

THE EFFECT OF ADVANCED PLACEMENT OR INTERNATIONAL BACCALAUREATE
EXAM SCORES UPON COLLEGE GPA AND COLLEGE CHOICE

by

Daniel Raymond Farmer

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

Liberty University

2017

THE EFFECT OF ADVANCED PLACEMENT OR INTERNATIONAL BACCALAUREATE
EXAM SCORES UPON COLLEGE GPA AND COLLEGE ENROLLMENT

by

Daniel Raymond Farmer

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

Liberty University, Lynchburg, VA

2017

APPROVED BY:

Christie McClendon, Ph.D., Committee Chair

Jonathan Burton, Ed.D., Committee Member

Paul Gallagher, Ph.D., Committee Member

ABSTRACT

This quantitative, causal-comparative and correlational study analyzed students' academic performance in college based on whether the student was classified as an International Baccalaureate student, an Advanced Placement student, or a non-accelerated student (those who did not participate in IB or AP) and how that choice of academic program affected the type of college a student chose. The study used data obtained from Florida's Education Data Warehouse (EDW). A stratified sample of 10,006 students was used to analyze college GPA performance and survey responses from 128,223 students were analyzed to determine effect on college choice. The college grade point averages (GPAs) of all Florida public school students who graduated in 2006 and who attended a Florida public university were analyzed by students' gender, ethnicity, income status, and high school curriculum: AP, IB, or non-accelerated. Whether students chose to attend college and whether they initially chose a 2-year or 4-year college was also analyzed by academic curriculum. Correlation results from various ANOVAs and multiple and logistic regression models indicated that IB students had statistically significantly higher college GPAs than AP students whose GPAs, in turn, were statistically higher than students who participated in neither program. Gender and income status were found to have little influence on college GPAs, while ethnicity and academic program had the largest impact. Taking and passing eight AP courses was found to have the same effect upon a student's college GPA as having achieved the IB Diploma. In this study, IB students had higher odds to attend college and select a 4-year university compared to AP students who were more likely to initially attend a 2-year college. More research comparing the programs is recommended.

Keywords: Accelerated Secondary Curriculum, Advanced Placement, International Baccalaureate, College Success, GPA, College Choice, College Selection

Acknowledgement

God is good all the time. I thank Him for His Grace for seeing this project to its completion through all its twists and turns, ups and downs, disappointments and joys. I rejoicingly affirm with the Apostle Paul that “He who began a good work in [me] will carry it on to completion until the day of Christ Jesus” (Phil 1:6).

I wish to thank Dr. Christie McClendon for her unwavering support over the past seven years. She patiently encouraged me with her emails, read and promptly deleted my whining missives venting my frustrations, accepted my apologies after periods of inactivity, and goaded me into finishing and polishing this dissertation. In our online world, she is undoubtedly the most influential person with whom I have communicated so often but never met in person. I also appreciate the encouraging and critical comments of Drs. Jonathon Burton and Paul Gallagher. They have both strengthened the quality of this research by challenging me to both widen, and at times narrow, my ambitions, perspective, and statistical analysis.

My deepest thanks also extend to my colleagues at Winter Park High School whose thoughtful interchanges challenge me to always think deeper and wider; to my colleagues at the Florida League of IB Schools who inspired me to empirically validate what we’ve always known; to Jane York, my statistician who made this all possible, and Don Worcester, who confirmed my statistical research plan; and to my many friends at the First Baptist Churches of Orlando, St. Cloud, and Winter Park who have prayed on my behalf over so many years.

Finally, I both commend and thank my wife, MarthaKay, for her endurance, her encouragement, her sacrifice, and her love. This would not have happened had you not pushed me onward. For my daughter, Hannah-Catherine, I hope my research will help you one day make the best choice when it comes time to choose whether you will pursue AP or IB.

Table of Contents

ABSTRACT.....	3
Acknowledgement	4
List of Tables	7
List of Figures.....	9
List of Abbreviations	10
CHAPTER ONE: INTRODUCTION.....	11
Overview.....	11
Background.....	11
Problem Statement.....	19
Purpose Statement.....	20
Significance of the Study.....	21
Research Questions.....	22
Null Hypotheses.....	22
Definitions.....	23
CHAPTER TWO: LITERATURE REVIEW	25
Overview.....	25
Theoretical Framework.....	27
Related Literature.....	31
Summary.....	47
CHAPTER THREE: METHODS	50
Overview.....	50
Design.....	51

Research Questions 52

Null Hypotheses 53

Participants and Setting 53

Instrumentation 56

Procedures 59

Data Analysis 59

CHAPTER FOUR: FINDINGS 64

 Overview 64

 Research Questions 64

 Null Hypotheses 65

 Descriptive Statistics 65

 Results 67

 Additional Analysis 82

 Summary 86

CHAPTER FIVE: CONCLUSIONS 87

 Overview 87

 Discussion 87

 Implications 97

 Limitations 100

 Recommendations for Further Research 101

REFERENCES 103

List of Tables

Table 1. Descriptive Statistics for Each Research Question	66
Table 2. Number of Students Responding to a Survey of Plans Upon High School Graduation Sorted by the Secondary Academic Curriculum They Completed	67
Table 3. Descriptive Statistics for College GPAs by Academic Curriculum	68
Table 4. ANOVA Results Comparing College GPA (DV) vs. Academic Curriculum (IV)	69
Table 5. Results of Games-Howell Post hoc Test of the Comparisons of GPA Means Between Academic Curriculums	70
Table 6. Predictors of College GPA, Model 1	71
Table 7. Predictors of College GPA, Model 2	72
Table 8. Predictors of College GPA, Model 3	73
Table 9. Descriptive Statistics: Number of Students in each Academic Program by Ethnicity .	74
Table 10. Games-Howell post-hoc Comparisons Among Caucasians by Academic Curriculum	74
Table 11. Games-Howell post-hoc Comparisons Among Hispanics by Academic Curriculum .	75
Table 12. Games-Howell post-hoc Comparisons Among Native Americans/Mixed/No Response by Academic Curriculum	76
Table 13. Games-Howell post-hoc Comparisons among African American Students by Academic Curriculum	77
Table 14. Games-Howell post-hoc Comparisons among Asian Students by Academic Curriculum	77
Table 15. Results of Logistic Regression Showing Odds of Accelerated Students Attending College Versus Non-Accelerated Students	79
Table 16. Results of Logistic Regression Showing Odds of Accelerated Students Attending a 4- Year College Versus Non-Accelerated Students	80
Table 17. Results of Logistic Regression Showing Odds of IB Students Attending College Versus AP Students.....	81
Table 18. Results of Logistic Regression Showing Odds of IB Students Attending a 4-Year College Versus AP Students	81

Table 19. Mean College GPAs of All Students Taking an AP or IB Exam	83
Table 20. Results of post-hoc Bonferroni Tests Comparing Mean Differences of College GPAs of Students with IB Diploma Scores and Multiple AP Exams	85

List of Figures

- Figure 1. A simplified model of how self-efficacy, outcome expectations, and goals contribute to performance outcomes according to social cognitive career theory.....28
- Figure 2. A model of how social cognitive career theory can explain a student's choice and motivation to complete the IB program or AP coursework in high school30
- Figure 3. GPAs of AP and IB students by number of AP exams taken or by IB Diploma points.82

List of Abbreviations

Advanced Placement (AP)

Florida Educational Data Warehouse (EDW)

Grade Point Average (GPA)

International Baccalaureate (IB)

Institutional Review Board (IRB)

Statistical Package for the Social Sciences (SPSS)

CHAPTER ONE: INTRODUCTION

Overview

This study contributed to the body of evidence that evaluates the effect of student participation in either Advanced Placement courses or the International Baccalaureate program upon college success as measured by student grade point average (GPA) in college. This chapter includes a discussion of the background of the problem, the problem statement, purpose statement and research questions. The chapter concludes with important definitions.

Background

For the past 60 years, reform has been the hallmark of the American educational system. A deep desire to improve educational quality and enhance academic achievement characterizes the sweeping changes that have been enacted by various progressive pieces of legislation over the past half century. In the past decade, however, the defining themes of public education have focused on higher standards and more accountability. This emphasis on increased curricular rigor and data-driven measurements has promoted a culture of high-stakes testing that was ultimately codified in the bipartisan passage of the No Child Left Behind Act (Jacobs, 2009; Zhao, 2009).

To meet the demands for a more rigorous curriculum, many high school leaders have opted to implement a greater number of Advanced Placement (AP) courses and International Baccalaureate (IB) programs in their schools. These two curricular options offer the cognitive benefits of college-level rigor, the accountability of end-of-course exams, and the accelerated opportunity of earning college credit for students' secondary coursework (WICHE, 2006). Thus, the number of AP and IB programs at American high schools has seen a dramatic rise over the past 10 years (College Board, 2010b; International Baccalaureate Organization, 2010c). Even

with the proliferation of such popular programs, the research literature reveals a lack of empirical studies that effectively compare the long-term efficacy of AP and IB programs once students enter postsecondary education.

Within the literature, the effectiveness of secondary college preparatory courses is largely measured by how well students achieve in terms of *access* to college, *persistence* in continuing their education in college from year to year, and *performance* in their college coursework as indicated by their GPAs (Adelman, 1999, 2006; Bailey & Karp, 2003; Karp, Calcagno, Hughes, Jeong, & Bailey 2007; Lerner & Brand, 2006; WICHE, 2006). The research decidedly indicates that the curriculum in which a student is engaged during the course of his or her high school career is the greatest single factor in determining whether he or she will continue on to complete a college degree (Adelman, 1999, 2006). Bailey and Karp (2003) identified three types of accelerated curricula that give students access to college-level rigor: singleton programs (e.g. AP courses), comprehensive programs (e.g. IB, technology preparatory), and enhanced comprehensive programs. In a meta-analysis of early studies evaluating these three types of curricula, the authors found that the outcomes were generally positive, demonstrating that those students enrolled in credit-based transition programs were more apt to graduate from high school, attend college, and have higher college GPAs than those students who did not take such high school courses (Bailey & Karp, 2003). The available research, however, was limited in the number of quantitative studies, most of which did not account for student achievement prior to completing accelerated learning options.

The Advanced Placement Program is operated by the College Board, a not-for-profit, educational association. Each of the College Board's 33 AP courses is designed to be taught on a college level of instruction and assessed by an end-of-course exam that is a mix of multiple-

choice and free-response questions. Each exam is scored on a scale of 1-5 (5=highest score, 1=lowest score) with “3” considered passing by most universities (College Board, 2010a). Every high school determines which, if any, AP courses it will offer and then sets its own policy for determining which students are eligible for taking AP courses. Many states do not financially contribute to paying for students to take individual AP exams. In Florida, however, the state pays for any student to take an AP exam in order to offer every student an equal opportunity to enroll in an accelerated curriculum.

Unlike the Advanced Placement program, which has been entrenched in the American education system for 50 years and has been the subject of many studies, the International Baccalaureate program is a relatively recent phenomenon to American schools (Nugent & Karnes, 2002). Based in Geneva, Switzerland, the International Baccalaureate Organization requires every school that offers the IB program to complete an extensive authorization process. Unlike the AP program that allows a student to choose as many or as few courses from the various AP course offerings that a school provides, the IB program is designed for students to take an integrated curriculum of six subjects over a period of two years in addition to completing an Extended Essay, the Theory of Knowledge course, and a Creative, Action, and Service (CAS) component in order to qualify for an IB Diploma. Each subject consists of a series of assessments and exams that are graded internally by the school-based teacher and externally by an IB examiner, all of which contribute a percentage to the total subject score (International Baccalaureate Organization, 2010b).

Both Advanced Placement courses and the International Baccalaureate program have been adopted by school districts across the country in an effort to broaden the range of schools' curricular offerings. Two large urban school districts, Chicago Public Schools and Denver

Public Schools, completed exhaustive reviews of the accelerated learning programs that were available to their students (Buckley & Muraskin, 2009; Roderick, Nagaoka, Coca & Moeller, 2009). While Chicago found that its AP and IB programs reflected the ethnic and economic diversity of its schools (Roderick et al., 2009), Denver discovered that its IB programs were dominated by white, non-low-income students while their AP and dual enrollment courses were populated by Hispanic and low-income students (Buckley & Muraskin, 2009). While examining any discrepancies in ethnic and socioeconomic diversity, both districts determined that many of their qualified graduates were either not enrolling in college at all or were not choosing to attend selective or highly-selective universities to which they were capable of being admitted. These issues of college access thus became the focus of the districts' improvement plans rather than further investigating how their accelerated academic graduates performed once they arrived at the university.

For several decades, a standard college admission practice has been to weight the grades of AP and IB courses in the admission formulas based on the assumption that better qualified candidates take more academically rigorous courses. In a surprising reversal of popular opinion, Geiser and Santelices (2004) found that the total number of AP courses that a student takes is actually a poor predictor of college success. Only the actual AP exam score, the indicator of a student's actual academic performance, is an excellent predictor of college performance, not the number of AP courses a student completed (Geiser & Santelices, 2004).

The same is true of dual enrollment courses. For this study, dual enrollment courses will be defined as college-level courses for which students can receive both high school and college credit (Bailey & Karp, 2003; Karp, et al., 2007; Kleiner & Lewis, 2005). They are generally taught either on a community college campus by a college professor, or on the high school

campus by a high school teacher serving as an adjunct college professor. Students taking such courses are usually referred to as dual enrollment students. Researchers working with data from students in Florida determined that dual enrollment students were more likely to graduate from high school, to enroll in community colleges, and to have higher GPAs than those students who did not take dual enrollment courses (Karp et al., 2007). These effects, however, were not amplified by the number of dual enrollment courses a student took (Karp et al., 2007). For example, a student's college GPA was not higher simply because he took more dual enrollment classes than other students. Participation intensity, which the researchers defined as “the number of dual enrollment courses taken” (Karp et al., 2007, p. 31), had little impact on short term outcomes such as whether the students were more likely to enroll in a 4-year college, continue their status as a full-time student, or persist to complete a second term.

While the number of AP courses a student takes may not be a good predictor of how successfully the student will perform in college, there are studies that have indicated positive outcomes in college performance associated with the AP exam scores themselves (Hargrove, Godin, & Dodd, 2008; Mattern, Shaw, & Xiong, 2009; Murphy & Dodd, 2009; Patterson, Packman, & Kobrin, 2011). Three studies financed and published by the College Board examined large national samples that disaggregated AP scores by subject area and compared them against the college performance of non-AP test takers. The results of these three studies identified not only the improved academic performance in college as defined by GPA, but also students' persistence and graduation rates. In each case, the AP student was found to outperform the non-AP or dual enrollment student in first-year college GPA, retention, and college selectivity (Mattern et al., 2009); the number of freshmen credit hours taken and subject specific GPA (Murphy & Dodd, 2009); and cumulative 4-year GPA and 4-year graduation rates

(Hargrove et al., 2008). Patterson et al. (2011) essentially confirmed these results in their recent nation-wide study using 128,000 students across 110 colleges that also analyzed how well AP students performed against their non-AP peers in nine subject areas. AP students who scored a 3 or better on the AP exam outperformed the non-AP students in seven out of nine subject areas, failing only in the areas of art/music and computer science, two exams with some of the smallest number of exam takers (Patterson et al., 2011).

Some other studies, however, have questioned the purported rigor of Advanced Placement courses (Dougherty, Mellor, & Jian, 2006a; Sadler & Tai, 2007). Sadler and Tai (2007) reviewed AP science students' scores in introductory college science courses. Few of the students' grades matched what their AP scores predicted they would achieve, and that was after having effectively taken the course twice (once as an AP course and once in college)! Dougherty, Mellor, and Jian (2006a) pointed out that districts and administrators who are placing unqualified students into AP courses in hopes that curricular rigor will increase low-performing students' abilities and attitudes are actually diluting the rigor for qualified students and frustrating those academically misplaced students even further. Although College Board has published the results of an extensive survey of its AP teachers indicating that the AP teachers themselves do not feel as though they have watered down the curriculum (Farkas & Duffett, 2009), the College Board has recently initiated the broadest redesign of its curriculum in the past 25 years (Drew, 2011) to address critical issues that have developed from its tremendous growth.

Another study by Klopfenstein and Thomas (2009) evaluated the contribution of both AP and non-AP coursework to a student's college GPA and found that after using multiple regression models, taking an AP course had no "causal impact on early college success" (p. 887). Instead, the researchers suggested that any predictive effect on college success that simply taking

an AP course may afford may actually be the result of “signaling,” which they define as the strategy by which “high ability, motivated students take more AP to differentiate themselves from other students in the college application process” (Kopfenstein & Thomas, 2009, p. 887).

Preliminary studies that investigated the success of IB students in college were originally few and limited in scope and were largely relegated to surveys of student perceptions regarding their experience in the IB program (Culross & Tarver, 2007; Foust, Hertberg-Davis, & Callahan, 2009; Shaunessy & Suldo, 2010; Shauness, Suldo, Hardesty, & Shaffer, 2006; Taylor & Porath, 2006). The International Baccalaureate Organization, however, in conjunction with other researchers, is beginning to address this lack of empirical research. Conley and Ward (2009) completed a study that compared the IB standards in English, math, chemistry, physics, biology, Theory of Knowledge, and the extended essay to the widely-accepted Knowledge and Skills for University Success (KSUS) standards which measure college readiness. Results of the study indicated English and math standards were very highly aligned and the chemistry and biology standards were completely aligned, indicating that the IB program, in terms of the language of academic standards, is designed to prepare students to meet the rigorous challenges of college education (Conley & Ward, 2009).

In terms of performance, the impact of advanced high school coursework on college GPA was examined in a large study comparing IB students in the University of California system with those students who did not take any accelerated courses (International Baccalaureate Organization, 2010a). The study indicated that IB students achieve higher college GPAs than like-compared cohorts or non-accelerated students. In addition, the research showed that up to 34% of the variance of factors that contributed to an IB student’s college GPA can be attributed to successful completion of an IB Diploma (International Baccalaureate Organization, 2010a).

An extensive study of the performance of IB students at the University of British Columbia analyzed the performance of students during their first year of college. IB students that achieve a range of 27-30 IB Diploma points perform the same as straight-A students out of Canadian public high schools (Bluhm, 2011). In fact, Dr. Martha Piper, former president of UBC stated that "in their first year, IB students' marks were 12 to 13 percent above the average. But even more impressive were the students who had accepted first-year credit and gone straight into the second year. They were still scoring from 7 to 12 percent above average. They were outperforming students who had already spent a year at university" (IBO, 2006).

More recently, researchers investigated IB Diploma Candidates and a matched group of non-IB students at the University of Oregon's Honors College (Conley, McGaughy, Davis-Molin, Farkas & Fukuda, 2014). While there was a statistically significant difference between the two groups on the mathematics exam used for initial placement when controlled for gender and race with IB students scoring higher, researchers found that there was not any statistically significant difference in GPA scores upon graduation. Caspary and Bland (2011) looked at the success IB students had in their first college courses that matched the subjects of their IB exams at the University of Florida, which has the highest raw number of IB graduates than any other university in the world. Results indicated that students who performed best on their IB exams (scoring a 6 or 7) also performed better in college courses and took more advanced courses than did those students who scored lower on their IB exams.

Other IB studies have focused on the enrollment rates of IB students compared to non-IB students. Caspary (2011) found that nationally, IB students have a higher college enrollment rate than that of the national average and that most IB students choose to attend 4-year universities rather than 2-year colleges. Also, the majority of IB students go on to enroll in selective or more

selective universities compared with their non-IB peers. Other studies have confirmed this data (Halic, 2013; Bergeron, 2015) with some samples of students reflecting a 95% enrollment rate of IB students in 4-year universities immediately upon graduation from high school compared to a national average of only 60% (Bergeron, 2015). A report released from the United Kingdom in 2016 (Higher Education Statistics Agency, 2016) compared IB students to a matched set of A level students. The findings indicated that IB students were more likely to attend a top 20 university in Britain compared to A level students. They were also significantly more likely to graduate with a first-class honors or second-class honors than A level students.

Although the number of studies validating the success of the IB program in terms of college performance is growing, there are no studies that directly compare the success of IB and AP students within the same university environments. While these studies strongly suggest a link between accelerated high school coursework, college GPA performance, and college enrollment, this dissertation seeks to bridge the gap in the literature by directly comparing the success of students from both accelerated programs within the same university system.

Problem Statement

College preparatory programs are designed to help increase student access to, performance in, and persistence through postsecondary education. Millions of federal, state, and local dollars are being spent to increase the rigor of the high school curriculum by implementing AP and IB programs and students and their families often have to pay additional costs to participate in these programs. If funds are limited, which program is the most effective? Can the expenditures on such programs actually achieve their objectives and directly benefit students in their next level of education? The problem is that research has not revealed to what degree accelerated academic curricula, specifically AP or IB courses that students complete in high

school, substantially impact students' performance at the university level as measured by grade point average and if any statistically significant difference exists between these two popular accelerated programs (Adelman, 1999, 2006; International Baccalaureate Organization, 2010a; Karp et al. 2007; Sadler & Tai, 2007). Not only is it unknown whether there is any difference between these two programs' effects on GPA, but is there any evident effect on a student's initial choice of college or the type of college he or she chooses to attend?

Purpose Statement

The purpose of this quantitative, causal-comparative study was to investigate the difference in college success as measured by college GPA contributed by completing Advanced Placement or International Baccalaureate exams. The researcher sought to determine if college performance can be predicted by analyzing a student's performance on an AP or IB exam as compared to students who did not participate in either program. It also explored whether a student's curricular program influences his or her choice to attend a 2-year or 4-year college. By exploring these questions, the effectiveness of the Advanced Placement and International Baccalaureate programs as college preparatory curriculums can be compared, giving more empirical evidence to help educators, parents, and policy makers appraise the value these programs provide students academically. The independent variable (IV) was a high school student's choice of academic program, whether Advanced Placement, International Baccalaureate, or non-accelerated courses. The dependent variables (DV) were student's cumulative grade point average (GPA) in college, and whether they attended college, and whether was is a 4-year or 2-year college. Covariates included gender, ethnicity, and income level.

Significance of the Study

Educators teach in the present for future results. They often, however, are unaware of how effectively their instruction prepares students for future coursework or higher levels of education. By evaluating the long-range achievement of high school students' success in college, high school teachers can be encouraged in the lasting significance of their work.

College Board and the International Baccalaureate Organisation have both conducted numerous large-scale studies that analyze the academic effectiveness of their respective individual programs (Hargrove, et al., 2008; Patterson et al., 2011; Zhang, 2011; International Baccalaureate Organization, 2010a, Bluhm, 2011, Caspary & Bland, 2011). Yet no recent study directly compares the college performance of AP students directly to IB students. In a closely related study, researchers used student data from the University of Oregon Honors College to compare cumulative college GPAs of IB students to a matched group of non-IB students, a group that while containing many AP students was not filtered solely for students who took an AP exam (Conley et al., 2014). This study sought to directly analyze the difference in how effectively the AP and IB curricula prepare students for college success as determined by resulting college GPAs. It compared the academic success of AP students to IB students to non-accelerated students in a similar university system in order to determine whether differences existed between accelerated curriculum options. The study attempted to isolate and compare the percentage of variance that each program contributed to a student's college GPA to determine the size of the academic impact each program had on students' future academic success. Additionally, it revealed that accelerated students are more likely to attend college than non-accelerated students and compared whether IB or AP students are more likely to attend 4-year universities versus 2-year colleges within the same university system. By exploring the level of

contribution these programs made towards students' success in college, educational leaders, parents, and students can better evaluate the value these academically rigorous programs provide students. This understanding then helps policy makers arrive at informed decisions regarding the fiscal allocations these programs receive from federal, state, and local funds while aiding students and their families to evaluate whether their choice to pursue the AP or IB program is worth the time and effort.

Research Questions

This study investigated the following questions:

RQ1. Does a significant difference in the cumulative college GPA exist between students who took AP exams, students who took IB exams, and students who did not take any AP or IB exams?

RQ2. To what extent, if any, do gender, ethnicity, lunch status, and mean scores on the AP exams and the IB Diploma score predict a student's cumulative college GPA?

RQ3. What difference, if any, is there in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took an accelerated exam (AP or IB) and students who took no accelerated exams?

RQ4. What difference, if any, is there in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took AP exams and students who took IB exams?

Null Hypotheses

H₀₁: No statistically significant difference exists between the means of the cumulative college GPAs of those students who took AP exams, IB exams, or neither AP nor IB exams.

H₀₂: Gender, ethnicity, lunch status, and mean scores on the AP exams and the IB Diploma score do not predict a student's cumulative college GPA.

H₀₃: There will not be a significant difference in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution between students who took accelerated exams (AP or IB) and students who took no accelerated exams.

H₀₄: There will not be a significant difference in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took AP exams and students who took IB exams.

Definitions

1. *AP Scores*: Subject specific exams scaled from 1-5 (5=highest score, 1=lowest score) with 3 considered passing (College Board, 2004).
2. *Grade Point Average (GPA)*: The average number of grade points per semester hour attempted. It is calculated on a 4.0 scale and computed by dividing the total number of grade points assigned by the total number of semester hours attempted, less hours resulting from No Credit, Withdrawal, Withdrawal Passing, and Incomplete grades (University of Central Florida, 2005).
3. *IB Diploma*: Awarded if a student completes an Extended Essay, documented Creativity, Action, Service (CAS) hours, and assessments in six subject areas and the Theory of Knowledge. A student must earn a minimum of 24 points out of 45 possible points to earn an IB Diploma (International Baccalaureate Organization, 2010b).
4. *IB Subject Scores*: A collection of assessments that contribute a percentage toward a single subject score scaled from 1-7 (7=highest score, 1=lowest score) with 4 considered passing (International Baccalaureate Organization, 2010b).

5. *Income Level*: Students are either classified as meeting or not meeting the federal government guidelines for Free or Reduced Lunch, based on certain household income levels (National School Lunch Act, 2001).
6. *Non-accelerated*: A term used in this study to indicate all students who were not specifically enrolled in either AP or IB courses and did not take AP or IB exams at any time during high school.
7. *State College*: Another term used specifically in Florida for 2-year community colleges. Florida's system of community colleges allows schools to use the term "state" in their name if the institution awards a 4-year bachelor's degree in at least one program area. Most of Florida's "state" colleges only offer a very limited number of bachelor's degree programs.

CHAPTER TWO: LITERATURE REVIEW

Overview

The past 10 years have seen an age of accountability come to dominate the language, policies, and instructional practices of the American educational system. Alongside the clamor for increased accountability on all levels of education is a concerted push for greater rigor within the curriculum (Jacobs, 2009; Zhao, 2009). This public drive to increase rigor has resulted in not only more accelerated learning options for bright, academically talented students, but also increased attention to developing the college readiness skills of all students preparing to venture onto higher education. The dramatic growth in credit-based transition programs such as Advanced Placement (AP), dual enrollment courses, International Baccalaureate (IB), Advanced International Certificate of Education (AICE), and technology preparatory programs (College Board, 2010b; International Baccalaureate Organization, 2010c) all attest to both the academic need and the popular desire for accelerated mechanisms for secondary students to earn college credit while increasing the level of rigor of their coursework. Yet, in the rush of administrators, school districts, and legislative bodies to approve funding for such programs as AP and IB, the need for empirical evidence to support the effectiveness of these programs still exists.

An examination of the available supporting evidence will begin with the presupposition that regardless of how many federal, state, and district mandates may be issued to improve the quality of instruction and increase enrollment in academically rigorous courses, a large measure of the success of these initiatives lies with individual students' motivation, interest, and ability to complete rigorous coursework. Thus, the theoretical foundation of improving college performance by offering accelerated secondary school coursework can be explained through a review of social cognitive career theory which explains why individual students would choose to

take accelerated courses and how that decision affects their performance (Lent, Hackett, & Brown, 2008). This practical explanation of predicting individual performance outcomes presents a unified framework upon which to build a robust picture of the many variables that affect academic achievement.

The literature review will begin with early examinations of the effect of AP and dual enrollment courses on college success. Moving from studies of participation (i.e. simply taking an AP course) to performance (i.e. the quality of the exam score), existing research will be examined that analyzes the link between high school scores and college GPAs. Although the available research on the International Baccalaureate program is significantly less than that of the Advanced Placement program, the findings of several recent studies will be evaluated to determine the impact of the IB curriculum on college performance. This chapter will point to the need for a study that deliberately compares the two programs' effectiveness by controlling for programmatic differences.

When conducting the literature review to collect the relevant research studies, two important sources were first consulted. The websites of both the College Board (<http://professionals.collegeboard.com/data-reports-research/ap>) and the International Baccalaureate Organization (www.ibo.org/research) contain a wealth of studies that have been conducted to validate each of their programs. Of course, each of the studies listed would only be expected to offer positive accounts of each program, so independent research studies were needed to balance the perspective. Global searches on both the Internet and educational subscription databases (ERIC, Education Research Complete, ProQuest Education Journals, PsychINFO, EBSCO, Academic Search Complete, and Summon) yielded more information on both programs as well as research on dual enrollment, grade point average, accelerated learning

options, college enrollment patterns, college success, and various standardized assessments. Research regarding social cognitive career theory was obtained from both monographs and research articles written by the theorists Robert Lent, Steven Brown, and Gail Hackett.

Theoretical Framework

A student's individual motivation to complete AP courses or the IB Diploma program can be grounded in the central components of social cognitive career theory (SCCT) that was first developed by Robert Lent, Steven Brown, and Gail Hackett (1994). Lent et al. based their construct on Bandura's (1986) social cognitive theory which emphasized self-efficacy and outcome expectations. Lent et al. expanded this to include a third element, personal goals, in order to explain "1) how basic academic and career interests develop, 2) how educational and career choices are made, and 3) how academic and career success is obtained" (Lent et al., 2008, p. 1627). The researchers began with Bandura's initial definition of self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391). What a person believes he or she is capable of doing is then impacted by four primary sources of information or learning experiences: personal performance accomplishments, vicarious learning, social persuasion, and physiological and affective states (Bandura, 1997). Of these sources, the most powerful factor on a person's self-efficacy, however, is one's performance accomplishments, the successes and failures that we personally experience in accomplishing tasks.

In order to determine a person's choice of behaviors, self-efficacy is factored together with one's outcome expectations --"beliefs about the consequences or outcomes of performing particular behaviors (e.g., what will happen if I do this?)" (Lent et al., 2008, p. 1627) --and one's personal goals--"one's intentions to engage in a particular activity or to attain a certain level of

performance" (Lent et al., 2008, p. 1627). SCCT posits that an individual will pursue those activities which he or she feels most capable of performing and which will allow him or her to obtain a favorable outcome. After setting those personal goals, the success or failure of attaining those goals will then affect future self-efficacy beliefs and outcome expectations, thus forming a perpetual cycle of human behavior.

The researchers have applied this cyclical model of human behavior to three areas: interests, choices, and performance (Lent et al., 1994). The model explains which variables impact a person's interests, choices, or performance and which process is used to make decisions. A simplified visual model of how personal interests and choices are made according to social cognitive career theory can be seen in Figure 1.

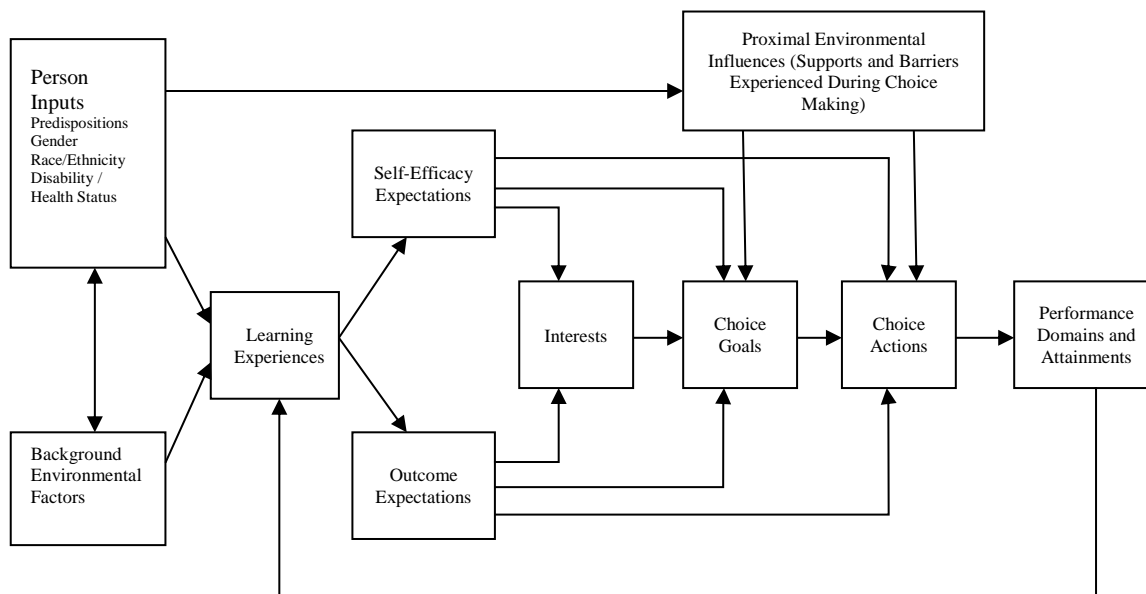


Figure 1. A simplified model of how self-efficacy, outcome expectations, and goals contribute to performance outcomes according to social cognitive career theory. Adapted from "Social Cognitive Career Theory" by R. W. Lent, G. Hackett, and S. D. Brown, 2008, *Encyclopedia of Counseling, Vol.4: Career Counseling*, Thousand Oaks, CA: Sage Publications Inc., p.1628.

Performance in accelerated secondary courses can be viewed in a similar manner. Assuming that both AP and IB programs are equally accessible and available, tenth grade students assess whether they believe they can achieve the work associated with one program or the other (self-efficacy). They then evaluate the long-term and short-term benefits of completing either program (outcome expectations). Throughout their junior and senior year, they are continually working on goals of academic achievement by working through their chosen program (personal goals). Their level of academic performance in high school (AP and/or IB exam scores) then affects their beliefs and actions regarding future activities (academic success in college). Because students tend to self-select themselves for either AP or IB, this study may shed indirect light on the level of self-efficacy of the students and their outcome expectations as judged by their college GPAs. If these variables were inserted into the SCCT model, the result would look like Figure 2. Due to the predominant linear nature of a student's formal education and a student's inability to return to high school, the cyclical nature of this decision-making process would be re-evaluated, not after calculating a student's college GPA (last box), but upon receipt of a student's 11th grade AP/IB exam scores when the student must determine if he or she wishes to take more advanced courses the following year of high school. Thus, the cycle repeats itself each year as the student reconsiders how well he can perform in AP/IB courses based on the previous year's exam results. The success that a student experiences in high school then leads to a similar cycle in college in which a student must determine choice of major, benefit of certain courses, career goals, and desired performance outcomes such as GPA, skills, and networked connections.

When researching the characteristics of IB students who were admitted into IB programs in the state of Florida, researchers with the Consortium for Policy Research in Education

developed a similar conceptual model for analyzing the factors that contribute to a student's decision to enroll in an IB program (May, Rodriguez, Sirinides, Perna, Yee, & Ransom, 2013).

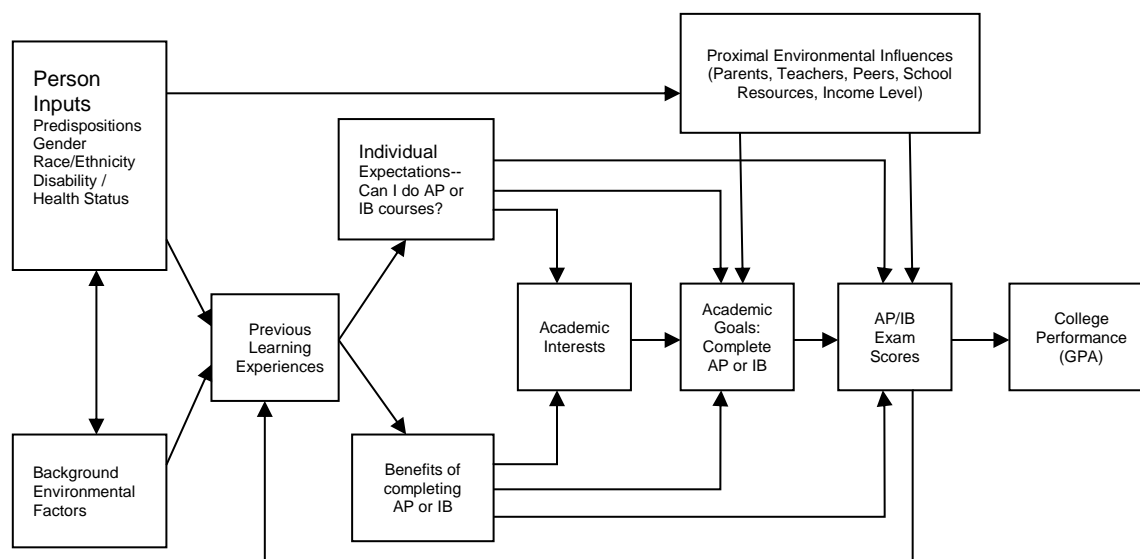


Figure 2. A model of how social cognitive career theory can explain a student's choice and motivation to complete the IB program or AP coursework in high school. Adapted from "Social Cognitive Career Theory" by R. W. Lent, G. Hackett, and S. D. Brown, 2008, *Encyclopedia of Counseling, Vol.4: Career Counseling*, Thousand Oaks, CA: Sage Publications Inc., p.1628.

May et al. categorized influential factors as 1) student predictors (demographics and individual student items such as gifted status, prior grades, English proficiency, attendance, and prior advanced courses), 2) family predictors (socioeconomic status, involvement, expectations, knowledge), and 3) school predictors (urbanicity, school poverty, racial diversity, magnet/charter status, school size, school performance, teacher quality, school finances, college attendance rates) (May et al., 2013). These three sets of factors contribute to a student's opportunity to participate in an IB program given the student's qualifications and self-motivation, admissions criteria, and input from teachers. The overlap of May et al.'s model with the one proposed in Figure 2 would place a student beginning as an IB student in the box labeled "Academic Goals: Complete AP or IB." Therefore, whether beginning students continue to pursue such an

accelerated curriculum would be shaped by their perception of their success within that program and the benefits they gain by continuing their participation.

Related Literature

Within the research literature, the effectiveness of secondary college preparatory courses is largely measured by how well students achieve in terms of *access* or admission to college, *persistence* in continuing their education in college from year to year, and *performance* in their college coursework as indicated by their GPAs (Adelman, 1999, 2006; Bailey & Karp, 2003; Karp, et al., 2007; Lerner & Brand, 2006; WICHE, 2006). Adelman's seminal study (1999) used longitudinal data from the U.S. Department of Education's High School & Beyond/Sophomore cohort files that followed students from the graduating class of 1982 to examine characteristics of students who obtained their bachelor's degree. After analyzing the predictive effect of 11 different variables on students' ability to graduate with a bachelors' degree, the "intensity and quality of secondary school curriculum" (Adelman, 1999, Executive Summary, p. 2) was found to be the greatest asset students had in achieving their undergraduate degree. In fact, the Academic Resources index that Adelman used, constructed from the academic intensity and quality of a student's transcript, his test scores, his class rank, and his GPA, accounted for 43% of the variance in bachelors' degree completion rates (Adelman 1999). "Test scores and class rank," wrote Adelman, "have little to do with those [school-college] connections and collaborations. Curriculum has everything to do with them" (Adelman, 1999, Introduction, p. 2).

In their meta-analysis of 45 studies on credit-based transition programs, Bailey and Karp (2003) identified three types of accelerated programs: singleton programs (e.g. AP courses), comprehensive programs (e.g. IB, technology preparatory), and enhanced comprehensive programs (e.g. middle college high schools). Most of the research projects examined were

descriptive or qualitative in nature with only 21 studies discussing program outcomes. Those outcomes were generally positive, demonstrating that those students enrolled in credit-based transition programs were more apt to graduate from high school, attend college, and have higher college GPAs than those students who did not take such high school courses. However, the researchers criticized the lack of quantitative studies that statistically evaluate the effectiveness of these programs' outcomes and formally control for prior academic achievement (Bailey & Karp, 2003). By statistically controlling for prior academic achievement, the achievement of students can then be more accurately attributed to the effectiveness of the instructional program, rather than the fact that highly able students who actively seek out accelerated learning opportunities will naturally perform better. Even the American Youth Policy Forum, in compiling a compendium of 22 various secondary-postsecondary learning options (SLPOs), could only find four studies that demonstrated statistically significant outcomes based on college GPAs (Lerner & Brand, 2006). In the end, the researchers concluded that "the available data in the field do not meet the 'gold standard' for data collection set by the U.S. Department of Education" (Lerner & Brand, 2006, p. 123) which requires random assignment to create treatment and control groups for comparison.

Two large urban school districts, Chicago Public Schools and Denver Public Schools, completed exhaustive reviews of their accelerated learning options available to their brightest students. Chicago researchers found that although the 8th grade students entering the high school AP and IB programs did exhibit higher achievement scores than those who did not, they were not statistically significant in terms of race, gender, or socioeconomic levels than the remaining population (Roderick, Nagaoka, Coca, & Moeller, 2009). Denver schools, however, found that its IB programs were dominated by white, non-low-income students while AP and dual

enrollment courses were populated by Hispanic and low-income students (Buckley & Muraskin, 2009). Yet, the Hispanics that were enrolled in Denver's IB program were more likely to attend college (57%) than the Hispanics taking only AP courses (41%) (Buckley & Muraskin, 2009). Thus, although it is important to note the ethnic diversity of those students enrolled in advanced academic programs, it is also crucial to consider how well those students perform academically. While gaining college admission can be a very significant indicator of a student's perceived ability to perform college-level work, accelerated academic programs should prepare students to be able to successfully achieve once they are attending college, not just help them get to the door.

Geiser and Santelices (2004) pointed out that just getting to the door, though, may be harder than it seems if one is relying solely on the number of advanced courses a student takes in high school. In 1982, the University of California system implemented the practice of weighting the final grades of any AP, IB, or dual enrollment courses with an extra point in the admission process. Using multiple regression models, Geiser and Santelices analyzed the predictive quality of the number of AP, IB, or honors level courses a student takes in high school on first and second year college GPAs. Surprisingly, the researchers found that the "greater the weight given to AP and honors, moreover, the weaker the prediction" (Geiser & Santelices, 2004, p. 13). Even breaking down the advanced courses by program variety (AP, IB, honors) did not produce any statistically significant predictive power. Yet, when the actual scores from AP exams were analyzed, the researchers found that "whereas AP coursework, by itself, contributes almost nothing to the prediction of college performance, AP examination scores are among the very best predictors" (Geiser & Santelices, 2004, p. 17). Geiser and Santelices used the findings of their research to recommend that college admission procedures needed to be re-examined if they

weight AP, IB, dual enrollment, or other honors courses based on the assumption that better qualified students take more rigorous courses. As they suggested, in many cases, students may take an Advanced Placement or honors level course, but refuse to take the associated end-of-course exam. Although there is a fierce debate in educational circles as to whether students should or should not be required to take an AP exam if they are enrolled in an AP course, this research, at least, indicates that the exam scores are much more predictive of future college success than simply completing the assigned secondary coursework.

Several studies (Dougherty, Mellor, & Jian, 2006b; Karp et al., 2007) have since confirmed what Geiser and Santelices (2004) originally discovered. In Texas, when college graduation rates were compared against the four categories of a student having 1) passed an AP exam, 2) failed the exam, but taken the corresponding AP course, 3) taken the course, but not the exam, or 4) not taken any AP course or exam, the results showed that having passed an AP exam was a greater predictor of college graduation than simply having taken the course (Dougherty et al., 2006b). The researchers noted that “enrolling more students in AP courses who do not also take and pass the AP exams has a weaker and often not statistically significant relationship to college graduation rates” (Dougherty et al., 2006b, p. 10). Thus, completing an AP course without taking or passing the exam does little to enhance or contribute to a student's ability to graduate from college.

Karp et al. (2007) confirmed these findings when they analyzed dual enrollment data from Florida. Dual enrollment (DE) programs differ from AP or IB programs in a number of ways, most significantly in that there are no high-stakes, end-of-course, nationally/internationally standardized exams. Once a student successfully completes a DE course, he or she automatically earns college credit, whereas college credit is only awarded to AP or IB students with a

successful passing exam score. Karp et al. discovered that dual enrollment students graduating in 2001 and 2002 were more likely to graduate from high school, more likely to enroll in community colleges, and were more likely to have higher GPAs than those students who did not take dual enrollment courses. However, it statistically did not matter how many dual enrollment courses a student took. Participation intensity, which the researchers defined as “the number of dual enrollment courses taken” (Karp et. al., 2007, p. 31), had little impact on short term outcomes such as whether the students were more likely to enroll in a 4-year college, continue their status as a full-time student, or persist to complete a second term. At least in terms of dual enrollment, while more courses are beneficial, the effect of multiple courses on long term outcomes is negligible (Karp et al., 2007).

While Karp et al. (2007) documented that the completion of dual enrollment courses seems to contribute to students' persistence to graduate, other researchers have identified similar findings for AP courses. Dougherty et al. (2006b) published a report indicating that students in Texas who took and passed an AP exam had higher graduation rates than those students who took an AP and failed the exam, took an AP course and did not take the associated AP exam, or those who did not take any AP course. Mattern, Shaw, and Xiong (2009) concurred three years later using a national SAT validity dataset to verify that AP students who achieved a 3 or more on their AP exams had a higher retention rate their second year in college than those students who only had a 1 or 2 on their AP exams or any non-AP students. Hargrove, Godin, and Dodd (2008) also found that at the University of Texas at Austin students who had passed an AP exam with higher scores (4-5) graduated at more statistically significant rates than those with lower scores (1-3) or no AP scores and accumulated more college credits more quickly, Researchers then used their results to account for student persistence and retention. This was consistent with

Zhang's (2011) research using the longitudinal Beginning Postsecondary Study dataset supplied by the National Center of Education Statistics for the years 1996-2001.

The research regarding college persistence of AP versus non-AP students compliments some of the research studies that have indicated positive outcomes in college performance associated with AP exam scores (Hargrove, et al., 2008; Mattern et al., 2009; Murphy & Dodd, 2009). Willingham and Morris (1986) cited a number of early studies from the 1960s and 1970s that investigated the performance of AP students in college as the College Board was in the process of expanding its course offerings as well as the number of students and schools it serviced. Casserly (1966), Burnham and Hewitt (1967), Ruch (1968), Chamerlain, Pugh, and Schellhammer (1978), and Cahow, Christensen, Gregg, Nathans, Strobel, and Williams (1979) all concurred that AP students perform better than non-AP students in college whether it be measured by college GPAs, higher SAT test scores, hours completed per semester, graduation with honors, or even election to Phi Beta Kappa. Willingham and Morris compared a sample of 1115 AP students who attended a group of nine private liberal arts colleges against a similarly matched non-AP group of students and found that AP students earned statistically significant higher freshman and cumulative GPAs than non-AP students, graduated with honors at higher rates, and scored higher on four broad scales of scholarship, leadership, significant accomplishments, and successfulness.

These findings continued to be supported by Morgan and Ramist's (1998) work twelve years later. Those researchers consulted the transcripts at 21 colleges and universities of AP students who had taken 25 different AP exams. Their examination found that AP students who were exempted from the introductory level course in various subjects for which they took an AP exam did at least as well or better in the subsequent level course compared to non-AP students

who had taken the introductory level course. Those students who earned a 5 on an AP exam consistently scored higher than did their non-AP peers in all subjects. A decade later, Morgan repeated his study with Klaric (2007) and documented that the findings had not changed: AP students with grades of 3 or better still had better scores than non-AP students in the intermediate college courses associated with their AP exams, graduated earlier, and took on more coursework in the subject areas in which they had taken AP exams.

Rather than looking just within specific subjects to compare grades, Hargrove, Godin, and Dodd (2008) looked, in addition, at students' overall college GPA. Analyzing the grades of students at the University of Texas at Austin from 1998-2002, the researchers compared students who took an AP course and the related exam, those who took only the exam, those who took the course but not the exam, and those who did not take any exam. In all cases, the students who took both the AP course and exam earned statistically significant higher freshmen and 4-year GPAs, accumulated more credit hours earned each semester, and graduated at a higher rate within four years than any of the other three groups (Hargrove et al., 2008).

Mattern et al. (2009) used a larger national database, the SAT Validity Study which contained data from 196,364 students from 110 colleges and universities. Students were divided into three categories (took no AP exams, took AP exams and scored a 1 or 2, took AP exams and scored a 3-5) across four AP subject areas: AP English Language, AP Biology, AP Calculus AB, and AP U.S. History. Even after controlling for SAT scores and high school GPA, the higher AP students scored corresponded to higher first year college GPAs, higher second-year retention rates, and increased attendance at more selective universities (Mattern et al., 2009). It is interesting, though, that the researchers found there was no difference in freshmen GPAs between those who had never taken an AP exam and those who scored either a 1 or a 2 on an AP

exam. Evidently, for there to be a significant impact upon a student's grades in college, he or she must perform well on and pass his or her AP exams with a 3 or higher.

Murphy and Dodd (2009) returned to the same University of Texas data used by Hargrove, Godin, and Dodd (2008) to determine if there were differences in grades across 10 different AP subject areas between AP students and non-AP students. Even breaking it down by subject level, the AP students still continued to have consistently higher GPAs than the matched non-AP students. Patterson et al. (2011) essentially confirmed these results in their nation-wide study using 128,000 students across 110 colleges that also analyzed how well AP students performed against their non-AP peers in nine subject areas. AP students who scored a 3 or better on the AP exam outperformed the non-AP students in seven out of nine subject areas. The two subject areas in which AP students failed to outperform their peers were the AP subject areas that had the smallest participation rates--art and music and computer science (Patterson et al., 2011).

While these studies looked at impressively large or national samples that disaggregated AP scores by subject area and compared them against the college performance of non-AP test takers, the fact remains that they were all financed and published by the College Board. In each case, the AP student was found to outperform the non-AP or dual enrollment student in first-year college GPA and in graduation rates. These studies are balanced by a growing number of privately funded research projects that present a more critical perception of the "AP effect."

The quality of AP exam scores has recently been called into question by some research (Sadler & Tai, 2007). Analyzing national surveys of students' prior AP coursework in science, researchers compared AP scores against the grades earned in college introductory science courses by those students who opted to take that initial college science course irrespective of whether or not they had been granted college credit for it due to their AP score. Sadler and Tai

(2007) found that former AP students did not achieve the scores to which College Board suggests AP exam scores are equivalent (5 = A, 4 = mid-level B, 3 = mid-level C) (College Board, 2004). In fact, they stated that “a preponderance of AP exam scores of 1 or 2 may be interpreted to mean that the AP course in their school offered little or no benefit to students beyond regular or honors level science courses” (Sadler & Tai, 2007, p. 17). When Thompson and Rust (2007) compared a small sample of 41 AP students' performance in the areas of English and science to the college success of other high achieving students, they also found no statistical difference between AP and non-AP students within each subject area.

While some researchers have questioned the validity of rigor that College Board purports its AP courses represent and deliver (Dougherty, Mellor, & Jian, 2006), the perception of AP teachers, however, is that College Board is maintaining its commitment to academic rigor. In a 2009 report, the Fordham Institute conducted a survey of AP teachers which indicated that 86% believe that the level of difficulty of AP exams has remained constant or become more difficult in the last few years while the same number believe that “AP exams maintain the quality of coursework” (Farkas & Duffett, 2009, p. vii).

This mixed message of quality and rigor within AP courses is even more compounded in light of the work of Klopfenstein and Thomas (2009). In analyzing statewide student data from Texas that allowed comparisons between secondary coursework and college GPAs, the researchers found that there was no evidence that taking AP courses increased a student's success in college measured by the first-year GPAs. This study notably evaluated the effect of students' non-AP courses in addition to their AP courses. Even after breaking down AP courses by subject area and factoring in students' non-AP curricular choices, the authors contend,

the most striking results of our analysis is that . . . the three most popular AP courses—calculus, English, and history—have no effect on first semester GPA for any group. . . . Our research finds no conclusive evidence that, for the average student, AP experience has a causal impact on early college success. (Klopfenstein & Thomas, 2009, p. 885, 887)

Instead, the researchers suggested that any predictive effect on college success that simply taking an AP course may afford may actually be the result of “signaling,” which they define as the strategy by which “high ability, motivated students take more AP to differentiate themselves from other students in the college application process” (Klopfenstein & Thomas, 2009, p. 887). If this theory holds true, then the conclusion could be drawn that highly talented students will naturally distinguish themselves and successfully achieve in college regardless of their academic curriculum in high school.

In a study with similar results, Duffy (2010) looked at three groups of students (n=786) from the University of Tennessee at Martin over a seven-year period (1999-2006): students who had entered college with AP credit, students with dual enrollment credit, and students receiving no credit. Using four predictor variables (a socioeconomic composite, an academic achievement variable, personal attribute variable (gender, race), and participation in dual credit programs), multiple regression models were ran against the criterion variables of first-year persistence, degree completion, first-year cumulative GPA, and cumulative graduation GPA. Although the raw mean scores of the credit-earning students were higher for every predictor variable, when controlled for pre-entry variables, the differences in the descriptive data were not significant. In fact, Duffy reported that "no significant differences in persistence and performance outcomes were discovered among regular course, AP, and credit-based [dual enrollment] college course participants" (p. 156).

If such conflicting evidence has begun to cast doubt on the impact of Advanced Placement courses on students' success in college, can the same be said of the International Baccalaureate experience? Studies that investigate the success of IB students in college were initially few and limited in scope, largely relegated to surveys of student perceptions regarding their experience in the IB program (Culross & Tarver, 2007; Foust et al., 2009; Shaunessy & Suldo, 2010; Shaunessy, Suldo, Hardesty, & Shaffer, 2006; Taylor & Porath, 2006). In a small study of science students (n=708) across seven high schools in Alberta, Canada, Poelzer and Feldhusen (1996) found that both Higher Level and Standard Level IB science students experienced a larger gain on a set of pre- and posttests than non-IB students in chemistry, biology, and physics. Duevel's (1999) dissertation at Purdue University defined college success in terms of the college graduation rate, revealing that at 11 selective national universities, 92% of IB Diploma students earned a bachelor's degree and that 87% of them attained it in 5 years or less.

The International Baccalaureate Organization, in conjunction with other researchers, has begun to address this lack of empirical research. Conley and Ward (2009) completed a study that compared the IB standards in English, math, chemistry, physics, biology, Theory of Knowledge, and the extended essay to the widely-accepted Knowledge and Skills for University Success (KSUS) standards which measure college readiness. The English and math standards were very highly aligned and the chemistry and biology standards were completely aligned, indicating that the IB program, in terms of the language of academic standards, is designed to prepare students to meet the rigorous challenges of college education (Conley & Ward, 2009).

The most comprehensive empirical report on the success of IB students in college was released in August 2010 (International Baccalaureate Organization, 2010a). To address the

insufficient empirical research on the effectiveness of the IB program on college performance, the International Baccalaureate Organization launched its own study of California students who enrolled in the University of California's (UC) system of eight campuses between 2000 and 2002. Each cohort of entering IB students was matched against a comparison group in terms of ethnicity, family income levels, and high school academic performance. Both groups were then compared against the performance of all UC students. Consistently each year, the IB students had higher GPAs both within the first year and upon graduation than either the comparison group or the overall UC student population. Consistent with the AP data (Geiser & Santelices, 2004; Klopfenstein & Thomas, 2009; Sadler & Tai, 2007), IB *scores* were a stronger predictor of college GPA than the number of IB exams taken. Regression analysis models of IB higher level exam scores explained 24.5% to 26.1% of the variance of college graduation GPAs while the total points earned on the IB Diploma accounted for 25%-34% of the overall variance, indicating that anywhere from one quarter to one third of a student's academic performance in college could be directly contributed to his or her performance in the IB Diploma program (International Baccalaureate Organization, 2010a).

An extensive study of the performance of IB students at the University of British Columbia analyzed the performance of students during their first year of college. IB students that achieve a range of 27-30 Diploma points perform the same as straight-A students out of Canadian public high schools (Bluhm, 2011). In fact, Dr. Martha Piper, former president of UBC stated that

in their first year, IB students' marks were 12 to 13 percent above the average. But even more impressive were the students who had accepted first-year credit and gone straight into the second year. They were still scoring from 7 to 12 percent above average. They

were outperforming students who had already spent a year at university. (IBO, 2006, para. 6).

More recently, researchers investigated IB Diploma candidates and a matched group of non-IB students (n=1691) at the University of Oregon's Honors College (Conley et al., 2014). When controlled for gender and race, scores on the mathematics exam used for initial placement indicated a statistically significant difference ($p=.013$) between the groups with IB students performing at higher rates. Researchers, however, found that there was not any statistically significant difference in GPA scores upon graduation between IB students and non-IB students. In addition to quantitative analysis of scores and GPAs, researchers also performed various qualitative experiments on the same sample of students to determine if there was a difference in whether IB and non-IB felt prepared for college. The authors drew the conclusion that

students perceive the IB Diploma Programme as providing an increased focus on building social and emotional metacognitive skills, whereas AP focuses more on the academic content acquisition necessary to pass the exam. There was a clear distinction between the two programs: students viewed the IB Diploma Programme as a holistic program to develop strong learners, while they viewed AP as a means to obtain college credit in high school. (Conley et. al., 2014, p. 19)

Casparly and Bland (2011) looked at the scores of IB students (n=4845) from 2000 to 2005 who attended the University of Florida, which has the highest raw number of IB graduates than any other university in the world. They compared IB students' exam scores to their grades in their first college courses that matched the subjects of their IB exams. Dividing IB students into three groups (scores of 1-3, scores of 4-5, and scores of 6-7), results indicated that students

who performed best on their IB exams (scoring a 6 or 7) also performed better in college courses and took more advanced courses than did those students who scored lower on their IB exams.

While the literature on the performance of accelerated students in college has continued to grow, the literature that analyzes accelerated students' college enrollment patterns is not as extensive. In 1998, a group of researchers compiled a report for the Department of Education that examined the factors that contribute to a student's decision to enroll in postsecondary education (Akerhielm, Berger, Hooker, & Wise). They divided their factors into three major areas: educational expectations, course-taking behaviors, and behavioral variables. Upon review, they discovered that income levels seem to be the factor with the largest impact upon college enrollment. However, their research indicated that "low income students who take advanced math and science courses are more likely to attend PSE [postsecondary education] than low income students who do not take these courses" (Akerhielm et al., 1998, p. ES-4). Those students in college preparatory programs are also more likely to attend college, but the likelihood is greatest that they will attend a 4-year private university (Akerhielm et al., 1998).

Fogg and Harrington (2010) investigated the "soft factors" that influence college enrollment using data from graduates of Rhode Island high schools. The key findings reveal that the academic factors of higher standardized test scores and taking advanced placement exams were statistically significant with a higher college enrollment rate. The curricular factor that exhibited the greatest relationship to college enrollment was regular instruction in writing skills. Demographics that resulted in lower college enrollment rates were students with disabilities, Hispanic or black ethnicity, low-income levels, poor English-language proficiencies, and those who access health care largely through community clinics or hospital emergency rooms. Interestingly enough, the researchers "found no relationship between per-pupil expenditures and

college-going rates of high schools” (Fogg & Harrington, 2010, p. 2) which implies that the greatest impact upon college enrollment remains individual student characteristics, not necessarily the amount of money school districts spend to educate young people.

In 2011, Chajewski, Mattern, and Shaw decried that “there has been no research examining the relationship between AP participation and college-going rates (not attending college versus attending a 4-year institution)” (p. 17). Their research drew upon a sample of 1.5 million students who graduated from high school in 2007 who had taken the PSAT. Within that sample, 61.33% did not take any AP exams while the remaining 38.67% had taken one or more AP exams. Descriptive statistics revealed that 83.3% of the AP students had enrolled in a postsecondary institution versus only 45.45% of those students who did not take any AP exams. Logistic regression modeling was used to compare the two groups of students, controlling for prior academic achievement, ethnicity, and gender. Results indicated an “increase of 171% in the odds of attending a 4-year postsecondary institution associated with the completion of a *single* AP exam” (Chajewski, Mattern, & Shaw, 2011, p.24). When AP participation was paired with academic proficiency, as seen in the sample of students who scored 1 standard deviation (+31 points) above the average PSAT results, the odds of enrolling in a 4-year institution increased to 514%. The largest drawback of this study was that it did not account for those students who chose to attend a 2-year college rather than a 4-year university, a population that has been growing in number in recent years due to the less expensive nature and greater accessibility of community colleges. Lloyd and Eckhardt (2010) even documented that nearly half of all students obtaining bachelor degrees in science attended a 2-year institution before enrolling at a 4-year university. Thus, while Chajewski et al.’s (2011) study overwhelmingly demonstrates the effect that taking AP exams has on attending a 4-year college, further research needs to be done

to show how advanced courses affect students' choices to attend *any* college, not just traditional 4-year institutions.

Since family income levels appear to be one of the most significant factors in college enrollment, the College Board conducted a study that matched a total of over 91,000 low-income non-AP students with low-income AP students in five different subject areas (English, math, science, social studies/history, and world languages) (Godfrey, Wyatt, & Beard, 2016). In all five areas, low-income AP students were more likely to enroll in a 4-year college than their matched non-AP peers as well as persist and graduate from a 4-year institution (Godfrey et al., 2016). Even in the face of financial obstacles, taking even one Advanced Placement course still positively impacted a student's likelihood of enrolling in a 4-year college.

Another study validated the positive outcomes of AP students enrolling in a 4-year institution at higher rates than their non-AP peers, but this time compared those results against other accelerated students taking dual enrollment courses. Wyatt, Patterson, and DiGiacomo (2015) compared AP and dual enrollment students' likelihood to enroll in a 4-year college while also investigating first year college GPA, persistence to the fourth year of college, and college graduation rates. Using data obtained from the National Student Clearinghouse (NSC), the researchers analyzed the data from 1,063,616 students who had graduated from a 4-year university. They classified students into five categories: students who did not take any AP or DE courses, those AP students who scored less than a 3 on AP exams, those AP students who scored 3 or greater on AP exams, DE students who took college courses at a 2-year institution, and DE students who took college courses at a 4-year institution. The results were consistent with prior research that found that AP students, particularly those scoring a 3 or better on their AP exams, had higher enrollment rates than either group of DE students or those that had not taken any AP

or DE course. In addition, those students who took a DE course at a 4-year institution were more likely to enroll in a 4-year college than those students who took a DE course at a 2-year institution (Wyatt et al., 2015).

Studies concerning International Baccalaureate students have similarly focused on the enrollment rates of IB students compared to non-IB students. Caspary (2011) found that in 2000 and 2001, IB students had a higher college enrollment rate (71%) than that of the national average (56%) and that, overwhelmingly, IB students (69%) choose to attend 4-year universities rather than 2-year colleges (2%). Also, the majority of IB students (68% of Diploma candidates and 61% of Certificate candidates) go on to enroll in selective or more selective universities compared with their non-IB peers. Other studies (Halic, 2013; Bergeron, 2015) have confirmed this data with some samples of students reflecting a 95% enrollment rate of IB students in 4-year universities immediately upon graduation from high school compared to a national average of only 60% (Bergeron, 2015). A report released from the United Kingdom in 2016 (Higher Education Statistics Agency, 2016) compared over 11,000 IB students to a matched set of A level students. It found that IB students were more likely to attend a top 20 university in Britain compared to A level students. Interestingly, the A level students were more likely to enroll in a STEM (Science, Technology, Engineering, and Mathematics) subject (44.2%) than their IB counterparts (39.4%). Upon graduation, however, the IB students were significantly more likely to graduate with first-class honors (27.9%) or second-class honors (84.8%) than A level students (19.4% and 80.4% respectively).

Summary

As indicated above, there are significant studies that analyze the data of student performance in either AP or IB programs but not both. Datasets from Texas and California have

been extensively evaluated in terms of AP or IB performance (Geiser & Santelices, 2004; International Baccalaureate Organization, 2010a; Klopfenstein & Thomas, 2009; Sadler & Tai, 2007), and data sets from the University of Florida have been utilized to evaluate individual course grades of IB students (Casparly & Bland, 2011). This study attempts to build upon the research by systematically analyzing the data from Florida for both AP and IB students across all public schools to see if the same results are found. This study then seeks to discover whether 1) there is any statistically significant difference between how AP and IB students perform in college, 2) what type of college AP and IB students choose to attend, and 3) whether any of those differences can be attributed towards a student's choice of academic program in high school.

An advantage of using data from Florida is that student demographic and performance data are tracked from kindergarten to postsecondary (Florida Department of Education, 2010), allowing comprehensive conclusions to be drawn from a rich collection of information. The Florida State University System (SUS), a collection of 11 different 4-year universities, attracts a high number of International Baccalaureate students as well as Advanced Placement students, allowing substantial samples to be drawn to permit comparisons between students. A cursory study by the Florida Community Colleges (2008), meant to highlight achievements of dual enrollment students, indicated that AP and IB students of the high school class of 2005 had higher mean first year GPAs (3.1) at SUS schools than dual enrollment students (2.8) or those students who did not complete any accelerated courses (2.6). However, none of these data were subjected to rigorous statistical analysis of difference, particularly with control for demographical or prior achievement variables. In addition, 90% of DE students earned college credit in 2005-6 compared with 84% of IB students and only 48% of AP students (Florida's Community Colleges, 2008). These figures beg further analysis and a detailed statistical

examination to properly understand the relationship of a student's high school curriculum with his or her academic performance in college. The following chapter will further define the research questions to be explored, describe the proposed research design, and outline the research methodology used to investigate the impact of secondary academic programs on college GPAs.

CHAPTER THREE: METHODS

Overview

In an era when educational public policy often equates the concept of enhancing academic rigor with simply offering more college-level Advanced Placement or International Baccalaureate courses in high school, empirical research that demonstrates the direct effectiveness of these programs to promote success within college is needed (Bailey & Karp, 2003). Previous research indicated that taking at least one AP course was highly correlated to earning a higher GPA in college (Adelman, 1999). Since then, Klopfenstein and Thomas (2009) found “no evidence that AP course-taking increases the likelihood of early college success beyond that predicted by the non-AP curriculum for the average student, regardless of race or family income” (p. 874). Other research (Sadler & Tai, 2007) showed that it is not the actual enrollment in an AP course that matters as much as the score that the student earns on the exam that is the best predictor of future success in college. Research was needed, then, to clarify whether a student’s participation in an advanced high school curriculum, such as the Advanced Placement (AP) or International Baccalaureate (IB) program, as measured by their exam scores versus course completion, truly does have a direct impact on a student’s success in college. This study sought to analyze the effect of accelerated academic high school programs on students’ cumulative GPAs in college, and in doing so, offer some measure of comparison between the two programs’ effectiveness. After describing the participants, setting, and instrumentation selected for this study, the rationale behind utilizing a quantitative non-experimental design will be presented. A final section will specify the process by which the data will be analyzed to generate the results.

Design

A quantitative methodology with a causal-comparative research design was chosen rather than a qualitative design to best accommodate the large sample of students drawn from the state-wide population of graduating high school students (Cohen, Manion, & Morrison, 2007; Gall, Gall, & Borg, 2005). This study is designed to examine the quantifiable impact of a student's high school academic program on his or her numerical college GPA rather than exploring how the quality of the college experience is affected by one's choice of high school coursework. A number of studies conducted thus far, with IB students in particular, have been of a qualitative nature with the aim of measuring students' perception of their academic preparation to successfully complete college work by having completed AP or IB courses program (Culross & Tarver, 2007; Foust et al., 2009; Shaunessy & Suldo, 2009; Shaunessy et al., 2006; Taylor & Porath, 2006). This study attempts to supplement these perceptions with empirical evidence of academic performance as indicated by college GPA and of student choice of college.

A causal-comparative research design was used to determine if there is any effect of secondary academic curriculum on college GPA (Research Question 1). This *ex post facto* research design attempted to explore a possible causative relationship between an independent variable (academic program) and a dependent variable (college GPA) where the researcher is unable to control the independent variable by randomly assigning students to a specific program (Cohen et al., 2007). Since randomization is not possible in a causal-comparative study, the control procedure of comparing homogeneous groups based on collected demographic data was adopted to help achieve equality of groups (Gall et al., 2005). Populations of AP, IB, and non-accelerated students were categorized based on the exam scores available for each student. The

difference in the cumulative college GPAs of AP, IB, and non-accelerated students was compared to determine if choice of academic program was correlated to college performance.

The effect of a student's choice of academic program was further examined using a correlational design which is used to predict effect (Gall et al., 2005; Johnson, 2000). First, a multiple regression model was used to predict the percentage of variance that a series of predictor variables (gender, ethnicity, income, and academic program) contributed to a student's college GPA. The size of this effect was analyzed to determine the lasting value of a student's choice of classes in high school. Second, logistic regression models were used to predict whether accelerated students are more likely than non-accelerated students to enroll in college and if so, what type. Similarly, logistic regression models were employed to also predict whether AP and IB students who go on to enroll in college are more likely to select a 2-year or a 4-year institution to attend.

Research Questions

This study investigated the following questions:

RQ1: Does a significant difference in the cumulative college GPA exist between students who took AP exams, students who took IB exams, and students who did not take any AP or IB exams?

RQ2: To what extent, if any, do gender, ethnicity, lunch status, and mean scores on the AP exams and the IB Diploma score predict a student's cumulative college GPA?

RQ3: What difference, if any, is there in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took an accelerated exam (AP or IB) and students who took no accelerated exams?

RQ4: What difference, if any, is there in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took AP exams and students who took IB exams?

Null Hypotheses

H₀₁: No statistically significant difference exists between the means of the cumulative college GPAs of those students who took AP exams, IB exams, or neither AP or IB exams.

H₀₂: Gender, ethnicity, lunch status, and mean scores on the AP exams and the IB Diploma score do not predict a student's cumulative college GPA.

H₀₃: There will not be a significant difference in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution between students who took accelerated exams (AP or IB) and students who took no accelerated exams.

H₀₄: There will not be a significant difference in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took AP exams and students who took IB exams.

Participants and Setting

The participants of this study included those high school students who graduated from a Florida public high school in May 2006. The population included a total of 130,019 students state-wide graduated with a standard high school diploma in 2006, which accounts for more than 90% of all high school students (Florida Department of Education, 2009). These students were then classified as AP students, IB students, or non-accelerated students. To account for differences between the three sample populations (AP, IB, and non-accelerated) and to limit the threat of internal validity due to selection, the covariates of gender, ethnicity, and income were controlled by statistical analysis.

In 2006, 36,889 public high school seniors, or 28.4% of all eligible seniors, took AP exams in the state of Florida (College Board, 2006). In 2005, Florida 11th grade students took 59,893 AP exams and in 2006, Florida 12th grade students took 79,869 AP exams (College Board, 2006). Thus, the Florida class of 2006 took a total of 139,762 AP exams during their last two years in high school. It should be noted that even though students can take AP courses in their freshman and sophomore year, only a relatively small number of Florida public school 9th and 10th grade students ($n=13,162$) took AP exams in 2004 (College Board, 2004). Also in 2006, 3035 Florida public school students were registered as IB Diploma candidates who sat for over 19,300 IB exams (J. Sanders, personal communication, October 25, 2011). The high school graduating class of 2006 was chosen to allow students six years to complete an undergraduate bachelor's degree for which the most recent GPA data from 2012 could be obtained.

The Florida Department of Education maintains a database that tracks all students from kindergarten through college graduation and includes such items as student demographics, test scores, course transcripts, and grade point averages (Florida Department of Education, 2010). Within the data, students were only identified by the researcher using their unique 10-digit Florida student identification number, thus protecting their anonymity and preserving student confidentiality.

Students were placed into one of three groups depending on the academic program that they completed in high school: International Baccalaureate students, Advanced Placement students, and non-accelerated students. Students who were enrolled in IB courses who took AP exams were deleted from the Advanced Placement group to prevent program overlap. Additionally, any student who began the IB program in 11th grade, but chose to withdraw before the completion of the 12th grade was considered an AP or non-accelerated student depending on

whether the student took any AP courses. For the purposes of this study, dual enrollment and AICE students were not defined as separate categories and were treated as non-accelerated students unless they took an AP exam during high school at which point they were coded as AP students.

This class of students was then further classified as those students who chose to attend a 2-year community or state college, those who chose to attend a 4-year public state university, or those who did not attend any college or university. Whether a student attended a Florida college or university was taken from self-reported data collected from a survey completed by graduating seniors state-wide. There were 129,772 surveys completed by students of which 1,549 left this question incomplete. Thus, responses were collected for 128,223 unique students and analyzed for college enrollment. There are 28 Florida community or state colleges that a student could have selected to attend for the purpose of this study: Eastern Florida State College, College of Central Florida, Daytona State College, Edison State College, Florida State College at Jacksonville, Florida Keys Community College, Florida Technical College, Gulf Coast State College, Hillsborough Community College, Indian River State College, Florida Gateway College, Lake-Sumter Community College, Miami-Dade Community College, North Florida Community College, Northwest Florida Community College, Palm Beach State College, Pasco-Hernando Community College, Pensacola State College, Polk State College, Saint Johns River State College, Saint Petersburg College, Santa Fe College, Seminole State College, State College of Florida, South Florida State College, Southwest Florida College, Tallahassee Community College, Valencia Community College. Students could also have chosen to attend any of Florida's 11 public 4-year universities which include the following: Florida Agricultural and Mechanical University (FAMU); Florida Atlantic University (FAU); Florida Gulf Coast

University (FGCU); Florida International University (FIU); Florida State University (FSU); New College (New); University of Central Florida (UCF); University of Florida (UF); University of North Florida (UNF); University of South Florida (USF); University of West Florida (UWF).

Instrumentation

This study was designed to investigate differences in college performance and college choice as related to a student's choice of high school academic curriculum. In each research question, the independent variable (IV) used was a high school student's choice of academic program, whether Advanced Placement, International Baccalaureate, or non-accelerated courses. The dependent variable (DV), however, varied for each question. The first research question analyzed the correlation between academic program choice (IV) and the dependent variable of a student's cumulative grade point average (GPA) in college. In the second research question, the covariate predictors of gender, ethnicity, and income level were added to the independent variable of academic program as represented by a student's AP or IB exam score and analyzed in a multiple regression model. The dependent variable remained a student's cumulative college GPA. The third research question simplified the independent variable of academic program into two groups: advanced (AP *and* IB) or non-accelerated. These groups were then compared using a logistic regression model that incorporated the dependent variable of whether a student was planning on enrolling at an institution of higher education or not. The fourth research question analyzed the dependent variable of attending a 4-year or 2-year public college based on the independent variable of being classified as an AP or an IB student.

In Research Question 2, two exam scores were used to represent academic program: AP exam scores and IB exam scores. Advanced Placement exams are scored on a scale of 1-5 in 34 different subject areas. Each exam, other than Studio Art, is divided into at least two sections: a

multiple-choice section and a free response section. Studio Art is divided into three sections based on content analysis, not format, since students submit their artworks for evaluation rather than sit for a written exam. For all of the exams, each of the sections comprises a certain percentage of the total score which differs for each exam. Common percentage splits include 60/40, 50/50, 66.7/33.3, and 45/55 (College Board, 2011). Total scores are then converted into a scaled score of 1 to 5. Three is considered a passing score. An average score for all AP exams each student took was calculated and used as the predictor representing AP performance.

International Baccalaureate subjects are evaluated on a scale of 1-7 with IB diploma candidates taking six total subjects. Each subject is subdivided into at least three different assessments: one internal assessment that is graded by the student's instructor and at least two externally assessed exams. Each subject varies according to the number and type of assessments, each of which constitutes a percentage of the total number of points possible within a subject area. Subject points are then converted into a scaled set of scores from 1 to 7. Four is considered a passing score. Diploma candidates can earn up to a maximum award of 45 point towards an IB Diploma with 42 points being earned through their subject area points and 3 "bonus" points earned through the successful completion of their Extended Essay and Theory of Knowledge course (International Baccalaureate Organization, 2010b). For this study, the total number out of 45 points students earn towards their IB Diploma was used as the predictor representing IB performance.

Other independent covariates collected in this study included demographic information. All demographic information was taken from the Florida Department of Education records for each student. For each student included, his or her gender, race, and income level (as determined by federal Free or Reduced Lunch eligibility) was recorded. Gender was denoted as male or

female. Race was coded as African-American, American Indian/Other/Mixed, Asian, Hispanic, and White. Income level was split into those students who qualified for free or reduced lunch and those students who were either not eligible or who did not apply. Using eligibility for free or reduced lunch as an instrument for family income levels has limitations because many families whose income would otherwise qualify them choose not to apply. Thus, the data were skewed to the side of higher income families who do not qualify for free or reduced lunch.

The dependent variable in Research Questions One and Two was the grade point averages (GPAs) obtained from students' final cumulative GPA upon graduation from college. All 11 universities within the Florida State University System (SUS) use a similar 4.0 grading scale, so GPA comparisons can be made equally across schools. Robbins, Lauver, Le, Davis, Langley, and Carlstrom (2004) noted in their meta-analysis of college GPA studies that several reports have linked positive academic behaviors to cumulative GPAs and that cumulative GPAs are the most common measure of academic performance within educational research. Thus, cumulative GPAs were used as criterion variables in an analysis to determine the variance contributed by several predictors of academic performance.

The dependent variable for Research Questions Three and Four was the response high school seniors indicated on a state-wide survey. The question asked, "What are your plans after your high school graduation?" The answer choices included the following: 1) Florida Public College/Community College; 2) Florida Private 2-Year/Junior College; 3) Florida Public 4-Year University; 4) Florida Private 4-Year College or University; 5) Out-Of-State 4-Year College or University; 6) Out-Of-State Technical, Trade or Other Institution; 7) State Technical, Trade or Other Institution; 8) None of the Other Choices Apply; 9) U.S. Armed Services; and 10) Out-Of-State 2-Year College. For the purposes of coding in this study, the answers were collapsed into

five categories: 2-Year Colleges (choices 1, 2, and 10); 4-Year Universities (choices 3, 4, and 5); Tech or Trade Schools (choices 6 and 7); the Military (choice 9); or None of the Above (choice 8). Those students who were placed in the category of 2-Year or 4-Year Colleges were designated as those students who were planning to attend college. Those in the remaining three categories were designated as students who were not planning to attend college.

Procedures

After approval was obtained from Liberty University's Institutional Review Board (IRB), a Unit Record Data Request packet was submitted to Florida's Education Data Warehouse (EDW) to request access to the data for the Class of 2006. Once the data files were obtained, Excel was used to merge independent pieces of information for each student based on their unique 10-digit ID number assigned to them by the Florida EDW to create a comprehensive spreadsheet of variables for each student. Then the SPSS (Statistical Package for the Social Sciences) statistical software program was used to analyze the data with the appropriate statistical procedures.

Data Analysis

The data used for this study was collected *ex post facto*. Since the data was collected from every public high school in the state of Florida, the data represents the complete spectrum of educational settings America's fourth largest state can offer: urban, suburban, rural; wealthy, middle-class, poor; small, medium-sized, large; newly founded, older established; White majority populations to minority majority populations.

Research Question 1

The first research question required a one-way between-subjects analyses of variance (ANOVAs) be run with the independent variable of academic program (AP/IB/non-accelerated) and the dependent variable of the cumulative college GPA. ANOVAs are used "when two or

more means are compared to see if there are any reliable differences among them" (Tabachnick & Fidell, 1989, p.37) while controlling for family-wise Type 1 error. The resulting F statistic obtained after running the ANOVA will only determine if the null hypothesis can be rejected that all three means are equal. Additional *post hoc* contrasts were then run in order to compare each of the three means against the others to determine if, indeed, any statistically significant difference existed between the means of GPAs for the three groups of students (AP/IB/non-accelerated) at the $p < .05$ level (Field, 2013; Stevens, 1996).

One concern that arises when using an ANOVA is that the means of the three programs will share an unequal n . Tabachnick and Fidell (1989) indicate that "in a simple one-way between subjects ANOVA, problems created by unequal group sizes are relatively minor" (p. 48). They suggest using the regression approach in SPSS to control for such differences where "the same hypotheses are tested as in the unweighted-means approach where each cell mean is given equal weight regardless of its sample size" (Tabachnick & Fidell, 1989, p. 48). Given the unequal group sizes of the three samples and the unequal variances, the Games-Howell test was determined to be the most robust test to use for the *post hoc* comparisons, particularly with such a large sample (Field, 2013; Tabachnick & Fidell, 1989).

Research Question 2

After the college GPA means are compared by academic program, the second research question required the use of multiple regression models to analyze how well participation in an academic program can predict college GPAs. The advantage of using multiple regression and correlation models is that the multiple independent or predictor variables can be continuous or categorical, correlated or uncorrelated, linear or curvilinear; however, it still involves only one dependent or criterion variable (Pedhazur, 1982). In each case, the predictor variables (gender,

race, income level, and sum of AP scores, IB Diploma score) were added to the regression equation in standard order to determine the degree of variance (R^2) each variable contributed to the criterion variable of college GPA and its level of significance. A hierarchical entry was not used because none of the predictor variables were judged to be of more importance than the others (Tabachnik & Fidell, 1989; Field, 2013). Field (2013) recommended that "stepwise methods are best avoided except for exploratory model building" (p. 121).

Field (2013) noted that at least 15 subjects per predictor need to be used to obtain a reliable regression model. Since the sample size incorporated well over 75 subjects (15 subjects * 5 predictors = 75), the results produced a reliable regression model. A series of models was run for cumulative GPAs using all five variables. After each model, any variable that was not found as statistically significant was removed from the regression equation. A $p < .05$ level of significance was used for all analyses to determine if Null Hypotheses 2 was able to be rejected. Results for all IVs were standardized so as to allow comparisons between predictors (Licht, 1995). Following the initial regression analysis, SPSS was used to run tests for normality of error distribution, linearity, homoscedasticity, independence of residuals, and multicollinearity (Cohen & Cohen, 1983; Field, 2013; Pedhazur, 1982; Tabachnik & Fidell, 1989). All of these assumptions must be met if the results are to be generalized to the entire population. In testing the power of the F test for the significance of R^2 , Cohen and Cohen's rules for performing power tests were followed which calculates that at least 144 subjects are needed to obtain a .90 probability of rejecting the null hypothesis for four predictors at the $\alpha = .05$ level (1983).

Research Questions 3 and 4

The next set of research questions required the use of logistic regression to determine whether a student's choice of academic curriculum affected the odds of him or her planning to

enroll in college and what the likelihood is that it would be a 2-year or 4-year institution. The dependent variable for Research Question 3 was whether the accelerated or non-accelerated student chose to attend college while the dependent variable for Research Question 4 was whether the AP or IB student chose to attend a 2-year or a 4-year college. Both dependent variables were dichotomous categorical variables (college enrollment or no college; 2-year or 4-year institution) which necessitated the use of logistic regression (Burns & Burns, 2008; Field, 2013). The independent variable for both questions was high school curriculum (AP, IB, non-accelerated). All of the independent variables were treated as categorical variables with assigned dummy levels automatically generated by SPSS since it is not the numerical value of the independent variables that is important but only whether a student is a member of that group (Field, 2013).

Logistic regression was chosen as the appropriate statistical model to analyze these questions since its main two uses are "the prediction of group membership...[and] providing knowledge of the relationships and strengths among the variables" (Burns & Burns, 2008, p. 569). The underlying mathematical assumptions of logistic regression are that the dependent variable is dichotomous, the dependent categories are mutually exclusive, there is not a linear relationship between the dependent and independent variables, and large samples are needed since a minimum of 50 cases per predictor are recommended (Burns & Burns, 2008). The data for both Research Question 3 and 4 met these qualifications.

Upon running the data in SPSS to obtain a regression equation and the probability that a case belongs to one of the two groups, the odds or likelihood ratio was calculated to determine the odds of a student going to college or attending a 2-year or 4-year institution depending on his choice of curriculum. After the model chi-squared test was run, it was compared against the Cox

and Snell measure, Nagelkerke's R^2 , and the Hosmer and Lemdshow goodness-of-fit test to verify the significance level of the model at $p < .05$ (Burns & Burns, 2008, Field, 2013). If the null hypothesis could be rejected, the Wald statistic was analyzed to assess the degree of variance that each of the predictors contributed to the probability of the dependent variable occurring. The odds ratio was used as the measure of effect size (Burns & Burns, 2008, Field, 2013).

CHAPTER FOUR: FINDINGS

Overview

This quantitative study analyzed how effectively the Advanced Placement (AP) or International Baccalaureate (IB) curricula prepare students for college success as determined by resulting college cumulative GPAs. It also compared the academic success of AP students, IB students, and students who participated in neither program, but who attended similar university systems in order to determine if differences exist between accelerated curriculum options. The researcher attempted to isolate the percentage of variance that each program contributed to a student's college GPA and to determine the effect size each program had on students' future academic success. Additionally, results also revealed whether advanced students were more likely to attend 4-year universities versus community or state colleges within the same university system, as well as the odds of them persisting in their college education to obtain a degree. By exploring the level of contribution these programs made towards students' success in college, educational leaders can better evaluate the advantages these academically rigorous programs provide students.

Research Questions

This study investigated the following questions:

RQ1: Does a significant difference in the cumulative college GPA exist between students who took AP exams, students who took IB exams, and students who did not take any AP or IB exams?

RQ2: To what extent, if any, do gender, ethnicity, lunch status, and mean scores on the AP exams and the IB Diploma score predict a student's cumulative college GPA?

RQ3: What difference, if any, is there in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took an accelerated exam (AP or IB) and students who took no accelerated exams?

RQ4: What difference, if any, is there in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took AP exams and students who took IB exams?

Null Hypotheses

H₀₁: No statistically significant difference exists between the means of the cumulative college GPAs of those students who took AP exams, IB exams, or neither AP or IB exams.

H₀₂: Gender, ethnicity, lunch status, and mean scores on the AP exams and the IB Diploma score do not predict a student's cumulative college GPA.

H₀₃: There will not be a significant difference in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution between students who took accelerated exams (AP or IB) and students who took no accelerated exams.

H₀₄: There will not be a significant difference in the likelihood of initially attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took AP exams and students who took IB exams.

Descriptive Statistics

A total population of 129,772 students graduated from a Florida public high school in 2006. Of these students, 44,370 students went on to attend a Florida public institution of higher education and were documented to have a matching cumulative college Grade Point Average (GPA). For Research Questions One and Two, this was still too large a population on which to perform the appropriate statistical tests, so a smaller stratified sample was selected from this

population. For Research Questions 3 and 4, the total population was subjected to statistical analysis.

The sample size used in Research Questions 1 and 2 was calculated by using the Slovin formula (Tejada & Punzalan, 2012) and stratified by ethnicity. All of the mixed race, Native Americans, and non-identified students were placed in one category due to lower numbers (n=933). An equal number of students was randomly chosen from each of the other ethnicities (African-American, Asian, Caucasian, and Hispanic) using a random number generator for a combined sample size of 10,006 students (J. Yank, personal communication, Sept. 27, 2015).

Table 1 shows information related to the sample of students addressed in the research questions.

Table 1

Descriptive Statistics for each Research Question

	Research Questions 1-2 Sample		Research Questions 3-4 Population	
	# of Students	% of Total	# of Students	% of Total
TOTAL STUDENTS	10,006	100.00%	129,772	100.00%
GENDER				
Male	5748	57.45%	61,371	47.30%
Female	4257	42.55%	68,401	52.70%
ETHNICITY				
Asian	2268	22.67%	4207	3.20%
Black	2269	22.68%	24,089	18.60%
Hispanic	2267	22.66%	27,530	21.20%
Combined (Indian, Mixed, Non-reported)	933	9.32%	4599	3.54%
Caucasian	2269	22.68%	70,338	54.20%
INCOME STATUS				
Free or Reduced Lunch	2397	24.09%	36358	28.02%
Did not apply/Not eligible/Did not report	7554	75.91%	93414	72.00%

ACADEMIC CURRICULUM

Non-Accelerated Students	3913	39.11%	87,320	67.30%
Advanced Placement Students	5444	54.41%	39,475	30.40%
International Baccalaureate Students	648	6.48%	2976	2.30%

To investigate Research Questions 3 and 4, the results of a self-reported survey all Florida high school students completed approximately one month before graduating were consulted. A total of 128,223 students completed the survey question which asked students what their plans were immediately upon finishing high school. Although there were 10 possible choices, they were condensed into five categories: attend a 2-year community or state college, attend a 4-year university, attend a trade or technical school, enter the military, or none of the above. The number of student responses broken down by choice of academic curriculum is indicated in Table 2.

Table 2

*Number of Students Responding to a Survey of Plans Upon High School Graduation
Sorted by the Secondary Academic Curriculum They Completed*

Academic Curriculum	Associate's Degree	Bachelor's Degree	Trade or Tech School	Military	None of the Above	Totals
IB	82	2483	14	7	390	2976
AP	5974	22510	447	346	10,124	39401
Non-Accelerated	28040	19127	3468	2,123	33,088	85846
Totals	34096	44120	3929	2476	43602	128223

Results**Null Hypothesis One**

The first null hypothesis stated that no statistically significant difference would exist between the means of the cumulative college GPAs of those students who took AP exams, IB exams, or neither AP or IB exams. When the original stratified sample of 10,006 students was drawn, the data were skewed with many outliers, mainly those students whose GPAs were below

1.5. Although various transformations were attempted, none produced sufficient normality. The choice was made to remove 675 extreme outliers from the sample of 10,006, leaving 9,331 cases. All GPAs below 1.5 were removed for non-accelerated and AP students and all GPAs below 1.75 were removed for IB students. See Table 3 for descriptive statistics for each curriculum group.

Table 3

Descriptive Statistics for College GPAs by Academic Curriculum

Academic Curriculum	N	Mean	SD	SE	95% CI		Minimum GPA	Maximum GPA
					Lower Bound	Upper Bound		
No accelerated course	3551	2.834	.603	.010	2.814	2.854	1.500	4.000
AP Exams	5149	3.054	.596	.008	3.037	3.070	1.500	4.000
IB Exams	631	3.375	.509	.020	3.335	3.415	1.906	4.000
Total	9331	2.992	.611	.006	2.979	3.004	1.500	4.000

Data were significantly right skewed (toward higher GPAs) for AP and IB students, although non-accelerated students' GPAs were not skewed. After removing the outlying cases, the assumptions of linearity, independence of errors, unusual points, and normality of residuals were generally met. Homogeneity of variance was violated, as assessed by Levine's Test for Equality of Variance ($p < .0005$), so the Welch correction was used. Given the large sample size, the ANOVA remains robust enough to account for differences in normality (Field, 2013). A statistically significant difference was found between the GPAs of the three academic curriculum groups, Welch's $F(2, 1820.604) = 326.388, p < .0005$.

Table 4

ANOVA Results Comparing College GPA (DV) vs. Academic Curriculum (IV)

	SS	df	MS	F	Sig.
Between Groups	200.900	2	100.450	285.244	.000*
Within Groups	3284.887	9328	.352		
Total	3485.787	9330			

Note. * $p < .0005$

To analyze the differences between the three academic groups, a *post hoc* analysis was completed. Given the unequal group sizes of the three samples and the unequal variances, the Games-Howell test was used for *post hoc* comparisons (Field, 2013). There was a mean difference in GPA between the groups of students, all of which were significant statistically ($p < .0005$) with a small effect size (partial eta-squared = .058). The largest difference occurred between the GPAs of those who took IB exams and those who took no advanced course exams (.541, 95% CI [.475-.607]). A smaller difference existed between IB and AP students' GPAs (0.321, 95% CI [.257-.385]). The smallest difference in GPA was between AP students and those taking no accelerated courses (0.22, 95% CI [.182-.258]), as shown in Table 5.

Table 5

Results of Games-Howell post hoc Test of the Comparisons of GPA Means Between Academic Curricula

(I) Type of Exam Taken	(J) Type of Exam Taken	Mean			99% CI	
		Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
NAC†	AP Exams	-.21980*	.013097	.000	-.25797	-.18163
	IB Exam	-.54106*	.022654	.000	-.60722	-.47490
AP Exams	NAC†	.21980*	.013097	.000	.18163	.25797
	IB Exam	-.32126*	.021902	.000	-.38524	-.25728
IB Exam	NAC†	.54106*	.022654	.000	.47490	.60722
	AP Exams	.32126*	.021902	.000	.25728	.38524

Note. Based on observed means. The error term is Mean Square (Error) = .352.

†No Accelerated Course Exams. *The mean difference is significant at the .01 level.

Thus, the first null hypothesis was rejected. The data, as seen in Table 5, indicated a statistically significant difference existed between each of the means of the cumulative college GPAs of those students who took AP exams, IB exams, and neither AP or IB exams.

Null Hypothesis Two

The second null hypothesis stated that gender, ethnicity, lunch status, and mean scores on the AP exams and the IB Diploma score would not predict a student's cumulative college GPA. As in Question 1, because of serious problems with normality, 675 extreme outliers were removed. Thus, the same representative sample of 9,331 students used in RQ1 was used for RQ2 (see Table 1, Table 3). After removing the outliers, the assumptions of linearity, independence of errors, unusual points, and normality of residuals were generally met.

The regression model indicated that ethnicity, mean AP scores, and IB Diploma scores were statistically significant in predicting college GPA $F(5,597) = 33.394, p < .0005$, contributing 21.5% (adj. $R^2 = .215$) of the variance within college GPAs. The predictors of

gender ($p = .079$) and lunch status ($p = .685$) were not statistically significant. Regression coefficients and standard errors can be found in Table 6.

Table 6
Predictors of College GPA, Model 1

Model 1	<u>Unstandardized</u>		<u>Standard</u>	<i>t</i>	Sig.
	<i>b</i>	SE <i>b</i>	β		
(Constant)	1.825	.190		9.621	.000
Ethnicity	.029	.011	.093	2.549	.011
Lunch Status	-.023	.056	-.015	-.406	.685
Gender	-.065	.037	-.064	-1.761	.079
Mean of AP Scores	.069	.026	.128	2.624	.009
IB Diploma Score	.037	.005	.366	7.594	.000

A second regression model excluding gender and lunch status as predictors was run to evaluate the effects of ethnicity, mean AP scores, and IB Diploma scores. These variables statistically significantly predicted college GPA, $F(3,599) = 55.375, p < .0005, \text{adj. } R^2 = .213$. The IB Diploma score had a three times larger effect (Std. $\beta = .367$) on GPA than did than the AP Mean score (Std. $\beta = .120$) and four times larger than Ethnicity (Std. $\beta = .09$) (Cohen, 1988). Given that the amount of change in variance between Model 1 and Model 2 was only .2% (adj $R^2, .215 - \text{adj. } R^2, .213$), gender and income levels, the two predictors left out of the second model, were found to be essentially negligible in affecting college GPAs. Regression coefficients and standard errors can be found in Table 7.

Table 7

Predictors of College GPA, Model 2

Model 2	Unstandardized Coefficients		Standardized	<i>t</i>	Sig.
	<i>b</i>	SE <i>b</i>	Coefficients β		
(Constant)	1.751	.185		9.449	.000
Ethnicity	.028	.011	.090	2.497	.013
Mean of AP Scores	.064	.026	.120	2.488	.013
IB Diploma Score	.037	.005	.367	7.604	.000

A third multiple regression model was used to determine whether mean AP scores or IB Diploma Scores predicted college GPA without regard to students who did not take advanced coursework or any other demographic predictors. In this analysis, 5,753 AP exam scores and IB Diploma scores were used. The assumptions of linearity, independence of errors, homoscedasticity, points, and normality of residuals were generally met. These variables were statistically significant in predicting college GPAs, $F(2, 5720) = 357.738$, $p < .0005$, adj. $R^2 = .11$. However, since the third model could only explain 11% of the variance within college GPAs compared to the second model's 21.3%, which contained the variable of ethnicity, the data imply that in this sample, ethnicity seems to contribute an almost equivalent percentage of variance to a student's GPA as a student's choice to pursue the AP or IB program. When other predictors were removed from the multiple regression model, both mean AP scores and IB Diploma scores had large effects sizes ($\beta = .178$ and $.198$, respectively). Regression coefficients and standard errors can be found in Table 8 (Cohen, 1988).

Table 8

Predictors of College GPA, Model 3

Model 2	Unstandardized Coefficients		Standardized	<i>t</i>	Sig.
	<i>b</i>	SE <i>b</i>	Coefficients β		
(Constant)	2.723	.019		147.132	.000
Mean of AP Scores	.011	.001	.178	11.866	.000
IB Diploma Score	.116	.009	.198	13.168	.000

Thus, null hypothesis two was rejected. The predictors of gender and income level do not contribute to predicting a student's cumulative college GPA, but ethnicity, mean AP exam scores, and IB Diploma scores provided a statistically significant prediction of a student's cumulative college GPA. Therefore, a student's choice of high school academic curriculum accounted for at least 11% of the variance within college GPAs.

After the multiple regression models had indicated the significance of ethnicity in predicting college GPAs, a further exploration using one-way ANOVAs was performed to evaluate how ethnicity affected a student's choice of academic program. Rather than comparing ethnic groups to each other, the performance of students in each academic program was analyzed by ethnic group. Within each ethnic group, the students who took IB courses had higher GPAs than either those who took AP exams or those students who did not take any accelerated courses. AP students' GPAs were consistently higher than those who did not take any accelerated courses. Within each ethnicity, the differences between each curriculum (IB and AP, AP and non-accelerated, and IB and non-accelerated) were statistically significant ($p < .0005$). In looking at the mean differences across all ethnicities, there was almost an entire half point difference in GPA between IB students and Non-Accelerated students (.494) versus little difference between AP and Non-Accelerated students (.195). The mean difference between IB

and AP students was almost a third of a grade point (.296). In other words, across all ethnic groups, IB and AP students achieved higher college GPAs than non-accelerated students, but IB students achieved higher college GPAs than AP students. Tables 9-15 give the statistical comparisons for each ethnicity.

Table 9

Descriptive Statistics: Number of Students in each Academic Program by Ethnicity

Academic Curriculum	Asian	African-American	Caucasian	Hispanic	Native American/No Response/Mixed	Total Students
AP Students	1303	906	1230	1239	471	5149
IB Students	312	70	107	82	60	631
Non-Accelerated Students	538	1052	823	804	334	3551
Total Students	2153	2028	2160	2125	865	9331

A statistically significant difference was found between the GPAs of the three academic curriculum groups among Caucasian students, $F(2, 2158) = 44.676, p < .0005$. The groups were unequal in size. Therefore, the Games-Howell test was used to run post-hoc comparisons as shown in Table 10 (Field, 2013).

Table 10

Games-Howell post-hoc Comparisons Among Caucasians by Academic Curriculum

(I) Caucasian	(J) Caucasian	Mean Difference (I-J)	Std. Error	Sig.	95% CI	
					Lower Bound	Upper Bound
Caucasian– NonAccl	Caucasian - AP	-.20361*	.02611	.000	-.2649	-.1424
	Caucasian - IB	-.41883*	.04773	.000	-.5318	-.3059
Caucasian - AP	Caucasian - NonAccl	.20361*	.02611	.000	.1424	.2649
	Caucasian - IB	-.21522*	.04623	.000	-.3247	-.1057
Caucasian - IB	Caucasian - NonAccl	.41883*	.04773	.000	.3059	.5318
	Caucasian - AP	.21522*	.04623	.000	.1057	.3247

Note. *The mean difference is significant at the 0.05 level.

A statistically significant difference was found between the GPAs of the three academic curriculum groups among Hispanic/Latino students, $F(2, 2122) = 8.768, p < .0005$. Since the three groups were unequal in size, the Games-Howell test was used to run post-hoc comparisons. The results are shown in Table 11 (Field, 2013).

Table 11

Games-Howell post-hoc Comparisons Among Hispanics by Academic Curriculum

(I) Hispanic	(J) Hispanic	Mean Difference (I-J)	Std. Error	Sig.	95% CI	
					Lower Bound	Upper Bound
Hispanic– NonAccl	Hispanic - AP	-.06778*	.02661	.029	-.1302	-.0054
	Hispanic - IB	-.25886*	.06543	.000	-.4145	-.1032
Hispanic - AP	Hispanic - NonAccl	.06778*	.02661	.029	.0054	.1302
	Hispanic - IB	-.19108*	.06431	.010	-.3442	-.0379
Hispanic - IB	Hispanic - NonAccl	.25886*	.06543	.000	.1032	.4145
	Hispanic - AP	.19108*	.06431	.010	.0379	.3442

Note. *The mean difference is significant at the 0.05 level.

A statistically significant difference was found between the GPAs of the three academic curriculum groups among Native American/Mixed/No Response students, $F(2, 862) = 27.102, p < .0005$. Since the three groups were unequal in size, the Games-Howell test was used to run post-hoc comparisons. The results are shown in Table 12 (Field, 2013).

Table 12

Games-Howell post-hoc Comparisons Among Native Americans/Mixed/No Response by Academic Curriculum

		95% CI				
		Mean				
(I) NatAm/Mix/NR	(J) NatAm/Mix/NR	Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
NatAm/Mix/NR – NonAccl	NatAm/Mix/NR - AP	-.21205*	.04460	.000	-.3168	-.1073
	NatAm/Mix/NR - IB	-.59557*	.08120	.000	-.7893	-.4019
NatAm/Mix/NR - AP	NatAm/Mix/NR - NonAccl	.21205*	.04460	.000	.1073	.3168
	NatAm/Mix/NR - IB	-.38352*	.07914	.000	-.5727	-.1944
NatAm/Mix/NR - IB	NatAm/Mix/NR - NonAccl	.59557*	.08120	.000	.4019	.7893
	NatAm/Mix/NR - AP	.38352*	.07914	.000	.1944	.5727

Note. * The mean difference is significant at the 0.05 level.

A statistically significant difference was found between the GPAs of the three academic curriculum groups among African American students, $F(2, 2025) = 70.993, p < .0005$. Since the three groups were unequal in size, the Games-Howell test was used to run post-hoc comparisons (Field, 2013). The results are shown in Table 13.

Table 13

Games-Howell post-hoc Comparisons among African American Students by Academic Curriculum

(I) African-Am	(J) African-Am	Mean Difference (I-J)	Std. Error	Sig.	95% CI	
					Lower Bound	Upper Bound
African-Am – NonAccl	African-Am - AP	-.24007*	.02588	.000	-.3008	-.1794
	African-Am - IB	-.62517*	.06213	.000	-.7735	-.4769
African-Am - AP	African-Am - NonAccl	.24007*	.02588	.000	.1794	.3008
	African-Am - IB	-.38510*	.06255	.000	-.5343	-.2359
African-Am - IB	African-Am - NonAccl	.62517*	.06213	.000	.4769	.7735
	African-Am - AP	.38510*	.06255	.000	.2359	.5343

Note. * The mean difference is significant at the 0.05 level.

A statistically significant difference was found between the GPAs of the three academic curriculum groups among African American students, $F(2, 2150) = 99.519, p < .0005$. Since the three groups were unequal in size, the Games-Howell test was used to run post-hoc comparisons. The results are shown in Table 14 (Field, 2013).

Table 14

Games-Howell post-hoc Comparisons among Asian Students by Academic Curriculum

(I) Asian	(J) Asian	Mean Difference (I-J)	Std. Error	Sig.	95% CI	
					Lower Bound	Upper Bound
Asian – NonAccl	Asian - AP	-.25323*	.03071	.000	-.3253	-.1812
	Asian - IB	-.57958*	.03814	.000	-.6691	-.4900
Asian - AP	Asian - NonAccl	.25323*	.03071	.000	.1812	.3253
	Asian - IB	-.32634*	.03236	.000	-.4024	-.2503
Asian - IB	Asian - NonAccl	.57958*	.03814	.000	.4900	.6691
	Asian - AP	.32634*	.03236	.000	.2503	.4024

Note. * The mean difference is significant at the 0.05 level.

Null Hypothesis Three

The third hypothesis stated that there would not be a significant difference in the likelihood of attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took an accelerated exam (AP or IB) and students who took no accelerated exams. In other words, are the odds of attending a 2-year or 4-year college different for a student taking any accelerated exams (AP and/or IB exams) compared to those who do not take any accelerated exams? Although every student who takes an IB exam must take the corresponding IB course, not every student who takes an AP exam takes the corresponding course. Thus, given the available data, the research question can only adequately address whether taking an exam (AP), not necessarily completion of the associated course, could predict a student's choice of college type as compared to students who took no AP or IB exams.

The data were drawn from a self-reported survey completed by 129,772 high school seniors approximately one month before graduating. Of these students, however, 1,475 were missing data for the question regarding future plans and were eliminated from the study. Of the 128,222 remaining cases, 85,846 (66.9%) took no accelerated exams, while 42,450 (33.1%) took either an AP or an IB exam. In addition, 35.98% (n=46,152) did not indicate any plan to attend any type of 2-year or 4-year college, whether public or private, in-state or out-of-state, whereas 64.02% did specify their plan to enroll in some type of college education.

A logistic regression was performed on the data, first ascertaining whether taking an accelerated exam could predict initial college enrollment regardless of type (2-year or 4-year). Results, as seen in Table 15, indicated that those students who do not take any accelerated exams were about half as likely (.499 odds) to attend college than those who do. Stated differently, those who took accelerated exams (AP or IB) were about twice more likely to attend college than

those who did not. Although the logistic regression model was statistically significant, $\chi^2(1)=2950.015$, $p < .0005$, and correctly classified 64% of the cases, it explained only 3.1% (Nagelkerke R^2) of the variance in college enrollment. The corresponding correlation between taking any accelerated exam (AP or IB) and attending college was .177, which is highly significant for this sample ($p < .0005$).

Table 15

Results of Logistic Regression Showing Odds of Accelerated Students Attending College Versus Non-Accelerated Students

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Step 1								
TookAccel	-.694	.013	2815.709	1	.000	.499	.487	.512
Constant	1.058	.011	9086.256	1	.000	2.880		

A second logistic regression was performed to ascertain the effects of taking any accelerated courses (AP or IB) compared to no accelerated courses on the likelihood that a student would attend a 4-year instead of a 2-year college. The logistic regression model was statistically significant, $\chi^2(1) = 12807.504$, $p < .0005$. The model explained 20.3% (Nagelkerke R^2) of the variance in accelerated classes and correctly classified 67.8% of cases. As seen in Table 16 the odds of students who took accelerated courses entering a 4-year college is 6.05 times higher than students who did not take accelerated courses.

Table 16

Results of Logistic Regression Showing Odds of Accelerated Students Attending a 4-Year College Versus Non-Accelerated Students

	Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	TookAccel	1.800	.017	11056.385	1	.000	6.051
	Constant	-.382	.009	1663.539	1	.000	.682

Thus, null hypothesis three was rejected. There was a significant difference in the likelihood of attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took an accelerated exam (AP or IB) and students who took no accelerated exams.

Null Hypothesis Four

The same data used in Research Question 3 was used to test the fourth null hypothesis which stated that taking AP or IB exams would not predict whether a student would attend a public, 4-year collegiate institution versus a public, 2-year collegiate institution. First, the results of the 128,296 survey responses were examined to determine if the odds of IB students enrolling in any college were any greater than those of AP students. A logistic regression found that the odds of IB students choosing a college education (2-year or 4-year colleges) were about 2.36 times higher than for AP students (see Table 17). The logistic regression model was statistically significant, $\chi^2(1) = 293.511$, $p < .0005$. The model explained only 1.0% (Nagelkerke R^2) of the variance in AP classes but correctly classified 74.2% of cases.

Table 17

Results of Logistic Regression Showing Odds of IB Students Attending College Versus AP Students

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Step 1 APvsIB	.861	.055	244.377	1	.000	2.366	2.124	2.636
Constant	.148	.059	6.402	1	.011	1.160		

Secondly, a similar logistic regression model was run to determine whether the odds of IB students attending a 4-year college over a 2-year college were greater than those of AP students. The data indicate that the odds of an IB student attending a 4-year college instead of a 2-year college were 8.13 times higher than the odds for the AP student (see Table 18). This can partially be explained by the large number of AP students who enroll in Florida community colleges instead of 4-year colleges or universities. The logistic regression model was statistically significant, $\chi^2(1) = 661.430, p < .0005$. The model explained only 3.4% (Nagelkerke R^2) of the variance in AP exams but correctly classified 80.5% of cases.

Table 18

Results of Logistic Regression Showing Odds of IB Students Attending a 4-Year College Versus AP Students

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Step 1 APvsIB(1)	2.096	.114	338.996	1	.000	8.134	6.507	10.167
Constant	1.327	.015	8308.727	1	.000	3.769		

Given the results that were obtained through both logistic regression models, null hypothesis four can be rejected since there is a significant difference in the likelihood of initially

attending a public, 4-year collegiate institution versus a public, 2-year collegiate institution college between students who took AP exams and students who took IB exams.

Additional Analysis

Once it was determined that there was a statistically significant difference in the college GPAs of IB and AP students, a set of ANOVAs was then run to determine if a difference existed between the number of AP exams a student took and his or her college GPAs. Since IB students take exams in six subject areas and are assessed in a seventh core subject known as Theory of Knowledge, an additional hypothesis was formed that an AP student who had taken an equivalent of seven AP subject exams would have a college GPA equal to that of an IB student.

Rather than using the same sample set of data 10,006 students that was employed for Research Questions 1 and 2, the entire population of AP and IB students was used to analyze the effect of the number of AP exams on college GPAs compared to IB scores. The sample for this analysis included a total of 26,483 students, 24,220 AP students and 2263 IB students. There were 15,816 females and 10,666 males. In this analysis, the variable of interest for AP students

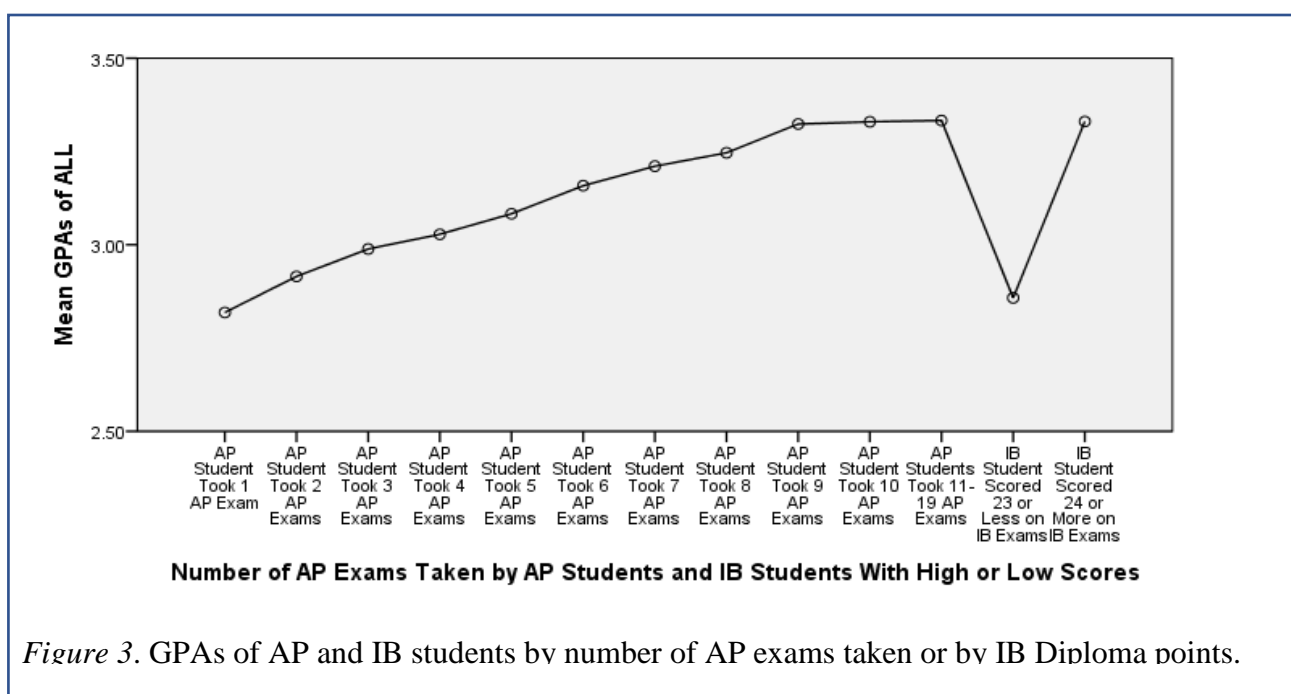


Figure 3. GPAs of AP and IB students by number of AP exams taken or by IB Diploma points.

was only the number of tests taken, not the mean score of all of their exams. For IB students, the variable of interest remained the IB Diploma score which was split into those who has achieved the IB diploma with 24 or more points (n=1925) and those who had not achieved the IB diploma with 23 or less points (n=338). The mean GPA was calculated for every number of AP exams taken along with the two categories of IB students. All those who took 11 or more AP exams were consolidated into one category given the low number of students (n = 499). The initial graph of the mean GPAs can be seen in Figure 3. This plot reveals that the mean estimated GPA for students who scored below 23 IB Diploma points was generally equivalent to those students who only took one AP exam whereas those students who took nine or more AP exams seem to be equivalent to those who scored 24 or more IB Diploma points. Table 19 lists the population number, the means for students taking each different number of AP exams and IB Diploma points, and the 95% confidence intervals of those GPA ranges.

Table 19

Mean College GPAs of All Students Taking an AP or IB Exam

Number of Exams Taken	N	Mean	SD	SE	95% CI of Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Took 1 AP Exam	6549	2.8185	.77234	.00954	2.7998	2.8372	.06	4.00
Took 2 AP Exams	4525	2.9152	.74936	.01114	2.8934	2.9371	.07	4.00
Took 3 AP Exams	3436	2.9886	.73163	.01248	2.9642	3.0131	.07	4.00
Took 4 AP Exams	2756	3.0280	.71671	.01365	3.0013	3.0548	.11	4.00
Took 5 AP Exams	2112	3.0830	.70587	.01536	3.0529	3.1132	.05	4.00
Took 6 AP Exams	1557	3.1582	.70553	.01788	3.1231	3.1932	.20	4.00
Took 7 AP Exams	1145	3.2106	.65252	.01928	3.1728	3.2485	.39	4.00
Took 8 AP Exams	785	3.2464	.66080	.02359	3.2001	3.2927	.11	4.00
Took 9 AP Exams	526	3.3236	.59534	.02596	3.2726	3.3746	.54	4.00
Took 10 AP Exams	330	3.3295	.67500	.03716	3.2564	3.4026	.57	4.00

Took 11-19 AP Exams	499	3.3329	.69852	.03127	3.2715	3.3943	.55	4.00
Scored 23 or Less on IB Exams	338	2.8578	.74285	.04041	2.7783	2.9373	.30	4.00
Scored 24 or More on IB Exams	1925	3.3304	.60048	.01369	3.3036	3.3573	.14	4.00
Total	26483	3.0134	.74189	.00456	3.0045	3.0224	.05	4.00

In order to statistically analyze these results, an ANOVA was performed on the GPAs of the 11 AP exams and the two sets of IB scores, $F(12, 26470) = 121.548$, $p < .0005$, partial $\eta^2 = .052$. Having found a statistically significant difference between the mean GPAs of the number of AP exams and IB Diploma scores, multiple comparisons were made between each number of AP exams and IB scores. As seen in Table 20, the *post-hoc* Bonferroni tests indicated that the mean GPA of IB students scoring 23 or less Diploma points were not statistically different in significance than those students who took one, two, or three AP exams. Only with those students taking four AP exams does the difference between AP and IB (< 23 pts) students become significant again, dropping to $p < .003$. Thus, students who achieved 23 or less points for their IB Diploma points were just as likely to perform in college at the same level as a student who only took one, two, or three AP exams.

Table 20

Results of post-hoc Bonferroni Tests Comparing Mean Differences of College GPAs of Students with IB Diploma Scores and Multiple AP Exams

(I) IB Diploma Points	(J) Number of AP Exams or IB Diploma Points	Mean Difference (I-J)	SE	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
IB Score \leq 23 Points	Took 1 AP Exam	.03928	.04030	1.000	-.0983	.1768
	Took 2 AP Exams	-.05744	.04074	1.000	-.1965	.0816
	Took 3 AP Exams	-.13084	.04118	.116	-.2714	.0098
	Took 4 AP Exams	-.17024*	.04163	.003	-.3124	-.0281
	Took 5 AP Exams	-.22524*	.04232	.000	-.3697	-.0808
	Took 6 AP Exams	-.30036*	.04335	.000	-.4484	-.1524
	Took 7 AP Exams	-.35283*	.04472	.000	-.5055	-.2002
	Took 8 AP Exams	-.38862*	.04700	.000	-.5491	-.2282
	Took 9 AP Exams	-.46582*	.05036	.000	-.6378	-.2939
	Took 10 AP Exams	-.47168*	.05591	.000	-.6626	-.2808
	Took 11-19 AP Exams	-.47510*	.05089	.000	-.6488	-.3014
IB Score \geq 24		-.47263*	.04261	.000	-.6181	-.3272
IB Score \geq 24 Points	Took 1 AP Exam	.51190*	.01873	.000	.4480	.5758
	Took 2 AP Exams	.41519*	.01966	.000	.3481	.4823
	Took 3 AP Exams	.34179*	.02057	.000	.2716	.4120
	Took 4 AP Exams	.30239*	.02146	.000	.2291	.3757
	Took 5 AP Exams	.24738*	.02276	.000	.1697	.3251
	Took 6 AP Exams	.17226*	.02462	.000	.0882	.2563
	Took 7 AP Exams	.11980*	.02696	.001	.0278	.2118
	Took 8 AP Exams	.08401	.03059	.471	-.0204	.1885
	Took 9 AP Exams	.00680	.03554	1.000	-.1145	.1281
	Took 10 AP Exams	.00094	.04304	1.000	-.1460	.1479
	Took 11-19 AP Exams	-.00248	.03629	1.000	-.1264	.1214
IB Score \leq 23		.47263*	.04261	.000	.3272	.6181

Note. *Mean Difference is significant at the .05 level.

The most significant finding, however, was the change in significance that occurred between taking 7 and 8 AP exams and those IB students who scored over 24 points. As seen in

Table 20, those students who took 7 AP exams still had a mean GPA that was statistically significantly different ($p < .001$) from IB students who scored 24 or more points on their IB Diploma. However, when a student took 8 AP exams, the difference between those students' mean GPA in college and the mean GPAs of IB students who achieved the IB Diploma was a matter of statistical chance with $p = .471$. At 9+ AP exams, p increased to and remained at 1 in comparison to IB scores of 24+ points. In other words, those students who took 8 or more AP exams achieved a statistically equivalent college GPA as those students who completed the IB Diploma Programme with 24 or more points.

Summary

The next chapter will analyze the results of each research question recorded in this chapter and draw some conclusions for how these results should be interpreted in the context of student choice of academic curriculum and academic performance in college. The implications of these results will also be discussed along with an acknowledgement of the limitations of this study. Finally, recommendations for future research will be shared that could better shape an understanding of how well high school curriculums prepare students for college work.

CHAPTER FIVE: CONCLUSIONS

Overview

Accountability, rigor, and choice are all influential topics of discussion within the current American education system. By analyzing how effectively the Advanced Placement (AP) or International Baccalaureate (IB) curricula prepare high school students for college success as determined by resulting college cumulative GPAs, this study provides a small measure of accountability of students' choice of rigorous secondary school curricula. The data also shed light on what type of college students are most likely to choose based on their curricular choices and which type of degree they are most likely to complete.

Discussion

The original population from which the data was drawn included every student who graduated from a public Florida high school in 2006 ($N=129,77n$). A stratified random sample was taken from this population based on ethnicity, providing equivalent groups of ethnicity to compare ($n=10,006$). By choosing random samples of more than a thousand in all but one of the ethnic groups, according to the Central Limit Theorem, there is a strong likelihood that the sample accurately reflects the larger population in terms of normality (Field, 2013). Thus, by drawing a sample which, statistically, is a relatively accurate representation of each ethnic group, it increases the power of analysis by using relatively equal sample sizes for the different ethnic groups even though this means a smaller proportion of Caucasian and African American students compared to the original population. In the case of Mixed Race/Native American/Other/Did Not Disclose, all cases of the group were used since it was the smallest ethnicity grouping ($n = 865$). The number of cases selected was derived using Slovin's formula plus 12% more to account for outliers (Jane Yank, personal correspondence, Sept 1, 2015).

When reviewing the data from this sample, the extreme outliers for all three academic groups (AP, IB, Non-accelerated) did not allow for tests of normality to be met. After various transformations were attempted without successfully producing a sufficient normality, the decision was made to drop the all GPAs lower than a 1.5 for all AP and Non-accelerated students and 1.75 for IB students. After removing the outlying cases ($n = 675$), the assumptions of linearity, independence of errors, homoscedasticity, unusual points, and normality of residuals were generally met.

Research Question 1

The first research question sought to discover if a difference existed in the cumulative GPAs between those students who took AP exams, those students who took IB exams, and those students who did not take any AP or IB exams. The ANOVA run on the data indicated that a statistically significant difference did exist between the three groups of students (Welch's $F(2,1820.604) = 326.388, p < .0005$). Further comparisons between groups revealed that statistically significant differences did exist between each of the academic groups, with IB students ($n = 631$) earning the highest mean GPA ($M=3.38, SD=.51$), AP students ($n = 5149$) earning the second highest mean GPA ($M=3.05, SD=.60$), and non-accelerated students ($n = 3551$) earning the lowest GPA ($M=2.83, SD=.60$). While the difference between both accelerated programs and non-accelerated students would be anticipated due to the fact that non-accelerated students did not take accelerated college-level courses, what does stand out is that there was a larger mean difference between the IB and AP students (.33) than there was between the AP and non-accelerated students (.22), with IB students performing at an entire half grade point above a non-accelerated student. The effect size (partial $\eta^2 = .058$) was of a medium magnitude (Cohen, 1988) indicating that of the two accelerated programs, the IB program

seemed to be consistently able to prepare students to achieve higher college grades than the AP program.

Although there are many reasons why IB students outperform the average AP student in college, one major contributing factor is that IB students tend to self-select themselves for the IB program even more so than AP students. Many IB programs are designated as magnet programs, giving them the ability to draw bright students from a wider area. In addition, most IB programs in Florida have some type of admissions requirements such as a minimum GPA, teacher recommendations, test scores, or minimum math or foreign language course prerequisites, all of which tend to attract the most academically capable students in a particular school or district. These programs usually also maintain an expected minimum standard of performance. Thus, academically low-performing students are often removed from many IB programs and placed in various AP courses, concentrating the number of academically talented students within the IB program. Thus, to some degree, these are the students who are going to succeed in college at a higher level regardless of what academic program in which they were enrolled in high school. By comparing college GPAs between graduates of the two academic curriculums, it could be extrapolated that many of these top-performing students are opting to select the IB program over the AP program.

This trait of self-selection is also enhanced by social cognitive career theory. Students choose the academic program that they think will best achieve their goals, interests, and expectations (Lent, Brown, & Hackett, 1994). Bright, motivated students who are driven to successfully gain admission to the college of their choice wish to choose the academic program that will best help them achieve this goal. Both the IB and AP programs give students benefits in their admissions process and then give them accelerated avenues of college credit once they are

accepted. If students and parents are hearing anecdotally that former IB students are gaining admission to the schools of their choice at a higher rate and that they are very successful in terms of college GPA, then many families are more likely to choose the IB curricular option, thus perpetuating the cyclical nature of the social cognitive career theory that bright students will choose the curricular option that gains them the greatest achievement of their goals. This study simply gives families quantifiable evidence that IB students actually achieve higher college GPAs than the average AP student.

The results of this study's AP students are comparable to earlier findings that found that AP students achieved higher GPAs than did non-AP students (Willingham & Morris, 1986; Morgan & Ramist, 1998; Geiser & Santelices, 2004; Dougherty et al., 2006b; Karp et al., 2007; Hargrove et al., 2008; Murphy & Dodd, 2009; Patterson et al., 2011). The International Baccalaureate Organization's 2011 study with the students within the University of California system showed that compared against a matched group of academically similar students, IB students achieved higher GPAs. Although many of these matched students took AP exams, they were not selected from an exclusive AP sample of students. However, when Conley et. al. (2014) looked at data from the University of Oregon's Honors College between IB students and a matched group of other honors students who were largely AP students they found no statistically significant difference among college GPAs. The advantage of this study is that it compares IB students' GPAs directly against AP students' GPAs within the same state educational system, allowing for more direct comparisons to be made.

When the mean GPAs of AP students were broken down by the number of AP exams taken and compared against high scoring (24+ points) and low scoring (23 or less points) IB students, the results were of great interest. When comparing the mean GPAs of all AP exam

takers ($n = 24,220$) and IB students ($n = 2263$) in an ANOVA, the number of AP exams and high or low scoring IB points was statistically significant $F(12, 26470) = 121.548, p < .0001$. When multiple comparisons were made between each number of AP exams and high or low IB scores, it was discovered that there was no statistically significant difference between the mean GPAs of a student taking only one, two, or three AP exams and those students scoring 23 or less points on their IB exams. The most revealing result, however, comes when the mean GPA of those taking 8 AP exams was found to be no different statistically from those students achieving an IB Diploma of 24 or more points.

A significant difference did still exist in mean GPAs for those taking only seven AP exams compared to those with 24+ IB points ($p < .001$), but that difference could be achieved by chance when a total of 8 exams ($p = .471$) is taken. There was no statistical difference between the mean GPAs of high scoring IB students and those students who take eight or more AP exams. Whether that is the point where the two accelerated programs intersect due to the intellectual caliber of the students, the degree of students' academic perseverance, or the quality and quantity of rigorous instruction is unknown, but in terms of performance on a cumulative college GPA, that is the point where students of the two programs demonstrate no difference.

Thus, the null hypothesis must be accepted that there is no difference between IB students and those students who take 8 or more AP exams. Given that IB students take exams in six content areas plus assessments in the Theory of Knowledge course, it would be expected that the IB Diploma could be considered the equivalent of taking and passing seven AP exams. Thus, the IB student and the AP student who took eight or more exams appear to have a similar educational experience in terms of rigor and preparation for college level work.

Research Question 2

The second research question aimed to determine whether college GPAs could be predicted with a collection of variables: gender, income level, ethnicity, academic program (AP, IB, Non-accelerated), the mean of all of a student's AP scores, and the IB Diploma score. Income level was determined by whether a student was classified as eligible for free or reduced lunch. The IB Diploma scores was the sum of a student's IB exam scores. In the first regression model, gender and income level were not statistically significant (gender, $p = .079$; income level, $p = .685$). However, ethnicity, AP mean scores, and IB Diploma scores were statistically significant and accounted for 21.5% (adj. R^2) of the variance in GPAs. A second regression model was run excluding the predictors of gender and income level. The IB Diploma score consistently demonstrated a greater effect on GPA (Std. $\beta = .367$) than did either AP scores (Std. $\beta = .120$) or ethnicity (Std. $\beta = .09$).

When ANOVAs were run to compare academic programs (AP, IB, non-accelerated) within each of the five different ethnicities, a statistically significant difference ($p < .0005$) existed within each ethnicity. The largest achievement gap between IB and Non-Accelerated GPAs existed among African-American students, a .62517 difference (SD = .06213), whereas the smallest gap was among the GPAs of Hispanic/Latino students, a .25886 difference (SD = .06543). The largest achievement gap between AP and Non-Accelerated GPAs existed among Asian students, a .25323 difference (SD = .03071), while the smallest difference (.06778, SD = .02611) was also among Hispanic/Latino students. When analyzing the difference between AP and IB GPAs, the largest gap was among African-Americans (a .38510 difference, SD = .06255) whereas the lowest difference was again among Hispanic/Latino students (a .19108 difference, SD = .06431).

Overall, the results indicated that African-American, Asian, Caucasian, and Native American/Mixed students performed better in college having completed the IB program. Whether this can be attributed to a more supportive environment, a more concentrated sample of bright students, or a more comprehensive and rigorous curriculum cannot be determined from this study. Interestingly, the difference in academic performance of IB Hispanics and AP Hispanics in college is almost half of that of any of the other ethnicities. It is not known why the choice of academic curriculum has less effect on Hispanic students as it does on students of other ethnicities.

When all other predictors except choice of academic curriculum (AP exam scores and IB Diploma scores) were removed in the final multiple regression model, the results revealed that only 5.8% of the variance of college GPA was attributed solely to curricular choice. As stated above, when ethnicity had been included in the model alongside AP exam scores and IB Diploma scores, 21.3% of the variance was explained. Thus, the interaction of ethnicity with curricular choice has a significant impact in predicting a student's college GPA.

Research Question 3

The third and fourth research questions investigated a student's choice of college, whether it would be a 2-year community or state college or a 4-year university and whether a student's choice of academic curriculum effected that choice. Research Question 3 specifically sought to determine the odds of a student within either accelerated course (AP or IB) choosing any type of college (2-year or 4-year) compared to a non-accelerated student. Both questions used the results of a self-reported survey of public high school seniors (n=128,223) which students completed within two months of their graduation from high school. The logistic regression indicated that when compared to accelerated students, the odds of a non-accelerated

student enrolling in college was .499 ($p < .0005$), or, in other words, students taking accelerated courses were twice as likely to enroll in college as non-accelerated students.

A second logistic regression was run to analyze more specifically what type of college accelerated and non-accelerated students were likely to choose to attend. The results indicated that an accelerated student was 6.05 times more likely ($p < .0005$) to attend a 4-year university than a 2-year college compared to non-accelerated students. Thus, those students who take AP or IB exams were twice as likely to attend college and six times as likely to choose a 4-year university rather than a 2-year college compared to those students who did not take accelerated exams. This corresponds to earlier studies that AP and IB students enroll in colleges at a higher rate than non-accelerated students (Karp et al., 2007; Mattern et al., 2009; Caspary, 2011), with IB students sometimes enrolling as high as 95% directly into a college compared to the national average of 60% (Bergeron, 2015).

One factor that could contribute to the overwhelming choice of accelerated students going on to college in greater numbers than non-accelerated students is Florida's Bright Futures Scholarship Program. The program substantially contributes to the college costs of students who qualify and who agree to attend a Florida college or university. Eligibility is determined based on high school GPA, SAT or ACT test scores, and the number of community service hours performed. Grades for all AP, IB, ACIE, or dual enrollment courses are weighted, enabling accelerated students to qualify for the program in higher numbers than students who have not taken any accelerated courses. College costs are much lower at Florida's community and state colleges, enabling more students to afford attending these institutions of higher education rather than 4-year universities. Bright Futures also covers a higher percentage of the costs of 2-year schools compared with 4-year colleges (Florida Department of Education, 2017).

Research Question 4

Using the same data set as Research Question 3, Research Question 4 examined differences specifically between IB and AP students in their choice of college. Hypothesis 4 states, “Whether a student took AP or IB courses provides a high degree of predictability as to whether a student will attend a 4-year university or a 2-year community or state college.” The first logistic regression run more generally explored whether IB students were more likely to attend any type of college compared to AP students. The results indicated that IB students were about 2.36 times ($p < .0005$) times more likely to enroll in college than AP students. A second logistic regression narrowed that choice to examine whether the odds of attending a 2-year or a 4-year college were different for students taking AP exams compared to those taking IB exams. At least among Florida public school students, IB students were 8.13 times more likely to initially attend a 4-year college rather than a 2-year college compared to AP students.

The research supports the fact that accelerated students are more likely to attend selective, 4-year universities over 2-year colleges (Buckley & Muraskin, 2009; Mattern et al., 2009; Roderick et al., 2009; Caspary, 2011; Bergeron, 2015). However, no other study directly compares AP and IB students and their choice of college type. Several reasons can be offered for the dramatic difference between these two groups. One reason lies within the options of higher education within Florida. Although there are 12 public universities, only one university, the University of Florida, is consistently ranked within the top 25 public universities in the country by U.S. News and World Report (2016). Accelerated students tend to pursue admission to selective and highly selective colleges, all of which are 4-year institutions. This study found that in 2006, large numbers of IB students left the state to attend college, with only 26.6% of IB students staying to attend Florida colleges. Florida does have, however, an extensive network of

community and state colleges that serve local communities. For financial and geographic reasons, a large number of AP students chose to enroll at a community or state college first and then later transfer to a 4-year institution. Those IB students who earn the IB Diploma and stay in Florida to attend college automatically qualify for the Bright Futures Scholarship which pays a substantial percentage of the cost of a Florida university, a variable which also supports why IB students attend a 4-year university at a greater rate than AP students. Other students can also qualify for the same scholarship, but must satisfy additional requirements of GPA, test scores, and community service hours. Finally, social cognitive career theory offers the explanation that many of the brightest students, who are concentrated in the IB program, will choose a 4-year university that offers them what they perceive are the greatest advantages for their chosen career path, interests, goals, and expectations.

Conclusions

The conclusions that can be drawn from this study are that, overall, the majority of IB students achieve a statistically significant higher GPA in college than the average AP student who, in Florida, only takes 1.8 AP exams (College Board, 2006) throughout high school. To concur with the existing literature, though, AP students achieve higher college GPAs than their peers who take no accelerated courses in high school. When predicting college GPA performance, the IB Diploma score remains a more powerful predictor of college success than mean AP scores. While ethnicity also is a strong predictor of college GPA performance, gender and income levels are not. The data also indicate that a student who has taken at least eight or more AP exams can achieve a college GPA that is statistically no different than that of an IB Diploma student. This is a new finding that links the college success of IB students to that of AP

students, giving educators, parents, and students the ability to compare the merits and benefits of both programs in a meaningful and quantifiable manner.

In this sample, accelerated students were more likely to choose to enroll in college than their non-accelerated peers. They were also more likely to choose to attend a 4-year university over a 2-year community college. When Florida AP and IB students were directly compared against each other, IB students were more likely to attend college than AP students and choose a 4-year university rather than a 2-year community college.

Social cognitive career theory posits that students are more likely to choose the academic program that will best benefit them given their interests, goals, and expectations (Lent et al., 1994). This study, then, supplies additional information that students can use to compare the AP and IB programs in order to determine which program can best meet their academic interests, goals, and performance abilities in continuing their education after high school.

Implications

When comparing academically accelerated curriculums such as the Advanced Placement and the International Baccalaureate programs, it is essential to keep in mind that both programs serve different purposes. The AP program was specifically designed to give high school students who were ready to study more rigorous content a chance to take college level courses before entering college. College Board now offers over 30 different courses in a wide variety of subjects, allowing students to choose the content area in which they are most interested in or most prepared to study. Although College Board is now examining ways to uniquely “package” some of its courses through its new Capstone program which includes new courses in critical thinking and research, the original intent was to allow students to choose individual, stand-alone courses (College Board, 2017). The International Baccalaureate program began with the intent

to offer a comprehensive diploma program that provided a global approach to learning skills within six content areas combined with research, critical thinking, and community service. Although students can choose to complete more demanding Higher Level courses that cater to their academic strengths and interests, students are still required to take rigorous, accelerated courses in all six subject areas. In contrast to College Board's new initiatives to offer more comprehensive curricular choices, the International Baccalaureate Organization is expanding the access to its individual core courses through new programs such as the International Baccalaureate Career-related Program which partners with vocational certification programs and career-related coursework to offer IB level courses to high school students pursuing a more vocational oriented curricular track (International Baccalaureate Organization, 2017).

This study is not intended to evaluate the value and merits of either academic program as better than the other one. Both programs fill a vital role within the public education system in offering rigorous curricular options to advanced students. The purpose of this study, instead, was to examine the academic performance of both AP and IB students in college in relation to their college GPAs. The results of this study indicate that overall, the majority of IB students achieved a statistically significant higher GPA in college than the average AP student and that the IB Diploma score is a more significant predictor of college performance than AP scores. IB students in the sample were also more likely to enroll in college and attend a 4-year university. However, the data indicate that a student who had taken at least eight or more AP exams could achieve a college GPA that is statistically no different from that of an IB student.

For schools that do not have the funds to support and maintain an IB program, or for students who are not able to afford the costs associated with taking IB exams, this is good news. Most schools have the fiscal capacity, personnel resources, and student interest to offer at least

one, if not many, AP courses. This study supports the future value of offering students the opportunity to take even just one or two AP courses and the corresponding exam. If a school can offer students a collection of at least eight AP exams over the course of four years, the data also support the possibility that those courses would prepare students to a level equivalent to the more comprehensive IB program. If schools are able to offer the International Baccalaureate program at their facility, though, this study suggests that the students who achieve the IB Diploma are more likely to attend a 4-year university and achieve a higher college GPA than the majority of their other accelerated peers who only take AP courses.

Although this study in no way advocates that the IB program is better than AP courses or visa versa, the research does begin to reveal some shared characteristics of the students who are most successful in either of them. Social cognitive career theory postulates that students make the initial decision to pursue either program based on a variety of environmental factors that contribute to creating a community of learners. Both IB Diploma students and those students who take multiple AP courses demonstrate a determined work ethic, an academic perseverance, and a resilient energy that allows them to complete what they start. IB students, particularly, as they strive to complete the core components of the Extended Essay, Creativity, Action, and Service (CAS) activities, and the Theory of Knowledge course, tend to develop a close community of student learners who support and encourage each other in their academic tasks. This strong community, in turn, reinforces academic performance. In schools that do not offer the IB curriculum, AP students who take multiple AP courses together also develop a strong sense of community that supports ongoing student success.

Offering accelerated courses to high school students is a challenging endeavor for schools to offer, teachers to create, students to complete, and parents to support. This study, however,

suggests some positive rewards exist for those who are willing to engage in rigorous, accelerated coursework. Social cognitive career theory offers the explanation that if students' individual expectations, academic interests, and academic goals are coupled with appropriate environmental influences (parental encouragement and guidance, teacher support, positive peer interaction, and school resources) then the benefits of successfully completing AP and IB exams result in higher college GPAs and arguably greater success within a chosen career field. This then furthers a student's positive learning experiences which enhance his or her ability to make informed choices about future decisions.

Limitations

As with any major research study, this study has several important limitations. This study did not control for academic aptitude prior to taking high school accelerated courses in the junior and senior year. With the data provided by the Florida Department of Education, there is no way to determine if students who began the IB program had a higher academic potential or ability level than those students who chose to take AP courses instead. Thus, while the study does analyze the college performance of students who have completed both programs, broad generalizations cannot be asserted about whether one curriculum is quantifiably better than the other since it is unknown whether the academic quality of the students entering either program was equivalent or different.

Also, while the majority of Florida students attend universities in Florida, as strongly encouraged by financial incentive programs such as the state's Bright Futures Scholarship Program, many AP and IB students choose to attend college out of state. The colleges GPAs of these students were not readily available, and thus these students were excluded from the study. This limitation will slightly skew the results since the elite national universities located outside

of Florida draw many top-performing AP and IB students whose scores were not analyzed.

The data were drawn from the graduating class of 2006 which is arguably dated. The researcher was limited to the data that the State of Florida was willing to release for analysis. Since this time, the number of AP and IB students has grown substantially across all Florida schools. Also, with the financial crisis that swept American beginning in 2007, many more students have chosen to remain in Florida to attend college, particularly due to the financial incentives offered by the Bright Futures Scholarship Program which has also increased the rigor of its requirements and decreased the individual award amounts in the intervening years. This has limited some of the generalizations that can be made regarding the conclusions based on the original data.

Two other accelerated credit options in Florida were not analyzed in this study—dual enrollment and the Cambridge Advanced International Certificate of Education (AICE). Given the variety of dual enrollment courses (i.e. college courses taken for high school credit) and the limited number of statewide AICE students (in 2006, $n < 100$), the effectiveness of these accelerated programs was not chosen to be included in this study due to the difficulty of obtaining data.

Recommendations for Further Research

As the push for more rigorous education continues with the introduction of the Common Core into the American education system, a greater need to investigate the merits of such high school accelerated credit options such as Advanced Placement, International Baccalaureate, the Cambridge Advanced International Certificate of Education, dual enrollment courses, and other programs will develop. Key questions will include such items as whether there is a difference in performance between students who take an AP exam and those who take the AP course but do

not take the exam. Is there a difference between accelerated students' GPA performance as first year college students versus their cumulative college GPA so as to determine the impact of the college experience versus secondary curriculum? The impact of secondary accelerated curriculum could be further clarified if the college performance of students of the same high school GPAs could be compared by program. Using pre-program assessments, such as the 10th grade PSAT, and post-program assessments, such as high school GPA or other test scores, could help quantify the effect of academic program by controlling for student differences. Could a test such as College Board's PSAT, usually given in the 10th and/or 11th grades, be used to determine the academic potential of IB students as well as AP students for whom it is currently aligned?

Once in college, does it make a difference in GPA whether a student pursues a STEM subject or a humanities subject? For new accelerated initiatives, how will those students who take the new AP Capstone Diploma course compare against those that opt to simply take a collection of AP exams and those who take the IB Diploma courses or even the new IB Career-related Program? In terms of college degree completion, is there a correlation between college degree completion and a student's academic curriculum? Do AP or IB students tend to finish college quicker and with what rate of degree completion? Which program is more likely to produce students who go on to pursue graduate degrees? The answers to these and other questions will continue to fill out our understanding of how these educational curricula compare and how parents and educators can best equip new generations of bright, motivated students who are ready to learn.

REFERENCES

- Adelman, C. (1999). *Answers in the tool box: Academic intensity, attendance patterns, and bachelor's degree attainment*. Washington, D.C.: U.S. Department of Education Office of Educational Research and Improvement.
- Adelman, C. (2006). *The toolbox revisited: Paths to degree completion from high school through college*. Washington, D.C.: U.S. Department of Education.
- Akerhielm, K., Berger, J., Hooker, M., & Wise, D. (1998). *Factors related to college enrollment. final report*. Retrieved from <http://ezproxy.liberty.edu/login?url=https://search.proquest.com/docview/62539283?accountid=12085>
- Bailey, T. & Karp, M. (2003). *Promoting college access and success: A review of credit-based transition programs*. U.S. Department of Education, Office of Adult and Vocational Education: Washington, D.C.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Bergeron, L. (2015). *Diploma Programme students' enrollment and outcomes at US postsecondary institutions 2008–2014*. Bethesda, MD, USA. International Baccalaureate Organization.
- Bluhm, M. (July 2011). *First Year University Experience of IB Graduates*. Paper presented at IB Conference of the Americas, San Antonio TX.
- Buckley, P. & Muraskin, L. (April 2009). *Graduates of Denver Public Schools: College Access and Success*. Washington, D.C. Pell Institute for the Study of Opportunity in Higher Education.

- Burnham, P. S. & Hewitt, B. A. (1967). *Study of advanced placement examination scores of the college entrance examination board*. New Haven, CT: Yale University.
- Burns, R. P. & Burns, R. (2008). *Business Research Methods and Statistics Using SPSS*. Los Angeles, CA: SAGE Publishing.
- Cahow, C. R., Christensen, N. F., Gregg, J. R., Nathans, E. B., Strobel, H. A., & Williams, G. W. (1979). *Undergraduate faculty council of arts and sciences--committee on curriculum--subcommittee on advanced placement report*. Durham, NC: Duke University.
- Casparly, K. 2011. *Postsecondary enrollment patterns of IB certificate and diploma candidates from U.S. high schools*. Menlo Park, California. SRI International.
- Casparly, K., & Bland, J. (2011). *First college courses taken by Florida IB students*. Research Brief. Menlo Park, CA, USA. SRI International.
- Cassery, P. L. (1966). *College decisions on advanced placement: A follow-up of advanced placement candidates of 1963*. College Board Research Report RDR-64-5, No. 15. New York: College Entrance Examination Board.
- Chajewski, M., Mattern, K. D., & Shaw, E. J. (2011). Examining the role of advanced placement exam participation in 4-year college enrollment. *Educational Measurement: Issues and Practice*, 30(4), 16-27.
- Chamberlain, P. C., Pugh, R. C., & Schellhammer, J. (1978). Does advanced placement continue throughout the undergraduate years? *College and University*, 53(2), 195-200.
- Chang, A. (2012). *StatTools*. Retrieved from <http://www.stattools.net/index.php>
- Cohen, J. (1988). *Statistical power analysis for the behavioural sciences (2nd ed.)*. New York: Academic Press.

- Cohen, J. & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education, 6th ed.* New York: Routledge.
- College Board. (2004). *Interpreting and using AP grades*. New York: NY.
- College Board. (2006). *Number of AP examinations per student 2006*. Retrieved from <http://research.collegeboard.org/programs/ap/data/archived/2006>.
- College Board. (2010a). *2010-11 Official educator guide to the PSAT/NMSQT*. Retrieved from <http://professionals.collegeboard.com/profdownload/official-educator-guide-to-the-psat-nmsqt.pdf>
- College Board. (2010b). *AP central – AP courses and exams*. Retrieved from <http://apcentral.collegeboard.com/apc/public/courses/index.html>
- College Board. (2011). *May 2012 AP Exam Formats*. Retrieved from http://apcentral.collegeboard.com/apc/public/repository/AP_Exam_Format.pdf
- College Board. (2017). *AP Capstone Overview*. Retrieved March 27, 2017, from <https://advancesinap.collegeboard.org/ap-capstone>
- Conley, D., McGaughy, C., Davis-Molin, W., Farkas, R. & Fukuda, E. (2014). *International Baccalaureate Diploma Programme: Examining college readiness*. Bethesda, MD, USA. International Baccalaureate Organization.
- Conley, D., & Ward, T. (2009). *International baccalaureate standards development and alignment project*. Eugene, OR: Educational Policy Improvement Center.
- Culross, R., & Tarver, E. (2007). Teacher and Student Perceptions of the International Baccalaureate Program: A First Year Perspective. *Journal of School Choice, 1*(4), 53-62.

- Dougherty, C., Mellor, L., & Jian, S. (2006a). *Orange juice or orange drink?: Ensuring that "advanced courses" live up to their labels*. National Center for Educational Accountability: Austin, TX.
- Dougherty, C., Mellor, L. & Jian, S. (2006b). *The relationship between advanced placement and college graduation*. National Center for Educational Accountability: Austin, TX.
- Drew, C. (2011, January 7). Rethinking Advanced Placement. *The New York Times*. Retrieved from <http://www.nytimes.com>
- Duevel, L. (1999). *The international baccalaureate experience: University perseverance, attainment, and perspectives on the process* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (UMI Number 9951943)
- Duffy, W. R. (2010). Persistence and performance at a four-year university: The relationship with advanced coursework during high school. In P. Sadler, G. Sonnert, R. Tai, & K. Klopfenstein (Eds.), *AP: A critical examination of the advanced placement program* (pp.139-163), Cambridge, MA: Harvard Education Press.
- Farkas, S., & Duffett, A. (2009). *Growing pains in the advanced placement program: Do tough trade-offs lie ahead?* Thomas B. Fordham Institute: Washington, D.C.
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics, 4th ed*. London: Sage Publications.
- Florida Department of Education. (2017). *Bright Futures Scholarship*. Retrieved March 27, 2017, from <http://www.floridastudentfinancialaid.org/ssfad/bf/>
- Florida Department of Education. (2010). *Fldoe hub home--research*. Retrieved from <http://www.fldoehub.org/Research/Pages/default.aspx>

- Florida Department of Education. (January 2009). *Florida public high school students receiving standard diplomas: 1977-2008*. Retrieved from <http://www.fldoe.org/evaluation/pdf/hsstuddips.pdf>
- Florida's Community Colleges. (May 2008). *Zoom 2008-01: High school students who take acceleration mechanisms perform better in SUS than those who take none*. Retrieved from www.fldoe.org/cc/osas/evaluations/pdf/Zoom2008-01.pdf
- Fogg, N. P., & Harrington, P. E. (2010). Soft factors influence college enrollment. *New England Journal of Higher Education*. Retrieved from <http://ezproxy.liberty.edu/login?url=https://search.proquest.com/docview/881462964?accountid=12085>
- Foust, R., Hertberg-Davis, H., & Callahan, C. M. (2009). Students' perceptions of the non-academic advantages and disadvantages of participation in advanced placement courses and international baccalaureate programs. *Adolescence*, 44(174), 289-312.
- Gall, M., Gall, J., & Borg, W. (2005). *Educational research: An introduction*. 5th ed. Boston: Pearson/Allyn & Bacon.
- Geiser, S., & Santelices, V. (2004). *The role of advanced placement and honors courses in college admissions*. Center for Studies in Higher Education: Berkeley, CA.
- Godfrey, K. E., Wyatt, J. N., & Beard, J. J. (2016). *Exploring college outcomes for low-income AP® exam takers with fee reductions. research report 2016-2* College Board. 250 Vesey Street, New York, NY 10281.
- Halic, O. (May 2013). *Postsecondary Educational Attainment of IB Diploma Programme Candidates from US High Schools*. Bethesda, MD, USA. International Baccalaureate Organization.

- Hargrove, L., Godin, D., & Dodd, B. (2008). *College Outcomes Comparisons by AP and Non-AP High School Experiences*. College Board Research Report No. 2008-3. New York: College Entrance Examination Board.
- Higher Education Statistics Agency. (2016). *International Baccalaureate students studying at UK higher education institutions: How do they perform in comparison with A level students?* Bethesda, MD, USA. International Baccalaureate Organization.
- International Baccalaureate Organization. (2017). *Vocational Study*. Retrieved March 27, 2017, from <http://www.ibo.org/programmes/career-related-programme/what-is-cp/>
- International Baccalaureate Organization. (2010a). *Academic performance of IB students entering the university of California system from 2000-2002*. Retrieved from <http://ibo.org/research/programmevalidation/index.cfm#UC>
- International Baccalaureate Organization. (2010b). *Diploma programme at a glance*. Retrieved from <http://www.ibo.org/diploma/>
- International Baccalaureate Organization. (2010c). *Diploma programme statistical bulletin, November 2009*. Retrieved from <http://ibo.org/facts/statbulletin/dpstats/index.cfm>
- International Baccalaureate Organization. (January 2006). Profile: Martha Piper, University of British Columbia. *IB World*. Retrieved from <http://www.ibo.org/ibworld/jan06/marthapiper.cfm>
- Jacobs, H., ed. (2009). *Curriculum 21: Essential education for a changing world*. Alexandria, VA: ASCD.
- Johnson, B. (2000). *It's (beyond) time to drop the terms causal-comparative and correlational research in education*. Retrieved from <http://itech1.coe.uga.edu/itforum/paper43/paper43.html>

- Karp, M. M., Calcagno, J. C., Hughes, K. L., Jeong, D. W., & Bailey, T.R. (2007). *The postsecondary achievement of participants in dual enrollment: An analysis of student outcomes in two states*. National Research Center for Career and Technical Education: St. Paul, MN.
- Kleiner, B., & Lewis, L. (2005). *Dual enrollment of high school students at postsecondary institutions: 2002-03*. National Center for Education Statistics: Washington, D.C.
- Klopfenstein, K., & Thomas, M. K. (2009). The link between advanced placement experience and early college success. *Southern Economic Journal*, 75(3), 873-891.
- Lent, R., Brown, S., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, 45, 79-122.
- Lent, R., Hackett, G., & Brown, S. (2008) Social Cognitive Career Theory. In F. Leong, E. Altmaier, & B. Johnson (Eds.), *Encyclopedia of Counseling* (pp. 1627-1630). Retrieved from <http://go.galegroup.com.ezproxy.liberty.edu:2048/ps/i.do?&id=GALE%7CCX3074200607&v=2.1&u=&it=r&p=GVRL&sw=w>
- Lerner, J. B., & Brand, B. (2006). *The college ladder: Linking secondary and postsecondary education for success for all students*. American Youth Policy Forum: Washington, D.C.
- Licht, M. H. (1995). Multiple regression and correlation. In L. Grimm & P. Yarnold (Eds.), *Reading and understanding multivariate statistics* (pp. 19-64). Washington, D.C.: American Psychological Association.
- Lloyd, P. M., & Eckhardt, R. A. (2010). Strategies for improving retention of community college students in the sciences. *Science Educator*, 19(1), 33-41. Retrieved from

<http://ezproxy.liberty.edu/login?url=https://search-proquest-com.ezproxy.liberty.edu/docview/228785197?accountid=12085>

- Mattern, K. D., Shaw, E. J., & Xiong, X. (2009). *The relationship between AP exam performance and college outcomes*. College Board Research Report No. 2009-4. New York: College Entrance Examination Board.
- May, H., Rodriguez, A., Sirinides, P. M., Perna, L. W., Yee, A., & Ransom, T. (2013). *Apples and oranges: Comparing the backgrounds and academic trajectories of international baccalaureate (IB) students to a matched comparison group*. Consortium for Policy Research in Education. University of Pennsylvania, 3440 Market Street Suite 560, Philadelphia, PA 19104.
- Morgan, R., & Klaric, J. (2007). *AP students in college: An analysis of five-year academic careers*. College Board Research Report No. 2007-4. New York: College Entrance Examination Board.
- Morgan, R., & Ramist, L. (1998). *AP students in college: An investigation of course grades in 21 colleges*. College Board Statistical Report No. 98-13. New York: College Entrance Examination Board.
- Murphy, D., & Dodd, B. (2009). *A comparison of college performance of matched AP and non-AP student groups*. College Board Research Report No. 2009-6. New York: College Entrance Examination Board.
- National School Lunch Act, 42 U.S.C. sect. 1758(b)(1) (2001).
- Nugent, S.A., & Karnes, F.A. (2002). The advanced placement program and the international baccalaureate programme: A history. *The Gifted Child Today*, 45(1), 30-39.

- Patterson, B. F., Packman, S., & Kobrin, J.L. (2011). *Advanced placement exam-taking and performance: Relationships with first-year subject area college grades*. College Board Research Report No. 2011-4. New York: College Entrance Examination Board.
- Pedhazur, E. J. (1982). *Multiple regression in behavioral research: Explanation and prediction* (2nd ed.). New York: Holt, Rinehart, & Winston.
- Poelzer, G. H., & Feldhusen, J. F. (1996). An empirical study of the achievement of International Baccalaureate students in biology, chemistry, and physics—in Alberta. *Journal of Secondary Gifted Education*, 8, 28–40.
- Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychological and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin*, 130, 261-288. doi: 10:103/0033-2909.130.2.261
- Roderick, M., Nagaoka, J., Coca, V., & Moeller, E. (2009). *From high school to the future: Making hard work pay off*. Consortium on Chicago School Research at the University of Chicago Urban Education Institute: Chicago, IL.
- Ruch, C. (1968). A study of the collegiate records of advanced placement and non-advanced placement students. *College and University* 44, 207-210.
- Sadler, P. M., & Tai, R. H. (2007). Advanced placement exam scores as a predictor of performance in introductory college biology, chemistry, and physics courses. *Science Educator*, 16(2), 1-19.
- Shaunessy, E., & Suldo, S. (April 2010). Strategies used by intellectually gifted students to cope with stress during their participation in a high school international baccalaureate program. *Gifted Child Quarterly* 54, 127-137, doi:10.1177/0016986209355977

- Shaunessy, E., Suldo, S., Hardesty, R., & Shaffer, E. (Winter 2006). School functioning and psychological well-being of international baccalaureate and general education students: A preliminary examination. *Journal of Secondary Gifted Education*, 17(2), 76-89.
- Stevens, J. (1996). *Applied multivariate statistics for the social sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- Tabachnick, B., & Fidell, L. (1989). *Using multivariate statistics, 2nd ed.* New York: Harper & Row.
- Taylor, M., & Porath, M. (Spring 2006). Reflections on the international baccalaureate program: Graduates' perspectives. *Journal of Secondary Gifted Education*, 179 (3), 149-158.
- Tejada, J.J., & Punzalan, J.R.B. (2012). On the Misuse of Slovin's Formula. *The Philippine Statistician*, 61 (1), 129-136.
- Thompson, T., & Rust, J.O. (2007). Follow-up of advanced placement students in college. *College Student Journal*, 41(2), 416-422.
- University of Central Florida. (May 2005). 2005-2006 Undergraduate Catalog. (38) 1. Retrieved from http://www.catalog.sdes.ucf.edu/archive/UCFUGRDCatalog_0506.pdf
- U.S. News and World Report. (2016). "Top Public Schools: National Universities." Retrieved June 28, 2016, from http://colleges.usnews.rankingsandreviews.com/best-colleges/rankings/national-universities/top-public/page_3
- Western Interstate Commission for Higher Education. (2006). *Accelerated learning options: Moving the needle on access and success, a study of state and institutional policies and procedures*. Retrieved from <http://www.wiche.edu/pub/12758>

- Willingham, W.W., & Morris, M. (1986). *Four years later: A longitudinal study of advanced placement students in college*. College Board Research Report No. 86-2. New York: College Entrance Examination Board.
- Wyatt, J. N., Patterson, B. F., & Di Giacomo, T. F. (2015). *A comparison of the college outcomes of AP® and dual enrollment students*. College Board Research Report No. 2015-3. New York: College Entrance Examination Board.
- Zhang, J. (2011). *Advanced placement courses and college student success: Evidence from BPS: 96/01* (Doctoral Dissertation). Retrieved from ProQuest Dissertations and Theses. (UMI Number 3455088)
- Zhao, Y. (2009). *Catching up, leading the way*. Alexandria, VA: ASCD.