.01$ ), Critical Reading and Writing ( $\mathrm{r}=.656$, $\mathrm{p}<.01$ ), Writing and Math ( $\mathrm{r}=.647, \mathrm{p}<.01$ ), and Critical Reading, Math, and Writing
$(\mathrm{r}=.677, \mathrm{p}<.01)$, each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP Human Geography exam in research question two can be accepted as having a positive relationship for PSAT Scaled Scores.

For the AP World History exam and PSAT Scaled Scores correlation coefficients in Critical Reading ( $\mathrm{r}=.679, \mathrm{p}<.01$ ), Math ( $\mathrm{r}=.655, \mathrm{p}<.01$ ), Writing ( $\mathrm{r}=.653, \mathrm{p}<.01$ ), Critical Reading and Math ( $\mathrm{r}=.720, \mathrm{p}<.01$ ), Critical Reading and Writing ( $\mathrm{r}=.701, \mathrm{p}<.01$ ), Writing and Math ( $\mathrm{r}=.702, \mathrm{p}<.01$ ), and Critical Reading, Math, and Writing ( $\mathrm{r}=.725$, $\mathrm{p}<.01$ ), each correlation is statistically significant at the $\mathrm{p}<.01$ level, which means that the hypothesis for AP World History exam in research question two can be accepted as having a positive relationship for PSAT Scaled Scores.

The principal researcher chose to create an expectancy table for AP Human Geography and AP World History using PSAT combined Critical Reading, Math and Writing scaled scores, because it has the highest Pearson product moment correlation coefficients as compared to the other PSAT Scaled Scores combination correlation coefficients for AP Human Geography ( $\mathrm{r}=.677, \mathrm{p}<.01$ ) and AP World History ( $\mathrm{r}=.725$, $\mathrm{p}<.01$ ).

Table 4.52 is an expectancy table for AP Human Geography, which shows the percentage of students who passed the AP exam at various PSAT score intervals.

Table 4.52
PSAT Combined Critical Reading, Math and Writing Expectancy Table for AP Human
Geography Students

| PSAT CR+M+W | N | AP Grade $\geq 3$ |
| :--- | :---: | :---: |
| Scores | 2 | $100 \%$ |
| $240-231$ | 0 | $0 \%$ |
| $230-221$ | 8 | $88 \%$ |
| $220-211$ | 16 | $94 \%$ |
| $210-201$ | 26 | $92 \%$ |
| $200-191$ | 35 | $77 \%$ |
| $190-181$ | 62 | $65 \%$ |
| $180-171$ | 91 | $48 \%$ |
| $170-161$ | 148 | $27 \%$ |
| $160-151$ | 189 | $16 \%$ |
| $150-141$ | 210 | $4 \%$ |
| $140-131$ | 203 | $2 \%$ |
| $130-121$ | 150 | $0 \%$ |
| $120-111$ | 106 | $1 \%$ |
| $110-101$ | 59 | $2 \%$ |
| $100-91$ | 27 | $0 \%$ |
| $90-81$ | 7 | $0 \%$ |
| $80-71$ | 2 | $0 \%$ |
| $70-60$ |  | 0 |

Note. N= Students taking AP Human Geography exam; AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP Human Geography; $\mathrm{CR}+\mathrm{M}+\mathrm{W}=$ Combination of Critical Reading, Math, and Writing PSAT Scaled Score.

Table 4.53 is an expectancy table for AP World History, which shows the percentage of students who passed the AP exam at various PSAT score intervals.

Table 4.53
PSAT Combined Critical Reading, Math and Writing Expectancy Table for AP World

History Students

| PSAT CR+M+W | N |  |
| :--- | :---: | :---: |
| Scores | 6 | AP Grade $\geq 3$ |
| $240-231$ | 24 | $100 \%$ |
| $230-221$ | 40 | $100 \%$ |
| $220-211$ | 66 | $98 \%$ |
| $210-201$ | 88 | $89 \%$ |
| $200-191$ | 120 | $76 \%$ |
| $190-181$ | 149 | $70 \%$ |
| $180-171$ | 203 | $47 \%$ |
| $170-161$ | 309 | $30 \%$ |
| $160-151$ | 367 | $15 \%$ |
| $150-141$ | 390 | $10 \%$ |
| $140-131$ | 351 | $4 \%$ |
| $130-121$ | 290 | $1 \%$ |
| $120-111$ | 149 | $0 \%$ |
| $110-101$ | 77 | $0 \%$ |
| $100-91$ | 29 | $0 \%$ |
| $90-81$ | 8 | $0 \%$ |
| $70-71$ | 0 | $0 \%$ |
| $70-60$ |  | $0 \%$ |

Note. N= Students taking AP World History exam; AP Grade $\geq 3=$ Percentage of students taking who scored a 3 or higher on AP World History; $\mathrm{CR}+\mathrm{M}+\mathrm{W}=$ Combination of Critical Reading, Math, and Writing PSAT Scaled Score.

## Summary of Results

Research question one asked whether there is a relationship between Stanford Achievement Test and AP exam scores. This study discovered there is a positive and statistically significant relationship between Stanford Achievement Test and AP exam scores except in AP Chinese Language exam.

Research question two asked whether there is a relationship between PSAT and AP exam scores. This study discovered there is a positive and statistically significant relationship between PSAT and AP exam scores.

In the next chapter, Chapter Five, presents the implications of the findings, limitations, suggests for further research, and the conclusions for this study.

## CHAPTER FIVE

## DISCUSSION AND CONCLUSIONS

The present study advanced the understanding of the relationship between Stanford Achievement Test, Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT), Advanced Placement (AP) exam scores. This study followed the method used in Ewing, Camara, Millsap (2006) in that they examined PSAT scores and AP exam scores using Pearson product moment correlation coefficients to test their hypothesis. Research question one involved 8,864 students in $8^{\text {th }}$ to $12^{\text {th }}$ grade, who took Stanford Achievement Test and AP exams. This population of students took 12,669 AP exams. Research question two involved 5,104 students in $8^{\text {th }}$ to $10^{\text {th }}$ grade, who took PSAT and AP exam exams. This population of students took 5,561 AP exams.

Research question one asked whether there is a relationship between Stanford Achievement Test and AP exam scores. Pearson product moment correlation coefficients were utilized for Stanford Achievement Test and AP exam scores in 21 AP exams in English, Fine Arts, Foreign Language, Math, Science, and Social Studies subjects. The Stanford Achievement Test utilized scaled scores from Reading, Math, Language, Science, and Social Studies. This study discovered there is a positive and statistically significant relationship between Stanford Achievement Test and AP exam scores except in AP Chinese Language exam.

Correlation coefficients derived from Stanford Achievement Test and AP exams ranged from low to very high. To categorize correlation coefficients as having a very high ( 80 to 1.00 ), high (. 60 to .80 ), moderate (. 40 to .60 ), low ( .20 to .40 ), and negligible
to low ( .00 to .20 ) relationship, the principal research follows the guidance provided in the book, "Practical Statistics for Educators" by Ravid (2011).

This study derived correlational coefficients between Stanford Achievement Test scaled scores in Reading, Math, Language, Science, and Social Studies and AP exams; however, in the end this study was able to focus on the strongest correlational relationship each AP exam had in common in their respective AP exam subject and Stanford Achievement Test subject. The following is a summary of those findings. In AP English subject exams, there is a high relationship in AP English Language (r=.756, $\mathrm{p}<.01$ ) and moderate relationship in AP English Literature ( $\mathrm{r}=.593, \mathrm{p}<.01$ ) related to Stanford Achievement Test Reading scaled scores. In AP Fine Arts subject exams, there is a moderate relationship in AP Art History Language $(\mathrm{r}=.537, \mathrm{p}<.01)$ and there is a moderate relationship in AP Music Theory ( $\mathrm{r}=.619, \mathrm{p}<.01$ ) related to Stanford Achievement Test Reading scaled scores.

In AP Math subject exams, there is a high relationship in AP Calculus AB ( $\mathrm{r}=.685, \mathrm{p}<.01$ ), a high relationship in AP Computer Science A $(\mathrm{r}=.661, \mathrm{p}<.01)$, and a very high relationship in AP Statistics ( $\mathrm{r}=.815, \mathrm{p}<.01$ ), related to Stanford Achievement Test Math scaled scores. In AP Science subject exams, there is a high relationship in AP Biology ( $\mathrm{r}=.713, \mathrm{p}<.01$ ), a very high relationship in AP Chemistry ( $\mathrm{r}=.840, \mathrm{p}<.01$ ), a high relationship in AP Environment Science ( $\mathrm{r}=.690$, $\mathrm{p}<.01$ ), and a very high relationship in AP Physics B ( $\mathrm{r}=.817, \mathrm{p}<.01$ ), related to Stanford Achievement Test Math scaled scores.

In AP Social Studies subject exams, there is a high relationship in AP European History ( $\mathrm{r}=.595, \mathrm{p}<.01$ ), a very high relationship in AP Human Geography ( $\mathrm{r}=.598$,
$\mathrm{p}<.01$ ), a high relationship in AP Psychology ( $\mathrm{r}=.512, \mathrm{p}<.01$ ), a high relationship in AP US Government ( $\mathrm{r}=.740, \mathrm{p}<.01$ ), a high relationship in AP US History ( $\mathrm{r}=.694, \mathrm{p}<.01$ ), and a very high relationship in World History ( $\mathrm{r}=.646, \mathrm{p}<.01$ ), related to Stanford Achievement Test Social Studies scaled scores.

In summary, Stanford Achievement Test Reading scaled score has the strongest common correlational relationship in AP English and AP Fine Arts exams. Stanford Achievement Test Math scaled scores has the strongest common correlational relationship in AP Science and AP Math exams. Stanford Achievement Test Social Studies scaled scores has the strongest common correlational relationship in AP Social Studies exams. There was no common correlational relationship between a Stanford Achievement Test subject and AP Foreign Language exams. This information can help school administrators focus their recruitment efforts for building their AP class enrollment.

Research question two asked whether there is a relationship between PSAT and AP exam scores. Pearson product moment correlation coefficients were utilized for PSAT and AP exam scores in 5 AP exams in English, Foreign Language, Science, and Social Studies subjects. The reason there were only 5 AP exams represented in question two as compared to the 21 AP exams in question one is that PSAT was only given to $8^{\text {th }}, 9^{\text {th }}$, and $10^{\text {th }}$ graders and most AP exams are given at the $11^{\text {th }}$ and $12^{\text {th }}$ grade.

This study utilized PSAT scaled scores in Critical Reading, Math, and Writing. This study discovered there is a positive and statistically significant relationship between PSAT and AP exam scores. Correlation coefficients derived from PSAT and AP exams ranged from moderate to very high. This study derived correlational coefficients
following the Ewing et al. (2006) study between PSAT scaled scores in 7 combinations, which included Critical Reading, Math, Writing, Critical Reading and Math, Critical Reading and Writing, Math and Writing, and Critical Reading, Math, and Writing PSAT scaled scores. However, in the end this study was able to focus on the strongest correlational relationship each AP exam had with one of the 7 combinations of PSAT scaled scores.

The following is a summary of those findings. There is a very high relationship in AP English Language ( $\mathrm{r}=.839, \mathrm{p}<.01$ ) related to PSAT combined scaled scores in Critical Reading and Math. There is a moderate relationship in AP Spanish Language ( $\mathrm{r}=.519$, $\mathrm{p}<.01)$ related to PSAT combined scaled scores in Critical Reading, Math, and Writing. There is a high relationship in AP Biology $(\mathrm{r}=.725, \mathrm{p}<.01)$ related to PSAT combined scaled scores in Math and Writing. There is a high relationship in AP Human Geography $(\mathrm{r}=.677, \mathrm{p}<.01)$ and AP World History $(\mathrm{r}=.725, \mathrm{p}<.01)$ related to PSAT combined scaled scores in Critical Reading, Math, and Writing.

In summary, PSAT combined scaled score in Critical Reading and Math has the strongest correlational relationship with AP English Language exam. PSAT combined scaled score in Critical Reading, Math, and Writing has the strongest correlational relationship with AP Spanish Language, AP Human Geography, and AP World History exams. PSAT combined scaled score in Math and Writing has the strongest correlational relationship with AP Biology exam.

The principal researcher used the information from answering research question one and two to create expectancy tables. The purpose of the expectancy table was meant to emulate the study conducted by Ewing et al. (2006), which shows the percentage of
students scoring 3 or higher at various exam achievement levels on the Stanford Achievement and PSAT exam. An AP exam of 3 and above is considered passing the AP exam (Dougherty, Mellor, \& Jian, 2006). The purpose of creating these expectancy tables is to recruit students in respective AP courses by using data based on students who are successful in passing the respective AP exams.

This study not only identified a positive relationship between Stanford Achievement Test scores and AP exams scores, but also created expectancy tables in Chapter 4 of this study that would prove useful to educators who are trying to recruit students to take various AP courses, because it provides the percentage of students who passed the respective AP exam at various Stanford Achievement Test score intervals and PSAT score intervals. For example, an administrator can look at Table 4.11 and select a Stanford Achievement Reading Scaled Score minimum score to focus their recruitment efforts on students who have proven to pass the AP English Language exam. If administrators want to be more inclusive in their recruitment efforts they may choose to recruit students with a minimum of Stanford Achievement Reading Scaled Score equaling 725, while only $15 \%$ of students in Stanford Achievement Reading Scaled Scores range from 725-749 passed the AP English Language Exam. If administrators wants to be more exclusive in their recruitment efforts they may choose a to recruit students with a minimum of Stanford Achievement Reading Scaled Score equaling 775, while only 86\% of students in Stanford Achievement Reading Scaled Scores range from 775-799 passed the AP English Language Exam.

## Implications of Stanford Achievement Test and AP Exam Results

This study provides evidence that there is positive and statistically significant relationship between Stanford Achievement Test and AP exam scores. This is important for two reasons, which include descriptive information for students who successfully pass AP exams and the identification of students who should be strongly encouraged to take AP courses by utilizing expectancy tables provided in Chapter 4. Until this point, only two studies have used another exam to correlate with AP exams, but in both cases PSAT scores were used to correlate to AP exams (Camara and Millsap, 1998 and Ewing et al., 2006). This study broadens the knowledge that students taking Stanford Achievement Tests have a statistically significant and positive relationship with AP exam performance.
"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" (College Board, 2012c, p. 8). With this in mind, it is appropriate to use Stanford Achievement Test scores to identify the academically prepared student for participation in AP courses given the positive relationship shown in this study. This means that Stanford Achievement Test scores can be used has an indicator for enrollment in AP courses just as PSAT exam performance is used by College Board.

In addition to identifying students for specific AP courses, the expectancy tables can also be used recruitment in taking preparatory coursework for such courses as AP Calculus. In the case of AP Calculus, students need to have taken Algebra 1 in their $8^{\text {th }}$ grade year in order to follow the prescribed sequence of taking Geometry, Algebra 2, PreCalculus, and AP Calculus their senior year. Given this information, students with
certain scores on Stanford Achievement Test Math Scaled Score could be recruited to take a math class in the summer if they didn't have the opportunity to take $8^{\text {th }}$ grade Algebra 1. Therefore, allowing more students the opportunity to take AP Calculus.

Since PSAT and AP exams are both given by College Board, an online tool by the name of AP Potential was created by College Board to use student PSAT scores and the expectancy tables created in Ewing et al. (2006) study to identify students who should recruited taking AP courses. However, in the Ewing et al. (2006) study the scaled scores used were Critical Reading, Writing, and Math along with four other combinations of these scores. The AP Potential online tool allows for a school administrator to choose the percentage of students who are likely to pass AP exams for specific AP courses, and the program generates names of students making this easy for administrators to using PSAT scores to recruit students into AP courses (College Board, 2012c).

For practical purposes, school administrators may find it difficult to look at a student's PSAT score report and combine their scores to emulate the expectancy tables in either this study or in Ewing's et al. (2006) study, which is why the AP Potential tool was created by College Board so administrators did not have to manipulate student test data to identify students to recruit for AP courses. However, since this study now broadens the current knowledge that Stanford Achievement Test scores can also be used for identification and no such online tool can be used for Stanford Achievement Test scores for identifying students to recruit in AP courses, administrators will need to actually look at a student's score report for Stanford Achievement Test results. Therefore, only one scaled score was used to create expectancy tables for Stanford Achievement Test scores, since it seems the most practical use for school administrators and the correlation
coefficients still showed strong relationships with just using one scaled score for Stanford Achievement Test.

In the case of Southwest Independent School District (SISD), currently PSAT is given to all $9^{\text {th }}$ and $10^{\text {th }}$ grade students, while Stanford Achievement Test is given to all students from Kindergarten to $8^{\text {th }}$ grade in SISD starting with the 2011-2012 school year. Therefore, the $7^{\text {th }}$ and $8^{\text {th }}$ grade test data from Stanford Achievement Test may be the most useful for identifying students for recruitment into AP courses in especially AP Human Geography since this is a $9^{\text {th }}$ grade course in SISD and PSAT data is not available for students until the $9^{\text {th }}$ and $10^{\text {th }}$ grade.

## Implications of PSAT and AP Exams Results

This study provides evidence that there is positive and statistically significant relationship between PSAT and AP exam scores as in the case of the studies by Camara and Millsap (1998) and Ewing et al. (2006). However, it's important to note that the Camara and Millsap (1998) and Ewing et al. (2006) study used single scaled scores and combined scaled scores for PSAT exam. This study emulated the Ewing et al. (2006) study, therefore using single and combined scaled scores for the PSAT exam. Although there is a positive and statistically significant relationship between PSAT and AP exam scores in this study, in most cases it is not using the same scaled score combination as in the Ewing et al. (2006) study.

The following compares findings in Ewing et al. (2006) study and this study. PSAT combined scaled score in Critical Reading and Math has the strongest correlational relationship with AP English Language exam for this study, where as in the Ewing et al.
(2006) the strongest correlational relationship was with Verbal (currently now referred to as Critical Reading) and Writing PSAT scaled scores. PSAT combined scaled score in Critical Reading, Math, and Writing has the strongest correlational relationship with AP Spanish Language, in this study, where as in the Ewing et al. (2006) study they did not identify a statistically significant or strong correlational relationship with any PSAT single scaled score or combined scaled score. PSAT combined scaled score in Critical Reading, Math, and Writing has the strongest correlational relationship with AP Human Geography, in this study, which is the same as in Ewing et al. (2006) study. PSAT combined scaled score in Critical Reading, Math, and Writing has the strongest correlational relationship with AP World History exams in this study, which is very nearly the same as in Ewing et al. (2006). PSAT combined scaled score in Math and Writing has the strongest correlational relationship with AP Biology exam in this study, where as in the Ewing et al. (2006) the strongest correlational relationship was with Verbal (currently now referred to as Critical Reading) and Math PSAT scaled scores. Of course, this study and the Ewing et al. (2006) utilized different population of students, which explains the difference in the specific findings.

This study followed the methods used in the Ewing et al. (2006) study and conducted analysis using single scaled and combined scaled PSAT scores. However, when using only one single scaled scores of Critical Reading, Math, and Writing, the strongest correlational relationship is the same in this study as in the Ewing et al. (2006) study. PSAT Critical Reading scaled score has the strongest correlational relationship with AP exam performance for AP English Language, AP Human Geography, and AP World History for both this study and the Ewing et al. (2006) study. PSAT Math scaled
score has the strongest correlational relationship with AP exam performance for AP Biology for both this study and the Ewing et al. (2006) study. Keeping this in mind, both this study and the Ewing et al. (2006) arrived at the same conclusion when using single scaled PSAT scores; therefore, supporting the usage of a single scaled score from PSAT exam performance. In addition, using a single scaled PSAT score may prove to be more useful for school administrators to look immediately at a student's PSAT scaled score and identify which AP course to recommend and place the student instead of relying solely on the AP Potential tool.

## Limitations

For research question one, this study did not have adequate representation of $12^{\text {th }}$ grade students present in this study because SISD did to give $12^{\text {th }}$ grade students the Stanford Achievement Test in the 2010-2011 school year. Not having $12^{\text {th }}$ grade student representation meant that AP exams traditionally taken by $12^{\text {th }}$ grade students including AP Calculus BC, AP Macroeconomics, AP Microeconomics, AP Comparative Government, and AP Physics C could not be analyzed in this study. This leaves a weakness in this study.

For research question two, this study did not have adequate representation of $11^{\text {th }}$ and $12^{\text {th }}$ grade students present in this study because SISD did to give $11^{\text {th }}$ and $12^{\text {th }}$ grade students the PSAT in the 2010-2011 school year. Not having $11^{\text {th }}$ and $12^{\text {th }}$ grade student representation meant that AP exams traditionally taken by $11^{\text {th }}$ and $12^{\text {th }}$ grade students including AP Art History, AP Calculus, AP Chemistry, AP Computer Science, AP English Literature, AP environmental Science, AP European History, AP Comparative

Government, AP US Government, AP Macroeconomics, AP Microeconomics, AP Physics, AP Psychology, AP Statistics, and AP US History could not be analyzed in this study. This is another weakness in this study.

For both research question one and two, this study utilized one school districts data, which included a majority of students from a disadvantaged background from an urban school district. Therefore, the findings in this study may only be generalizable to these types of students.

## Suggestions for Further Research

For research question one, Stanford Achievement Test scores were not available for most $12^{\text {th }}$ grade students, since they didn't take that exam in the 2010-2011 school year. Therefore, further research would be to gather student Stanford Achievement Test data for their $11^{\text {th }}$ grade year alongside $12^{\text {th }}$ AP exam performance for the same group of students. For research question two, PSAT scores were not available for most $11^{\text {th }}$ and $12^{\text {th }}$ grade students since they didn't take that exam in the 2010-2011 school year. Therefore, further research would be to gather student PSAT test data for their $10^{\text {th }}$ grade year alongside $11^{\text {th }}$ and $12^{\text {th }}$ AP exam performance for the same group of students. Both of these suggestions would allow for analysis of the before mentioned AP exams not included in this study.

Taking into consideration that Stanford Achievement Test scaled scores system does not have to be restricted to a grade level, in theory a student taking Stanford Achievement Test from $7^{\text {th }}$ or $8^{\text {th }}$ grade can have their test data reflect their expected performance on an AP exam at the $10^{\text {th }}$ or $11^{\text {th }}$ grade level. However, to reaffirm this
notion it would be beneficial to conduct another study utilizing $8^{\text {th }}$ grade Stanford Achievement Test scores alongside performance on AP exams in the $9^{\text {th }}, 10^{\text {th }}, 11^{\text {th }}$, and $12^{\text {th }}$ grade for the same group of students.

Stanford Achievement Test scores was utilized for this study, but other exams such as Iowa Tests of Basic Skills or state assessments can be used to correlate to AP exams and determine if there is a relationship.

## Conclusion

This study discovered there is a positive and statistically significant relationship between Stanford Achievement Test and AP exam scores as well as PSAT and AP exam scores. This study's findings provide practical information for identifying students who should be encouraged to take AP courses. Given the relationship between taking AP courses, passing AP exams, and college degree attainment, it is imperative to identify more students, who are willing and academically able to take challenging high school coursework. A school administrator can use the information in this study to recruit for AP courses ultimately improving the quality of their AP program and giving an opportunity to students who would not have otherwise taken college preparatory coursework. However, careful consideration should be taken to not use Stanford Achievement Test scores or PSAT scores as barriers to students willing to take the challenge of partaking in AP coursework. Although the expectancy tables in this study show the percentage of students passing AP exams at various PSAT and Stanford Achievement Test scores intervals, it is amazing to see students scoring lower on these assessments but still pass an AP exam. It is these outliers that mean administrators should not turn away a willing
student who would like to take an AP course even though their Stanford Achievement
Test and/or PSAT score suggest that they do not have a strong indication of passing the AP exam, because human will can not be ruled out of the equation.

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## APPENDIX A

## Letter of Approval from Houston Independent School District



HOUSTON INDEPENDENT SCHOOL DISTRICT
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Clara Cantu
2608 Museum Way \#3203
Forth Worth, TX 76107
Dear Ms. Cantu,
The Houston Independent School District (HISD) is pleased to approve the research study titled "Analyzing Trends in Student Performance on the Stanford Achievement Test, Preliminary Scholastic Aptitude Test (PSAT)/National Merit Scholarship Qualifying Test, and Advanced Placement Exams." The purpose of this research is to explore the relationships between student achievement and performance on college entrance exams and advanced placement exams. This study is being conducted for the partial fulfillment of a graduate dissertation at the University of Houston. The project will commence in May of 2012 and the projected date of completion is May of 2013.

Approval of this data request is granted with following conditions:

- The investigator is requesting the demographic and testing data of approximately 12,252 students in HISD, who took 21, 357 Advanced Placement (AP) tests in May 2011.
- The student demographic data will include race, ethnicity, free and/or reduced lunch status, and grade level. Due to FERPA laws, the HISD Research Department will not release any student personal identifiable data.
- The researcher is requesting the 2011 AP student exam score and the respective AP examination name, as well as the 2009 and/or 2010 PSAT student raw and scaled scores in mathematics, writing, and critical reading.
- The request will include the tests results (raw score and scaled score) from 2010-2011 on the Stanford Achievement Test on the reading, mathematics, language, environmental science, and social science subtests.
- The investigator will follow the guidelines of HISD and the University of Houston's Committee for the Protection of Human Subjects regarding confidentiality. While the Institutional Review Board (IRB) of the university is responsible for oversight of the study, the HISD Department of Research and Accountability will also monitor the study to ensure compliance to ethical conduct guidelines established by the Department of Health and Human Services, Office for Human Research Protection (OHRP) as well as the disclosure of student records outlined in Family Educational Rights and Privacy Act (FERPA).
- Given that the HISD Department of Research and Accountability will be extracting data, a fee will be charged for this request.
- In order to eliminate potential risks to populations under investigation, the reporting of proposed changes in research activities must be promptly submitted to the HISD Department of Research and Accountability for approval prior to implementing changes. Non-compliance to this guideline could impact the approval of future research studies in HISD.
- The final report must be submitted to the HISD Department of Research and Accountability within 30 days of completion.

Should you need additional information or have questions concerning the process, please call (713) 556-6700.


CS: kt
cc: Michele Pola
Alicia Thomas
Arnold Viramontes
June Giddings

## APPENDIX B

# IRB Approval Letter from UH Human Subjects Committee 

# UNIVERSITY of HOUSTON <br> DIVISION OF RESEARCH 

May 23, 2012

Ms. Clara Cantu<br>c/o Dr. Lilia Ruban<br>Curriculum and Instruction<br>Dear Ms. Clara Cantu,

Based upon your request for exempt status, an administrative review of your research proposal entitled "Analyzing Trends in Student Performance on the Stanford Achievement Test, Preliminary SAT/National Merit Scholarship Qualifying Test, and Advanced Placement Exams" was conducted on May 9, 2012.

At that time, your request for exemption under Category 4 was approved pending modification of your proposed procedures/documents.

The changes you have made adequately respond to the identified contingencies. As long as you continue using procedures described in this project, you do not have to reapply for review. *Any modification of this approved protocol will require review and further approval. Please contact me to ascertain the appropriate mechanism.

If you have any questions, please contact Alicia Vargas at (713) 743-9215.
Sincerely yours,

## Queombecend

Kirstin Rochford, MPH, CIP, CPIA
Director, Research Compliance
*Approvals for exempt protocols will be valid for 5 years beyond the approval date. Approval for this project will expire May 1,2017. If the project is completed prior to this date, a final report should be filed to close the protocol. If the project will continue after this date, you will need to reapply for approval if you wish to avoid an interruption of your data collection.

Protocol Number: 12421-EX

