

The relationship of college credit earned while in high school to first-semester college GPA and persistence to the second college year

by

Kimberly J. Fara

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Program of Study Committee:
Larry H. Ebbers, Major Professor
Frankie Santos Laanan
Sharon K. Drake
Soko S. Starobin
Robyn M. Cooper

Iowa State University

Ames, Iowa

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ABSTRACT

The purpose of this study was to examine how a student's college academic success at Iowa State University (ISU) is related to college credit earning while in high school. The unit of analysis for this research was first time full time first year students who entered ISU in the fall semester of 2006, 2007, and 2008. This study examined the relationships between students' college credit earning while in high school, background attributes such as high school grade point average (GPA) and/or ACT/SAT scores, and their college academic success as measured by GPA and persistence to the second fall. The types of college prep courses taken were also examined, for example college credits earned versus no college credits earned and Advanced Placement (AP) credits versus two-year college credits.

The first year students' first semester college GPA were regressed on four variables associated with high school preparation for college (high school GPA, ACT score, sum of credits earned while in high school, and type of credits earned while in high school. High school GPA, ACT score, and sum of college credits earned while in high school accounted for 32.8% of the variation in first semester college GPA.

A logistic regression was performed with high school GPA, ACT score, number and type of college credits earned while in high school as the independent variables, and the persistence to the second fall as the dichotomous dependent variable. Increases in high school GPA, ACT score, and number and type of college credits earned while in high school increased the likelihood of students returning for a second fall semester.

The findings of this study provide evidence to K-12 and community college administrators, high school counselors, parents and high school students. These findings suggest that college credit earning while in high school does increase college academic success as measured by first semester GPA and persistence to the second fall term.

CHAPTER ONE

INTRODUCTION

Background of the Study

Since the publication of *A Nation at Risk* in 1983, education reform has been at the top of most state agendas. Many states have tied educational accountability to incentives urging teachers and schools to improve teaching and learning (Kirst & Venezia, 2004). One of the responses to the increased focus on accountability was the closer examination of the rigor and relevance of the high school senior year.

In *Answers in the Toolbox*, Adelman (1999) found the rigor of a student's high school curriculum was the strongest predictor of success in postsecondary education. In his later *The Toolbox Revisited*, Adelman (2006) found that even seven years later, academic rigor remained the strongest indicator of post secondary success. College credit earning before high school graduation could also have a bearing on degree completion. Earning college credit while in high school has a positive relationship with high school academic curriculum intensity and selectivity of the first institution attended by the student. Since college courses taken as part of the high school day can increase the intensity and rigor of the high school curriculum, challenging students through these dual-credit programs could pave the way to high levels of college academic success (Bailey, Hughes, & Karp, 2003).

Problem

The National Commission on the High School Senior Year (2001) found that student motivation drops in the senior year. College bound students know that the

work in their senior year will not determine if they attend college or not, or even which college they attend. According to ACT (2006), formerly known as American College Testing, fewer than half of high school graduates are ready for first-year college math and science. Only slightly more than half of ACT-tested 2005 graduates took the recommended core curriculum for college bound students: four years of English and three years each of math, science, and social studies.

To assess how increased rigor and relevance would be supported at the district level, then Iowa Department of Education director, Judy Jeffrey, met with representatives from almost every Iowa public school district in the spring of 2005. The discussions were summarized in the report “Improving Rigor and Relevance in the High School Curriculum” (Iowa Department of Education [IDE], 2005). Educational leaders across Iowa agreed that simply raising graduation requirements would not be in all students’ best interest. But beyond that, participants were of varied opinions. Some felt the students would not be well served by a universal college prep curriculum. While still others felt the community would not support the increased rigor for seniors (IDE, 2005). In 2008, the Senior Year Plus Program was created by the Iowa Legislature (Chapter 261E). This program puts concurrent enrollment, access to Advanced Placement (AP) courses, and regional and career academies into law.

This issue is both local and national. How can schools increase rigor in the high school senior year and have the students and their parents embrace the increase. How do differences high school preparation for college effect college academic success?

Purpose

The purpose of this study was to better understand how students' college academic success at Iowa State University (ISU) is related to their high school preparation for college. During freshman orientation students provided background data by completing the Cooperative Institutional Research Program (CIRP) Freshman Survey and giving the university permission to use their data for further research. The academic records of these students were examined for differences in high school preparation for college, specifically analyzing college credits earned while in high school and college credits earned by exam. The unit of analysis for this study was the population of high school graduates who are entering first year students at ISU in the fall of 2006, 2007, and 2008. This study examined the relationships between students' college credit earning while in high school, background attributes such as high school grade point average (GPA) and/or ACT/SAT scores, and their college academic success as measured by GPA and persistence to the second fall. The types of college prep courses taken were also examined, for example college credits earned versus no college credits earned and Advanced Placement (AP) credits versus two-year college credits.

Theoretical Perspective

The conceptual perspective for this study is provided by elements of Astin's Student Involvement Theory (1984, 1999), and elements of Tinto's theory of institutional departure (1993). Only the components of the theories involving attributes students bring with them to college will be examined.

Astin's theory states that the amount of physical and psychological energy that a student devotes to the academic experience determines the quality of the experience and the quality of student development (Pascarella & Terenzini, 2005). Involved students are more likely to be satisfied with their college experience. Satisfied students stay in college and are successful (Astin, 1993; Tinto, 1993). Will students who have college credits when they begin their first year persist to the second?

Tinto tied educational and personal experiences students bring with them to college to the decision to continue in or depart from the college (Tinto 1993; Swanson 2008). The question remains, will college courses taken in high school enhance student success once in college?

This study used the input-environment-outcome (I-E-O) model as one conceptual framework (Astin, 1993). The focus of this research was on the college preparation environment in the high school. However, the environment of the university also influences the outcome of student college academic success and cannot be ignored. Student college academic success is due to the environment of high school preparation for college and will be evaluated through the lens of some exposure to the college environment. This study modified Astin's framework to include two environment blocks and looks at the concept of I-E₁-E₂-O (see Figure 1.1). The study focused on both college credit earning while in high school and the college environments, and examined how credit earning while in high school bridges the high school environment and the college environment. Astin's model provides a

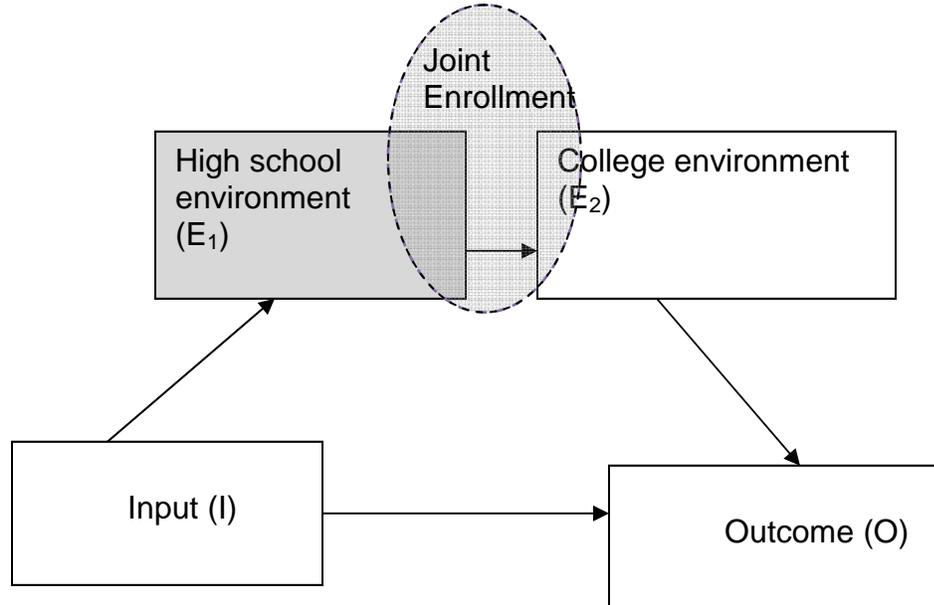


Figure 1.1. I-E-O Model (Astin, 1993) modified for this study

useful way of thinking about college influences (Pascarella & Terenzini, 2005) while the I-E₁-E₂-O model adds the influence of college credit earning while in high school environment to the development of the student.

Elements of Tinto's longitudinal model of institutional departure (1993) also guided this study (see Figure 2). The available data inform the Pre-entry Attributes categories of Skills and Abilities and Prior Schooling, and the Academic Performance element of the Institutional Experiences with the Academic System. The entire model could not be investigated due to limitations of the data available.

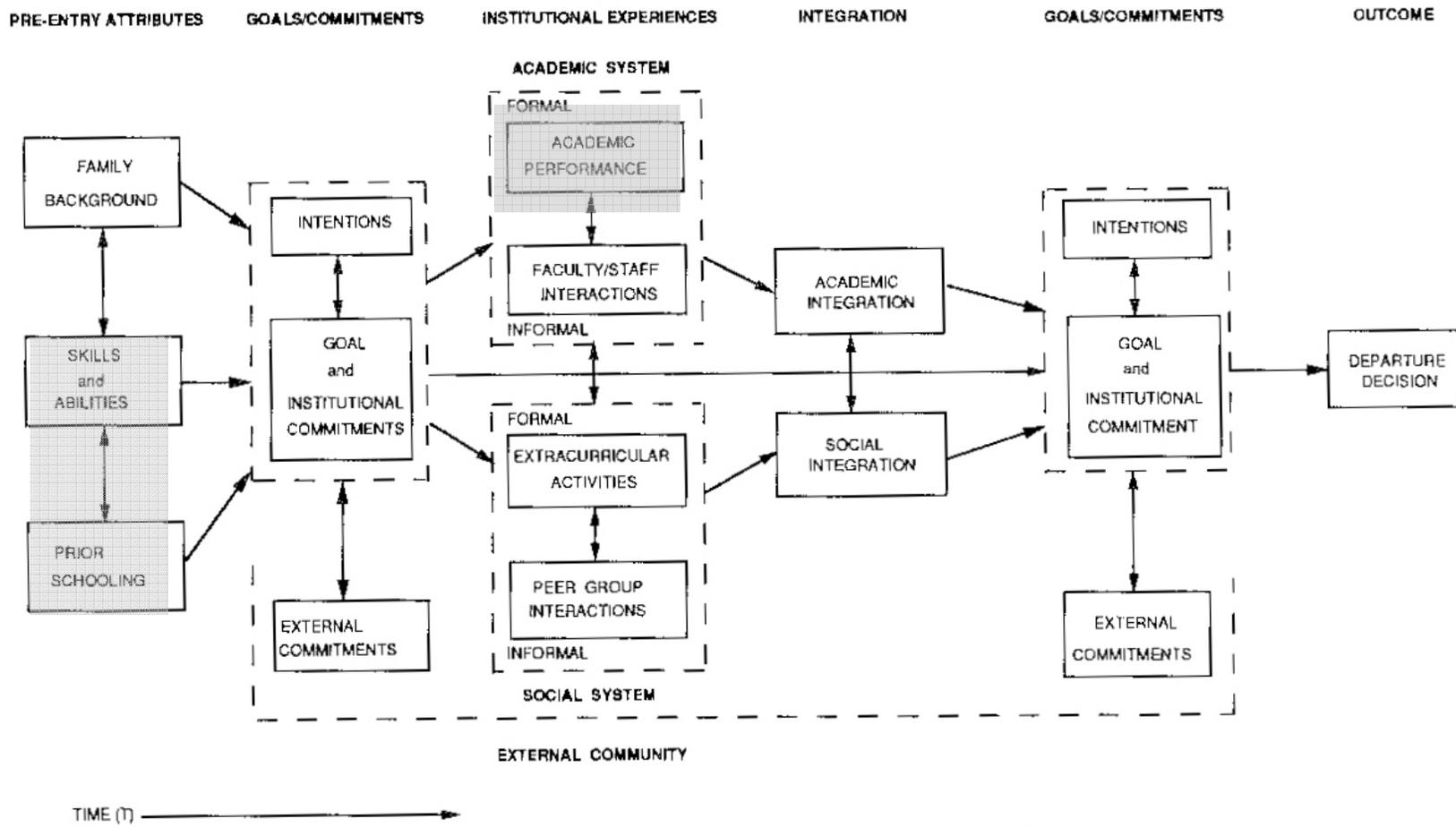


Figure 2. A longitudinal model of institutional departure (Tinto, 1993, p. 114; used with permission)

Research Questions

The following research questions guided this study:

1. What are the demographic characteristics of the first time full-time first year students at Iowa State University?
2. Is there a difference in first semester college GPA between groups when differentiated by gender, race, and type of college credits (AP, IB, 2-year, 4-year, and technical) earned while in high school?
3. Is there a relationship between first semester college GPA and high school GPA, SAT or ACT scores, and number of previous college credits earned?
4. Is there a difference in persistence to the second fall between groups when differentiated by gender, race, and type of college credits (AP, IB, 2-year, 4-year, and technical) earned while in high school?
5. Is there a mean difference in high school GPA, SAT or ACT scores, and number of previous college credits earned between students who persist to the second fall and those who do not?
6. To what extent do high school GPA, ACT or SAT scores, and number and type of previous college credits (AP, IB, 2-year, 4-year, and technical) predict first semester college GPA?
7. To what extent do high school GPA, ACT or SAT scores, and number and type of previous college credits (AP, IB, 2-year, 4-year, and technical) predict first semester college GPA and persistence to the second year?

Significance of Study

The information gathered in this study is designed to contribute to the literature on college readiness and to strengthen the case for increasing the rigor of the high school curriculum by encouraging students to earn college credits while in high school. One way for students to earn credit while in high school is to enroll in dual-credit courses which partner secondary schools with local community colleges. In Iowa, regional community colleges can negotiate programs that fill the needs of individual school districts that are beneficial to both systems. The joint enrollment courses can be provided to the high school students at little or no cost. This research will help local school districts inform their constituencies about the value of increased rigor introduced through college credit earning while students are still in high school. This research can be used to suggest that dual-credit courses strengthen the high school curricula by increasing the college prep value in future college academic success. Academic rigor is the strongest indicator of postsecondary success (Adelman, 1999, 2006; Bailey et al., 2003; Horn & Kojaku, 2001).

Delimitations and Limitations

This study was delimited to first-time full-time first year students at ISU who participated in the ISU orientation program immediately before their first fall semester. The students were of traditional age for the most part. The students did range in age from 17 to 54, but the average (mean) age was between 18 and 19 years (Iowa State University, 2010). This purposeful sampling procedure decreased

the generalizability of the study. This study is not generalizable to all first year students at universities in the United States, but only generalizable to the ISU incoming freshmen.

There were no data available regarding the socioeconomic status of the students, parental education, size of a student's high school or home community (Tinto, 1993 p. 115). All of these attributes are part of the family background category of Tinto's (1993) pre-entry attributes in the model of institutional departure used to guide this study. Any and all of these variables may have had a role in predicting college academic success if the data had been available.

Race and gender were the only variables present in the available data set that represented the input category in Astin's (1993) I-E-O model, or the family background category in Tinto's (1993) model. Race and gender were not included in the prediction models used to answer research questions six and seven since the main focus of this study is to compare the impact different types of college credits bring to a student's university experience.

The data available regarding AP credits were only for students who took the AP exam and scored high enough for the individual college or department at ISU to award credit. Many students take AP courses while in high school and for whatever reason, do not take the AP test. Many students take the AP tests, but do not score a 3, 4, or 5 required to earn credit. Many students who earn a high enough score are not awarded credit by their college or department in the university, since some institutions use AP scores only for placement purposes (Hoffman & Robins, 2006). According to the 6th Annual Report to the Nation (College Board, 2010), only 8.3% of

the entire Iowa 2009 public school graduating class scored at a level to be considered for credit at a college. On the other hand, 65.6% of the 12,512 Iowans who took an AP exam scored 3 or higher on at least one exam.

This study was limited by the types of data available to the ISU Office of the Registrar. The original intention of this study was to compare persistence to the first spring semester as well as persistence to the second fall semester. Through limitations in the data gathering process in the Office of the Registrar, there were no data in the enrollment (first spring) category. Because of this, there is no way to know if students who were enrolled their second fall had been enrolled the previous spring. For the purpose of this study, students enrolled the second fall semester were assumed to have persisted through the fall and spring semester of their first year.

Definition of Terms

Several terms were defined for use in the study:

ACT or SAT scores: The scores reported to ISU on behalf of students by the two major college entrance exams. The students may have had only ACT or only SAT or both scores reported to the university. The SAT combined score was converted to an equivalent ACT composite score using a concordance (College Board 2010). . If both scores were available, only the ACT score was used. If the student had more than one score for a test reported to the school, only the most recent was used.

Academic adjustment: Describes how well students transitioned to the academic side of college life. Do students feel they have met the academic challenges of college life?

Academic performance: Measured by high school grade point average (GPA), first semester college GPA, and scores on the ACT test or the SAT test.

College-ready: The level of preparation needed for a student to be ready for college level course work without remediation. College-ready students will have a 75% chance of earning a course grade of C or better, and 50% chance of B or better in a college level class (ACT, 2006, 2007). ACT recommends a core high school curriculum of four years English, three years science, social studies, and math.

College academic success: A measure of how well a student performs in college. Measures of college academic success include first semester college GPA, persistence to the second year, and appropriate accumulation of credits. Most students who drop out of college do so during the freshman year, or simply do not re-enroll for the second (Tinto 1993, Pascarella & Terenzini 1980). College academic success is an interaction of academic, social, and institutional performance (Tinto 1993).

Dual-credit: Used interchangeably with dual-enrollment, joint enrollment, and concurrent enrollment for the purpose of this study. These terms will be used to refer to high school students who are taking a college level course for both high school and college credit in an agreement between the local K-12 and community college districts. The classes may be held in the high school building, at the local community college, or an outreach center. The instructors may be employed by the community

college, or by the high school. All instructors of dual-credit courses in Iowa have the credentials required by the community college. These programs have also been referred to as credit-based transition programs since they expose high school students to college level work and expectations. These courses may also be classified as joint enrollment.

First semester college GPA: Refers to the grade point average the student earned their first fall of attendance at Iowa State University. No transfer credit grades were used to calculate this variable.

High school GPA: The grade point average reported to ISU on the student's high school transcript. Dual credit course may be used in the calculation of this variable.

Previous college credits earned: Credits a student earned before entrance to ISU. These college credits may have been earned as part of the student's high school curriculum as dual credits, or outside of the high school calendar.

Credit earning while in high school: Includes any college credits earned by dual-credit courses, college credits earned outside of the high school calendar, and college credits earned by examination, AP or College Level Examination Program (CLEP). The college credits earned before enrolling as a first time, full-time first year student will be defined as:

AP credit—The only way to count these credits from college transcripts is to count the credits transferred to ISU. This means the student actually took the AP test and scored high enough for the college or department at ISU to issue credit. Many more students take AP courses at their local high school than take the AP tests, and students may or may not score well enough on the exams to earn credit. The receiving post secondary institution decides whether or not to issue the credit to the student.

Two-year credit—Defined as liberal arts credits transferred from a two-year institution. This is credit the student earns from the two-year institution as a consequence of completing a course successfully. For the purposes of this study, these credits will be assumed to have been taken during a student's high school career. These credits may have been earned while students were jointly enrolled in high school and the community college. There is also a possibility that these credits were earned outside of the school day. This study will include all two-year credit in the same category.

Four-year credit—Students have taken courses and consequently earned credit from a four-year institution.

Technical credit—Students have completed technical or vocational courses from a two-year institution and as a result of success, have earned credits. Examples of technical courses would be a certified nurse aid course or an automotive course. Again, these courses may have been taken as part of the student's high school curriculum, or they may have been taken outside of the school day.

High school preparation for college: Includes high school course work, extracurricular activities, and high school advising both formal and informal. Quality of high school preparation for college will be measured by high school GPA, and ACT or SAT scores.

Persistence to the second year: Demonstrated by the student enrolling in the second fall term. For example, the students enrolling in the fall of 2006 would persist to the second year if they consequently enroll in the fall of 2007. There was no information about first year spring enrollment in the data set, so students may or may have not been enrolled that semester.

Quality of effort: Is related to student involvement, but is much narrower, focusing on time-on-task and attention paid to the learning experience (Astin 1999; Ethington & Horn, 2007; Pace, 1979, 1980, 1984).

Student involvement: "...refers to the amount of physical and psychological energy that the student devotes to the academic experience" (Astin, 1999 p. 518).

Underprepared: The level of preparation not meeting college-ready standards. Underprepared students need remediation to meet the skill requirements of entry level college courses (Grimes & David, 1999).

Summary

This research sought to inform educators and policy makers by providing insight into the role college credit earning while in high school can play in first year college academic success as measured by GPA and persistence to the second year. The findings will assist in identifying factors that contribute to first year college academic success.

This chapter provided an overview of this study including the problem, purpose, theoretical perspective, research questions, definition of terms, significance of the study, and delimitations and limitations. Chapter 2 presents a review of the literature relevant to this study. The chapter begins with a review of the types of dual credit programs and high school preparation for college followed by sections on the rigor and relevance of high school curriculum, college relevance, and K-12 postsecondary education relationships. The chapter ends with a review of literature

concerning the high school senior year and theoretical perspectives used for this study.

Chapter 3 provides a discussion of the methodology of this study, beginning with a brief overview including the research questions. The balance of the chapter presents the methodology, research design, population and sample, and data analysis procedures needed to answer the research questions. The results of the statistical analyses are presented in Chapter 4. These include descriptive data, exploratory analyses, multiple regression analyses, and logistic regression analyses. The final chapter includes a summary and discussion of the findings of this study including suggestions for future research.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

This chapter presents a review of the literature relevant to this study. This review is organized into a summary of the of the literature related to the following topics: types of dual credit programs, high school preparation, rigor and relevance, college readiness, K-12 postsecondary education relationships, concern about senior year, and theoretical perspectives.

Types of Dual Credit Programs

Credit-based transition programs can be put into broad categories: examination based college credit, middle college high schools, tech prep, and dual-enrollment. Although this review focuses on dual enrollment, it is of import to describe the other categories.

Examination-based college credit consists of programs like Advanced Placement (AP) and the International Baccalaureate (IB) program. The AP program was started in 1955 for prep school students and is administered by the College Board. Students *may* earn credit by taking an AP exam and scoring high enough, as determined by each individual college. Many institutions use AP scores for placement purposes but do not award college credit making it an “iffy” proposition for accelerating time to a degree (Hoffman & Robins, 2005). High school teachers who teach AP courses are encouraged but not required to have an advanced degree in their subject area but must participate in a workshop to qualify as an AP teacher. In

2002 more than 1.5 million tests were given to over 900,000 students. About 60% of high schools in the United States offer AP courses ("The College Board," 2006; Hoffman, 2003). "Minority students are often concentrated in the 40 percent of schools that do not offer AP" (Hoffman, 2003, p. 6).

The IB program is a comprehensive program which offers students an opportunity to learn the behaviors and attitudes required for success in college. This program serves fewer students than AP. The primary focus remains on academic preparation, exposure to rigorous coursework, and the ability to earn college credit. Schools are certified by the program to issue the diplomas. IB serves schools in 114 countries with 479 high schools in the United States, including some inner-city high schools (Hoffman, 2003; "International Baccalaureate Program," 2006).

Middle college (or early college) high schools were organized as blended institutions to assist students at risk of dropping out of high school meet the graduation requirements and transition to postsecondary education. They provide high school and college curricula and are usually located on college campuses. These are usually local initiatives where students take high school courses and begin to take dual-credit college courses when they are ready (Bailey & Karp, 2003). Students are coached through their college program, and because these programs are free, students can focus on their studies rather than the intimidating task of college and financial-aid applications (Hoffman, 2003). Jobs for the Future, with support from the Bill & Melinda Gates Foundation and other foundations, is establishing 170 small public schools that blend high school and college so that

students simultaneously earn an Associate's degree, or its equivalent, and a high school diploma (Hoffman & Robins, 2005).

Tech prep is a program established by the Carl D. Perkins Vocational and Technical Education Act reauthorization in 1990. The program coordinates high school and college courses in technical or occupational areas (Bailey & Karp, 2003). College credits earned in a vocational program may not transfer to a 4-year institution.

High School Preparation

Some high school students have the skills necessary to be successful in higher education, while others do not. The rigor of a student's high school curriculum is the strongest predictor of postsecondary education success (Adelman, 1999, 2006; Bailey, Hughes, & Karp, 2002, 2003; Horn & Kojaku, 2001). Students who take dual-credit courses as part of their high school day can increase the rigor and intensity of their high school curriculum. This increased rigor through credit earning before high school graduation could also have a bearing on degree completion. Challenging students through these dual-credit programs could pave the way to high levels of college academic success (Bailey et al., 2003).

According to Andrews (2004), dual-credit may answer two national education concerns: (1) what to do with the senior year, and (2) how to shorten time to degree (baccalaureate) that is now averaging 5 to 5.5 years for students.

Rigor and Relevance

Many experts agree that increased rigor is key to high school success (ACT, 2007, 2009; Adelman, 1999, 2006; Andrews & Davis, 2003; Bailey & Karp, 2003; Hoffman & Robins, 2005; Hugo, 2001; IDE, 2005; Welsh, Brake, & Choi, 2005, 2006). According to the Iowa Department of Education (2005), 14.1 percent of Iowa high school students opt to take applied math rather than the college prep courses of Algebra or Geometry. In 2004 only 37 of Iowa's 365 districts required graduates to complete the ACT recommended college prep core of four years of English, three years of math, science and social studies. During a series of meetings sponsored by the Iowa Department of Education (2005), some school leaders voiced concerns about increasing graduation requirements for all students. The increase in requirements may decrease participation in career education and fine arts. Some educational leaders were concerned about their ability to find teachers for a more rigorous curriculum. Still others felt that parents and community members would not support a more rigorous academic experience for all students.

ACT (2009) reported concern that even the suggested core curriculum may not ensure college readiness. Of the ACT-tested graduates in 2009, only 23% of the students who completed the suggested core curriculum were ready to take college courses in English, math, science, and social studies. The conclusion of the ACT study is that not only do the subject areas of the core need to be met, but the rigor of the high school curriculum needs to be augmented. ACT argued that college readiness also means workplace readiness. A college prep curriculum is needed for all students, college bound or not. This must be done to give high school graduates

the basic academic skills needed to learn additional skills as they change jobs, or as their jobs change with time.

Even as more students who take the core curriculum are not college ready in all four subject areas, the percent of students not meeting the core is increasing. More students are not taking the courses that give them a chance of college academic success. ACT (2007) found that 21% of all ACT-tested 2006 graduates met none of the suggested core benchmarks, while 56% met one to three of the benchmarks. The loss of momentum in progress toward college readiness was also reported. "This loss of momentum appears to be occurring most dramatically in grades 11 and 12" (p. 14).

In addition, Thompson and Rust (2007) found that there was no statistical difference between the grade point average (GPA) of students taking AP English and those not taking the AP course in high school. Just because students take AP courses in high school, they do not necessarily do better in college. There was also no difference in how students rated the value of their high school courses.

A number of researchers (Andrews, 2004; Bailey & Karp, 2003; Bailey, Hughes, & Karp, 2003; Dougherty, Mellor, & Jian, 2006a,2006b; Grimes & David, 1999; Klopfenstein & Thomas, 2006; Thompson & Rust, 2007) concluded that simply adding AP courses does not guarantee the increased rigor of the curriculum. Klopfenstein and Thomas (2006, p. 17) researched students entering Texas public universities directly from high school and found that students who simply take an AP course are not more prepared for college than those who take a non-AP curriculum rich in math and science. More research in Texas points out that there seems to be

“Course Credit Inflation” taking place. Because of the emphasis on rigor, more students are being pushed in advanced courses even when they are not ready academically. Students are being given high school credit even if they don’t learn the content implied by the course title, a new form of social promotion. Teachers cannot address the content of the advanced course because they are spending significant time reviewing concepts from the preceding courses (Dougherty, Mellor, & Jian, 2006a).

The only way students get college credit for AP courses is if they take the test, and if they score high enough. It is the college that decides if the exam score is high enough to issue credit. Dougherty et. al (2006) studied students in Texas and found that there was connection with the *percentage* of students who take and pass the AP exams with the rigor of the college prep curriculum. Their findings were consistent with other studies (Klopfenstein & Thomas, 2006; Thompson & Rust, 2007) that find that the number of AP and other honors courses do not predict college academic success. In other words, it does not matter what the title or classification of the course is. What matters is the content, and the student attaining the knowledge.

College Readiness

Grimes and David (1999) researched the differences between underprepared and college-ready students. College-ready students differed from underprepared students in their reasons for attending college, ability ratings, previous year’s activities, goals and values, plans for the future, and opinions, as well as academic performance and persistence. Underprepared students, on the other hand, were

more likely cite other reasons for attending college such as they wished to improve reading and study skills, they were encouraged by parents, or they could not find a job. There was also a significant difference in how underprepared students rated their own academic ability. The underprepared students rated their academic skills lower than the college ready students. Underprepared students spent more hours during the previous year partying and watching television. In addition, they more often reported expectations of failing one or more courses, needing extra time to earn a degree, and higher probability of getting tutoring.

The Chronicle of Higher Education conducted a survey of high school teachers and college faculty (Sanoff, 2006). The findings reflect the difference in perception regarding the students moving from high school to college between high school teachers, and college faculty. The majority of college faculty (84%) felt that entering students are less than well prepared for college level work as compared to students in the past, while only 65 percent of high school teachers held the same opinion. The college faculty that rated students as underprepared was 24% as compared to 12% of high school teachers with the same view. College faculty found that the students were becoming more dichotomous: eager, hard-working, well prepared versus clueless, terrible study habits, and low motivation. The gap between the groups has been growing with few students in between.

Rigorous college prep curriculum should improve student success, college GPA and returning for the second year (Adelman, 1999, 2006; Bailey, Hughes, & Karp, 2003, Klopfenstein, & Thomas, 2006). When the dual credit curriculum

replaces entry level college courses, and benefits to the students should be apparent within the freshman year (Klopfenstein & Thomas, 2006).

K-12 Postsecondary Education Relationships

To examine dual-credit programs, an exploration of the traditional relationship between the K-12 system and postsecondary education is necessary. The Stanford University's Bridge Project: Strengthening K-16 Transition Policies is a policy research study focused on the policies, perceptions, and practices related to the transition between high school and college. This national study examined policies related to student transitions between K-12 and postsecondary education in six states and found numerous disconnects between the two educational systems (Kirst & Venezia, 2004).

Many current policies grew out of education reform spurred by the publication of *A Nation at Risk* in 1983. Forty-nine states created K-12 content standards in most academic subjects, with many also developing statewide K-12 student assessments (Kirst & Venezia, 2004). Iowa, the lone state without content standards in 2004, adopted the standards and is currently in the process of developing the Iowa Core Curriculum (ICC). This accountability issue is also a big part of the No Child Left Behind (NCLB) Act (No Child Left Behind, 2002).

The researchers in Stanford University's Bridge Project focused on perceptions of secondary students, their parents, counselors, and administrators regarding higher education admission policies. In some states the surveys were

focused on eighth graders because, by eighth grade, students generally have chosen or have been placed in a particular curriculum track that affects their academic preparation for college. This is the time when students need to begin planning academically if they wish to attend a selective college or university. In other states the researchers looked at sections of both honors and non-honors English. The surveys were given to ninth and eleventh graders and their parents. Ninth graders were targeted because they were one year past the eighth-grade classes that may have influenced their course-taking choices in high school. The high school juniors were chosen because they were at the point where they were making postsecondary plans (Kirst & Venezia, 2004).

The study revealed there was a disconnect between what the students, parents, and school personnel knew, or thought they knew about college entrance requirements, and most college entrance requirements. Even in states like Oregon which had a legacy of progressive reform at both the K-12 level and in the Oregon University System, parents and students were confused about what it takes to get into college. The K-12 reforms started out as proficiency-based assessments, but over time the assessments have become more traditional and have devolved into mostly multiple-choice exams. The higher educational system reform has retained the original proficiency-based model (Kirst & Venezia, 2004).

These disconnects make it difficult for marginally prepared students. Students felt if they graduated by meeting the state standards and state high school exit exams, they would automatically have the requirements for university admission. One community college adviser told this story:

Well, I think the biggest thing for them is, . . . they've graduated from high school but they come and take our placement test and they're still in, . . . , pre-college reading, writing and math, and they don't understand that if they stop taking math in their sophomore year that, you know, they don't get it . . . no one. And I think the sad thing is that they say, and I don't know what really happens, I suppose it's different at every school, "No one told me that I should be taking math all the way through." They just weren't warned or they don't remember being warned, so now they're having to pay for it and sit through, and that is extremely frustrating. I think it's embarrassing, especially with reading and writing. It's embarrassing to them. And they'll almost start crying because [they'll say], "I graduated [from high school]. (Kirst & Venezia, 2004, p. 269)

In 2001, 38 states had policies in place to promote dual-credit programs (Boswell, 2001), but by 2004, Andrews found evidence of some dual-credit in all 50 states. The majority of programs have been negotiated locally between secondary schools and technical and community colleges. Since these postsecondary institutions are located to serve students in the state, the logistics of these agreements are ideal. Policy makers are using dual credit courses as a way to introduce higher education to those high school students that do not consider themselves to be college bound. These students may not have even considered college without the dual credit exposure (Hoffman & Robins, 2005, p. 3). The increased interest in dual-credit courses comes at a time of educational reform. This reform provides support for the idea of community colleges partnering with secondary schools to increase participation in post secondary education (Welsh et al., 2005).

In Iowa, the community college relationship with the K-12 system is outlined in the Code of Iowa, Chapter 260 C (Community Colleges, n.d.). One of the purposes for community colleges enumerated in the legislation is to provide

“Programs for students of high school age to provide advanced college placement courses not taught at a student’s high school while the student is also enrolled in the high school”.

Concern about Senior Year

In 2001, the National Commission on the High School Senior Year issued a number of reports (National Commission on the High School Senior Year 2001a; 2001b) dealing with the momentum loss in the senior year of high school. College bound students have their fates set by what they have accomplished up to the end of their junior year. Many times, serious preparation for college ends at grade 11. The Commission found that students not ready for college by their senior year had run out of time to catch up. The Commission recommends that high school graduation gain a new meaning, with graduates able to meet skills and standards expected by employers and required for college admission. The commission also called for a commitment to provide all students with rigorous and challenging preparation.

Dual-credit courses, taken either in high school or area community colleges, are one way for high school seniors to be productive and advance their educational goals. Andrews (2004) reported that for Northern Iowa Area Community College, “there were no differences between students on-campus and in area secondary schools. Final exams in each of these classes were used as comparative measures” (p. 419). Dual-credit courses are free or at a low cost, and they can serve as an economical way for high school students to leverage their educational dollar to go

farther (Bailey & Karp, 2003). Dual credit programs appeal to students who are often neglected—the students just below the level of the advanced placement student (Hugo, 2001).

In Arizona, Rio Salado College in the Maricopa Community College District, began efforts to track, study and analyze every aspect of dual-enrollment in 1993. They learned that about one third of the seniors who chose to take a math class would not have enrolled in the class had it not been offered for dual-credit. Instead, they would have opted for an “early out” dismissal time of 11:30 A.M. Most of the students did not need the course to meet high school graduation requirements; they simply wanted the college credit. High school faculty also reported that classroom management became easier because students accepted that the college classes took more study and attention (Puyear, Thor, & Mills, 2001).

Another advantage of dual-credit programs is that course offerings complement the high school curriculum. Some large urban and small rural school districts have been forced to eliminate programs like performing arts (Robertson, Chapman, & Gaskin, 2001). These districts can work with local colleges to at least partially to restore their offerings, and they may be able to offer courses that previously were never part of their curriculum.

Pascarella, Whitt, Nora, Edison, Hagendorn, and Terenzini (1996) revealed that successful programs must include either a bridge program to ease the transitions from work or high school to college, or they must provide systematic and comprehensive academic support services. The needs of the underprepared students must be addressed. Underprepared students are motivated by extrinsic

circumstances like the inability to find a job or encouragement by parents. Low self-efficacy in underprepared students and lower ability ratings can decrease motivation. These students feel control of the situation is out of their hands, so they project blame for poor performance on luck or others. Without considering psychological theory addressing specific discipline content is less likely to be effective with previously less successful students, however it may be effective for highly-motivated, goal-oriented students with a strong support structure.

In 2002, FIPSE supported a yearlong demonstration project, Latino Student Success at Hispanic-Serving institutions [LSS]. The program did focus on transfer from community colleges to baccalaureate programs and focused on best practice for school to college transition. Among these best practices identified in the LSS report was to partner with feeder high schools, community colleges and community-based organizations. The LSS report also pointed out the need to reevaluate the traditional measures for success of community college students. One of these measures, time to degree, doesn't always fit with the majority of community college students who are nontraditional, part-time students (Benitez & DeAro, 2004).

Not all dual-credit courses are seen as equal. Some institutions do not treat credits earned in courses taught by college faculty the same as those taught by high school teachers (Hebert, 2001). In a retrospective study comparing students who were dual-enrolled in math classes taught by high school teachers with other dual-enrolled students whose math classes were taught by college faculty, Hebert (2001) found that the first group had significantly higher grades in their subsequent coursework at the university than the second group. Students also earned

significantly more A's and B's in the dual credit courses taught by high school teachers than expected. In addition, a three way analysis of variance showed no interaction between the variables of group, race, or sex. Dual enrollment students taught by high school teachers were found to be better prepared for subsequent coursework at the university level than those taught by college faculty. When high school teachers teach dual enrollment classes, they typically meet high school schedules and regulations (twice as many contact minutes as college courses). There are data (Andrews, 2004) that show that there was no difference in performance on the final exam between on-campus students and students in the same course taught in area high schools. But there are still institutions that won't accept college credit if it was used to meet high school graduation requirements.

Student Success

Student success can be defined many different ways. One of the most prominent definitions of student success is that of retention, persistence, and degree attainment (Adelman 1999, 2006). Does a student finish the first semester (year)? Does a student enroll in the next semester (year) at their first institution? Does the student earn a degree at their first institution? Adelman suggested this is too narrow of an approach. Just because a student has not persisted at this institution does not mean the student will not continue her education at another institution. Nevertheless, persistence is a measure of student success.

Adelman(1999, 2006) also suggested that students success can be measured in credits earned per semester. He found that students who earned a

minimum of 20 credits in their first year of post-secondary education were more likely to persist to the second year (2006, p. 109)

College grades “may well be the single best predictor of student persistence, degree completion, and graduate school enrollment in both national representative and single institution studies” (Pascarella & Terenzini, 2005, p. 645). Adelman also tied the quality of student effort to the grades earned (2006 p. 37). If grades predict persistence, they are also a predictor of student success.

The current study focused on early college academic success. Early college academic success is indicated by first semester GPA, and persistence to the second fall. These indicators were chosen since most students who drop out of college do so during or immediately following their first year (Pascarella & Terenzini 1980; Tinto 1993).

Theoretical Perspective

Since the beginning of the 20th century, psychological and sociological theorists have been examining how higher education encourages the growth and development of students. As researchers test relationships, the relationship is formalized into a theory. A theory is a concept that helps to explain and predict the relationships being tested (Creswell, 2005). Out of these examinations have come an entire spectrum of student development theories which provide the basis for professionals to design programs, develop policies, and create college environments that encourage student growth. These theories also encourage collaboration between student service professionals and faculty to augment student learning and

take full advantage of positive student outcomes (Evans, Forney, & Guido-DiBrito, 1998).

The current study used the approach in student development theory that focuses on how student interaction with the environment impacts or influences development. “Rather than examining development itself, Astin’s approach focuses on factors that facilitate development” (Evans et al., 1998). Astin (1999) developed five central postulates in student involvement theory:

1. Involvement refers to the investment of physical and psychological energy in various objects. The objects may be highly generalized (the student experience) or highly specific (preparing for a chemistry examination).
2. Regardless of its object, involvement occurs along a continuum; that is, different students manifest different degrees of involvement in a given object, and the same student manifests different degrees of involvement in different objects at different times.
3. Involvement has both quantitative and qualitative features. The extent of a student’s involvement in academic work, for instance can be measured quantitatively (how many hours the student spends studying) and qualitatively (whether the student reviews and comprehends reading assignments or simply stares at the textbook and daydreams).
4. The amount of student learning and personal development associated with any educational program is directly proportional to the quality and quantity of student involvement in that program.
5. The effectiveness of any educational policy or practice is directly related to the capacity of that policy or practice to increase student involvement. (p. 519)

Student involvement theory implies that the student has an active role in the learning process and the process of student development. Astin’s theory focuses on how student development happens, the behavioral mechanisms and processes that assist student development.

The theory of individual departure developed by Vincent Tinto (1993) was also used as a guiding structure for the variables of this study. Tinto turned away from the previous studies of leaving college that focused on only the psychological attributes and those focused on only the societal influences on departure. The psychological studies invariably focused on the failure of the individual student or student type. The societal studies focus on the importance of external forces in the process of student persistence often ignoring individual situations. Tinto's work developed "an explanatory, predictive model of the dropout process which has at its core the concepts of academic and social integration (Pascarella & Terenzini, 1980, p 60).

Using the work of Arnold Van Gennep, who studied rites of passage in tribal studies, Tinto (1993) began researching postsecondary students with the framework of Van Gennep's stages of (a) separation, (b) transition, and (c) incorporation. By using these stages, the studies were given a framework to posit the longitudinal process of student persistence in college. Tinto extended this to "the time dependent process of student departure" (p. 94). Tinto focused on the impact of context on the student decision leave the institution. Student departure reflects the difficulties individuals face in seeking to navigate the rites of passage successfully.

The rite of separation for a college student is to separate from communities of the past: hometown, high school, family and friends. The translation of the rite of transition to college students is the transition from high school to college. The rite of incorporation is when the student becomes familiar with the academic and social systems of the college, both formal and informal (Tinto 1993).

Tinto (1993) examined the interplay between the categories of (a) pre-entry attributes, (b) entry goals/commitments, (c) institutional experiences, (d) integration, (e) future goals/commitments, and (d) outcome. Specifically how these categories, when taken together, influence the decision to leave the institution of higher learning.

Summary

In reviewing the literature relevant to this study, the types of college credit earning opportunities open to high school students were explored. Many researchers agree that rigor of the high school curriculum is a good predictor of postsecondary academic success. Many policy makers are concerned about maintaining the rigor of the high school senior year and how that translates to college readiness.

CHAPTER THREE

METHODOLOGY

Overview

The purpose of this study is to explore to what extent differences in college credit earning in high school influence a student's success in college. This chapter will present the research design of the study, including the research questions and hypotheses, population and sample, data collection, variables, and planned method of analysis.

This study was guided by the following research questions:

1. What are the demographic characteristics of the first-time full-time first year students at Iowa State University?
2. Is there a difference in first semester college GPA between groups when differentiated by gender, race, and type of college credits earned (AP, IB, 2-year, 4-year, and technical) while in high school?
3. Is there a relationship between first semester college GPA and high school GPA, SAT or ACT scores, and number of previous college credits earned?
4. Is there a difference in persistence to the second fall between groups when differentiated by gender, race, and type of college credits earned (AP, IB, 2-year, 4-year, and technical) while in high school?
5. Is there a difference in persistence to the second fall when considering high school GPA, SAT or ACT scores, and number of previous college credits earned?

6. To what extent do high school GPA, ACT or SAT scores, and number and type of previous college credits (AP, IB, 2-year, 4-year, and technical) predict first semester college GPA?
7. To what extent do high school GPA, ACT or SAT scores, and number and type of previous college credits (AP, IB, 2-year, 4-year, and technical) predict first semester college GPA and persistence to the second year?

Hypotheses

The research questions are addressed with hypotheses written in the null hypothesis form which assumes there are no differences in groups and or other outcomes. The data analysis was used to find evidence against the null hypotheses.

The following hypotheses will guide this research:

Hypothesis I: There is no need for a hypothesis here since the first research question simply asks about the demographic characteristics of the first-time full-time first year students at Iowa State University.

Hypothesis II: There is no difference in first semester college GPA between groups when differentiated by gender, and race, type of college credits earned while in high school (AP, IB, 2-year, 4-year, and technical).

Hypothesis III: There is no relationship between first semester college GPA and high school GPA, SAT or ACT scores, and number of previous college credits earned.

Hypothesis IV: There is no difference in persistence to the second fall between groups when differentiated by gender, and race, type of college credits earned while in high school (AP, IB, 2-year, 4-year, and technical).

Hypothesis V: There is no difference in persistence to the second fall when considering high school GPA, SAT or ACT scores, and number of previous college credits earned.

Hypothesis VI: First semester college GPA cannot be predicted to any extent by high school GPA, SAT or ACT scores, and number and type of previous college credits earned (AP, IB, 2-year, 4-year, and technical).

Hypothesis VII: Persistence to the second fall cannot be predicted to any extent by high school GPA, SAT or ACT scores, and number and type of previous college credits earned (AP, IB, 2-year, 4-year, and technical).

Theoretical Perspective

This study utilized the model of college departure developed by Vincent Tinto to tie the independent variables of student background and high school preparation for college to college academic success. Permission to use this copyrighted model was granted by the University of Chicago Press (see Appendix A). Tinto's theory of departure was first published in 1975 and revised in 1987, 1993, and 1997. The focus of the theory is to determine how students separate and transition from the home and high school environment and to the college environment with its new social and academic demands. The "Tool Box" studies of Adleman (1999, 2006) corroborate Tinto's theoretical view that a rigorous high school curriculum impacts

the attainment of a post-secondary education. “Tinto’s theory has the potential to assist researchers in evaluating the possible effects of dual enrollment courses on the pre-college events and on academic and social integration experiences gained from the college environment” (Swanson 2008) . In Tinto’s efforts to conceptualize the dropout process, he defines the pressures and attributes that lead to the decision to separate from the institution of higher learning. In this process, he also addresses attributes that lead to persistence.

This study also expands Astin’s (1993) Input-Environment-Output (I-E-O) framework to an I-E₁-E₂-O framework. Credit earning while in high school bridges the high school environment (E₁) and the college environment (E₂). Astin’s approach focuses on how the attributes a student brings to college influences what the outcome will be. The two environment components, a high school environment, and a college environment that will interact to produce an outcome, in this case measured as college academic success.

Research Design

This study used transcript data from the Office of the Registrar at Iowa State University (ISU). The target population for this longitudinal study was first time, full-time, first-year students at ISU.

Setting

The site of this study was Iowa State University, located in Ames, Iowa. This public land-grant university is classified as a Doctoral/Research University-Extensive in the 2000 Carnegie Classification of Higher Education. This university serves more

than 28,000 students in a wide variety of undergraduate and graduate programs (Iowa State University, 2010).

Population and Sample

Population

The target population for this longitudinal study included freshmen students who entered ISU in the fall of 2006, 2007, 2008. Some data were available for the students entering ISU the fall of 2009, but these students were eliminated because they had not had the opportunity to register for the fall semester of 2010 at the time of this study. The population was identified from those first year students who gave ISU permission to use their data in further research. Access to the data was obtained after the approval from the Office of Responsible Research at ISU by making arrangements with the Office of the Registrar.

Sample

A single stage sampling procedure was used for this study. Students were purposefully selected from the population of first time full time first year who gave permission to use their data for further study. The original intent of the researcher was to use only one cohort of entering freshmen students. Preliminary investigation of the incoming 2008 freshmen provided inconclusive data regarding the numbers first-time, full-time freshmen with transfer credits. Expanding the target population to include past cohorts of first time first year students allowed for a sample large enough to maximize the probability of finding statistically significant differences. The sample was further stratified by identifying whether or not students had earned

college credits and what types of credits earned while still enrolled in high school and by year first enrolled at ISU.

Initial analysis of the sample showed an extremely small number of students with credits from the International Baccalaureate (IB) program. This group was combined with the group which had a combination of credit types earned for all but the demographic analysis.

Ethical Issues

This study utilized the secondary data already collected by ISU. During freshman orientation, students gave consent to ISU to use CIRP Freshman Survey and other student data for research. The Office of the Registrar compiled data for this research by removing student identification numbers and replacing them with artificial identification numbers constructed for the purposes of this study. The appropriate Human Subjects Review Form was submitted with the Institutional Review Board (IRB) and according to federal regulations this research was found not to involve human subjects because the researcher has no way of knowing the identity of any of the subjects. There was no further permission needed to use this data.

Variables

The following dependent and independent variables were used in this study.

Dependent

The dependent variables used in this study to indicate college academic success were first semester college GPA, and persistence to second fall.

Independent

The independent variables used in this study were both continuous and discrete. The discrete variables are gender, race, type of credits earned while in high school. The continuous variables are high school GPA, ACT or ACT equivalent scores, and number of credits earned while in high school. Any SAT scores were converted to an ACT equivalent score using a concordance (College Board 2010). . If both scores were reported, only the ACT score was used. If the tests were taken more than once, only the most recent score was used.

It is important to note that students who had earned AP credits took the official AP tests and scored high enough for the college or department to issue credit. Many students who took AP courses but did not take the AP tests, or who did take the AP tests and failed to score at a level to earn credit at the college are not counted in this category. There were no reliable data to know how many AP courses and/or tests a student had taken. The survey the students took as part of the freshman orientation process did ask how many AP courses and how many AP tests a student had taken. This self-reported data had no way of being confirmed, therefore, they were not used. The registrar counts the number of credits transferred in, and the survey asked for number of courses. A summary of all of the variables used appears in the Appendix, Table A.

Data Analysis

Statistical Package for Social Sciences (SPSS) (1989-2005) software was used to analyze the data for this study and updated to PASW Statistics 18 (1993-2007).

Descriptive statistics

To answer the Research Question 1: *What are the demographic characteristics of the first-time full-time first year students at Iowa State University?* frequency tables and crosstabulation were used to produce the descriptive statistics and examine the differences in the demographic groups. This study separates the students into groups by gender, race, and types of credit earned while in high school. The SAT Critical Reading and Mathematics scores were combined and converted to a score comparable with the ACT Composite score using a concordance table (College Board 2010).

To answer Research Question 2: *Is there a difference in first semester college GPA between groups when differentiated by gender, and race, type of college credits earned while in high school?* a *t*-test was utilized to compare the mean college GPA by gender, and a one-way analysis of variance (ANOVA) followed by a Scheffé post-hoc test was used to compare the mean college GPA by race and type of college credits earned while in high school. The ANOVA tested for an overall difference among groups, while the Scheffé post-hoc test looked for significant differences between each pair of groups.

For Research Question 3: *Is there a relationship between first semester college GPA and high school GPA, SAT or ACT scores, and number of previous college credits earned?* a Pearson's product-moment correlation coefficient was calculated comparing the first semester college GPA with the continuous variables that indicate high school success, high school GPA, SAT or ACT scores, and number of previous college credits earned.

To answer Research Question 4: *Is there a difference in persistence to the second fall between groups when differentiated by gender, race, and type of college credits earned while in high school?* cross-tabs were used to compare the counts and percents of the categorical variables, gender, race, and type of credits earned while in high school who returned for the second fall, and those who did not return. A Chi-square test of expected values discovered if any differences from the expected distribution were statistically significant.

Research Question 5: *Is there a difference in persistence to the second fall when considering high school GPA, SAT or ACT scores, number of college credits earned while in high school?* was answered by again using *t*-tests to compare the mean high school GPA, mean SAT or ACT score, and mean number of college credits earned while in high school for those students who did return to ISU for a second fall and those who did not.

To answer Research Question 6: *To what extent do high school GPA, ACT or SAT scores, and number and type of previous college credits (AP, IB, 2-year, 4-year, and technical) predict first semester college GPA?* a sequential multiple regression was carried out. Sequential multiple regression analyses enable a

researcher to assess the relationship between one dependent variable and several independent variables. The goal of multiple regression analysis is prediction and assessment of the relationship between the dependent and independent variables when each independent variable is removed before the effects of the later independent variables are assessed (Tabachink & Fidell, 2007).

Since the dependent variable studied in Research Question 7: *To what extent do high school GPA, ACT or SAT scores, and number and type of previous college credits (AP, IB, 2-year, 4-year, and technical) predict first semester college GPA and persistence to the second year?* is dichotomous, a logistic regression was appropriate. Logistic regression allows prediction of group membership when the independent variables are a combination of continuous (hs GPA, ACT/SAT score, and sum of credits earned while in high school) and discrete (type of credits earned while in high school) predictors (Tabachink & Fidell, 2007). Any cases that were missing data were eliminated list wise.

Multicollinearity

When independent variables in a regression analyses are highly correlated to each other multicollinearity can cloud the analysis. The first step is to do a scatterplot of the data. Since there are more than three independent variables required for both Research Question 6 and 7, it is impossible to graph in more than three dimensions. If the correlation among the independent variables are .75 or greater, multicollinearity exists. Multicollinearity makes it difficult to identify the unique contribution of each variable in predicting the DV. The standard errors will be

larger than when the independent variables are not correlated, this makes the null hypothesis harder to reject. The collinearity statistics of tolerance and variance inflation factor (VIF) were examined to determine if any multicollinearity exists. Multicollinearity exists when tolerance is below 0.1; and VIF is greater than 10 or an average much greater than 1.

CHAPTER FOUR

RESULTS

This chapter provides a comprehensive overview of the results of the study. The chapter is organized into three sections. The first section describes the demographic characteristics of the first year ISU students studied. The second section examines the differences in the college academic success variables of first semester GPA and persistence to the second fall according to background characteristics of race, gender, high school GPA, SAT/ACT score, type and number of college credits earned while in high school. The final section provides the results of the regression analyses, both sequential multiple regression and logistic regression. The analyses explore the relationships between the variables and the strengths of the predictive models.

Demographic Characteristics of ISU First Year Students

Research Question 1: What are the demographic characteristics of the first-time full-time first year students at Iowa State University?

First-time, fulltime, first-year students attending fall orientation at Iowa State University during the falls of 2006, 2007, and 2008 and who have given permission to use their data for further study were the sample for this study. As shown in Table 4.1, approximately one third of the sample entered in each cohort group, as expected. The students were 45.1% female, and 54.9% male. The racial makeup of the sample was 0.4% American Indian or Alaskan Native, 3.2% Black (not Hispanic),

84.5% White (not Hispanic), 3.7% Asian or Pacific Islander, 3.2% Hispanic, and 5.1% who preferred not to indicate race on the survey or in other records.

The data regarding credits earned while in high school were recoded to provide a yes/no option for the purposes of the initial description of the sample. Table 4.1 also reveals that there were five types of credits earned before a student's first fall semester: IB, AP, Two-year, Four-year, and Technical credits. There were a number of students who came to ISU with no credits earned. Since students were able to earn more than one type of credit, a simple sum is not a good predictor of this number. Further analysis was needed to determine that 47.2% of the sample had earned no college credits while in high school. The International Baccalaureate (IB) program is small, so it is not unexpected that only 0.2% of the sample have IB credits. The IB group was very small and was combined with the group that had a combination of credit types for the balance of the data analysis. About 15% have AP credits, while almost 38% have credits from two-year institutions that transfer. A few students have credits from four-year institutions (6.9%) and 10.1% have technical credits that may or may not transfer into a four-year program.

The students with only IB credit were combined with the group of students that had earned a combination of types of transfer credits for the balance of the data analysis.

Table 4.1. Demographics of first-time, full-time, first-year students at ISU

Variable	<i>N</i>	Percent
<i>Gender</i>		
<i>N=12,879</i>		
Male	7,070	54.9
Female	5,809	45.1
<i>Cohort Year</i>		
<i>N=12,879</i>		
2006	3,985	30.9
2007	4,348	33.8
2008	4,546	35.3
<i>Race/Ethnic Background</i>		
<i>N=12,879</i>		
American Indian or Alaskan Native	52	0.4
Black (not Hispanic)	409	3.2
White (not Hispanic)	10,879	84.5
Asian or Pacific Islander	482	3.7
Hispanic (Spanish American)	407	3.2
Prefer not to Indicate	650	5.1
<i>Types of Credit Earned</i>		
<i>N=12,879</i>		
International Baccalaureate (IB)	30	0.2
Advanced Placement (AP)	1,974	15.3
Two-year	4,813	37.4
Four-year	892	6.9
Technical	1,299	10.1
None*	6,076	47.2

*The sum of the percents will not add to 100 because some individuals are represented in more than one credit type category.

Table 4.2 Combinations of types of credits earned by students while in high school

Variable	<i>N</i>	Percent
<i>Combinations of Dual Credit Types</i>		
<i>N=12879</i>		
None	6076	47.2
IB only	23	0.2
AP only	1203	9.3
Two-year Credit only	3012	23.4
Four-year Credit only	409	3.2
Technical Credit only	138	1.1
Combination of Credit Types	2018	15.7

Comparison of College Academic Success Variables by Group

Research Question 2: Is there a difference in first semester college GPA between groups when differentiated by gender, race, and type of college credits earned while in high school?

The independent variables are gender, race, and type of credits earned while in high school, all categorical variables. The dependent variable is first semester college GPA, a continuous variable. To compare the mean first semester GPA for each category, a *t*-test of means was performed for the gender variable, and an ANOVA for the other variables. The number of subjects in this analysis is different from *N*= 12879 because some participants did not provide information on their gender, or race. Those with missing data were eliminated from the analysis.

Tables 4.3 and 4.4 provide a summary of the descriptive statistics and the independent samples *t*-test of means. Levene's Test for equality of variance of means indicated significance ($F=131.044, p<0.001$); therefore, the *t*-score for

Table 4.3. Descriptive statistics of first semester college GPA by gender ($N=12,727$)

Gender	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
Male	6,996	2.5393	0.98291	0.01175
Female	5,731	2.8273	0.86170	0.01138

Table 4.4. Independent samples *t*-test for equality of means of first semester college GPA by gender

	<i>t</i>	<i>df</i>	<i>p</i>	Mean Difference
Equal Variances not assumed	-17.603	12666.666	.000*	-0.28798

* $p < .001$

unequal variances was used. The mean first semester college GPA was significantly different between men and women. These data provide strong evidence that women had higher first semester college GPA than the men.

Tables 4.5 through 4.8 provide a summary of the results of an ANOVA to compare the first semester college GPA by race and type of college credits earned while in high school. There was a statistically significant difference in first semester college GPA by race. Furthermore, a Scheffé post hoc test indicates that there were no significant differences between American Indian/Alaskan Native and any other racial group. The post hoc test showed Black (not Hispanic) did have a lower first semester college GPA than all other racial groups except American Indian/Alaskan Native. The White (not Hispanic) students had a statistically significant difference from Black students as previously mentioned and in addition also had a higher first

semester college GPA than Hispanic students. Hispanic students earned a lower first semester college GPA than those students who chose not to indicate a race.

Scheffé post hoc tests were performed because the numbers in the race and credit type groups were not the same. The Scheffé test only compares only two groups of interest, requires more evidence, and is less likely than other post hoc tests to give a Type I error (Gravetter & Wallnau, 2007).

Because there were statistically significant differences in the mean first semester college GPA between groups when separated by types of credits earned while in high school, null hypothesis II was rejected. Post hoc tests show that, while the mean first semester college GPA of the few students with IB credit only did not differ from any other groups, there were significant differences between other groups. Students with only AP credits had a mean first semester college GPA higher than all other groups except IB. Those with 2-year credit only had a mean GPA higher than students with no credits earned while in high school, and lower than students with a combination of types of credits earned. Students with only 4-year credits had a higher GPA than those with technical credits only.

Table 4.5. Descriptive statistics of first semester college GPA by race ($N=12,301$)

Race	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>	<i>Min</i>	<i>Max</i>
American Indian/Alaskan Native	52	2.4550	0.8960	0.1242	0.00	3.89
Black (non-Hispanic)	401	2.0513	0.9860	0.0492	0.00	4.00
White (non-Hispanic)	10,753	2.6985	0.9209	0.0089	0.00	4.00
Asian/Pacific Islander	475	2.6447	0.9901	0.0454	0.00	4.00
Hispanic	404	2.3701	1.0017	0.0619	0.00	4.00
Prefer not to Indicate	216	2.8732	0.9090	0.0619	0.00	4.00
Total	12,301	2.6666	0.9372	0.0085	0.00	4.00

Table 4.6. One-way ANOVA of first semester college GPA by race ($N=12,301$)

Dependent variable	Groups	SS	df	MS	F	p
First semester college GPA	Between	210.072	5	42.014	48.760	0.000*
	Within	10,594.035	12,295	0.862		
	Total	10,804.106	12,300			

* $p < .001$ Table 4.7. Descriptive statistics of first semester college GPA by credit type ($N=12,727$)

Credit type	N	M	SD	SE	Min	Max
None	5,969	2.4432	0.97047	0.01256	0.00	4.00
IB only	23	2.7257	1.24690	0.26000	0.00	4.00
AP only	1,197	3.1215	0.78495	0.02269	0.00	4.00
2-Year only	2,995	2.7396	0.87616	0.01601	0.00	4.00
4-Year only	404	2.9009	0.81018	0.04031	0.00	4.00
Tech only	138	2.5188	0.85085	0.07243	0.00	4.00
Combination of credit types	2,001	2.9290	0.86468	0.01933	0.00	4.00
Total	12,727	2.6690	0.94122	0.00834	0.00	4.00

Table 4.8. One-way ANOVA of first semester college GPA by credit type ($N=12,727$)

Dependent variable	Groups	SS	df	MS	F	p
First semester college GPA	Between	724.624	6	120.771	145.622	0.000*
	Within	10,549.278	12,720	0.0829		
	Total	11,273.902	12,726			

* $p < .001$

Research Question 3: Is there a relationship between first semester college GPA and high school GPA, SAT or ACT scores, and number of previous college credits earned?

A series of Pearson's r correlation coefficients were calculated. Some students had only SAT scores, other students had only ACT scores, and a few students had both. The SAT scores were converted to a scale equivalent to ACT scores using a concordance (The College Board, 2010). If a student had both scores, only the ACT score was considered. A one-tailed test of significance was used, since a positive correlation coefficient was expected. The numbers in two of the groups differed from the $N=12,879$ because not all students reported a high school GPA and not all students who started the fall semester completed the fall semester. Cases were excluded pair wise. The correlation coefficients were statistically significant; therefore, null hypothesis III was rejected.

Table 4.9, Descriptive statistics of first semester college GPA, high School GPA, sum of credits earned while in high school, and ACT or ACT equivalent score

Variable	M	SD	N
First semester college GPA	2.6690	0.9412	12,727
High school GPA	3.4855	0.4457	12,879
Sum of credits earned while in high school	6.9636	9.5583	12,879
ACT or ACT equivalent score	23.9355	5.4446	12,879

Table 4.10. Correlation matrix for first semester college GPA, high school GPA, sum of credits earned while in high school, and ACT or ACT equivalent score

Variable	High school GPA	Sum of credits earned while in high school	ACT or ACT equivalent score
First semester college GPA	+.569*	+.226*	+.239*
High school GPA		+.300*	+.380*
Sum of credits earned while in high school			+.270*

* $p < .001$, one tail

The coefficient of determination (r^2) can be used to determine the strength of the correlation of the variables. The relationship between first semester college GPA and high school GPA has a coefficient of determination of 0.3238. This means that more than 32% of the variation in college GPA is accounted for by the relationship with high school GPA. This indicates a large correlation, or strong relationship. The r^2 value for the correlation between first semester college GPA and sum of credits earned while in high school is 0.051 and for college GPA and ACT or ACT equivalent scores is 0.057. The relationship between college GPA and the number of credits earned while in high school and ACT or ACT equivalent scores explains between 5 and 6% of the variation in college GPA. A coefficient of determination smaller than 0.09 indicates a weak relationship—statistically significant, but weak none the less (Gravetter & Wallnau 2007).

Research Question 4: Is there a difference in persistence to the second fall between groups when differentiated by gender, race, and type of college credit earned while in high school?

Since all of the variables of interest in this question are categorical, an analysis using crosstabs and Chi-square test of expected values was done. Tables

4.11 through 4.16 summarize the findings of the analysis. There were 432 individuals who did not indicate a race category, including “Prefer not to indicate”. These individuals were not included in the analysis of persistence versus race. When comparing the credit types to persistence, the expected count of “IB Only” students who did not return was less than five. The Chi-square statistic can be distorted when expected counts are very small; therefore, the IB only students were combined with the group of students who had a combination of credit types earned while in high school.

Table 4.11. Distribution of types of credits earned while in high school by persistence to second year ($n=12879$)

Variable	Counts	Did not return second fall	% above or below expected value	Did return second fall
None	observed	1,268	+4.9%	4,808
	expected	969.0		5,107.0
AP only	observed	107	-7.1%	1,096
	expected	191.9		1,011.1
2-Year only	observed	388	-3.1%	2,624
	expected	480.4		2,531.6
4-Year only	observed	45	-4.9%	364
	expected	65.2		343.8
Technical only	observed	21	-0.7%	117
	expected	22.0		116
Combination & IB only	observed	225	-4.9%	1,816
	expected	325.5		1,715.5

Table 4.12. Summary of Pearson's χ^2 statistic and Cramer's V for credit type by persistence to second year

Pearson's χ^2 Statistic			Cramer's V		
Value	df	Asymp. sig. <i>p</i> -value	Value	Approx sig. <i>p</i> -value	Size of effect
219.972*	5	.000	0.131*	.000	Small

**p*<.001

The Chi-square statistic shows statistically significant differences between the observed and expected counts when considering type of credit earned while in high school and persistence to the second fall, $\chi^2(5, n=12,879)=219.972, p<.001$.

The categories that deviated the most from the expected values are students with no credit earned while in high school who did not return for a second fall, AP only students who did not return, combination of credit type and IB only students who did not return, and 2-year only students who did not return. More students who had no credit earning while in high school left after their first year than expected by almost 5% of the category total. Approximately 7.1% fewer students who had AP only credit left school before the second year than expected, and approximately 5% fewer students who had combination of credits and IB than expected left before the second fall. Fewer 2-year only students did not return for the second fall than expected by about 3.1%.

There were also statistically significant differences between the race groups when considering persistence to the second fall: $\chi^2(5, n=12,447)=47.229, p<.001$.

By far, the biggest contributor to the Chi-square statistic is the Black student category. Almost 45 (+11.0%) students more than expected did not return for a second fall.

Table 4.13. Distribution of race by persistence to second fall (N=12,447)

Race	Counts	Did not return second fall	% above or below expected	Did return second fall
American Indian or Alaska Native	observed	14	+11.0%	38
	expected	8.3		43.7
Black (non-Hispanic)	observed	110	+11.0%	299
	expected	65.2		343.8
White (non-Hispanic)	observed	1,701	-0.3%	9,178
	expected	1,733.2		9,145.8
Asian/Pacific Islander	observed	62	-3.1%	420
	expected	76.8		405.2
Hispanic	observed	68	+0.8%	339
	expected	64.8		342.2
Prefer not to indicate	observed	28	-3.1%	190
	expected	34.7		183.3

Table 4.14. Summary of Pearson's χ^2 statistic and Cramer's V for credit type by persistence to second fall

Pearson's χ^2 Statistic			Cramer's V		
Value	df	Asymp. sig. p-value	Value	Approx sig. p-value	Size of effect
47.229*	5	.000	0.062*	.000	Small

* $p < .001$

The Cramer's V statistic indicates that, even though the differences are statistically significant, the size of the effect is small (Gravetter & Wallnau 2007).

The differences in persistence to the second fall by gender (Table 4.15 & 4.16) are not statistically significant: $\chi^2 (n=12,879) = 1.076, p > .05$. Null hypothesis IV was only partially rejected.

Table 4.15. Distribution of gender by persistence to second fall ($N=12,879$)

	Counts	Did not return second fall	Did return second fall
Female	observed	905	4,909
	expected	926.4	4,882.6
Male	observed	1,149	5,921
	expected	1,127.6	5,942.4

Table 4.16. Summary of Pearson's χ^2 statistic and Cramer's V for gender by persistence to second fall

Pearson's χ^2 Statistic			Cramer's V		
Value	df	Asymp. sig. p-value	Value	Approx sig. p-value	Size of effect
1.076	1	.300	0.009	.300	Not significant

* $p < .001$

Research Question 5: Is there a difference in persistence to the second fall when considering mean high school GPA, ACT or ACT equivalent scores, and number of college credits earned while in high school?

Independent sample t -tests were done comparing the averages of high school GPA, ACT or ACT equivalent scores, and the number of college credits earned while in high school between the group of students who did not return for a second fall, and the group of students who did return. To explain the differences in the numbers of subjects in the three independent t -tests, not all of the students had a reported high school GPA, these students were eliminated when comparing the returning/non-returning groups.

There is a statistical difference between the mean high school GPA of the students who persisted to the second fall semester and those who did not. The Levene's test for equality of variances was statistically significant. This means that

the group variances are not equal; therefore, the *t*-test for unequal variances was used. The group who persisted averaged $M=3.5312$ GPA with $SD=0.4288$, while the group who did not persist averaged $M = 3.2442$ GPA with $SD = 0.4101$. The group who persisted had a higher GPA than would be expected simply by chance, $t(2774.806)=-26.375$, $p<.001$, $r^2=20.22\%$. The r^2 value is the percent of the variance in high school GPA accounted for by persisting or not persisting to the second fall. An r^2 value of this magnitude indicates a medium effect (Gravetter & Wallnau 2007).

Table 4.17. Descriptive statistics of high school GPA by persistence to second fall ($N=12,861$)

Returned second fall	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
Yes	10,814	3.5312	0.4288	0.0041
No	2,047	3.2442	0.4556	0.0101

Table 4.18. Independent samples *t*-test for high school GPA by persistence to second fall ($N=12,861$)

	<i>t</i>	<i>df</i>	<i>p</i>	Mean Difference
Equal variances not assumed	-26.375	2,774.806	.000*	-0.2870

* $p<.001$

Students were required to submit an ACT or SAT when applying for admission to ISU. For the purposes of this study, SAT scores were converted to ACT equivalent scores using a concordance (College Board, 2010). When comparing the mean ACT or ACT Equivalent Score, there again was a statistically significant difference in the group who persisted to the second fall and those who did

not. The Levine's test for equality of variance was significant indicating unequal variances, so the *t*-test for unequal variances was used. The group who persisted had a mean ACT or ACT equivalent score $M=24.1283$, $SD=5.48125$, while the group who did not persist had a mean ACT or ACT equivalent score $M=22.9192$, $SD=5.1303$. This difference was statistically significant: $t(3011.852)=-9.684$, $p<.0001$, $r^2 = 3.02\%$. The group who persisted had a higher mean ACT or ACT equivalent score than the group who did not persist. This difference is large enough not to have happened simply by chance. Analysis of the data indicate the difference is statistically significant, but the effect of the relationship is weak ($r^2=3.02\%$).

Table 4.19. Descriptive statistics of ACT or ACT equivalent score by persistence to second fall ($N=12,879$)

Returned second fall	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
Yes	10,825	24.1283	5.4813	0.0527
No	2,054	22.9192	5.1303	0.1132

Table 4.20. Independent samples *t*-test for equality of means of ACT or ACT equivalent score by persistence to second fall

	<i>t</i>	<i>df</i>	<i>p</i>	Mean Difference
Equal variances not assumed	-9.684	3,011.852	.000*	-1.2091

* $p<.001$

The analysis of the means of the sum of credits earned while in high school of groups of subjects who persisted to the second fall and those who did not, a statistically significant difference was found: $t(3365.439)=-13.741$, $p<.001$, $r^2=5.31\%$. The group who did persist averaged $M=7.3978$ credits with $SD=9.7809$ earned while in high school, while the group who did not persist averaged $M=4.6754$ credits with

SD=7.9041. The Levene's test for equality of variances was significant; therefore, the *t*-test for unequal variances was used. The difference between the means of 2.7224 credits was too large to have happened by chance. These data suggest that the group who persisted averaged more credits earned while in high school, but only about 5% of the variance in credits earned is due to the relationship with persisting or not persisting to the second fall. Null hypothesis V can be rejected.

Table 4.21. Descriptive statistics of sum of credits earned while in high school by persistence to second fall ($N=12879$)

Returned second fall	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
Yes	10,825	7.3978	9.7809	0.0940
No	2,054	4.6754	7.9041	0.1744

Table 4.22. Independent samples *t*-test for equality of means of sum of credits earned while in high school by persistence to second fall

	<i>t</i>	<i>df</i>	<i>p</i>	Mean Difference
Equal variances not assumed	-13.741	3,65.439	.000*	-2.7224

* $p < .001$

Correlation and Regression Analyses

Multicollinearity

A correlation was done to examine the relationships among the independent variables of High School GPA, ACT/SAT Score, Sum of Credits Earned while in High School, and Type of Dual Credit Earned. A correlation coefficient of .75 or more among the independent variables indicates multicollinearity; some sources even go

as high as a correlation coefficient of .90. Multicollinearity can cause the standard error of a multiple regression to be magnified and makes rejecting the null hypothesis more difficult. Table 4.23 clearly shows that no correlation coefficient exceeds the .75 value. Multicollinearity is not present, so does not present any concerns about the sequential multiple regression necessary to answer Research Question 6 or the logistic regression needed to answer Research Question 7. Data were eliminated list wise for this analysis. During the regression analyses, the Tolerance value did not go below .1, and the VIF value did not approach 10. This is another indication that multicollinearity was not an influence in the outcomes of the regression analyses. (see Appendix, Table B.)

Table 4.23. Correlation matrix for high school GPA, ACT or ACT equivalent score, sum of credits earned while in high school, and type of dual credit earned

Variable	High School GPA	ACT or ACT equivalent score	Sum of credits earned while in high school	Type of dual credit earned
High school GPA	1.00	.380*	.300*	-.331*
<i>N</i>	12,861	1,2861	1,2861	1,2861
ACT or ACT equivalent score		1.00	.270*	-.327*
<i>N</i>		12879	12879	12879
Sum of credits earned while in high school			1.00	-.638*
<i>N</i>			12879	12879
Type of dual credit earned				1.00
<i>N</i>				12879

* $p < .01$, two tail

Research Question 6: To what extent do high school GPA, ACT or SAT scores, and number and type of previous college credits (AP, IB, 2-year, 4-year, and technical) predict first semester college GPA?

Sequential multiple regression was used to determine if each independent variable improved the prediction model. Each independent variable was entered in a separate block starting with high school GPA in block 1, ACT or ACT equivalent score in block 2, number of credits earned while in high school in block 3, and type of credits earned while in high school in block 4. Table 4.24 displays the correlations between the variables, the unstandardized regression coefficients (B) and intercept, the standardized regression coefficients (β), the semipartial correlations (sr_1^2), and R, R^2 , and adjusted R^2 after entry of all four independent variables. R was significantly different from zero at the end of each step. After step 4, with all independent variables in the equation: $R^2 = .327$, $F(4,12709)=1542.854$, $p<.001$. The adjusted R^2 value of .327 indicates that about a third of the variability in first semester college GPA is predicted by the independent variables of high school GPA, ACT or ACT equivalent score, sum of credits earned in high school, and type of credits earned in high school.

After step 1, with the high school GPA in the equation, $R^2=.323$, $F_{inc}(1,12712)=6,070.648$, $p<.001$. After step 2, with the ACT or ACT equivalent score included in the prediction equation, $R^2=.324$, $F_{inc}(1,12711)=11.401$, $p<.01$. The addition of ACT or ACT equivalent score improved the prediction slightly, but this was statistically significant. In step 3, the sum of credits earned while in high school was added to the other independent variables to predict first semester college GPA,

$R^2=.327$, $F_{inc}(1,12710)=57.722$, $p<.001$. After step 4, with type of credit earned in high school, $R^2 = .328$, $F_{inc} (1,12709)=.28.587$. The addition of type of credit earned in high school did improve R^2 . This pattern of results suggests that almost one third of the variability in first semester college GPA is predicted by high school GPA. ACT or ACT equivalent score, sum of credits earned in high school contribute, and the type of credit earned while in high school slightly to the prediction. Null hypothesis VI was rejected.

Research Question 7: To what extent do high school GPA, ACT or SAT scores, and number and type of previous college credits (AP, IB, 2-year, 4-year, and technical) predict first semester college GPA and persistence to the second year?

A logistic regression was done with high school GPA, ACT or ACT equivalent score, number of college credits earned while in high school, and type of college credits earned while in high school as the independent variables, and the persistence to the second fall as the dichotomous dependent variable. There were 18 cases with missing data, these were excluded from the analysis. The SPSS program eliminated the types of college credits earned from the analysis because the parameter estimates changed by less than .001. Table 4.24 summarizes the results.

A test of the full model with the three remaining predictors against a constant only model was statistically significant, $\chi^2(3, N=12861)=724.837$, $p<.001$, indicating that the predictors, as a set, reliably distinguished between the students who persisted to the second fall and those who did not. Null hypothesis VI can be rejected. Although the success rate of predicting those who did not return was 0%,

Table 4.25 Logistic regression of high school success variables on persistence to second fall semester ($N=12861$)

Variables	<i>B</i>	Wald χ^2	Odds Ratio	95% confidence interval for Odds Ratio	
				<i>Lower</i>	<i>Upper</i>
High school GPA	1.352	513.478	3.864*	3.438	4.343
ACT or ACT equivalent score	-.004	.699	.996	.986	1.006
Sum of credits earned while in high school	.016	25.021	1.017*	1.010	1.023
(Constant)	-2.922	219.486	.054*		

* $p < .001$

the success rate of predicting those who did return was 100%. These combined for an overall success rate of prediction was 84%. According to the Wald criterion, high school GPA, $\chi^2(1, N=12,861) = 513.478$, $p < .001$, and sum of credits earned while in high school, $\chi^2(1, N=12861) = 25.021$, $p < .001$ reliably predicted persistence to the second fall semester. The odds ratio for high school GPA of 3.864 shows a significant change in the likelihood of returning for a second fall on the basis of a one-unit change in GPA. For each one point change in high school GPA, students are almost four times more likely to return for a second fall semester.

On the other hand the odds ratio for the sum of credits earned while in high school of 1.017 shows only a small change in the likelihood of persistence to the second fall semester on the basis of a one-unit change in the number of credits earned. Even though the relationship is statistically significant, each credit earned in high school only slightly increases the likelihood of a student returning for a second fall. But since students rarely take only one credit courses as part of their college credit earning while in high school, a three credit course would increase the

likelihood of returning for a second fall by a little more than 5%, and a four credit course would increase the probability of returning for the second fall by almost 7%.

CHAPTER FIVE

SUMMARY AND DISCUSSION

Summary

The purpose of this study was to explore the extent differences in college credit earning while in high school influence a student's academic success in college. Data were obtained from the Office of the Registrar for three fall cohorts, 2006, 2007, and 2008, of first year students at Iowa State University.

This research supports the literature that ties rigor in high school curriculum to college academic success. The results suggest that high school students increased the rigor of their high school curriculum through credit earning while in high school.

The findings and conclusions of this research are intended to inform policymakers, administrators at the community college level and high school level, high school counselors and advisors, parents, and high school students. The findings of this study provide insight into factors that may increase a student's college academic success. This chapter is organized into five sections: (a) Discussion; (b) Limitations; (c) Implications; and (d) Final Thoughts.

Discussion

The first year students who gave ISU permission to use their data for research were comprised of 54.9% male and 45.1% female. The race/ethnic background of the students was 0.4% American Indian or Alaskan Native, 3.2% Black (not Hispanic), 84.5% White (not Hispanic), 3.7% Asian or Pacific Islander, 3.2% Hispanic (Spanish American), and 5.1% preferred not to indicate a category.

Almost half (47.2%) earned no college credits while in high school, 9.32% earned only AP credits, 23.4% earned only two-year credits, 3.2% earned only four-year credits, 1.1% earned technical credit only, and 15.9% earned IB or a combination of credit types.

This study did find a difference in first semester college GPA between genders and among race categories. Women had a statistically significant higher GPA than men. There were statistically significant differences among some of the race categories and not among others. This makes it difficult to rank the race categories by GPA. The mean first semester college GPA's by race ranged from 2.0513 for the Black (non-Hispanic) group to 2.8732 for the group who preferred not to indicate race.

A small positive correlation was suggested for the relationship between first semester college GPA, high school GPA, sum of credits earned while in high school, and ACT or equivalent score. There was a strong relationship with about 32% of the variation in college GPA explained by the relationship with high school GPA. The proportion of the variance explained in college GPA was about 5% when looking at the relationship with sum of credits earned while in high school and ACT or equivalent score. This indicates a significant but weak relationship.

This research supports students pursuing courses that provide for college credit earning while in high school, and in the case of AP courses, also pursuing the AP test. These findings support other research (ACT, 2007, 2009; Adelman, 1999, 2006; Andrews & Davis, 2003; T. Bailey & Karp, 2003; Hoffman & Robins, 2005;

Hugo, 2001; IDE, 2005; Thompson & Rust, 2007; Welsh, Brake, & Choi, 2005, 2006) which link college academic success to rigor in the high school curriculum.

Students in this study differed in the rate of persistence to a second fall semester when categorized by types of credits earned while in high school and race. Students who did not earn credits while in high school left college before the second fall by a rate of 4.9% more than expected. Those students who earned AP credits while in high school left college at a rate 7.1% less than expected before the second fall. Other credit earners left college at rates below the expected by between 0.7% and 4.9%. American Indian or Alaska Native and Black (non-Hispanic) race groups left college at a rate 11% higher than expected. The Hispanic group left at a rate 0.8% above what was expected. The White group left 0.3% less than expected and the Asian/Pacific Islander group and those who chose not to indicate race left at a rate 3.1% less than expected. The rate of persistence did not differ when students were categorized by gender.

Students who persisted to the second fall had higher high school GPAs, higher ACT or equivalent scores, and higher number of credits earned while in high school. The students who returned for a second fall earned on average about seven credits while in high school, where those who did not return earned on average less than five credits.

This study suggests that one can predict first semester college GPA using high school GPA, ACT or equivalent score, sum of credits earned, and type of credits earned. High school GPA was the best predictor of first semester college GPA when used alone.

The best predictors of whether a student would return for a second fall were high school GPA and the sum of the credits earned while in high school. ACT or equivalent scores did not seem to improve the odds of a student persisting to a second fall. For each point increase in GPA on a four point scale a student was about four times more likely to return. For each credit earned while in high school a student was about 2% more likely to persist to a second fall.

What does this mean? Although there was no difference found in the type of credit earned while in high school and the prediction of persistence, there was a difference in persistence between those who earned college credit while in high school and those who did not. This means that students who have earned credit while in high school find more academic success once in college. Parents, school administrators at all levels, and policy makers should be encouraged to provide high school students credit earning opportunities. Furthermore, high schools should be encouraged to take advantage of such credit earning opportunities for their students.

The theory of individual departure developed by Vincent Tinto (1993) was used as a guiding structure for the variables of this study. Tinto's work developed "an explanatory, predictive model of the dropout process which has at its core the concepts of academic and social integration" (Pascarella & Terenzini, 1980, p. 60). Tinto examined the interplay between the categories of: (a) pre-entry attributes, (b) entry goals/commitments, (c) institutional experiences, (d) integration, (e) future goals/commitments, and (d) outcome. His research specifically explored how these categories, when taken together, influence the decision to leave the institution of higher learning.

Tinto (1993) used Arnold Van Gennep's tribal rites of passage stages of (a) separation, (b) transition, and (c) incorporation to posit the longitudinal process of student persistence in college. The rite of separation translates to college students as the separation from communities of the past: hometown, high school, family and friends. College students pass through the rite of transition as they move from high school to college. The rite of incorporation is achieved when the student becomes familiar with the academic and social systems of the college, both formal and informal (Tinto 1993).

The findings of this study support the research conducted by Tinto (1993) that suggest pre-entry attributes of students play a role in the decision to remain or to leave college. Credit earning while in high school fosters students' successful transition from high school to college as demonstrated by college academic success. In addition, the rite of incorporation is enhanced by credit earning while in high school. Students are exposed to the academic systems of higher education. This exposure can promote familiarity with what is supposed to happen in a college classroom and promote college academic success. College academic success is measured in this study by persistence to the second fall, and first semester college GPA.

This study explored modifying Astin's (1993) I-E-O model by adding an additional environment block representing the high school environment. The additional block represents the focus of this research, the college preparation environment in high school. The credit earning opportunities while in high school (joint enrollment) form a bridge between the high school environment block and the

college environment block. The modified model, I-E₁-E₂-O (see Figure 1) is supported by the results of this study, and adds to the theory base. The credits earned before entering ISU do influence the college academic success of the students. Both the number of credits earned and the type of credits are included in the regression models that predict first semester college GPA. Students who had earned more credits while in high school were more likely to persist to the second fall. Each credit earned while in high school increased the probability of persistence to the second fall by about 2%.

Limitations

This study used first-time, full-time first year at Iowa State University. Because all subjects were from the same institution, the results of this study are not generalizable to all first-time, full-time first year at any institution of higher education in the United States. However, because this was a longitudinal study that used three separate cohort groups of first year, we can make generalizations about future ISU students.

Background data regarding the socioeconomic status of the students, parental education or income, high school size, hometown size, were not available in the data set. These attributes would have informed more of Tinto's pre-entry attributes, and Astin's input category. Race and gender were only used when comparing groups and not in the prediction models since this study focused on the effects of credit earning while in high school on college academic success. The data analysis was limited by the data that were available from the Office of the Registrar.

Students who had taken AP courses, but did not choose to take the AP tests or did not score high enough for credit to be granted, were not represented in this data. Access to high school transcripts could possibly capture these data, but the problem of non-standard course titles could introduce additional murkiness to the findings

Implications

State and local policy

The Iowa legislature has provided financial assistance to schools and families to pay part of the cost of the AP tests in the Senior Year Plus Program (2008). This legislation also addressed the availability of concurrent enrollment classes through the Iowa AP Online Academy. Legislation provided for additional funding of joint enrollment students by allowing for increased funding for the students shared between community colleges and the local high schools. This funding is distributed to the high school and then is available to finance the agreement between the high school and the local community college. The findings of this study support the continuation of the investment in Iowa high school students by funding joint enrollment and other college credit earnings opportunities while in high school.

High schools are being encouraged to offer more rigorous curriculum at every turn. AP courses are mentioned in almost every political speech as the way to offer the rigor shown to help students succeed in college. Many people equate AP with any advanced level course and are not aware that it is a brand name given to the curriculum offered by the College Board. Educators and policy makers need to be sure that all of the options are presented in an equal manner. Local school districts

need the flexibility to offer the rigor needed for success in a manner that is most logistically feasible for their students. There is no way to build a single program that will fit the needs of every k-12 district, every community college district, and every four year institution.

Institutions

Many studies, including this one, have revealed that increased rigor in the high school curriculum increases academic success in college (ACT, 2007, 2009; Adelman, 1999, 2006; Andrews & Davis, 2003; Bailey & Karp, 2003; Hoffman & Robins, 2005; Hugo, 2001; IDE, 2005; Welsh, Brake, & Choi, 2005, 2006). Building credit earning opportunities into policy and making the opportunities available to every student will make the advantages of increased rigor equitable in all districts. Credit earning while in high school is an available way to increase rigor.

Local administrators and boards should have the freedom to make arrangements with local community college and other entities to provide the credit earning opportunities that benefit the students in their school. The credit earning opportunities may be on-line or other distance learning platforms, or face-to-face on the high school campus, or on the post-secondary institution campus. Combinations of these credit earning opportunities will have the highest probability of serving the greatest number of students.

Some post-secondary institutions do not accept credits earned while in high school. Research has shown that there are no differences in performance on the final exams between students enrolled in courses held on the campus of Northern

Iowa Community College and the same courses for dual enrollment in the local high school (Andrews, 2004). High school students who have earned credits may make enrollment decisions based on the most credits accepted by the post secondary institution. By staying informed about curriculum changes at all levels, educators are in a position to help students and their families leverage education dollars to go as far as possible.

Practice

High school educators can take the findings of this study and use them to help encourage students to take advantage of any credit earning opportunities available to them while in high school. Public school students have access to courses at little or no cost to themselves or their parents. In Iowa, funding for community college courses and the Iowa AP Online Academy are provided for in the Iowa Code (Senior Year Plus, 2008). When students are not offered the opportunities for joint enrollment, they may opt for “early out” dismissal. Research in Arizona by Puyer, Thor, and Mills (2001) revealed that about one third of seniors would not have taken a college math class if it had not been offered for credit. Most of the high school students did not need the course to meet graduation requirements; they simply wanted the college credit. [no contractions]

By educating parents about the advantages of a rigorous high school curriculum, high school educators can nurture an ally to help guide students to pursue a more rigorous curriculum. Parents should also be wary of encouraging their child to use the senior year as a time to enjoy only the social aspects of school.

Parents who are encouraged to keep themselves informed about the opportunities available to earn college credits while in high school understand the positive effects credit earning while still in high school have on the student's post-secondary education success. In Iowa, students attending public schools have access to credit earning opportunities at little or no cost to parents. Some parents are aware of the lower tuition costs and/or the opportunity of taking a lighter academic load at the post-secondary institution when transferring some previously earned credits. For each three-hour course a student transferred to ISU in the fall of 2010, the student/parent saved \$944.25 in tuition for that course (Tuition, n.d.).

Encouraging students to be proactive and research credit earning opportunities that are available could help them benefit in their college academic success. Are there advanced level courses students can take on-line or through another distance education system? Even if students are not sure about their future career choices, college general education courses are applicable to many college programs. Advanced high school science and math courses increase the rigor of the high school curriculum and lead to greater college academic success (ACT, 2007, 2009; Adelman, 1999, 2006; Andrews & Davis, 2003; Bailey & Karp, 2003; Hoffman & Robins, 2005; Hugo, 2001; IDE, 2005; Thompson & Rust, 2007; Welsh, Brake, & Choi, 2005, 2006).

The Iowa AP Online Academy was created by the legislature to ensure equal access to credit earning opportunities for students, regardless of the size of their high school. The legislation supports concurrent enrollment whether in a face-to-face classroom at the community college, or high school, or in a distance learning format

(Senior Year Plus, 2008). Additional information regarding access to credit earning opportunities could help policymakers work to providing equal access to all students from various backgrounds.

Recommendations for Future Research

In the future, similar studies could be done to collect and analyze data on the attributes that would inform the entire input and pre-entry attributes of the theoretical models. The influences of parental income and education as well as community type and size of high school could be examined for the influence these variables have on college academic success. Including the missing enrollment data regarding the first spring semester could also strengthen the conclusions of this study.

Adding a qualitative portion to a future version of this study would address some of the limitations of the present study. Randomly selecting subjects from a large group who would then be interviewed and/or surveyed about the pre-entry attributes of parental income, parental education, size of community, size of high school would provide more information for the prediction models. Furthermore, surveying these students' parents regarding the same information would allow for verification of the self-reported data and increase the reliability of the data and, hence, the predictions. These additional data could be used to answer the research question: Do students with different backgrounds have different access to college credit earning opportunities while in high school?

Data collected from this smaller sample of students could include more specific information about the student's high school curriculum. The survey in the

research could be expanded to include the student's high school. Did the student take rigorous courses while in high school? Did the student take any courses that used the suggested AP curriculum? Did the student choose not to take the AP test? Did the student take any AP tests, but scored a 1 or 2 and failed to earn credit? Did the student take an AP test, earn a 3, 4 or 5 and was not granted credit by the college or department of study? This additional information would help to evaluate the impact that simply taking an AP course may have on college academic success and examine other ways rigor is introduced into the high school curriculum. By collecting data from both the student and the high school, any self-reported data would be verified.

This study could be expanded to other peer land grant universities to increase the generalizability. By expanding the study, policy makers would have more information about how student success differs among groups when differentiated by personal traits and college credit earning while in high school. Data could be collected over a longer period in order to gather data about student persistence to the third and fourth years as well as persistence to the degree.

Measures of student academic success that were not included in this study are credit acquisition and appropriate course sequencing. Close examination of college transcripts for these measures could reveal more differences in student college academic success among groups.

Final Thoughts

First-time, full-time first year students at ISU are more successful when they have earned college credits while in high school. They earn a higher first semester college GPA, and they are more likely to persist to a second fall. Even students who earn technical credits have a higher first semester GPA than students with no college credit earned while in high school. In this study, the type of credit did not help predict persistence to the second fall semester; only those students who had credit were predicted to have a higher probability of persisting to the second fall. All of these findings support parents and school administrators promoting college credit earning while in high school to students. Because every high school in Iowa has internet access and access to the Iowa Communications Network, every school has the ability to access credit earning opportunities for the students in that district. In Iowa, every high school is also in one of 15 community college districts, so there are chances to plan programs to provide high school students with credit earning opportunities.

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APPENDIX B. SUMMARY DATA TABLES

Table B-1. Variables Used in the Study

Student Variables	Coding
Gender	1—male, 2--female
Race	1—American Indian or Alaskan Native, 2—Black (not Hispanic), 3—White (not Hispanic), 4—Asian or Pacific Islander, 6—Hispanic, 8—Prefer not to indicate
IB Credit	sum of credits
AP Credit	sum of credits
Two-year Credit	sum of credits
Four-year Credit	sum of credits
Technical Credit	sum of credits
Dual Credit	sum of credits
ACT Composite Score	10 - 36
SAT Combination Score—a sum of SAT Verbal and SAT Math scored	570 - 1600
ACT Equivalent Score	10 - 36
ACT or ACT Equivalent Score	10 - 36
IB Credit Y/N	0—no, 1—yes
AP Credit Y/N	0—no, 1—yes
Two-year Credit Y/N	0—no, 1—yes
Four-year Credit Y/N	0—no, 1—yes
Technical Credit Y/N	0—no, 1—yes
Dual Credit Y/N	0—no, 1—yes
Dual Credit Type	0—none, 1—IB only, 2—AP only, 3—Two year only, 4—Four year only, 5—Technical only, 6--Combination
Dual Credit Type (recoded by mean of GPA)	1—AP only, 2—Combination & IB only, 3—Four-year only, 4--Two year only, 5—Technical only, 6—None
High School GPA	4-point scale
First Semester College GPA	4-point scale
Returned Second Fall	0—no, 1—yes

Table B-2. Collinearity statistics for multiple regression (Research Question 6)

Model		Tolerance	VIF
1	(constant)		
	High School GPA	1.000	1.000
2	(constant)		
	High School GPA	.856	1.069
	Sum of Credits Earned While in High School	.856	1.069
3	(constant)		
	High School GPA	.814	1.228
	Sum of Credits Earned While in High School	.829	1.133
	ACT/SAT Score	.883	1.133
4	(constant)		
	High School GPA	.800	1.205
	Sum of Credits Earned While in High School	.808	1.237
	ACT/SAT Score		
	Type of Credit Earned While in High School	.585	1.710
		.560	1.787

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