The Treatise Committee for Steven Ray Gonzales certifies that this is the approved version of the following treatise:

REMEDIAL EDUCATION AND ITS RELATIONSHIP TO ACADEMIC PERFORMANCE AND RETENTION OF STUDENTS AT CENTRAL ARIZONA COLLEGE: A CASE STUDY

Committee:

John E. Roueche, Supervisor

Norvell Northcutt

Cynthia Osborne

Terry A. Calaway

Doris Helmich

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by

Steven Ray Gonzales, B.S., M.A.T.

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DEDICATION

This culmination of blood, sweat, and tears is dedicated to my wife, Jenni, and children, Austin and Jenna. Your support and understanding made it possible. I also dedicate this work to Ray and Frances, my mom and dad, who instilled in me the value of education. Finally, I dedicate this to the memory of my grandfathers, Hector and Lupe, whose sacrifice and will inspired me most.

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REMEDIAL EDUCATION AND ITS RELATIONSHIP TO ACADEMIC PERFORMANCE AND RETENTION OF STUDENTS AT CENTRAL ARIZONA COLLEGE: A CASE STUDY

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Steven Ray Gonzales, Ed.D.
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Supervisor: John E. Roueche

This study examined the relationship between remedial education, academic performance, and student retention. Using an *ex post facto* research design and the fall 2002 cohort of first-time, degree-seeking students at Central Arizona College, this study used quantitative analysis to explore how need and success varied according to select student characteristics that included, but were not limited to, gender, ethnicity, and enrollment status. Additionally, this study compared levels of academic success and student retention rates for students with a remedial background to those of students who did not require remedial education. This study also identified which select student characteristics served as predictors of academic performance in remedial courses.

Finally, this study examined whether grades earned by students in exit remedial courses were predictors of academic performance in subsequent college-level courses.

This study had several major findings. First, Hispanics represented the largest percentage of minority students requiring remediation. However, Black students required remediation proportionately higher than any other ethnic group. Furthermore, African-American females who demonstrated financial need and attended part-time were most likely to require remediation. Second, female students outperformed their male counterparts in remedial courses. However, African-American and Native-American females were most likely not to achieve academic success in remedial courses. Third, students in initial college-level courses without a remedial background experienced higher levels of success than students with a remedial background. Fourth, students with a remedial background were more likely to be retained each semester and persist to the end of the three-year period under study. Fifth, performance in remedial courses and number of visits to the learning assistance center emerged as greatest predictors of academic success in initial college-level courses. Finally, this study found that academic success in exit remedial courses was a predictor of success in initial college-level courses.

This study was concluded with recommendations for further research and strategies that institutions could implement to improve remedial programs.

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CHAPTER 1
INTRODUCTION TO THE STUDY

All who have meditated on the art of governing mankind have been convinced that the fate of empires depends on the education of youth.

- Aristotle

Overview of the Study

Never before in the history of this country has the demand for a highly educated populace been so apparent. Well into the 21st century, the United States continues to be in a time of great transition and uncertainty. Americans are witnessing unprecedented growth in knowledge, technology, global economies, and, in some regions, population. Friedman (2005) contends that technological advances have flattened the world and are allowing previously underdeveloped countries such as India, China, and countries in the former Soviet Union to "compete for global knowledge work as never before" (p. 7). In contrast to the extent of globalization over the past 400 years, in today's flat world, there exists a "newfound power for *individuals* to collaborate and compete globally" (p. 10).

In addition to increasing levels of global competition, challenges such as societal ills, persistent poverty, the existence of a seemingly permanent underclass, and especially poor student achievement in elementary and secondary schools threaten the United States' status as a world superpower (Friedman, 2005). Over reliance on foreign

energy sources, constant threats of terrorist attacks, and the effects of a deteriorating climate add to the obstacles that the U.S. faces daily.

Positioned at the center of society, institutions of higher learning stand as one of few entities capable of producing an educated citizenry who can resolve complex societal issues and compete well in a knowledge-based global economy; no one understands this better than academia itself. The short- and long-term benefits of a college education are well documented. However, while being called upon to address America's problems, institutions of higher learning also face challenges. According to Boggs (2000), diminishing state support, increasing enrollment, changing student demographics, and accountability from stakeholders and policymakers signal the brewing of a "perfect storm" (p. 8). For many colleges and universities, the expectation is that more needs to be done with less (Levinson, 2005). For community colleges, that expectation is greater.

Educating a citizenry begins with the fundamental act of providing access. Roueche and Baker (1987) state that "in accordance with democratic ideals, every human being should be allowed, if not encouraged, to develop his or her fullest potential" (p. 3). Since its inception, the community college has held steadfast to that ideal by maintaining open-door admissions policies and affordable tuition, prompting one scholar to refer to community colleges as the "Ellis Island of higher education" (Vaughan as cited in Roueche & Baker, 1987, p. 3). However, with open-access admission policies arise many forms of diversity and levels of academic preparedness,

but none has stirred more debate than the large percentage of students entering community colleges who are not adequately prepared for college-level work. Because providing open-access and opportunity are not enough to ensure the production of a well-informed citizenry, a closer look at that special population becomes necessary.

With nearly half of all students arriving on campus inadequately prepared for college-level work, community colleges are morally obligated to assure student success. Yet, "too often, institutions have welcomed new populations of students while failing to serve these students' unique needs" (Roueche & Baker, 1987, p. 6). One way that community colleges attempt to attend to academically underprepared students is through remedial education.

In community colleges, remedial education generally refers to a set of courses where basic reading, writing, and math skills are taught. Virtually all community colleges offer remedial education and, in many instances, with multiple levels in each subject (Remedial Education, 2003). Level of placement and subject deficiency for students generally depends on his or her results on an assessment instrument.

Regardless of where a student begins remediation, the underlying theory of remedial education is that after successfully completing a prescribed number of remedial courses, he or she is ready for college-level coursework. However, the reality of remedial education is that only 43 percent of the students who require remediation eventually matriculate into college-level courses (McCabe, 2000). Of that group, 65 percent to 88 percent of the students pass their first college-level course (Boylan, 2002).

The fact that 57 percent of the students who begin remedial education never make it to a college-level course and 12 percent to 35 percent of those who do, fail to pass, leads many to question whether remedial education is effective.

This country faces far too many internal and external challenges to ignore the sheer number of students who start remedial education each year, yet do not successfully complete remedial programs and, as a result, do not earn college credentials. Given the current trends for population growth, characteristics of the growing population, and academic performance of students in the pipeline to higher education, remedial education is most likely here to stay. As Roueche, Roueche, and Ely (2001) assert, "As an educational flash point, remedial education is not going away any time soon, nor will skill-deficient students" (p. 15).

Chapter One furnishes a synopsis of this study. More specifically, this chapter includes (a) an overview of the study, (b) statement of the problem, (c) the purpose of the study, (d) research questions, (e) the methodology, (f) the significance of the study, (g) limitations of the study, (h) delimitations of the study, (i) assumptions, (j) the organization of the remainder of the study, and (k) summary.

Statement of the Problem

For nearly half of all U.S. undergraduates, higher education begins at a community college and almost half of these students are inadequately prepared for college-level work, thus requiring some form of academic intervention—i.e., remedial education. Although many students begin remedial education, too many of these

students fail to complete remedial programs successfully. Given the sheer number of students who require remediation, not improving the effectiveness of remedial education is detrimental to the well being of this country's governance and prosperity. Yet, some researchers contend that colleges struggle to measure effectiveness because either "they do not assess their effectiveness very well, do not know how to assess it, or do not want to know" (Roueche & Roueche, 1999, p. 27).

If an educated citizenry holds great promise in overcoming America's challenges, then how community colleges address the critical issues of an academically underprepared population is of highest priority. In response to rapidly changing demographics, political realities and accountability related to funding and improved academic performance, and rise in postsecondary education participation, researchers recommend further research in a number of areas before definitive judgments can be made about the effectiveness of remedial education (Higbee, Arendale, & Lundell, 2005). Before efficiently addressing issues such as improving effectiveness of remedial programs, community colleges must first understand the effect remedial education has on academic performance and retention. However, researchers contend that many community colleges fail to address this fundamental need (Boylan, 2002; Grubb, 2001; McCabe & Day, 1998).

Purpose of the Study

The primary purpose of this study was to investigate the relationship between remedial education, academic performance, and retention of students at Central Arizona

College (CAC). Specifically, this study examined how need and success varied according to select student characteristics (e.g., gender, ethnicity, enrollment status, etc.). Additionally, this study compared rates of success and student retention for students with a remedial background to those who did not require remedial education. This study also identified select student characteristics as predictors of academic performance in remedial courses. Finally, this study examined the predictability of grades earned in remedial courses to academic performance in subsequent college-level courses.

CAC is a community college located in Pinal County and is between the cities of Phoenix and Tucson. Classified as a rural institution, CAC is comprised of three campuses and six centers. CAC serves approximately 11,500 students annually. Demographers expect the county's population to increase by nearly six fold over the next two decades, expanding the population in the county to nearly 1.5 million.

Research Questions

In order to examine the relationship between remedial education, academic performance, and retention at Central Arizona College, this study raised six questions. In each of the questions below, student academic success was measured by earned grades of A, B, C, or at least a 2.0 grade point average. Specifically, this study asked:

1. How does need, as measured by the number of students who enroll in one or more remedial course, vary by select student characteristics at Central Arizona College (i.e. when data are disaggregated)?

2. How does student academic success vary by select student characteristics for students in remedial courses at Central Arizona College (i.e. when data are disaggregated)?
3. How do rates of academic success in initial college-level course for students with a remedial background compare to students with a non-remedial background when the effects of select student characteristics are controlled?
4. How do three-year retention rates of students with a remedial background compare to those with a non-remedial background when the effects of select student characteristics are controlled?
5. Which select student characteristics best predict academic success in initial college-level course for students who took one or more remedial course?
6. Is academic success in exit remedial courses a predictor of academic success in initial college-level course when the effects of select student characteristics are controlled?

Methodology

This *ex post facto* study employed strictly quantitative methods to evaluate the relationship between remedial education, academic performance, and retention at Central Arizona College. Independent variables included student characteristics such as gender, ethnicity, enrollment status, age, commuting status, financial aid status, athletic status, and grades in remedial or college-level courses. Dependent variables focused primarily on student academic performance in remedial and college-level courses, need

for remediation, and three-year retention rates. These data allowed for descriptive, correlational, and inferential statistical analysis.

Definitions of Terms

The following terms require explanations for the purposes of this study:

Academic success refers to a student having earned a grade of A, B, or C or in some instances possessing a cumulative remedial or non-remedial grade point average greater than or equal to 2.0.

Academically underprepared student refers to a student who is not prepared for college-level coursework.

College-level course refers to a course that applies toward the requirements of an associate's degree or university transfer.

Level of remediation refers to number of courses required before a student can enroll in a college-level course. Multiple levels of remediation may describe a student if he or she requires remediation in two or more subjects.

Need refers to the requirement of enrolling in one or more remedial courses as identified by the student's performance on a placement exam.

Persistence refers to the condition of retaining a student until he or she completes a program or degree.

Remedial education refers to the set of "courses in reading, writing, or mathematics for college-level students lacking those skills necessary to perform college-level work at the level required by the institution" (Remedial Education, 2003,

p. iii). The literature and practitioners commonly use *developmental education* and *compensatory education* interchangeably with remedial education.

Retention refers to the continuance of student enrollment from one semester to the next.

Select student characteristics refers to attributes that are most likely to influence academic performance. Notable attributes include gender, ethnicity, enrollment status, age, commuting status, financial aid status, and athletic status.

Significance of the Study

Given rapidly shifting demographics, growing participation in a global economy, and the political realities of increased accountability and shrinking appropriations in higher education, improving remedial education is vital to this country's well-being. Roueche and Roueche (1999) advise, "It is clear that if the community colleges do not better address remedial education, this country will suffer enormous consequences" (p. 41). In addition to adding to an existing body of knowledge regarding remedial education, this study provided a replicate example of how community colleges can utilize data to examine the relationship between remedial education, academic performance, and retention. Community colleges may then use their findings to create learning environments and policies that foster academic success for students in remedial education.

Limitations of the Study

Most studies encounter some degree of limitations associated with validity, particularly with internal and external validity (Mertens, 2005). For all practical purposes, remedial education is an intervention for students who lack the basic skills necessary for college-level work. After all, students who are placed into remedial courses because of placement exam results should be prepared for college-level work after taking a regimen of courses. Internal validity was threatened in this study by assuming that remedial education explained student success without considering additional supports for students in remedial courses such as tutoring or peer mentoring. Moreover, this study did not include the use of a control group to ensure internal validity (Trochim, 2001).

A one-time "snapshot" of a cohort threatens external validity in this study, and unlike using a longitudinal study, generalization is limited (Mertens, 2005). However, Trochim (2001) states that using random selection to create a sample from a population improves external validity. However, this study used the entire cohort for the study, which may have mitigated that threat.

Delimitations of the Study

Remedial education is part of a larger developmental process that community colleges engage in to help students develop skills necessary for college-level work (Oudenhoven, 2002). In addition to the remedial courses, CAC provides academic support services such as advising, peer-mentoring, and success skills workshops. The

role that these additional services play in preparing students for college-level work was not included in this study.

Although other variables influenced performance of students in remedial education or retention, variables such as employment status, marital status, number of dependents, or disabilities were not explored. Moreover, this study did not provide an opportunity for students to express reasons for performance outcomes. Therefore, the "student voice" was not heard. Finally, this study did not evaluate the pedagogical practices used by CAC instructors in remedial courses nor the format in which the course was offered (i.e., traditional, online, hybrid, ITV).

Assumptions

Several assumptions underscored this study. The researcher assumed that a cross-sectional sample of students in remedial education at CAC could be generalized to all students subsequently enrolled in remedial courses at CAC. Furthermore, the researcher assumed that the results of the analysis could be generalized to other institutions within the state and nation with similar populations. The researcher further assumed that the chosen independent variables, after statistical analysis, appropriately addressed the research questions.

Summary

The United States faces many challenges in the future. To overcome those challenges, this country will need an educated citizenry. Institutions of higher learning

are looked upon as one of few existing societal infrastructures that have far-reaching capabilities to prepare the masses. However, they too face impending challenges, namely increasing student enrollments with simultaneous decreasing state appropriations. At the same time, institutions of higher learning face increasing numbers of students who are academically underprepared for college-level work. Moreover, at community colleges, nearly half of all students are not academically prepared when they arrive on campus. Students who are underprepared require remedial education, but just over half ever matriculate into college-level courses. Thus, in order for community colleges to assist in developing an educated populace, improving remedial education must be a primary concern.

Organization of the Remainder of the Study

This chapter furnished (a) an overview of the study, (b) the statement of the problem, (c) the purpose of the study, (d) the research questions, (e) the methodology, (f) the significance of the study, (g) limitations of the study, (h) delimitations of the study, (i) the assumptions, and (j) organization of the remainder of the study.

Chapter Two includes a review of the literature and research related to remedial education with a primary focus on community colleges. Chapter Three includes an in-depth discussion of the methodology and procedures used in this study, as well as a relevant institutional profile of Central Arizona College. In Chapter Four, results and analyses that emerged from the study are presented. Finally, Chapter Five includes a summary of the study and findings, conclusions and implications based on the findings,

recommendations for further research, and recommended strategies for institutional improvement for CAC and institutions with similar populations.

CHAPTER 2

REVIEW OF THE LITERATURE

This institution will be based on the illimitable freedom of the human mind. For here we are not afraid to follow truth wherever it may lead, nor to tolerate any error so long as reason is left free to combat it.

– Thomas Jefferson, 1820

Introduction

The primary purpose of this study was to investigate the relationship between remedial education, academic performance, and retention of students at Central Arizona College (CAC). This chapter furnishes a review of the literature that establishes an appropriate context for achieving the objective of this study. This chapter is divided into three major sections. The first section includes an overview of the community college. The second contains discussion on remedial education, including an overview and current state of remedial education. The third section encompasses an examination of overall effectiveness of remedial education and methods for evaluating the effectiveness of remedial programs.

Overview of the Community College

Mission, Vision, and Values

By now, virtually every community college has its own self-created mission, vision, and values that were developed to meet the specific needs of the communities in which they serve. Nevertheless, scholars have offered broader versions of the community college mission, vision, and values that capture the essence of what community colleges represent. For example, Gleazer (1980) synthesized the characteristics of exemplary institutions to arrive at the following mission for community colleges: "To encourage and facilitate lifelong learning, with community as process and product" (p. 16). Twenty-six years later, Vaughan (2006) offered a similar rendition, "Broadly stated, the community college mission is to provide access to postsecondary educational programs and services that lead to stronger, more vital communities" (p. 3).

Satisfying the needs of a community means that community colleges have to offer a wide range of educational opportunities. Therefore, community colleges offer programs that permit students to transfer to four-year institutions, obtain certifications for quick entry into the workforce, or enroll for personal enjoyment. Community colleges also serve as hubs for community involvement through fine arts and sporting events. Community colleges often reach out to elementary and secondary education students by offering summer college institutes for all ages. Regardless of a person's age, community colleges have something to offer. Thus, with a strong commitment to

developing life-long learners, maintaining excellence and open access, and community improvement, community colleges attract students from all "walks of life." The community college profile is a true reflection of the United States.

Community College Profile

According to the American Association of Community Colleges (AACC), community colleges are the largest and fastest growing segment of higher education. Currently 1,158 community colleges serve 11.6 million students, or 46 percent of all U.S. undergraduates nationwide. Women constitute the majority of this population at 58 percent. Community college students are ethnically diverse, 10 percent are Black, 10 percent are Hispanic, 5 percent are Asian/Pacific Islander, and 69 percent are White (Phillippe & Gonzalez Sullivan, 2005).

Compared to other institutions of higher learning, community colleges serve proportionately higher numbers of minorities. For instance, 47 percent of all Black undergraduates attend community colleges. The corresponding figure for Hispanic, Asian/Pacific Islander, and Native American undergraduates is 56 percent, 48 percent, and 57 percent, respectively. Six percent of the community college student population are non-U.S. citizens, and 45 percent are first-generation college students (Phillippe & Gonzalez Sullivan, 2005).

The average age of the community college student is 29, which is expected to lower over the next decade due to rising university tuition and more stringent admission requirements. More specifically, forecasters predict traditional college-age students

between the ages of 17 and 21 years to increase from 26 million to 30 million, with Hispanics accounting for nearly half of the increase (Phillippe & Gonzalez Sullivan, 2005). As evidenced by the data, community colleges serve a diverse group of students largely attributable to its overarching mission to provide open access to higher education.

The fundamental and defining component of the community college mission that sets itself apart from most four-year colleges and universities is its commitment to "serving all segments of society through an open-access admissions policy that offers equal and fair treatment to *all* [emphasis added] students" (Vaughan, 2006, p. 3). Hence, use of the term "open-door" institutions is often used to describe community colleges. Vaughan asserts that community colleges further distinguish themselves from other institutions of higher education in how they respond to students who do not meet the prerequisites for college-level work. Rather than ignore the needs of students who are academically underprepared, "the community college offers avenues for students to obtain the necessary prerequisites" (p. 5). Remedial education is one of the avenues by which community colleges provide for students who are not ready for college-level work.

Remedial Education

Overview—What's in a Name?

Scholars give much attention to the name that should be assigned to the practice of teaching skills to students who are academically underprepared. Remedial education and developmental education are the two most commonly used terms, and while many scholars differentiate between the two, there are those who see little, if any, difference between the terms. In fact, nearly four decades ago, Roueche and Hurlburt (1968) weighed in on the debate of what to call the process of teaching basic skills. The authors wrote, "Remedial and developmental are often used interchangeably, despite a subtle difference in the actual meaning of the terms" (p. 454). Despite the philosophical debate, Roueche and Roueche (1999) report that in no instance did the use of any specific term affect student performance or program outcomes.

For many scholars, whatever name is chosen implies a philosophical difference in the approach to educating academically underprepared students. Developmental education refers to a comprehensive approach that includes courses and academic support services specifically designed for serving underprepared students. Higbee, Arendale and Lundell (2005) maintain that developmental education "encompass[es] both the academic and noncognitive factors that influence student success in higher education" (p. 6). Boylan (2002) defines developmental education "as courses or services provided for the purpose of helping underprepared college students attain their academic goals" (p. 3). Additionally, researchers argue that developmental education is

likely grounded on principles of student developmental theory and transformative theories such as democratic theory and multicultural education theory (Breneman & Haarlow, 1998; Higbee et al., 2005).

Other scholars argue that using the term developmental education is merely an attempt to avoid the stigma associated with "remedial" education. Some colleges avoid the use of developmental and remedial education altogether, adopting terms such as college-preparatory, compensatory education, or transitional studies. Some scholars recognize and even commend educators for exploring alternative terms such as these, but choose to utilize remedial education because it is the vernacular used and understood by the general public, the media, and policymakers (Roueche & Roueche, 1999). The National Center for Educational Statistics (NCES) defines remedial education as "courses in reading, writing, and mathematics for college students lacking those skills necessary to perform college-level work at the level required by the institution" (Remedial Education, 2003, p. 1). While the debate on whether to use remedial or developmental has been ongoing for nearly four decades, the practice of providing remedial education is much older.

Historical Background

The need for remedial education dates back nearly 400 years with the founding of Harvard College, America's first institution of higher learning. Harvard College assigned tutors to students who struggled with Latin and Greek (Breneman & Haarlow, 1998). In 1849, the University of Wisconsin offered the first remedial courses in

reading, writing, and arithmetic (Taylor, 2001). Because elementary and secondary education was neither easily accessible nor required by law, researchers contend that the need for remedial education during that time was inevitable and perhaps even justifiable (Bogue & Aper, 2000). Thus, "those halcyon days when all students who enrolled in college were adequately prepared [and] all courses offered at higher education institutions were 'college level,'…simply never existed" (Merisotis & Phipps, 2000, p. 69).

Scholars have long debated whether institutions of higher education should be in the business of remediation. In 1828, the Yale Report recommended that the institution cease the practice of admitting students with academic deficiencies. Yet in 1869, Charles W. Eliot stated in his inaugural address as president of Harvard, "The American college is obliged to supplement the American school. Whatever elementary instruction the schools fail to give, the college must supply" (as cited in Spann, 2000). While remedial education is as old as higher education itself in the U.S., specific historical events have led to its rise.

Rise in the Need for Remediation

Certain national policies expanded access to higher education for many Americans and subsequently increased the demand for remedial education. Because of access-granting policies, a more socioeconomic and ethnically diverse group of students gained right of entry to postsecondary education for the first time in the history of American higher education.

Morrill Land Grant Acts. In addition to creating public universities in every state whose missions centered initially on agriculture, mechanics, and teacher training, the Morrill Land Grant Acts of 1862 and 1892 represented a major shift in access to higher education. Land grant colleges became institutions where the "working-class" person could attend without experiencing social disdain from elites who preferred private liberal arts institutions (Bogue & Aper, 2000).

Rise of the junior college. During the latter half of the 19th century, universities sought ways to relegate general or lower-division and vocational education to other entities. The idea of the junior college emerged as the popular solution. Junior colleges were either situated on existing university campuses or operated somewhere offsite completely independent of the university. In 1901, Joliet Junior College in Joliet, Illinois became the country's first official junior college (Vaughan, 2006).

Universities, however, did not uphold their end of the bargain as they continued to offer lower-division courses and accept freshman and sophomore students. As a result, community colleges were "doomed…to status of alternative institutions" since poorly prepared students were typically required to attend junior colleges (Cohen & Brawer, 2003).

G.I. Bill. The previously mentioned changes primarily benefited White males wanting to obtain a higher education. After WWII, the Servicemen's Readjustment Act, commonly known as the G.I. Bill, gave ethnically and socioeconomically diverse veterans the opportunity to participate in higher education. Regardless of the veteran's

background, at least two years had passed since their most recent classroom learning experience. Between 1944 and 1951, more than eight million veterans attended college with the help of the G.I. Bill, which meant that at least 2.3 million of these veterans required remediation at the start of college (Levinson, 2005).

The Elementary and Secondary Schools Act of 1965. Although this act dealt exclusively with elementary and secondary schools, the significance is that it was the federal government's first attempt to target poor academic performance in public schools. In his address to the nation, President Lyndon B. Johnson stated that the purpose of the new bill was to "rekindle the revolution—the revolution of the spirit against the tyranny of ignorance" (Johnson, 1965). This act resulted in institutions of higher education seeking similar financial assistance to address academic underpreparedness on their campuses, as well.

Other access-granting policies. Access to higher education improved with the occurrence of the following significant events: Truman's Commission Report in 1947, which called for "community colleges" to provide general education to all Americans; the proliferation of nearly 500 new community colleges during the 1960s; the Higher Education Facilities Act of 1963; the Higher Education Reauthorization Acts of 1965 and 1972; and the Civil Rights Act of 1964 (Levinson, 2005; Vaughan, 2006). These events made financial aid available to low-income students, prohibited discrimination on multiple bases, and created funding for race-based programs. Consequently,

between the 1940s and 1970s, virtually every American who was granted access to higher education now had access to funding to address their financial needs.

In the early 1980s and into the 1990s, widespread access was expanded once more for Americans. The Carl D. Perkins Vocational and Applied Technology Education Act expanded access in technical areas where students did not have to complete traditional university-transfer tracts (Levinson, 2005). The Workforce Investment Act of 1998 created job training and education to Americans who were in a mandatory welfare phase-out process that resulted from welfare reform in the mid-1990s. These two acts expanded access to a population of students who disproportionately required basic skill attainment before progressing into college-level courses. For many of these individuals, community colleges were their point of entry into higher education (Vaughan, 2006).

Immigration. In addition to expanded access, a growing immigrant population who lacks English proficiency attributes to the need for remedial education. During the 20th century, the U.S. population grew from 76 million in 1900 to just over 280 million in 2000 (Census of Population, 2006). According to the Department of Homeland Security, nearly 47 million immigrants were granted legal residence status between 1900 and 2000, thereby representing almost a quarter of the growth in population during that century (Immigrants, 2000). This total does not include the estimated 12 million undocumented immigrants who are permitted to attend institutions of higher education

in many states despite their lack of a legal immigration status in the United States (Passel, 2006).

Community colleges were not only instrumental in accommodating the population explosion in the U.S. during the 20th century, but were often the initial entry point for legal or undocumented immigrants who sought basic skills in speaking, reading, and writing English. All this translates into to high demand by adults who need English as a Second Language (ESL) or Limited English Proficiency (LEP) services or instruction, areas that many community colleges consider remedial education. While demand for remedial education has risen in higher education including community colleges, so have controversial issues surrounding it.

Controversy and Remedial Education

According to researchers, controversy involving remedial education has resulted from the paucity of information available to answer the following four questions: What is remediation? How does it work? What does it cost? Who is responsible for meeting the needs of students (Phipps, 1998)? Shaw (1997) asserts that "remedial education has emerged as a flash point for competing ideologies regarding access to—and indeed, the purpose of—higher education" (p. 285). Proponents and critics of remedial education each make compelling arguments to support their stance. Critics of remedial education cite exorbitant costs, compromised standards, unnecessary re-teaching of basic skills, and "mission creep" as reasons to abandon the practice of remediation in higher education (Phipps, 1998; Taylor, 2001). Additionally, opponents argue that remedial

education is unsuitable for college-level instruction and forces taxpayers to pay twice for the same service.

Critics also believe that remedial education has a negative effect on students. First, they assert that remediation adds to the length of time required to earn a degree or to transfer to a four-year college, thereby creating a culture of "aimless academic drift" among students. Second, critics claim that remediation devalues a college degree because underprepared students eventually can earn such a degree. Third, critics argue that remediation "dumbs down" the curriculum and misleads students to believe that regardless of academic readiness, college acceptance is automatic (Manno, 1995, p. 47).

Proponents, on the other hand, argue that the benefits of remedial education far outweigh the costs. Moreover, they believe that any contemplation of removing remedial education from higher education is counterproductive to the community college mission. An advocate for remedial education, McClenney (2004) aptly creates a scenario while taking into consideration that the average age of a community college student is 29 years old. In her view, even if high schools immediately began providing flawless education, graduates would still arrive on the community college campus underprepared for the next 10 years. Proponents further assert that high standards and open access can be simultaneously maintained and that community colleges can fulfill multiple missions. However, as the debate and the absence of research focusing on the effect of remedial education continues, pressure from critics and proponents ultimately influence state and institutional policies regarding remedial education.

Institutional and State Policies

State and institutional policies regarding remedial education vary in a manner that seems disjointed from afar. One can even find differences in remedial education policies between colleges within the same system. Merisotis and Phipps (2000) argue, "There is little consensus and understanding [regarding remediation] . . . Consequently, this lack of fundamental information renders public policy discussions ill informed at best" (p. 68). This is unfortunate because remedial education policies delineate how community colleges assess skills and place students, charge students for remedial courses, place time or course limits on students, assign credit, or disburse financial aid. At the state level, remedial policies determine which institutions of higher learning provide remedial courses and describe how to fund colleges that do.

Providers of remedial education. Most states' policies designate community colleges as the primary providers of remedial education. Whereas state policies restrict or "discourage" 29 percent of public four-year institutions from offering remedial education, only five percent of community colleges have similar guidelines (Ignash, 1997). States such as Arizona and Connecticut report that remedial education is "not allowed," or they deny that "any remediation is officially conducted in the state" (Breneman & Haarlow, 1998, p. 4). However, Arizona takes advantage of the law's loophole and offers *developmental education* rather than remedial education. States such as Florida, Missouri, and South Carolina prohibit the offering of remedial education in public universities (Cohen & Brower, 2003). Besides stipulating who

provides remediation, policies also state how students are to be assessed and placed into remedial courses.

Assessment and placement. Assessment instruments are important and useful tools for deciding where a student should begin his or her college coursework. Institutions use a variety of instruments ranging from institutionally homemade to nationally normed tests to gauge skills that students possess. According to a recent study, 26 states have policies that require mandatory assessment of all first-time community college students (Boylan, 2002). Furthermore, 63 percent of all community colleges have policies that require mandatory assessment. Mandatory assessment, however, does not imply mandatory placement as one might presume. In fact, 71 percent have mandatory placement policies for reading, 76 percent for writing, and 75 percent for math (Remedial Education, 2003). Between 24 percent and 29 percent of the institutions with "mandatory" assessment do not "require" students to enroll into remedial courses even when results demonstrate need for remediation. States such as Washington, California, and New York assess all students, but allow students to self-select into remedial courses (Perin, 2006). In addition to placement procedures, policies also outline any limitations regarding remedial courses.

Remedial course limitations. Many community colleges place limits on the type of credit students receive for completing remedial coursework. For example, some colleges do not issue credit for any completed remedial coursework. NCES reports that 73 percent to 78 percent of the colleges give institutional credit for remedial courses.

Additionally, many community colleges prohibit simultaneous enrollment in remedial and college-level courses. NCES reports that between 82 percent and 88 percent of community colleges disallow students from enrolling in college-level and remedial courses concurrently.

At some community colleges, students encounter limitations regarding when and the number of times student can enroll in remedial courses. For instance, some colleges allow students to enroll in remedial courses only during their first two semesters. According to NCES, 26 percent of the colleges enforce a time limit. Of those institutions with time-limit policies, 71 percent choose such policies, while state law mandates that 24 percent enact such policies (Remedial Education, 2003). In addition to limitations on remedial courses, some states have policies that hold students and public schools fiscally accountable for expenses incurred by having to offer remedial education.

Fiscal responsibility. Holding public high schools accountable if the school's graduates need remediation is an emerging trend among state policies regarding remedial education. In states such as New Jersey, Montana, Florida, West Virginia, and Oregon, legislators are recommending plans that require public school districts to reimburse community colleges if graduates from the district require any remedial work (Arendale, 2001; Merisotis & Phipps, 2000). In Florida, policymakers are considering a proposal that holds students accountable by requiring them to pay the "true" cost of a remedial course if they are taking the course for a third time. This means that students

would be required to pay up to three times the normal rate for college-level courses (Arendale, 2001, p. 3).

Exiting requirements. How students exit remedial programs also differs from institution to institution. Besides Texas, Perin (2006) found no other state with policies that delineate how students complete remedial courses and advance to college-level courses. She discovered that institutions rely mostly on test scores, course grades, and instructors' judgment to decide whether a student is ready to progress to the next level remedial course or to begin college-level courses. In Texas, state policy requires students to complete prescribed remedial courses before advancing to college-level courses.

State of Remedial Education

Pervasiveness and Magnitude

NCES reports that in fall 2000, nearly all (98 percent) community colleges offered one or more remedial courses in reading, writing, or mathematics, while 80 percent of public four-year institutions offered at least one remedial course in the same disciplines. NCES further reports that during that same year, 28 percent of all entering first-time students enrolled in one or more remedial courses, regardless of which type of institution they attended, suggesting that more than one million students require remediation each year. Compared with public four-year institutions, community colleges enroll a higher proportion of freshmen that require remediation. At community

colleges, 42 percent of freshmen enroll in one or more remedial courses, while the corresponding figure for public four-year colleges is 20 percent (Remedial Education, 2003). These findings support the results from the National Study of Community College Remedial Education completed by McCabe in 2000.

Based on data gathered from 25 community colleges and a random sample of 1,520 students, McCabe (2000) found that 95 percent of the colleges offered remedial courses and 41 percent of the students required remedial education. The study found that students who require remediation are most likely to need remedial math. Of the students who demonstrate a need for remediation, 62 percent need remedial math, nearly 38 percent need remedial reading, and about 45 percent need remedial writing (McCabe, 2000).

NCES reports that of the students in remedial education, 37 percent took less than one year to complete prescribed remedial courses before moving on to college-level courses, 53 percent took one year, and 10 percent took more than one year. At public four-year institutions, the corresponding figures were 62 percent, 35 percent, and three percent, respectively (Remedial Education, 2003). Thus, community college students are over three times more likely to spend more than a year in remedial courses than university students. Because of the pervasiveness and magnitude of remedial education in community colleges, researchers urge colleges to understand the characteristics of students in remedial programs (Roueche & Roueche, 1999; Saxon & Boylan, 1999).

Characteristics of Students in Remedial Education

Scholars debate on how to refer to students who need remedial education. Terms such as remedial students, at-risk, underprepared, low-achieving, developmental, skill-deficient, and disadvantaged are commonly used in the literature to refer to students in remedial education (Saxon & Boylan, 1999). Some scholars prefer to use the terms "at-risk" or "underprepared students" arguing that "at best, the term remedial student is offensive; at worst it is destructive and insulting" (Roueche & Roueche, 1999, p. 17). Once institutions agree upon an appropriate term, learning more about the students in remedial programs is one of the most important steps that an institution can take toward improving effectiveness (Roueche & Roueche, 1999). More specifically, researchers urge community colleges to first learn the characteristics of students in remedial education and "then develop effective programs to address the needs for remediation based upon these characteristics" (Ignash, 1997, p. 16).

Demographic profile. A demographic profile of the of the students who enroll in remedial education usually includes variables such as gender, socioeconomic status, ethnicity, enrollment status (i.e., full-time or part-time), age, level of deficiency, and commuter status. Nationally, women comprise 55 percent of the students in remedial education (Saxon & Boylan, 1999). In *No One to Waste*, McCabe (2000) reports that 54 percent of students in remedial education are under the age of 24, while 24 percent are between 25 and 34, and 17 percent are over 35. A separate study reports that the average age of students in remedial education is 23 (Saxon & Boylan, 1999). Using

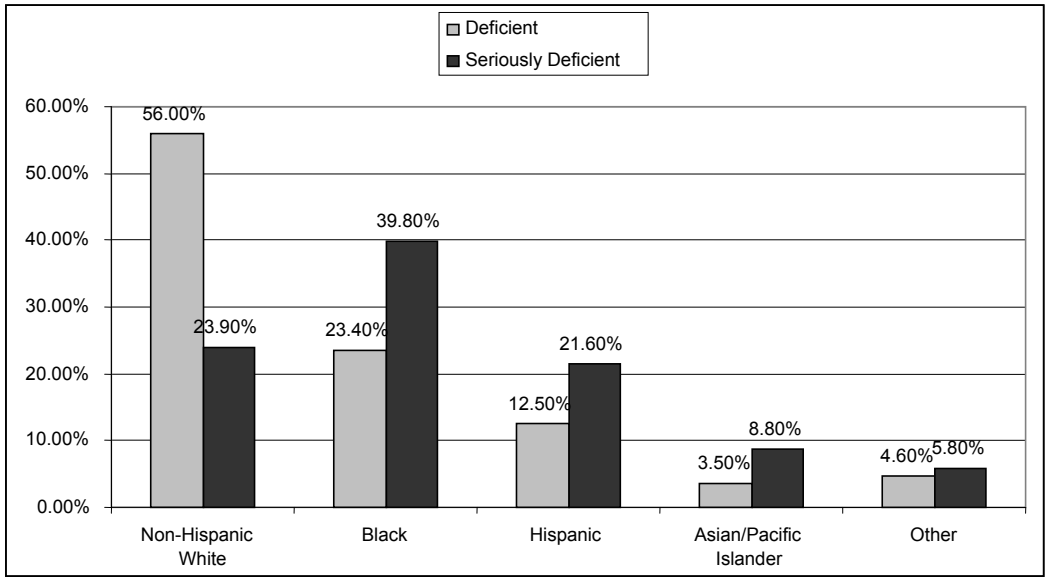
data supplied by National Study of Developmental Education (NSDE), Breneman and Haarlow (1998) report that 80 percent of remedial students are 21 years or younger, and 90 percent are 27 or younger.

In addition to diversity in age and gender, students in remedial courses are ethnically diverse, as well. A study by Saxon and Boylan (1999) finds that 62 percent of students in remedial courses are non-Hispanic White, 23 percent are Black, 12 percent are Hispanic, three percent are Asian, and one percent is Native-American. McCabe (2000) reports that of the students in remedial courses, 56 percent are non-Hispanic White, 23.4 percent are Black, and 12.5 percent are Hispanic. Despite this minor discrepancy in data, Black and Hispanic students consistently enroll in remedial courses at rates disproportionate to other ethnic groups (Boylan, Bonham, & Tafari, 2005; Cloud, 2002). In fact, Black and Hispanic students enroll in remedial courses at a rate twice that of Whites and Asians (Shaw, 1997). When considering all institutions of higher education, minorities equal 23 percent of students enrolled in remedial courses although they account for just 9 percent of students in higher education (Saxon & Boylan, 1999).

McCabe (2000) furnishes data on what he refers to as "seriously deficient" and "deficient" students. Seriously deficient students require remedial education in reading, writing, and mathematics and must enroll in at least one lower-level remedial course. If a student does not satisfy those conditions, then he or she is deficient. According to his findings, of the seriously deficient students, 39.8 percent are Black, 21.6 percent are

Hispanic, 8.8 percent are Asian/Pacific Islander, 5.8 percent are other, and 23.9 percent non-Hispanic White (see Figure 1). Therefore, minority students account for more than 75 percent of all those who require remedial education and are seriously deficient.

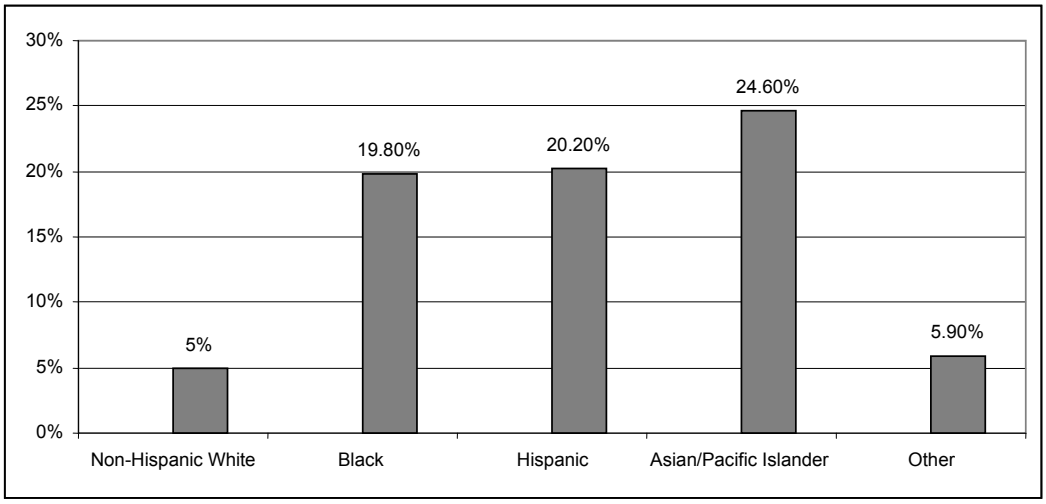
***Figure 1*. Percentage of Deficient and Seriously Deficient Students by Ethnicity**



(McCabe, 2000, p. 37)

While non-Hispanic Whites constitute the majority of deficient students, minority students disproportionately reflect those who are considered seriously deficient. Figure 2 shows that while five percent of non-Hispanic White students are seriously deficient, approximately 20 percent of Black, Hispanic and Asian/Pacific Islander students are seriously deficient.

***Figure 2*. Percentage of Students in Each Ethnic Group Who Are Seriously Deficient**



(McCabe, 2000, p. 37)

Students from disadvantaged socioeconomic backgrounds, which are disproportionately minorities, are more likely to enroll in remedial courses when compared to students from higher income backgrounds. McCabe (2000) reports that 54 percent of the students in remedial education have an annual family income of less than $20,000, an amount that hovers around the federal poverty level for a family of four. Fifty-one percent of the students in remedial education report that they are financially independent (Saxon & Boylan, 1999). Roueche and Roueche (1999) write, "Underprepared students come from all economic situations and geographic areas—although at-risk students are disproportionately minority and poor. These students may

be characterized by multiple circumstances, but poverty is their most common denominator" (p. 18).

The Community College Survey of Student Engagement (CCSSE) defines at-risk students as those who are enrolled in remedial courses, delay entry into college, are single parents, have one or more dependents, are financially self-supportive, attend on a part-time basis, are first generation to attend college, and work at least 30 hours per week. According to findings from the CCSSE survey, community college students are three to four times more likely to exhibit four or more of the characteristics listed above than students who attend four-year institutions (Evelyn, 2005).

Enrollment status. One national study reports that 68 percent of the students in remedial education enroll full-time. Furthermore, approximately 83 percent of the students in remedial education indicate that they are degree-seeking students. Of all students who receive financial aid, 40 percent are students in remedial education. Although many community colleges do not have residential facilities for students, of the colleges that do, six percent of students in remedial education live on campus (Saxon & Boylan, 1999).

While studies use various characteristics to identify students in remedial education, researchers argue that it is difficult to construct a profile of the "typical" student who needs remedial education (McCabe & Day, 1998; Roueche & Roueche, 1999; Saxon & Boylan, 1999). "The only factor that appears to separate them from non-remedial students is that they have lower scores on institutional assessment tests"

(Saxon & Boylan, 1999, p. 8). In the same manner that typifying students in remedial education is complex, deciding upon an organizational structure to deliver remedial education is equally challenging for community colleges.

Organizational Design Characteristics

The terms centralized and decentralized describe the organization of remedial programs within an institution (Roueche & Roueche, 1999; Boylan 2002). Centralized remedial programs exhibit the following characteristics: maintain high levels of coordination between remedial courses and availability of academic assistance; supervision provided by a director, coordinator, or chair; and recognized as an independent department or division on campus. According to Boylan (2002), more than half of all community colleges structure and manage remedial education via a centralized model. Decentralized remedial programs are nearly opposite in nature. For example, remedial courses and services in a decentralized remedial program permeate the institution with minimal coordination between faculty and academic assistance staff. Additionally, decentralized remedial programs commonly lack an administrator who oversees the program.

To centralize or decentralize. The debate on whether to centralize or decentralize remedial programs has been a controversial issue in academia for years. Research shows that community colleges with centralized remedial programs tend to experience higher levels of student success (Boylan & Bliss, 1997; Roueche & Roueche, 1999; Quirk, 2005). However, some researchers argue that coordination and

communication are what really differentiate centralized from decentralized remedial programs and what accounts for the success of centralization (Boylan & Bliss, 1997). Therefore, when revamping the organization is not an option, researchers argue that an institution can achieve successful remedial programs by increasing levels of coordination and communication among faculty and academic support staff (Boylan 2002, Roueche & Roueche, 1999).

In their study of *at-risk* students and the remedial programs that serve them, Roueche and Roueche (1997) found that no "one-size fits all" organizational model exists for effective remedial programs. They argue that institutions, students, and the environment introduce too many variables for a prototypical design to exist. In their study of exemplary programs, the authors find that the underlying attributes that successful remedial programs share is their alignment of the program's mission to the overarching mission of the institution and, once again, higher levels of communication and coordination. While community colleges face challenges in deciding how to organize remedial programs, determining the cost of remediation is also challenging.

Costs of Remedial Education

National figures. Between 1995 and 2000, several major studies generated similar data regarding the cost of remediation in higher education, notwithstanding varied collection techniques. The studies consistently report that remediation consumes $1 billion each year from the total public higher education budget of $115 billion, which equals less than one percent of expenditures (Breneman & Haarlow, 1998; Merisotis &

Phipps; Phipps, 1998; Saxon & Boylan, 2001). Phipps (1998) suggests that the cost of remediation is probably closer to $2 billion, which is less than two percent of expenditures. Researchers argue that even at two percent, for the number of students served by colleges providing remediation, this figure is relatively minute and still a bargain (McCabe, 2000; Saxon & Boylan, 2001). Phipps (1998) writes, "Even if remedial education were terminated at every college and university in the country, it is unlikely that the money would be put to better use" (p. vii).

Community college figures. Because community colleges provide more remediation than any other sector of higher education, total expenditures for remediation are higher than national averages previously reported. Phipps (1998) reports that community colleges devote nine percent, on average, of their operational budgets to remedial education, while four-year institutions only set aside two percent. Community colleges in California expend 11 percent of their budgets on remedial education, Illinois 6.5 percent, Texas 18.8 percent, Washington six percent, and Wyoming 8.8 percent. (Breneman & Haarlow, 1998). Arkansas, a state lauded for its ability to maintain accurate and comprehensive data on remedial education costs, reports that colleges and universities in the state spend three percent of their total budgets on remediation (Phipps, 1998). Prior to making a decision to outsource remedial education to proprietary educational entities, the City University of New York (CUNY) system reported that remedial education consumed eight percent of its total budget (Saxon & Boylan, 2001).

Calculation challenges. Researchers argue that calculating the cost of remediation is fraught with challenges, which increases the potential for inaccuracies (Saxon & Boylan, 2001). For instance, private institutions are not included in the national studies to determine the total cost of remediation. Because most private colleges and universities receive direct and indirect federal and state assistance, excluding these institutions skews data. As mentioned previously, public institutions inconsistently define, organize, and deliver remedial education, which leads to inconsistencies in how institutions report the cost of remediation. For example, how does one account for a professor's salary and benefits when he or she teaches both remedial and college-level courses? Finally, studies fail to consider forgone earnings and a reduction in labor productivity that result when students spend more time in college because of remediation (Merisotis & Phipps, 2000).

Profitable venture. Regardless of what amount institutions of higher learning spend to prepare their academically underprepared students better, strictly from a business perspective, research shows that remedial education is indeed a profitable venture. Saxon & Boylan (2001) write, "For every case in which revenues generated by remedial education were reported, the revenues fully covered, if not exceeded, the costs of delivering the service. There were no reports of remedial programs that operated at a loss" (p. 6). While calculating costs to offer remedial education to students is difficult, assessing the need for remediation in the future is less complex.

Outlook for Remedial Education

Shifting population demographics. Nationally, the racial profile of community colleges closely reflects the profile of the U.S. population. In community colleges, non-Hispanic Whites represent 69.5 percent of the student population, Hispanics 14 percent, Blacks 12 percent, and Asians six percent (Phillippe & Gonzalez Sullivan, 2005). For the U.S. population, non-Hispanic Whites represent 75.1 percent, Hispanics 12.5 percent, Blacks 12.3 percent, and Asians 3.6 percent. Researchers suggest that for a number of reasons it is crucial to recognize that the ethnic make-up of community college students reflects that of the U.S. population (McCabe & Day, 1998). However, no reason is perhaps more important than to be aware that demographers expect Hispanics, Blacks, and Asians to outpace non-Hispanic Whites in population growth over the next 45 years (U.S. Census Bureau, 2000).

Between 2000 and 2050, demographers anticipate that the U.S. population will increase by 70 percent. During this time of rapid growth, Hispanic, Asian, and Black populations will increase by 188 percent, 213 percent, and 71 percent, respectively. Meanwhile, non-Hispanic Whites will increase by only seven percent. At the end of this period of growth, non-Hispanic Whites will constitute just over half of the U.S. population. By 2050, Hispanics, Blacks, and Asians will account for 24.4 percent, 17.6 percent, and eight percent, respectively, of the population (Bergam, 2004).

Implications of shifting population. As previously mentioned, studies indicate that Hispanic and Black students require remedial education at rates higher than any

other ethnic group (McCabe, 2000; Saxon & Boylan, 1999). Therefore, research and demographic forecasts suggest that if current community college-going trends continue for minorities, then community colleges should anticipate not only increasing enrollment from Hispanic and Black populations but also a higher demand for remedial education (Boylan, Bonham, & Tafari, 2005; Boswell & Wilson, 2004; Cloud, 2002). Besides shifting population demographics, other factors will influence the outlook for remedial education.

Additional factors. According to researchers, other factors will influence the need and possible rise for remedial education in the future. For example, the workforce needed to compete in the growing knowledge-based global economy will require higher levels of postsecondary education. Ignash (1997) acknowledges that the need for remediation changes "as the level of knowledge in a field changes or skills required to do a job become more specialized" (p. 13). McCabe (2000) reports that approximately 80 percent of newly created jobs will require some form of postsecondary education over the next several years. Therefore, many job seekers may return to community colleges to update their skills and are very likely to require remedial education given the elapsed time since high school completion.

Other researchers believe that factors such as low literacy rates, existence of poverty, and decline of "traditional" family structures influence the need for remedial education (McCabe & Day, 1998; Roueche & Roueche, 1999). These factors are closely connected to one another. For example, research reveals that a child from a

single-parent home is more likely to live in poverty and possess characteristics such as poor reading skills that invariably inhibit knowledge acquisition and subsequent secondary and postsecondary educational attainment (Iceland, 2003). Because research shows that remedial education will remain a core function of community colleges, building effective remedial programs must be a priority.

Effectiveness of Remedial Education

Effects on Student Performance

A review of the literature on the effectiveness of remedial education yields two observations. First, national studies on effectiveness of remedial education are extremely limited; and second, researchers claim that many community colleges are not able or willing to measure the effectiveness of remedial education, perhaps explaining the paucity of national studies (Grubb, 2001; Boylan, 2002; Roueche & Roueche, 1999). Phipps (1998) writes, "Research regarding the effectiveness of remedial education programs has been sporadic, typically underfunded, and often inconclusive" (p. 10). Grubb (2001) echoes Phipps's sentiment:

> For all the debate over remedial education, there is almost no discussion about what it looks like—what goes on in classrooms, whether it appears to be educative in any sense of the word, whether it stands any chance of bringing students up to "college level." (p. 5)

McCabe performed the most extensive study found in the literature, the National Study of Community College Remediation. His findings are the result of a 10-year longitudinal study performed between 1990 and 2000.

McCabe (2000) reports that 43 percent of students in remedial courses successfully complete their remedial program. Of the seriously deficient students, only 20 percent successfully complete remedial education. Moreover, the ethnic makeup of the students who successfully complete their remedial programs reflects the greater population of students in remedial courses. Of the students who successfully completed remedial programs, McCabe found that after ten years, 14 percent went on to earn academic associate's degrees, 16.2 earned bachelor's degrees, 36.8 percent earned occupational degrees or certificates, and 3.7 percent earned graduate degrees. At the conclusion of the study, 98.5 of the participants who successfully completed remedial programs were employed in a variety of professions.

In a separate longitudinal study that tracked the national high school class of 1982 to 1994, students who required no remediation were nearly two times more likely to earn an associate's or bachelor's degree than students who needed five or more remedial courses. More specifically, of the students who earned associate's or bachelor's degree, 60 percent did not require remediation, 55 percent took one remedial course, 45 percent took two remedial courses, 44 percent took three to four remedial courses, and 35 percent took five or more remedial courses (Phipps, 1998). The aforementioned data suggest that an inverse relationship exists between the extent of

need for remediation and degree attainment. However, even for the seriously deficient students, more than one-third eventually earned a college degree.

According to results from institutions that participate in the Achieving the Dream initiative, between 82.9 percent and 86.2 percent of the students who earned an A, B, or C in a remedial course in the fall semester persisted to the spring semester. Those findings suggest that successful completion of a remedial course in the first semester is an important indicator of persistence to the following semester. Additionally, students who take remedial courses are more likely to persist to the next semester than students who did not take remedial courses (McClenney, 2006).

In a single-institution based study in Maryland, one researcher found that students who began in remedial education took longer to graduate from the institution. Furthermore, the researcher found that students with a remedial background performed equally well in college-level courses as did students with a non-remedial background. Additionally, the two groups had equivalent mean overall grade point averages upon graduation (Kolajo, 2004).

In a statewide study performed in Ohio, researchers found that students who took remedial courses were less likely to drop out of school and were more likely to complete a bachelor's degree when compared to students who did not take remedial courses. Additionally, when using ACT scores to define level of ability, the researchers found that students with lower abilities who required remedial English were less likely to "stop out" and more likely to graduate within five years. The term stop out is

commonly used in the literature to describe a student who experiences at least a one semester break in his or her attendance. As ACT scores increased, the effect of remediation on those outcomes diminished. The opposite was true for students in remedial math courses; as ACT scores increased, so did the measured outcomes. Overall, the researchers found that students in remedial education had "better educational outcomes in comparison to students with similar backgrounds and preparation who were not required to take the courses" (Bettinger & Long, 2005, p. 16). Although the responsibility to learn and succeed rests primarily on the learner, the literature suggests that the presence of certain components of remedial education programs improve the likelihood for student success.

Components of Successful Remedial Programs

A large body of literature on remedial education provides research on "what works" in remedial programs. *High Stakes, High Performance* by Roueche and Roueche (1999) and *What Works* by Boylan (2002) are the two most widely cited and recent publications in the existing literature. Their suggestions reflect more than 30 years of research and practice on remedial education.

Roueche and Roueche (1999) stress that community colleges must take a "systemic approach" in order to establish a successful remedial program (p. 29). Boylan (2002) supports that same principle and asserts that remedial education "does not work well when it is consigned to the periphery of institutional endeavors...when it is a random, nonsystematic effort carried out by uncoordinated units spread across the

institutional flow chart" (p. 7). Thus, a comprehensive approach to remediation has the greatest potential for improving retention, achievement, and ultimately the graduation rates of students in remedial education. According to the three authors, successful remedial programs share the following characteristics: (a) support from the institution and leadership, (b) centralized organizational design or highly coordinated decentralized models, (c) grounded in a philosophy that guides learning and teaching, (d) mandatory assessment and placement, (e) prohibits concurrent enrollment in college-level and remedial courses, (f) use of peer and faculty mentors to assist students, (g) diversity in pedagogy and course length and design, (h) use of supplemental instruction and tutoring, (i) systematic and frequent evaluation of students and programs, and (j) availability of professional development for part-time and full-time faculty.

Successful remedial programs seek opportunities to link traditional skill building with college-level content because such linkages tend to improve student persistence and achievement. Successful pedagogical strategies include the use of paired/linked courses, supplemental instruction, and learning communities as alternatives to conventional "skill and drill" practices (Grubb, 2001; Koski & Levin, 1998).

Paired/linked courses, as the name implies, link remedial courses with college-level courses. For example, remedial writing may be paired with a college-level psychology course. Supplemental instruction entails the use of advanced students, for example, to re-teach and provide alternative learning strategies to the course in a laboratory setting. Learning communities are designed to allow for interaction between

students, and thus increase the likelihood for formation of study groups. Students in learning communities enroll in a block of courses as a cohort (Koski & Levin, 1998). When a remedial program and its students experience success, the true benefits of remedial education begin to surface.

Benefits of Remedial Education

Societal benefits. The literature suggests there are societal, institutional, and personal benefits to remedial education. For society, remedial education is indeed a sound investment when compared to the alternatives, which likely include unemployment, low-wage jobs, dependence on welfare assistance, and even incarceration (McCabe & Day, 1998; Phipps, 1998; McCabe 2000). Studies show that people with higher levels of educational attainment increase tax revenues, exhibit greater levels of productivity, consume more goods, offer workforce flexibility, and rely less on government assistance (The Investment Payoff, 2005). In fact, if just one-third of the students enrolled in remedial courses were to earn a baccalaureate degree, then those graduates would produce more than $87 billion in federal, state, and local taxes in one year—a healthy return on taxpayers' $1 billion annual investment (Spann, 2000). In addition to improving economic conditions, once a person is educated, he or she is more likely to engage in community service, voting, and charitable giving; appreciate diversity; and adapt more rapidly to technological advancements (The Investment Payoff, 2005).

Institutional benefits. Because minorities participate in remedial education at proportionately higher rates than non-minorities, remedial programs indirectly serve to diversify the student population. Boylan et al. (2005) write, "Although these programs are not specifically charged with promoting minority retention, the fact that so many minorities pass through developmental education courses makes them de facto contributors to minority enrollment in upper-class courses at many colleges and universities" (p. 61). However, dependence on remedial programs to diversify campuses should be a short-term goal. Besides improving the effectiveness of remedial programs, good policy ultimately strives to mitigate the need for remediation across all ethnic groups (Shaw, 1997).

Student benefits. Perhaps the greatest benefactor of remedial education is the student. Remedial education provides a second chance for students to gain the necessary skills for college-level coursework. Without remedial education, over one million students each year could not participate in higher education (McCabe, 2000). As mentioned previously, research shows repeatedly that students who begin in remedial education perform as well, if not better, than similar students who did not take remedial education (Bettinger & Long, 2005; Kolajo, 2004, McClenney, 2006). Therefore, remedial education serves as an agent that contributes to student retention and academic success, which for the purposes of this study are indicators of academic performance for students in remedial education. However, according to the literature, certain institutional and student characteristics and factors tend to affect student

retention and academic success. Thus, a closer examination of those characteristics and factors is necessary.

Student Retention and Academic Success

Institutional Characteristics Affecting Retention

Studies regarding retention involve primarily two categories: (1) institutional characteristics that influence retention, and (2) student characteristics that influence retention. Based on a national study, Astin (1993) reports that 33 different input characteristics yielded statistical significance in predicting degree attainment within four years. Astin (1993) states that faculty measures such as morale, liberalism, diversity, and number of women among the faculty positively affect student retention. Institutions experience increases in student retention when students are required to give presentations in class, take essay exams, and work on independent research projects. Moreover, if students are required to take a women and gender studies course as a graduation requirement, then student retention increases.

In a separate national study that included 915 community colleges, Bailey, Calcagno, Jenkins, Kienzl, and Leinbach (2005) report that smaller rural colleges tend to have four percent higher graduation rates. Astin (1993) reports that the size of a college is the institutional characteristic that has the greatest impact on student retention. More specifically, larger institutions are more likely to post lower retention rates. Bailey et al. (2005) also report that greater per student spending on instruction

has greater effects on retention than financial aid to students. In fact, for every additional $1,000 spent per student on instruction, graduation rates improve by 1.3 percent.

When an institution has a large proportion of minorities, a large part-time student population, and a higher proportion of women, retention rates are predictably lower. This contradicts other studies that claim institutions with a higher proportion of women increases retention rates. Bailey et al. (2005) explain that contradictory phenomenon, "a high proportion of female students lowers the institutional completion [retention] rate primarily when the college also serves a large number of part-time students" (p. 3). Some of the institutional characteristics discussed above are closely related to the characteristics that students possess.

Student Characteristics Affecting Retention

In the same manner that characteristics of institutions affect student retention, students possess characteristics that affect retention as well. Studies consistently show that the effect of grades on retention is positive. For professors, students, and, if applicable, parents, grades reflect a combination of understanding of course content, level of student ability, and effort put forth in class (Pilcher, 1994). Therefore, a great deal of weight is assigned to grades as a student outcome. Pascarella and Terenzini (2005) write:

> The positive and statistically significant effects of grades on persistence and degree completion are evident whether the studies track persistence from the

first to second semester, to the second year, or over longer periods of time in a two-year institution. (p. 397)

In addition to grades, studies consistently suggest a relationship between ethnicity and student retention (Astin, 1993; Bailey, 2005). In fact, research shows that minority students tend to post lower rates of retention. More specifically, one study reveals that students who are Black, enrolled in an occupational major or in no major, enrolled in remedial courses, delayed college enrollment by more than one year after high school, or have "stopped out" for a period of four months or more are least likely to be retained by the college (Bailey et al., 2005). Studies also show that a student's high school grade point average (GPA) is the strongest predictor of future retention. Some of the characteristics that positively influence student retention include, SAT scores, socioeconomic status, gender (female), possessing desire to become more knowledgeable, and majoring in business or a social science (Astin, 1993: Pacarella & Terenzini, 2005).

Bailey (2005) states that family income predicts whether a student is capable of attaining a credential or transferring to a four-year institution within six years. He reports that approximately 66 percent of all low-income students fail to earn an associate degree, certificate, or to transfer within eight years of starting college. However, institutions are more likely to retain students who received financial aid to make up family income shortfalls. Astin (1993) states that the educational level of the student's parent(s) has a greater influence on student retention than family income.

Lower family income or financial independence generally translates to working students. Studies consistently demonstrate that the number of hours worked per week by students negatively affects student retention as working status approaches full time (Price, 2004).

In terms of involvement, student retention is positively influenced by high levels of student-to-student and student-to-faculty interactions (Astin, 1993). Living on campus is a positive factor for students, perhaps due to the high probability for student-to-student interaction (Pascarella & Terenzini, 2005). Moreover, students who receive vocational or career counseling and participate in honors programs are retained at higher levels (Astin, 1993). In a manner that retention is affected by certain factors, academic success is similarly affected.

Factors Affecting Academic Success

Academic success, as defined by earned grades, has received considerable negative attention in the literature because grades are considered by many to be confounding and measures vary within and across academic departments and colleges. For example, some professors use essay exams, homework assignments, and attendance to calculate student grades, while other professors teaching the same subject within the same college may use multiple-choice exams and occasionally offer "extra credit" for the eager student. Because of inconsistencies and little oversight on grading practices, 56 percent of interviewed faculty members in one study believe that grade inflation exists at their institution (McCabe & Powell, 2004). Nevertheless, "given their

limitations...grades are one of the most consistent predictors of these outcomes [academic success and retention] in both large, nationally representative studies and in the far more numerous single-institution studies" (Pascarella & Terenzini, 2005, p. 396).

Although academic success does not automatically imply persistence or retention, the relationship between them is very strong (McClenney, 2006). Therefore, institutional and student characteristics that affect academic success are very similar to those that affect retention. Most notably at the institutional level are class size, availability of academic support services, peer-mentoring programs, and levels of financial aid. At the individual level, ethnicity, socioeconomic status (SES), number of hours worked per week, and level of motivation to excel affect academic success (Astin, 1993, Boswell & Wilson, 2004; McCabe, 2000).

Evaluating Effectiveness of Remedial Programs

Although components of successful remedial programs were discussed previously, this section examines what many researches consider to be one of the most important—evaluation. Exemplified by many studies over time as an essential feature to successful programs, program evaluation has been linked to student success in many colleges (Roueche & Snow, 1977; Roueche & Roueche, 1999; Boylan, 2002). Additionally, research shows that colleges who regularly evaluate their remedial education outcomes often have higher rates of retention for students in remedial courses (Boylan, et al., 2005). However, only 14 percent of community colleges regularly and systematically evaluate their remedial programs (Boylan & Bliss, 1997). Fortunately,

researchers provide an array of methods for evaluating effectiveness of remedial education.

Phipps (1998) states that the following questions must be addressed for an institution to assess effectiveness: (1) Do students successfully complete remedial courses? (2) Do students move from remedial education to college-level courses? (3) Are students who take remedial education courses eventually completing college-level courses? (4) Are remedial education students persisting and reaching their academic goals? Other researchers suggest that evaluation needs to include qualitative methods as well. For example, Grubb (2001) recommends that a multi-pronged approach be used to address dropout rates by interviewing students to learn precisely why students dropped the course. Additionally, Grubb suggests the use of ethnically designed control groups and classroom observations to measure the effects of remediation.

Boylan (2002) states that the following criteria have evolved as the "industry standard" for measuring remedial program effectiveness: (a) completion rates for remedial courses, (b) grades in remedial courses, (c) grades obtained in post-remedial courses in the same subject area, (d) retention or persistence rates for remedial students, (e) student satisfaction with courses and services, (f) faculty satisfaction with the skills of students who participate in remedial courses and services, and (g) graduation rates for students in remedial education. Researchers contend that assessing the effectiveness of remedial programs extends beyond improvement of institutional effectiveness. Students are the ultimate beneficiaries of effective remedial programs. "For many of

these individuals, effective community college developmental education programs are their pathway to success" (McCabe & Day, 1998, p. 9).

Summary

This chapter provided the foundation needed to establish an appropriate context for this study. A historical background illustrated how remedial education became a core function for community colleges over the past years. Additionally, this chapter addressed the current state of remediation and presented a case for the need for remediation in the future based on the changing demographics and other impending factors that this country faces. This chapter also examined institutional and individual characteristics that affect retention and academic success related to remedial education. Finally, this chapter demonstrated that community colleges do not regularly measure the effectiveness of remedial education, thereby prompting researchers to call for drastic improvement in this area, which provided the impetus for this study. The next chapter provides a "blueprint" for the construction of this study.

CHAPTER 3
METHODOLOGY AND PROCEDURES

We can have facts without thinking but

we cannot have thinking without facts.

–John Dewey

Introduction

This chapter will delineate the methodology and procedures used to complete this study. As mentioned previously, the purpose of this study was to examine the relationship between remedial education and academic performance and retention of students at Central Arizona College (CAC). In order to meet that objective, this study raised the following research questions where academic success was measured by earned grades of A, B, C, or at least a 2.0 grade point average.

1. How does need, as measured by the number of students who enroll in one or more remedial course, vary by select student characteristics at Central Arizona College (i.e., when data are disaggregated)?
2. How does student academic success vary by select student characteristics for students in remedial courses at Central Arizona College (i.e., when data are disaggregated)?

3. How do rates of academic success in initial college-level course for students with a remedial background compare to students with a non-remedial background when the effects of select student characteristics are controlled?
4. How do three-year retention rates of students with a remedial background compare to those with a non-remedial background when the effects of select student characteristics are controlled?
5. Which select student characteristics best predict academic success in initial college-level courses for students who took one or more remedial courses?
6. Is academic success in exit remedial courses a predictor of academic success in initial college-level courses when the effects of select student characteristics are controlled?

This chapter will include a description of the research design, an institutional profile of Central Arizona College, an explanation of the procedure used for data collection, and approach to data analysis.

Research Design

Fundamentally, the research process involves the methodical collection, analysis, and interpretation of data. Best and Kahn (1998) define research as "the systematic and objective analysis and recording of controlled observations that may lead to the development of generalizations, principles, or theories, resulting in the prediction and possibly ultimate control of events" (p. 18). None of which, however, can happen without a research design. In essence, the research design "is used to

structure the research, to show how all of the major parts of the research project—the samples or groups, measures, treatments or programs, and methods of assignment—work together to address the central research questions" (Trochim, 2001, p. 171). Research begins with choosing a theoretical framework from which to work.

Philosophical Position

Research is performed within one of four theoretical frameworks or paradigms: (1) positivist/postpositivist, (2) interpretivist, (3) critical theory, and (4) deconstructivist. Within each paradigm, a researcher defines his or her ontological, epistemological, and methodological beliefs (Mertens, 2005).

The research in this study was conducted within the postpositivist paradigm. The ontological belief of this paradigm was that "reality" can only be found within a certain degree of accuracy. Epistemologically, this study drew upon the objectivist viewpoint, which recognizes that knowledge is the result of manipulation, verification, and discovery (Guba & Lincoln, 1998). Methodologically, quantitative research was used to complete the objectives of this study.

Methodology—Quantitative Research

The primary purpose of quantitative research is "to describe, predict, and control.…Specific variables are isolated through control of the environment to eliminate the effects of confounding variables and testing their relationship to various behaviors" (Borland, 2001, p. 8). Within that context, quantitative research was appropriate for this

study because it sought to explain the relationship between remediation, academic performance, and retention by examining the association between select predictor variables. As a methodology, quantitative research attempts to achieve validation through precision in approach. Patton (1990) writes of the advantages of quantitative research:

> The advantage of a quantitative approach is that it's possible to measure the reactions of a great many people to a limited set of questions, thus facilitating comparison and statistical aggregation of the data. This gives a broad, generalizable set of findings presented succinctly and parsimoniously. (p. 15)

However, critics claim that analytical methods that are typically used by quantitative researchers limit this type of research in several ways.

First, quantitative approaches that focus on a particular set of variables potentially exclude other variables that may alter the findings. Second, chosen theories from an outside researcher may have little or nothing to do with the population under study. Third, although statistically sound, generalizations tend to be ambiguous in nature. Finally, the "human voice" is generally not considered in quantitative approaches, thereby excluding meaning and purpose from observed human behavior (Guba & Lincoln, 1998). However, researchers assert that a well-planned research design can minimize those limitations and capitalize on the strengths of quantitative research (Mertens, 2005; Trochim, 2001).

Nonexperimental—Ex Post Facto Research Design

Because this study relied on existing or previously collected data, the research design was nonexperimental in nature and classified as *ex post facto*, which in Latin translates to "after the fact." Researchers use *ex post facto* studies when experimental or quasi-experimental research is not possible (Diem, 2002). *Ex post facto* studies are suitable when independent variables cannot be manipulated for ethical or palpable reasons. Ethnicity and gender are examples of variables that cannot be manipulated for obvious reasons. Because variables cannot be manipulated, one disadvantage of *ex post facto* studies is that controlling for extraneous variables is difficult. Additionally, *ex post facto* studies do not allow for random assignment of groups receiving the treatment, which in this study, would be considered unethical to deny a student remedial education when, in fact, he or she needs it (Johnson & Christensen, 2000). As with any research design, validity is a concern for *ex post facto* research.

Validity

Validity is an overall appraisal of the soundness or truthfulness of the research. There are four major types of validity: (1) conclusion validity, (2) internal validity, (3) construct validity, and (4) external validity. Researchers contend that internal and external validity are the most important to address within a study (Mertens, 2005; Trochim, 2001). According to Mertens (2005), internal validity "means that changes observed in the dependent variable are due to the effect of the independent variable, not some other unintended variables (known as extraneous variables, alternative

explanations, or rival hypotheses)" (p. 121). External validity, on the other hand, refers to the extent that the findings of the study are generalizable to other groups in other situations and at other times (Vogt, 2007). Both internal and external validity were threatened within this study.

Internal validity. The underlying assumption of this study was that remedial education was largely responsible for preparing students for college-level courses at Central Arizona College. However, while students were enrolled in remedial courses, some may have taken advantage of available academic assistance services on campus. The Cooperative Learning Center (CLC) was where students could receive academic assistance via tutoring, workshops, or academic software. Researchers consider this type of threat historical in nature (Trochim, 2001). Therefore, this study attempted to control for this extraneous variable by treating visits to the CLC as an independent variable. Additionally, other events that occur in one's life may have some affect on the performance outcome of a student enrolled at CAC. For example, changes in employment, marital status, health, or number of dependents may influence outcomes. This study did not attempt to control for those changes.

In addition to receiving academic assistance, biological and academic maturation may explain performance in remedial courses, particularly since the study encompassed a three-year period. Maturation can be controlled by having a control group that undergoes similar maturational change but does not receive the treatment (Mertens, 2005). Although an *ex post facto* study did not allow for a control group, this

study attempted to eliminate much of maturation threat by comparing students with a remedial background to students without a remedial background.

Internal validity was also threatened in this study by the use of grades as the defining measure to determine academic success within remedial and college-level courses. As measures, grades are confounding and varying within and across academic departments and colleges. For example, some instructors used essay exams, homework assignments, and attendance to calculate student grades, while other instructors teaching the same subject within the same college may have used multiple-choice exams and occasionally offered "extra credit" for the eager student. Therefore, grading variation and possibly grade inflation may be realities that were statistically difficult to control during analysis. Nevertheless, Pascarella and Terenzini (2005) argue that "given their limitations…grades are one of the most consistent predictors of these outcomes [persistence and retention] in both large, nationally representative studies and in the far more numerous single-institution studies" (p. 396).

External validity. The exhaustive sampling technique used in this study, which will be discussed later in this chapter, posed the greatest threat to external validity. Because this study used one cohort of students to answer the research questions, generalization to other cohorts was weakened. Additionally, "experimenter effect" threatened external validity. According to Mertens (2005), experimenter effect refers to the absence of an individual who administers and possibly influences the outcome of the treatment in other situations. At CAC, instructors who teach remedial courses

influence student academic performance through various pedagogical practices, willingness to help students succeed, and amount of passion displayed for the subject. Although instructional methods used in remedial courses varied from instructor to instructor, every course had defined learning outcomes and standards in place that ensured common coverage of material in each class. CAC policy states that learning outcomes and standards must accompany the course syllabus when handed out during the first days of the semester. Moreover, students were surveyed on teacher evaluations to indicate whether learning outcomes and standards were covered and met during the course. External validity was also threatened by the interaction of history and treatment (remedial education), meaning that the treatment cannot be exactly duplicated in another location. This study did not attempt to isolate or measure the interactions between the above-mentioned phenomenon and remedial education. However, if random sampling is used to draw a sample from the population, then the aforementioned threats to external validity will be eliminated (Trochim, 2001). Because the entire population of the cohort was used during analysis, this threat was most likely nullified.

Independent and Dependent Variables

Variables are categorical or quantitative in nature; however, researchers refer to variables as either independent or dependent. Independent variables are considered the treatment, program, or cause, whereas dependent variables are the effects or outcomes. As mentioned previously, in nonexperimental research, independent variables cannot be

manipulated by the researcher. In other words, the researcher cannot exert direct control over the independent variable (Johnson & Christensen, 2000). However, independent variables can be statistically controlled during analysis. The term predictor variable is often used interchangeably with independent variable. Similarly, the term criterion variable is often used in place of the term dependent variable (Kachigan, 1991).

Trochim (2001) states that variables must satisfy two conditions: (a) each variable should be exhaustive; and (b) the attributes of a variable should be mutually exclusive. In this study, "select student characteristics" referred to the independent variables. The independent variables included *Gender, Ethnicity, Enrollment, Age, Residency, FinAid, Athlete, CLC Visits, Remedial, Campus, ENG100, ENG101, RDG100, CIS120, MAT121, MAT141*, and *MAT151*. The dependent variables were *Remedial, AgeClass, REMGPA, Performance, NoREMGPA, ColOutcome, S03Enr, F03Enr, S04Enr, F04Enr,* and *S05Enr*. Table 1 provides a brief description of the variables that were used in this study.

Table 1: Description of Independent and Dependent Variables

Variable	Description or Subcategories	Range
INDEPENDENT		
Gender	Male or Female	1 or 0
Ethnicity	Non-Hispanic White, Black, Hispanic, Native American, Other	1—5
Age	Actual Age	0-99
Enrollment	Full-time = enrolled in 12 credit hours or more. Otherwise, student is considered part time.	1 or 0
Drop/Transfer	Departed after at completion of first semester in study	1 or 0
Stop Out	At least a one semester gap between enrollment	1 or 0
Persisted	Attended every semester during study	1 or 0
Residency	Resided on campus or off campus	1 or 0
FinAid	Received financial aid or not. None, Pell, NoPell	0—2
CLC visits	The number of times student visited the Learning Center	0-150
Athlete	Student athlete or not	1 or 0
Campus	Location where student took courses	0 - 4
Remedial Background	Need for remedial education	0 or 1
DEPENDENT		
REMGPA	GPA for remedial courses	0—4.0
NoRemGPA	GPA for initial college-level courses	0—4.0
S03, F03, S04, etc.	Enrolled or Not Enrolled after said semester	1 or 0
MAT121, ENG101, etc.	Numerical course grade	0-4
ColOutcome	Defined as either Academic Success =1 or Non-Success =0 (Based on results of NoRemGPA)	1 for GPA greater than or equal to 2.0 0 for GPA less than 2.0
AgeClass	Defined as either Traditional = 1 or Non-Traditional = 0	1 for 17 -21 years 0 for 22 or older
Performance	Defined as either Success = 1 or No Success = 0 (Based on results of REMGPA)	1 for GPA greater than or equal to 2.0 0 for GPA less than 2.0

Institutional Profile—Central Arizona College

Background

CAC is a rural community college located in rapidly growing Pinal County, which is situated equidistant between the cities of Phoenix and Tucson. The college opened its doors to students in fall 1969. CAC is a learner-centered institution that is accredited by the Higher Learning Commission of the North Central Association of Colleges and Schools (HLC). Its mission, vision, guiding values, and strategic goals guide decision making and processes at CAC. The mission reads:

> Central Arizona College provides a vibrant environment centered on learning and learner success. Our diverse college community values the power of innovation, continuous quality improvement and the contribution of the individual. Our commitment is to act as a catalyst for economic and cultural vibrancy and to inspire individuals to pursue their unique goals.

The vision states:

A dynamic partner...enriching your future through learning. The college's guiding values are:

1. Appreciation of Diversity
2. Development of a caring and concerned community
3. Accessibility of Services
4. Emphasis on learning excellence
5. Maintenance of high academic standards

6. Openness to innovation

7. Emphasis on quality

The college's strategic goals for 2003-2008 are:

1. Optimize Development and Allocation of Resources

2. Serve Stakeholder Needs in Targeted Areas

3. Advance the Learning College Culture

4. Create Environments That Promote Learner-Centeredness

5. Strengthen Community Relations

6. Expand Partnerships and Linkages

CAC enrolls more than 11,500 students annually (IPEDS, 2005). CAC students may choose from various associate's degree and certificate programs. For students seeking the convenience of earning a degree without leaving the college, the University Center on campus provides seamless transfer for students into bachelor's and master's degree programs offered through Northern Arizona University and Arizona State University. CAC offers a wide range of courses in academic and continuing education areas. Of the credit-bearing courses, 44 percent are comprised of career and technology, 43 percent are academic, and 13 percent are developmental (remedial).

Description of Participants

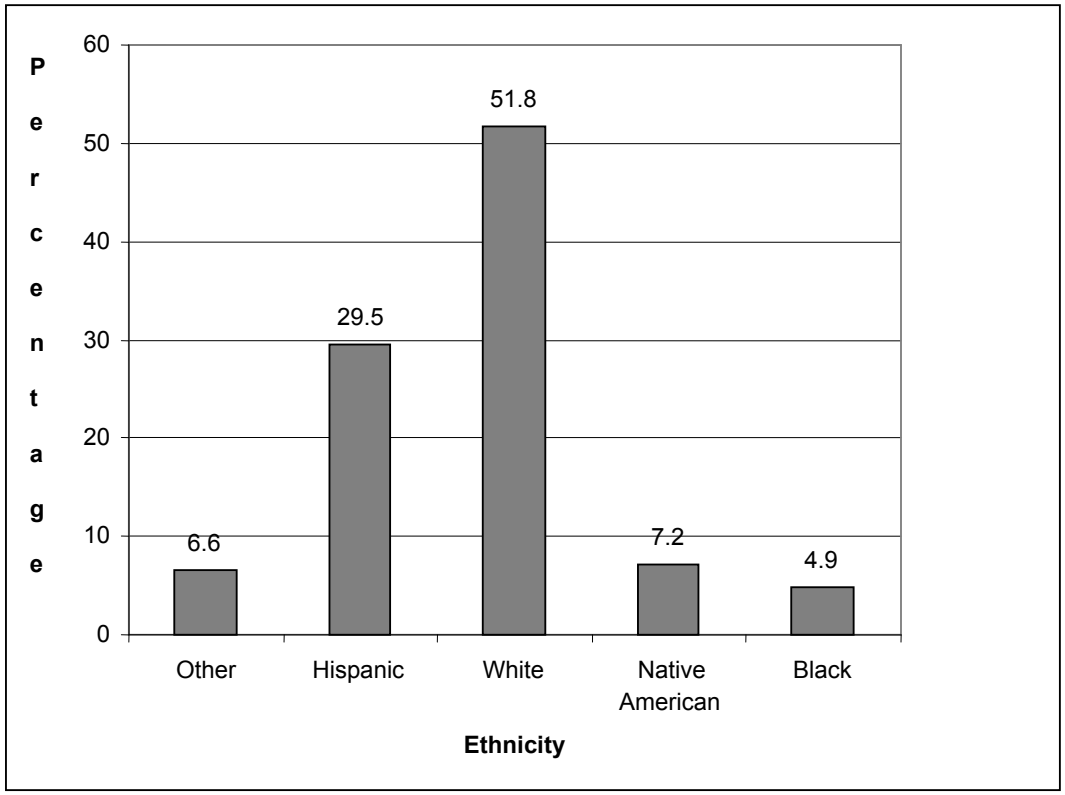
This study focused on the cohort of first-time students who began Central Arizona College in the fall 2002 semester. Because data reporting typically falls one year behind the current year, choosing the fall 2002 cohort allowed for a three-year

longitudinal study. Of the 1,906 students in the cohort, 401 (21 percent) were enrolled full-time and 1,505 (79 percent) were enrolled part-time (12 credit hours or more determined full-time status). Men totaled 800 (42 percent), and women equaled 1,103 (57.9 percent) students in the cohort. Black students represented 4.9 percent of the cohort, Hispanics equaled 29.5 percent, Native Americans represented 7.2 percent, and Whites equaled 51.8 percent (see Figure 3).

Sampling Method

The goal of sampling is to generate a representative group of the target population so that inferences can be made about the target population. For this study, the target population was students who attended Central Arizona College, and the sample was the entire fall 2002 cohort. Therefore, this study used an exhaustive sampling technique. Given that 41 percent of community college students require remedial education, the number of students who needed remedial education was expected to be approximately 780 students, which is well above the recommended sample size for statistical analysis such as correlational and multiple regression (McCabe, 2000; Mertens, 2005).

Figure 3: Fall 2002 Cohort Ethnic Profile



Procedures and Data Collection

This study relied on existing data that CAC collected regularly and systematically. Because CAC collected the data for institutional, state, and federal reporting purposes, the reliability of the data was very strong. CAC utilizes an administrative information system known as SCT Banner to store and organize data. Considered as the most widely used data collection and storage system in the country, the SCT Banner database organizes data into five modules; Student, Alumni, Financial, Human Resources, and Financial Aid. This study utilized data stored within the Student

module, which contained pertinent student information such as name, age, gender, ethnicity, class standing, major, degree audit, academic transcripts, ASSET or COMPASS scores, e-mail address, and many more student record data. SCT Banner did not allow users to create summary reports for groups of students. However, CAC developed and implemented its own summary-reporting instrument, known as Central Arizona Software Applications (CASA) that interfaces with data collected for SCT Banner. In order to acquire necessary data from CAC databases, a set of procedures had to be followed.

Gathering the Data

Initially, permission to perform this study was approved by the president of CAC. Once permission was granted, the director of institutional research and planning was contacted to determine the feasibility of the study. Additionally, the researcher contacted the associate vice president for enrollment management and the dean of academic services for additional information on the type of data available for research purposes.

The Office of Institutional Research and Planning (OIRP) oversees data requests at CAC. Because a programmer must complete CASA summary reports, OIRP established a request process. When a user submits a request for a report through CASA, a review committee decides the outcome. Either the committee will assign, deny, or seek additional information for the request. In some instances, a request is denied because the report was previously generated, at which point the committee

supplies the report to the user. A request may also be denied if resources such as staff, time, or money are limited. If the request is approved, then the programmer receives instruction to create the summary and the user will receive the data as a PDF file, MS Word file, or a comma delimited file within three weeks. For this study, a programmer was assigned to generate a summary.

Access to SCT Banner student records is less formal. Access levels in SCT Banner vary according to the user's need as determined by the user's supervisor. Within the student module, read-only access is generally permitted to the user.

Description of the Treatment

The focus of this study was to determine the relationship between remedial education, academic performance, and retention. Within that context, students who failed to demonstrate college-level readiness received a treatment—remedial education. Remedial education at CAC included various remedial courses, a decentralized organizational design, and policies that delineated how to assess and properly place students.

Remedial education at CAC. Although CAC referred to their remedial courses as developmental, the term remedial course was used for the purposes of this study. Students were able to enroll in remedial courses in traditional lecture, online, or hybrid format in 16-, 8-, or 5-week course lengths. Remedial courses in math included MAT 081 Prealgebra, MAT 091 Introductory Algebra, and MAT 121 Intermediate Algebra. The first college-level course in math was either MAT 141 College Mathematics or

MAT 151 College Algebra. Remedial courses in reading included RDG 090 Introduction to College Literacy, RDG 091 College Vocabulary, and RDG 100 Reading for Reasoning. Remedial reading did not have a particular first college-level course as did remedial math and English. However, RDG 100 was a prerequisite course for any course that was transferable or satisfied credits toward degree completion. Remedial courses in English included ENG 090 English Composition I, ENG 095 Writing Center, and ENG 100 English Composition II. ENG 101 English Composition III was the first college-level English course. For purposes of this study, MAT 121, RDG 100, and ENG 100 were referred to as "exit-level" courses. In other words, those courses were the final ones taken before a student enrolls into college-level courses.

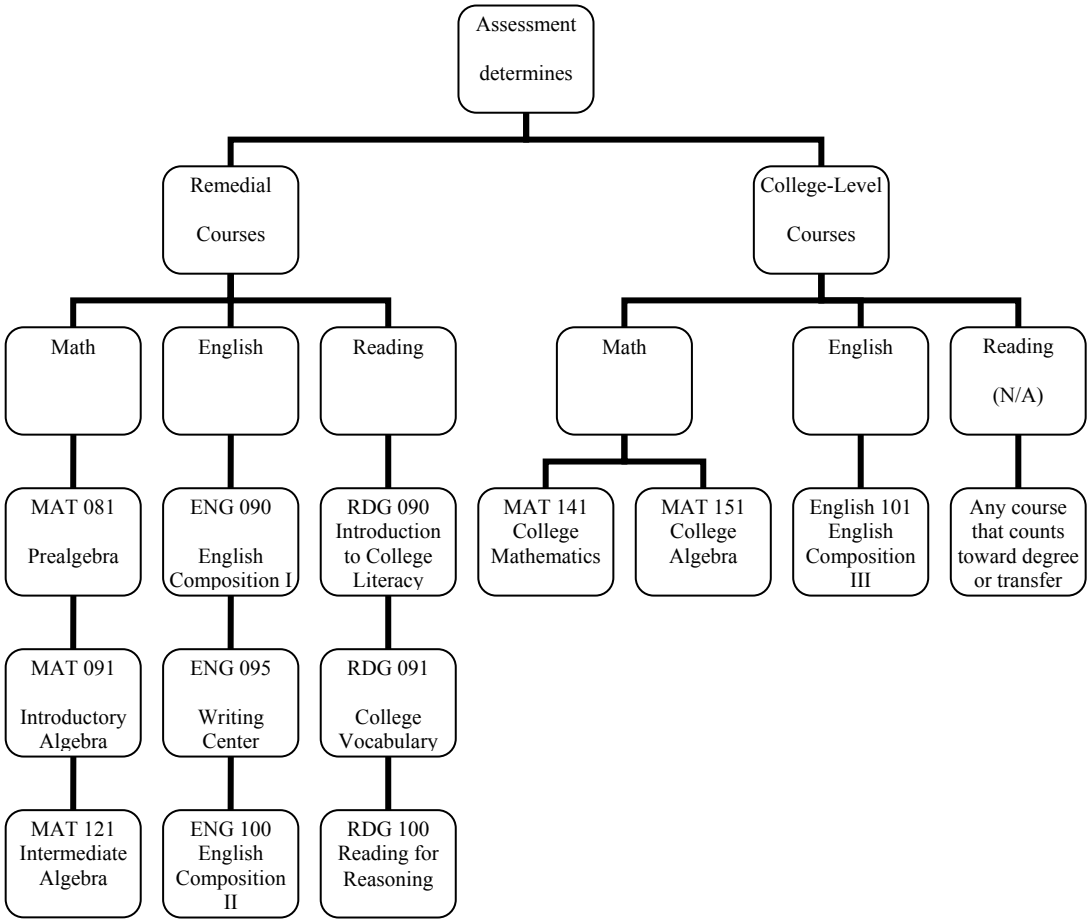
Organizational design. CAC utilized the decentralized model for organizing remedial education. Therefore, remedial courses permeated the institution and were taught by instructors who also taught college-level courses. CAC did not have a position for a person whose primary responsibility was to oversee remedial education, which is considered a defining characteristic of the decentralized model. Instructors of remedial courses must possess a master's degree or have a master's degree with 24 upper-division credit hours in the subject they teach. Those qualifications were set forth by CAC and exceeded the standards required by the HLC accrediting body.

Assessment and placement policies. Policy regarding remedial education at CAC began with assessment and placement; both were mandatory. Every person planning to enroll in credit-bearing courses for the first time were required to take a

placement exam and had to choose between COMPASS and ASSET basic skills assessment instruments. Both tests are nationally normed and are developed by American College Testing (ACT). While both instruments assess reading, writing, and mathematical abilities, the primary difference between them is that COMPASS tests are completed on computers and ASSET tests are completed in written form. The results, which are generally made available immediately following the exam, help academic advisors appropriately place students.

The two assessment instruments are not pass or fail exams. The results consist of individual scores for each of the three subject areas. Essentially, one of two outcomes occurs: (a) student is not ready for college-level work and must enroll in remedial courses; or (b) student is ready for college-level work. With the results in hand, the student visits with an academic advisor who uses the student's results and fixed "cut-off" scores to place students. Figure 4 provides a matriculation pathway which students follow once assessed and placed into appropriate courses.

Figure 4: Fall 2002 Cohort Matriculation Pathway for First-Time, Degree-Seeking Student



A student who needs remedial education in one or more areas may also demonstrate varying levels of need. For instance, a student may need only remedial math, but tests into MAT 081. In that case, the particular student is at level 3, the lowest level of remediation in math and will need to complete two more remedial courses

before reaching college-level math courses. As another example, a student may require remedial education in math and reading at levels one and three, respectively. Occasionally, a student needs remediation in all three subjects and all at level three. Essentially, if a student requires remedial education, there exist 84 different matriculation combinations.

Data Analysis

Once the data were retrieved and organized, descriptive statistics were used to summarize the data. Descriptive statistics uses measures of central tendency and measures of variability to describe or identify characteristics common to the sample. Measures of central tendency included calculation of the mean, median, and mode. Measures of variability entailed the computation of the range, standard deviation, and variance (Johnson & Christensen, 2000).

Primary analyses in this study involved multivariate statistical analysis. Multivariate statistical analysis is useful when research involves the simultaneous examination of two or more variable characteristics that are measured over a set of objects (Kachigan, 1991). Within the context of multivariate statistical analysis, correlational and inferential statistical techniques were used to reach conclusions. Correlational statistics describe the strength of the relationship between two or more variables found in the sample, whereas inferential statistics are used primarily to compare differences between groups. Virtually all inferential statistics originate from a

system of mathematical equations known as the General Linear Model (GLM). This study used inferential statistics from the GLM that included t-tests, analysis of variance (ANOVA), regression analysis, discriminant function analysis, and Chi-square analysis to draw conclusions and to measure the statistical significance of those conclusions (Mertens, 2005; Trochim, 2001). The type of data retrieved ultimately determined the appropriate statistical approach to answer each research question. Nevertheless, the nature of the questions afforded speculative direction for statistical methods required for this study.

Research question 1. How does need, as measured by the number of students who enroll in one or more remedial course, vary by select student characteristics at Central Arizona College (i.e., when data are disaggregated)?

The primary intent of this question was to determine which independent variables, *Enrollment, FinAid, Age, Residency, Ethnicity, Athlete, Campus,* or *Gender* shared the strongest relationship with the dependent variable, *Remedial*. The researcher anticipated conclusions such as part-time students who received financial aid and were over 29 years of age were most likely to need remedial education. Crosstabulation analysis was employed to assist with the deeper analysis required to draw any conclusions.

To answer this question, the FREQUENCIES subcommands of DESCRIPTIVE STATISTICS in SPSS was used to analyze the data. As a follow-up to that analysis, under the menu of ANALYZE, CLASSIFY, followed by DISCRIMINANT,

discriminant function analysis was performed, as well. According to Mertens (2005), discriminant function analysis is a statistical technique that is used to predict group membership on the basis of a variety of predictor variables. Therefore, discriminant function analysis was employed to generate a mathematical model that could predict need for remedial education based on student characteristics inputted for analysis (Kachigan, 1991). However, in this case, it can also be used to identify independent variables that influenced student need for remedial education the same way that multiple linear regression does.

Because of their nominal scale of measurement, it was necessary to consider some of the independent variables as "dummy variables" during analysis (Green & Salkind, 2005). The dependent variable, *Remedial*, was dichotomous in nature and therefore subcategorized as *Remedial* or *Non Remedial* during analysis to distinguish between the two groups (Kachigan, 1991).

Research question 2. How does student academic success vary by select student characteristics for students in remedial courses at Central Arizona College (i.e., when data are disaggregated)?

This question was very similar to research question 1. Therefore, SPSS was used to perform frequencies, descriptive statistics, and crosstabulation. For this question, however, it was necessary to use multiple linear regression given the nature of the dependent variable, *REMGPA*. The independent variables used in research question one were used for this question as well. If the forced entry method for entering

variables into model did not produce results that were statistically significant at the .05 level, then the stepwise method for variable entry was used. The stepwise method allows only the variables that will generate a statistically significant mathematical model (George & Mallory, 2006).

The primary purpose of this question was to identify the characteristic(s) that influenced student academic performance most in remedial courses.

Research question 3. How do rates of academic success in initial college-level courses for students with a remedial background compare to students with a non-remedial background when the effects of select student characteristics are controlled?

The primary intent of this question was to determine whether remedial background provided an advantage over students without a remedial background in initial college-level courses. For the purposes of this research question and because not all students with a remedial background went on to complete college-level courses, *NoREMGPA* was created as the grade point average that student earned in his or her initial college-level courses. Because answering this question required the comparison of the performance of two distinct groups—students with remedial and non-remedial backgrounds—independent-sample t-tests was the most appropriate statistical approach to use. Again, SPSS was used as the statistical tool to conduct the analysis.

Research question 4. Do three-year retention rates differ between students with a remedial background and those with a non-remedial background when the effects of select student characteristics are controlled?

The purpose of this question was to identify whether having a remedial background affected retention rates for students in the cohort. SPSS was used to create frequency distributions and perform crosstabulations to investigate retention patterns on a per-semester basis. The cohort was separated according to remedial background. Additionally, the subcategories, *Drop/Transfer*, *Stop Out*, and *Persisted* were created to examine more closely any distinctions between the remedial and non-remedial groups. Although this question was very similar to research question 3, frequency distributions and crosstabulations were considered the most suitable technique to answer the question.

Independent variables used in this question included *S03Enr, F03Enr, S04Enr, F04Enr, S05Enr,* and *Remedial*. Subcategories of *Remedial* included *Remedial* or *Non Remedial* relative to student academic background.

Research question 5. Which select student characteristics best predict academic success in initial college-level courses for students who took one or more remedial course?

The primary purpose of this question was to discover which student characteristics mostly influenced performance once in initial college-level courses. To answer this question, SPSS was used to perform discriminant function analysis. In this case, the predictor variables included the set of independent variables used in the previous questions. The dependent variable, *ColOutcome*, was dichotomous in nature, meaning that students were either members of the group Non-Success (GPA < 2.0) or

Academic Success (GPA ≥ 2.0). Independent variables for this question included *REMGPA, CLC Visits, Ethnicity, Enrollment, Gender, Campus, Athlete,* and *Residency*.

Research question 6. Is academic success in exit remedial courses a predictor of academic success in initial college-level courses when the effects of select student characteristics are controlled?

The purpose of this question was to determine whether academic performance in exit remedial courses played any role in student academic performance in initial college-level courses. To answer this question, multiple regression analysis was performed multiple times using SPSS in order to address the variety of combinations in which students completed exit remedial and initial college-level courses. As follow-up assessment to each question, crosstabulations between each exit remedial and initial college-level course were performed. The list of independent variables included the respective exit remedial course grade, *FinAid, CLC Visits, Age, Ethnicity, Gender, Enrollment, Residency, Campus, Athlete,* and *Remedial*. Respective initial college-level course grades were used as dependent variable in each analysis. Thus, if *MAT121* was included as one of the independent variables, then either *MAT141* or *MAT151* were included as dependent variables.

As in research question two, forced entry was used initially to enter variables into regression models, and if results were not statistically significant at the .05 level, then the step-wise method was employed.

Statistical analysis required the use of SPSS 13.0 software, a TI-84 Plus calculator, and Microsoft Excel. According to the *SPSS 13.0 Brief Guide*, "SPSS can take data from almost any type of file and use them to generate tabulated reports, charts and plots of distributions and trends, descriptive statistics, and complex statistical analyses" (2004, p. iii). The TI-84 calculator was used for simple calculations, and Microsoft Excel was used for data organization and creation of charts.

Summary

The primary purpose of this study was to examine the relationship between remedial education, academic performance, and retention of students at Central Arizona College (CAC). The goal of this chapter was to delineate how that objective was completed. This chapter included discussion regarding this study's research design. Additionally, this chapter described the institution under study, the participants, and the sampling method. In the final sections of the chapter, procedures for data collection were explained, as well as the data analysis used to answer the research questions. The following chapter will report the findings of this study.

CHAPTER 4
FINDINGS

An obvious connection exists between open access to higher education and the American commitment to equality. Unfortunately, most of the debate on remedial education is based on anecdotes rather than facts.

—Robert H. McCabe, 2000

Introduction

The primary purpose of this study was to explore the relationship that existed between remedial education, academic performance, and retention of students at Central Arizona College (CAC). Contained within this chapter are in-depth descriptions of the statistical methods that were discussed in Chapter 3. Additionally, findings from statistical analysis for each of the six research questions are reported in this chapter. Those findings will lead to conclusions and recommendations for the final chapter of this study.

Analysis

Research Question 1

How does need, as measured by the number of students who enroll in one or more remedial courses, vary by select student characteristics at Central Arizona College (i.e., when data are disaggregated)?

A three-tiered approach was used to answer this question. First, frequency analysis provided general descriptions related to the variables or select student characteristics. Second, discriminant function analysis was performed to compile a condensed list of the most influential independent variables in determining need for remedial education. Third, findings from discriminant analysis were used to perform crosstabulations for deeper analysis of the most influential independent variables.

Frequencies. The FREQUENCIES subcommands of DESCRIPTIVES STATISTICS in SPSS was used to analyze data for the following variables (referred to as select student characteristics in the question): *Remedial*, *Campus*, *Gender*, *Ethnicity*, *Age*, *Enrollment*, *Residency, FinAid*, and *Athlete*. With the exception of *Age*, all variables were recoded as dummy variables.

Campus. Based on the results from the frequency analysis, 488 (25.6 percent) of the 1,906 students in the fall 2002 cohort enrolled in one or more remedial courses between fall 2002 and spring 2005. Of the 488 students who required remediation, 24 percent needed remedial reading, 33 percent needed remedial writing, and 43 percent needed remedial math. Given that Signal Peak Campus (SPC) was the largest of the

four campuses, as expected, the majority (77.2 percent) of all CAC students who required remediation were enrolled there. During that same period, 15.4 percent, 0.2 percent, and 7.2 percent were enrolled at Superstition Mountain Campus (SMC), Arizona State Prison (ASP), and Aravaipa Campus (AVC), respectively.

Gender, Ethnicity, and Age. Nearly 60 percent of the students who took at least one remedial course were female. The ethnic proportion of those students in remedial courses was reflective of the entire cohort (see Table 2). For instance, 31.8 percent of the students in remedial courses were Hispanic, 47.8 percent were White, 6.4 percent were Native American, 11.7 percent were Black, and 2.5 were identified as Other (see Table 3). When data were disaggregated according to ethnic group, interesting findings emerged. For example, 28 percent of the Hispanics in the cohort had to take one or more remedial course. The corresponding statistic for White, Black, and Native Americans was 23.5 percent, 61.3 percent, and 22.5 percent, respectively. Thus, Black students disproportionately required remediation when compared to other ethnic groups. While ethnic makeup between students who needed remedial education and the cohort was similar, the two groups differed widely in age.

Table 2: Ethnicity for Fall 2002 Cohort

Ethnicity	Frequency	Percent	Valid Percent	Cumulative Percent
Other	125	6.6	6.6	6.6
Hispanic	562	29.5	29.5	36.0
White	988	51.8	51.8	87.9
Native American	138	7.2	7.2	95.1
Black	93	4.9	4.9	100.0
Total	1906	100.0	100.0	

Table 3: Ethnicity for Fall 2002 Cohort Enrolled in One or More Remedial Course

Ethnicity	Frequency	Percent	Valid Percent	Cumulative Percent
Other	12	2.5	2.5	2.5
Hispanic	155	31.8	31.8	34.3
White	233	47.8	47.8	82.0
Native American	31	6.4	6.4	88.3
Black	57	11.7	11.7	100.0
Total	488	100.0	100.0	

Students who took at least one remedial course ranged in age from 13 to 60 years, and 22.9 years was the mean with a standard deviation of 8.4 years, which is significantly lower than the cohort's overall average age of 32.3 years with a standard deviation of 16.1 years. Additionally, 70.2 percent of the students in remedial courses were considered *traditional students*, whose age ranged between 17 and 21 years.

Enrollment, Residency, FinAid, Athlete. Forty-five percent of the 488 students who took one or more remedial courses at CAC between fall 2002 and spring 2005 enrolled part time (11 credit hours or less). Additionally, 76.6 percent of the students in remedial courses lived off campus, and only 4.3 percent were athletes. As for financial aid status, 41.1 percent of the students in remedial courses did not receive any form of

financial aid between fall 2002 and spring 2005. Furthermore, 37.2 percent received federal Pell grants, which students received based on financial need, and nearly 22 percent received other forms of financial aid that included federal or private loans or scholarships but not Pell grants.

Discriminant Function Analysis. Discriminant analysis is used to explore how independent variables influence dependent variables or to predict group membership (Kachigan, 1991). Because of its exploratory ability, discriminant analysis was conducted using SPSS to determine which of the eight variables—*Campus, Gender, Ethnicity, Age, Enrollment, Residency, Finaid, and Athlete*—influenced need for remedial education among the cohort. Variables entered the model initially via forced entry. For this particular analysis, *Remedial Background* was used as the dependent variable and was dichotomous in nature, meaning that students were categorized into either one of two mutually exclusive groups, *Remedial* or *Non Remedial*.

In SPSS, under the menu of ANALYZE, CLASSIFY followed by DISCRIMINANT were selected to perform the analysis. SPSS provided an extensive list of outputs for discriminant function analysis, but in the following sections only outputs that were pertinent to answering research question one were discussed. Table 4 provides the pooled within-groups matrices for correlation. From an examination of these data, the strongest significant correlation occurred between the variables *FinAid* and *Enrollment* (r = .583), *Residency* and *Enrollment* (r = .493), and *Residency* and *FinAid* (r = .405). Coincidentally, those correlations were positive relationships. The

strongest significant negative correlations occurred between the variables *Age* and *Enrollment* (r = -.227), *Age* and *FinAid* (r = -.183), and *Age* and *Campus* (r = -.167).

Table 4: Pooled Within-Groups Correlation Matrix

Variables	Campus	Gender	Eth-nicity	Age	Enroll-ment	Residency	FinAid	Athlete
Campus	1.000							
Gender	-.007	1.000						
Ethnicity	.064	.049	1.000					
Age	-.167	-.024	-.157	1.000				
Enroll-ment	.035	.035	.144	-.227	1.000			
Resi-dency	.099	.107	.198	-.166	.493	1.000		
FinAid	-.022	-.010	.111	-.183	.583	.405	1.000	
Athlete	.040	.039	.113	-.079	.251	.269	.251	1.000

The subsequent tables demonstrate the significance and strength of the discriminant analysis and provide information needed to answer question one. Table 5 provides the standardized canonical coefficients and pooled within-groups correlations between discriminating variables and standardized canonical discriminant function. Of the variables entered into the analysis, *Enrollment* had the largest standardized

coefficients of .549, which was closely followed by *FinAid* (.435). *Age* had the largest negative standardized coefficient of -.336. According to Kachigan (1991), squaring standardized canonical coefficients describes the relative importance of each variable, but not the absolute importance. Thus, the relative importance of *Enrollment*, *FinAid*, and *Age* were .301, .189, and .113, respectively.

The pooled within-group correlations column lists r values that describe the strength of the relationship that existed between actual student data and the respective discriminant score yielded by the discriminant function. *Enrollment* had the largest r value of .853, which indicated that a very high correlation existed between the enrollment status of the cohort and the discriminant function scores for the cohort. In general, the variables *FinAid* (r = .795), *Age* (r = -.547) and *Residency* (r = .448) were strongly correlated with discriminant function scores. Those data suggested that the need for remedial education was strongly influenced by students' enrollment status, financial aid status, age, and residence (on or off campus).

Table 5: Standardized Canonical Coefficients and Pooled within-groups correlations between discriminating variables and standardized canonical discriminant function (Variables ordered by absolute size of correlation within function)

Variable	Standardized Canonical Coefficients	Pooled Within-Group Correlations
Enrollment	.549	.853
FinAid	.435	.795
Age	-.336	-.547
Residency	.014	.488
Ethnicity	.021	.192
Athlete	-.122	.158
Campus	.074	.147
Gender	-.066	.000

Significance tests and strength-of-relationship statistics were performed for the discriminant analysis to support the reliability of the statistical results. In particular, the Wilks' Lambda test was used to determine whether there were significant differences among groups across the independent variables. According to Green and Salkind (2005), the Wilks' Lambda statistic is equal to the proportion of the total variance in the discriminant score not explained by the differences among groups and also measures how well the discriminant function separates cases into groups. According to data in Table 6, the Wilks' Lambda was significant $\Lambda = .696, \chi^2(8, N = 1906) = 687.353, p < .01$, indicating that the entered independent variables differentiated significantly among the

Remedial and *Non Remedial* groups. Additionally, the high chi-square value indicated that the function discriminated well.

Table 6: Summary of Canonical Discriminant Function: Wilks' Lambda

Test of Function	Wilks' Lambda	Chi-square	df	Sig.
1	.696	687.353	8	.000

The eigenvalues presented in Table 7 provide the strength-of-the relationship or effect size for the discriminant analysis. An eigenvalue can be mathematically described as the ratio between the group sums of squares to the within-group correlations (Green & Salkind, 2005). The discriminant function yielded an eigenvalue of .436 and a canonical correlation of .551. According to Kachigan (1991), the canonical correlation is equivalent to Pearson's Correlation and is considered a more interpretable index because eigenvalues have no upper limits. Additionally, squaring the canonical correlation of .551 yielded the eta square, which equaled .304. Computing Eta square is equivalent to the one found when conducting a one-way ANOVA on the discriminant function. Therefore, more than 30 percent of the variability in this analysis was accounted for by differences among the Remedial and Non Remedial groups (Green & Salkind, 2005).

Table 7: Summary of Canonical Discriminant Functions: Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.436	100.0	100.0	.551

One of the primary purposes of discriminant analysis was to discriminate between two mutually exclusive groups such as *Remedial* and *Non Remedial*. Discriminant analysis produced a function that gave a discriminant score when values for each variable were entered into the function. Coefficients from Table 8 were used to generate the function D = .101 + .078(*Campus*) - .132(*Gender*) + .025(*Ethnicity*) - .022(*Age*) + 1.544(*Enrollment*) + .051(*Residency*) + .782(*FinAid*) - .897 (*Athlete*). SPSS used that function to compute discriminant scores in order to classify each case. Although the discrimination indices of Wilks' Lambda were calculated and shown to be significant, perhaps the most meaningful assessment of the discriminant function was in its ability to classify each case accurately (Kachigan, 1991). The discriminant function above accurately classified 82.3 percent of the cases from the original cohort.

Table 8: Canonical Discriminant Function Coefficients (Unstandardized Coefficients)

	Function 1
Campus	.078
Gender	-.132
Ethnicity	.025
Age	-.022
Enrollment	1.544
Residency	.051
FinAid	.782
Athlete	-.897
(Constant)	.101

Table 9 provides a summary of the classification results of the original cohort and results from a cross-validated sample. For example, the discriminant function accurately classified 1263 (89.1 percent) in the *Non Remedial* group and 306 (62.7 percent) in the *Remedial* group. The leave-one-out technique was used in the cross validation to evaluate how well the discriminant function would classify with a new sample. SPSS reported that 82.3 percent of the perspective cases would be correctly classified by the discriminant function if given a new sample. In this case, the discriminant function accurately classified 1262 (89 percent) in the *Non Remedial* group and 306 (62.7 percent) in the *Remedial* group with the cross-validated sample.

As mentioned previously, the purpose of discriminant analysis was to predict group membership given one or more variables. However, as a byproduct of the analysis, canonical coefficients and pooled correlations were also provided.

Table 9: Classification Results

Remedial Background			Predicted Group Membership		Total
			Non Remedial	Remedial	
Original	Count	Non Remedial	1263	155	1418
		Remedial	182	306	488
	%	Non Remedial	89.1	10.9	100.0
		Remedial	37.3	62.7	100.0
Cross-validated	Count	Non Remedial	1262	156	1418
		Remedial	182	306	488
	%	Non Remedial	89.0	11.0	100.0
		Remedial	37.3	62.7	100.0

The remainder of the analysis was necessary and supported the conclusion that student characteristics such as enrollment status (part-time or full-time), age, and type of financial aid award, if any, were most relevant in determining whether a student needed remedial education upon admittance to Central Arizona College. For deeper investigation, crosstabulation analysis was performed and included the variables *Enrollment*, *Age*, and *FinAid*. Although not identified by discriminant analysis as strong influential variables, *Ethnicity* and *Gender* were considered important for further examination.

Crosstabulation. Crosstabulation provided a deeper analysis of how select relevant student characteristics influenced need for remedial education. *Crosstabs*, as referenced by SPSS, were performed for the following cases: (1) *Remedial, Gender*, and

Ethnicity, (2) *Remedial, Ethnicity*, and *FinAid*, and (3) *Remedial, Enrollment, AgeClass, and FinAid*. The independent variable *AgeClass* was created to identify students as either traditional (less than or equal to 21 years) or non- traditional (greater than 21 years) students relative to age.

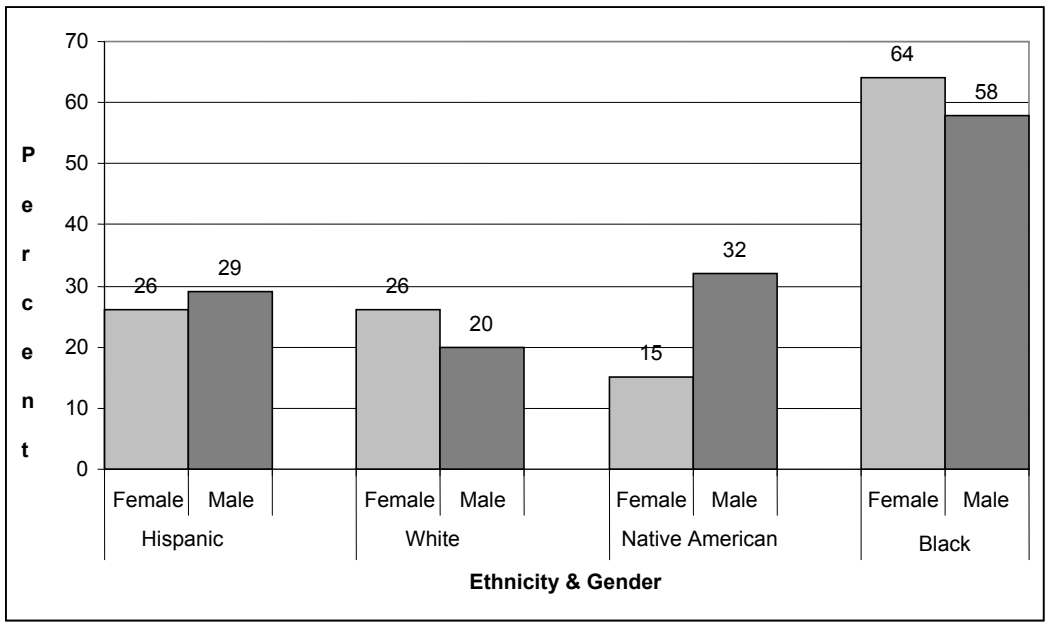
Table 10: Remedial Background * Gender * Ethnicity Crosstabulation

Ethnicity			Gender			Total
			No Response	Female	Male	
Other	Remedial Background	Non Remedial	2	60	51	113
		Remedial	0	7	5	12
	Total		2	67	56	125
Hispanic	Remedial Background	Non Remedial		259	148	407
		Remedial		92	63	155
	Total			351	211	562
White	Remedial Background	Non Remedial	1	417	337	755
		Remedial	0	144	89	233
	Total		1	561	426	988
Native American	Remedial Background	Non Remedial		67	40	107
		Remedial		12	19	31
	Total			79	59	138
Black	Remedial Background	Non Remedial		16	20	36
		Remedial		29	28	57
	Total			45	48	93

As mentioned previously, 488 or 25.6 percent of the cohort were required to enroll in one or more remedial courses during the period under investigation. Based on the results of the crosstabulation for *Remedial*Gender*Ethnicity*, of the 155 Hispanics

in remedial courses, 92 were female (59 percent) and 63 were male (see Table 10). Of the 233 Whites, 144 were female (62 percent) and 89 were male. Of the 31 Native Americans, 12 were female (39 percent) and 19 were male. Of the 57 Blacks enrolled in one or more remedial course, 29 were women (51 percent) and 28 were men. Thus, with the exception of the Native American population, females made up between 51 percent and 62 percent of students in remedial courses for each ethnic group.

Figure 5: Proportion of Need for Remediation by Ethnicity and Gender



The crosstabulation data revealed that Blacks disproportionately enrolled in remedial courses when compared to other ethnic groups (see Figure 5). For example, 64 percent of Black females and 58 percent of Black males in the cohort took one or more remedial course. Among Hispanic females, 26 percent enrolled in at least one

remedial course. The corresponding statistic for Whites and Native Americans was 26 percent and 15 percent, respectively. Of all of the Hispanic males in the cohort, 29 percent enrolled in one or more remedial courses. For Whites and Native Americans, the corresponding statistic was 20 percent and 32 percent, respectively. Thus, Hispanic and Native American males were more likely to require remediation within their respective ethnic group, but among Whites and Blacks, females were more likely to require remediation.

Table 11: Remedial Background*Ethnicity*FinAid Crosstabulation

FinAid			Ethnicity					Total
			Other	Hispanic	White	Native American	Black	
None	Remedial Background	Non Remedial	107	390	661	102	27	1287
		Remedial	7	72	97	11	13	200
	Total		114	462	758	113	40	1487
Pell	Remedial Background	Non Remedial	3	11	46	2	3	65
		Remedial	3	57	74	17	31	182
	Total		6	68	120	19	34	247
Other	Remedial Background	Non Remedial	3	6	48	3	6	66
		Remedial	2	26	62	3	13	106
	Total		5	32	110	6	19	172

Data for the second crosstabulation case, *Remedial Background *Ethnicity*FinAid*, revealed that regardless of ethnic background, 74 percent of students who enrolled in at least one remedial course received federal financial assistance in the form of Pell grants (see Table 11). More specifically, 31 percent were Hispanic, 41

percent were White, 9 percent were Native American, and 17 percent were Black. Because Pell grants were awarded based on financial need, data supported the probability of an association between the need for remediation and need for financial assistance. Furthermore, data suggested that minority students in the cohort with lower socioeconomic backgrounds tended to be academically underprepared.

When students in the cohort did not receive any form of financial assistance as indicated in Table 11 by the sub-variable *None*, a large percentage of the students did not have to enroll in any remedial courses during the period under investigation. In fact, 87 percent of the cohort who did not receive financial assistance also did not take any remedial courses. Students with a remedial background were the largest benefactors (62 percent) of "other" forms of financial aid, which included private or government loans and academic and need-based scholarships. That statistic further supported the notion that those students with financial need generally were more apt to require remedial education as well.

According to data in Table 12, of the students in remedial education who did not receive any form of financial aid and were of traditional age, 31.2 percent were enrolled full time. For non-traditional age students, the corresponding statistic was 12.9 percent. For students in remedial education who did receive financial aid in the form of Pell grants and were of traditional age, 85.5 percent enrolled full time. The corresponding statistic for non-traditional age students was 44 percent. Finally, for students in remedial education who received scholarships or loans and were traditional age, 91.6

percent were enrolled full time. For non-traditional age students, the corresponding statistic was 45.5 percent. Those data suggested that traditional age, full-time enrollment status, and financial need were closely associated with the need for remedial education, thereby supporting the findings of discriminant analysis for this research question.

Table 12: Remedial Background * Enrollment * AgeClass * FinAid Crosstabulation

FinAid	AgeClass			Enrollment		Total
				Part time	Full Time	
None	Traditional	Remedial Background	Non Remedial	277	24	301
			Remedial	95	43	138
		Total		372	67	439
	Non Traditional	Remedial Background	Non Remedial	965	19	984
			Remedial	54	8	62
		Total		1019	27	1046
Pell	Traditional	Remedial Background	Non Remedial	6	23	29
			Remedial	16	94	110
		Total		22	117	139
	Non Traditional	Remedial Background	Non Remedial	26	10	36
			Remedial	40	32	72
		Total		66	42	108
Other	Traditional	Remedial Background	Non Remedial	4	49	53
			Remedial	8	87	95
		Total		12	136	148
	Non Traditional	Remedial Background	Non Rem	6	7	13
			Remedial	6	5	11
		Total		12	12	24

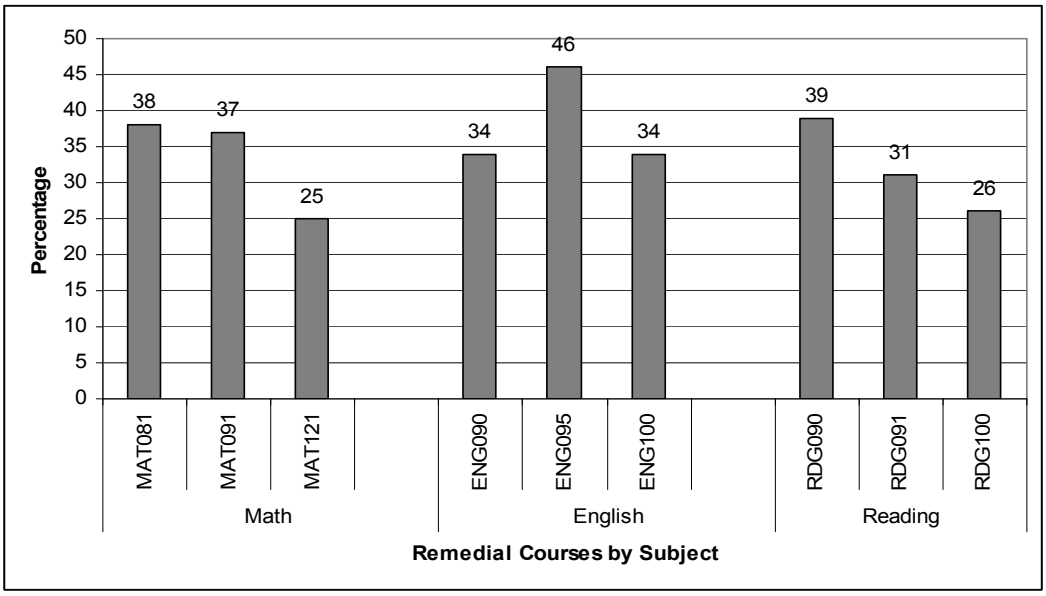
Research Question 2

How does student academic success vary by select student characteristics for students in remedial courses at Central Arizona College (i.e., when data are disaggregated)?

As in the previous question, a multi-tiered approach was used to answer this question. Initially, descriptive analysis in the form of frequencies was performed followed by crosstabulation of student performance in remedial courses and each independent variable or select student characteristics. Regression analysis was then used to identify a short list of independent variables that influenced student performance most. Finally, crosstabulation analysis was performed and included the variables identified by regression analysis previously discussed.

SPSS was used to perform frequencies, descriptive statistics, crosstabulation, and regression analysis. For the purposes of this research question and because not all students in remedial education took all remedial courses, *REMGPA* was created as the dependent variable to represent the grade point average (GPA) that a student earned in remedial courses taken during the period under study. Therefore, a student experienced academic success when his or her GPA in remedial courses was 2.0 or higher. Independent variables used in this question included *Athlete, Campus, Gender, Age, Ethnicity, FinAid, CLC Visits, Residency,* and *Enrollment*.

Figure 6: Percentage of Students Who Did Not Pass Remedial Courses



Frequencies. As mentioned previously, 488 (25.6 percent) of the students in the cohort were required to enroll in one or more remedial course. After examination of the cohort's *REMGPA*, 37.9 percent did not earn GPAs of 2.0 or higher for any attempted remedial courses. A course-by-course assessment indicated that 38 percent were not successful in MAT 081, while 37 percent and 25 percent were not successful in MAT 091 and MAT 121, respectively (see Figure 6). Similar investigation of remedial English courses showed that 34 percent, 46 percent, and 34 percent were not successful in ENG 090, ENG 095, and ENG 100, respectively. For remedial reading courses, 39 percent, 31 percent, and 26 percent were not successful in RDG 090, RDG 091, and RDG 100, respectively. Analysis of those data suggest that students were more likely to be successful in terminal remedial courses rather than in initial remedial courses.

Crosstabulations. Crosstabulations were computed for the variable *Performance*, which was created to differentiate between students who were identified as *No Success* or *Success* according to *REMGPA* results, and each of the variables *Gender, Ethnicity, FinAid, Campus, Enrollment, Residency, CLC Visits,* and *Athlete*. As in the previous section, students who earned a GPA of 2.0 or higher in their remedial courses were identified by SPSS as *Success*. The crosstabulation for *Performance*Gender* (see Table 13) indicated that overall, 38 percent of all students in remedial education were not successful as defined above. Within the group of unsuccessful students, females consisted of 56 percent of the total. Additionally, data in Table 13 indicated that 62 percent of all remedial students were successful and females comprised 60 percent of that group. Further analysis of differences between genders showed that of the 284 females, 64 percent were successful, while the corresponding statistic for males was 62 percent. Therefore, the aforementioned findings support the conclusion that females were more likely to experience success in remedial courses.

Table 13: Performance * Gender Crosstabulation

		Gender		
		Female	Male	Total
Performance	No Success	103	82	185
	Success	181	122	303
Total		284	204	488

For the *Performance*Ethnicity* crosstabulation, of the students who took one or more remedial course and were successful, 54 percent were White, 32 percent were

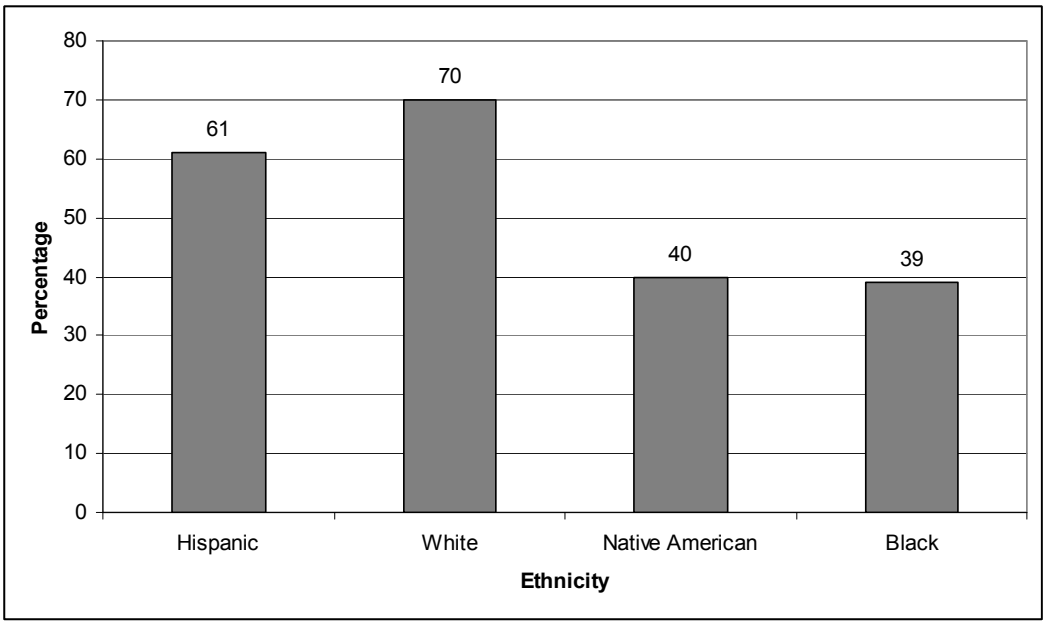
Hispanic, 4 percent were Native American, and 8 percent were Black (see Table 14). Of all Whites in remedial courses, 70 percent were successful. For Hispanics, Blacks, and Native Americans, the corresponding statistic was 61 percent, 40 percent, and 39 percent, respectively (see Figure 7). Those data indicated that less than half of Native American and Black students had GPAs of 2.0 or higher in remedial courses.

Table 14: Performance * Ethnicity Crosstabulation

		Ethnicity					
		Other	His-panic	White	Native Ame-rican	Black	Total
Perfor-mance	No Success	4	60	69	19	34	186
	Success	8	95	164	12	23	302
Total		12	155	233	31	57	488

For the *Performance*FinAid* crosstabulation, 68 percent of the students in the cohort who took one or more remedial course and did not receive any form of financial aid were successful. For students who received financial aid in the form of Pell grants, 54 percent were successful. When students received financial assistance in forms other than Pell grants, 66 percent were successful. Those data suggest that students from lower-income backgrounds were less likely to be successful in remedial courses.

Figure 7: Proportion of Students Successful in Remedial Courses by Ethnicity



For the *Performance*Campus* crosstabulation, 68 percent of the students enrolled in remedial courses at the Superstition Mountain Campus (SMC) were successful. At the Signal Peak Campus (SPC), 59 percent of the students were successful, and at Araviapa Campus (AVC), 77 percent were successful. The *Performance*Enrollment* crosstabulation showed that part-time students were more successful than full-time students with 65 percent of part-timers compared to 59 percent of full-time students achieving success. The crosstabulation for *Performance*Residency* yielded similar results; 64 percent of the students who lived off campus were successful, while 55 percent of the students who lived on campus were successful. The crosstabulation for *Performance*Athlete* revealed that athletes and non-athletes were equally successful in remedial courses (62 percent).

Crosstabulations for *Performance*CLC Visits* demonstrated that when students did not visit the Cooperative Learning Center (CLC), 68 percent were successful. When students visited the CLC one to nine times between fall 2002 and spring 2005, 50 percent were successful. Fifty-two percent of the students who visited the CLC between 10 and 19 times were successful. The largest percentage (63 percent) of students who were successful visited the CLC between 20 and 29 times or more than 40 visits. The mean number of visits to the CLC was 9.78 with a standard deviation of 17.046.

Multiple Regression Analysis. Multiple linear regression analysis was used to identify the independent variables that contributed most to the success of students enrolled in remedial courses. To perform multiple linear regression, the REGRESSION and LINEAR subcommands of ANALYZE were used to analyze data for the following variables: *Campus, Gender, Ethnicity, Age, Enrollment, Residency, FinAid,* and *Athlete*. The variables were entered into the analysis using the forced entry method. However, the forced entry method did not produce results that were statistically significant at the .05 level, $R^2 = .027$, $R^2_{adj} = .009$, and $F(9,478) = 1.467$, $p = .157$ based on an ANOVA test of significance (see Table 15 and 16). Thus, the relationship between the independent variables and the dependent variable, *REMGPA*, was not significant.

Table 15: Multiple Linear Regression: Model Summary (Forced Entry)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.164	.027	.009	1.35894

Table 16: Test of Significance: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regres-sion	24.375	9	2.708	1.467	.157
	Resi-dual	882.734	478	1.847		
	Total	907.109	487			

An alternative method of entry known as the stepwise method was used to enter independent variables into the analysis and produced results that were statistically significant at the .05 level. The stepwise method removed variables that weakened the predictive validity and left those that were statistically significant at the .05 level (George & Mallory, 2006). The probability value of F to enter a variable into the regression equation was $p \leq .05$. During the second regression analysis, $R^2 = 0.24$, $R^2_{adj} = .020$, and $F(2, 485) = 6.065$, $p < .01$ (see Table 17 and 18).

Table 17: Multiple Linear Regression: Model Summary (Stepwise Entry)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.156	.024	.020	1.35081

Table 18: Test of Significance: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regres-sion	22.134	2	11.067	6.065	.003
	Residual	884.974	485	1.825		
	Total	907.109	487			

The only variables left in the model after using the stepwise method were *Ethnicity* and *Gender*. The multiple correlation coefficient, R = .156, meant that 2.4 percent of the variance of the *REMGPA* was accounted for by the two variables, *Ethnicity* and *Gender*. The β values indicated the level of influence that each variable had on REMGPA, and in this particular analysis (see Table 19), *Ethnicity* had the greatest influence on *REMGPA* (β = -0.166), which was followed by *Gender* (β = -0.260).

Table 20 presents the relative strength of each independent variable. The bivariate correlations between the two variables and *REMGPA* were both negative and statistically significant at the .05 level. The partial correlation between the two variables and *REMGPA* were also negative and statistically significant at the .05 level. The bivariate correlation value between *Ethnicity* and *Gender* of -.125 indicated that 1.5

percent of the variance in *REMGPA* was accounted for by *Ethnicity*, which suggested that *Gender* accounted for the remaining 0.9 percent (2.4 percent—1.5 percent).

Table 19: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.816	0.216		13.034	0.000
	Ethnicity	-0.166	0.063	-0.118	-2.630	0.009
	Gender	-0.260	0.124	-0.094	-2.095	0.037

Table 20: The Bivariate and Partial Correlations of the Variables with REMGPA

Variables	Correlation between each variable and REMGPA	Correlation between each variable and REMGPA controlling for all other variables
Ethnicity	-.125	-.119
Gender	-.102	-.095

Based on the results of the multiple regression analysis, crosstabulation for *Performance*Gender*Ethnicity* was completed to further disaggregate the data (see Table 21). For females, 68 percent of Hispanics, 67 percent of Whites, 42 percent of Native American, and 38 percent of Blacks had GPAs of 2.0 or higher in all of their remedial courses. For males, the corresponding statistic was 51 percent for Hispanics, 75 percent for White, 37 percent for Native American, and 43 percent for Black. Those data suggested that male and female Native American and Black students in remedial courses were less likely to experience success (see Figure 8).

Table 21: Performance * Ethnicity * Gender Crosstabulation

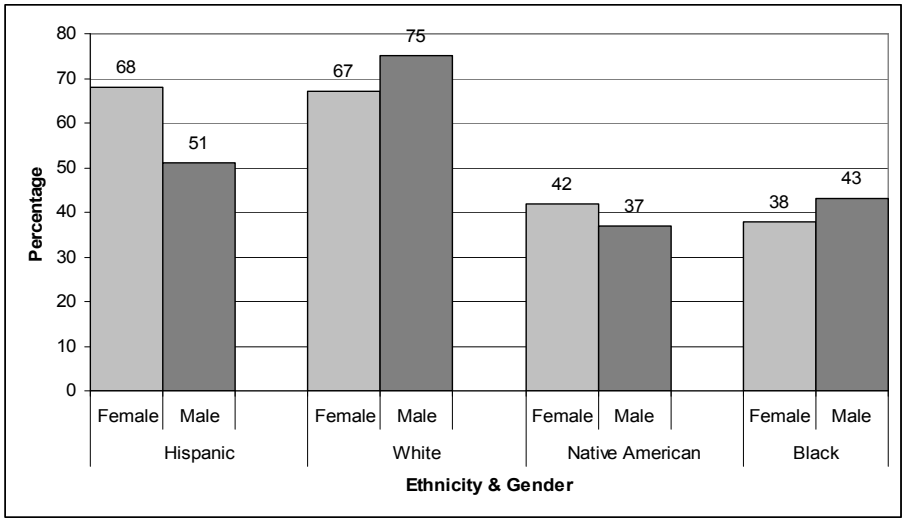
Gender			Ethnicity					Total
			Other	Hisp.	White	Native Am.	Black	
Female	Performance	No Success	2	29	47	7	18	103
		Success	5	63	97	5	11	181
	Total		7	92	144	12	29	284
Male	Performance	No Success	1	31	22	12	16	82
		Success	4	32	67	7	12	122
	Total		5	63	89	19	28	204

Research Question 3

How do rates of academic success in initial college-level courses for students with a remedial background compare to students with a non-remedial background when the effects of select student characteristics are controlled?

For the purposes of this research question and because not all students in remedial education completed the same initial college-level courses, *NoREMGPA* was created as the dependent variable to represent the grade point average (GPA) that a student earned in his or her initial college-level courses. For example, one student may have taken MAT141 and ENG101, while another student may have taken MAT151 and CIS120 as their initial college-level courses during the period under study.

Figure 8: Academic Success in All Remedial Courses by Ethnicity and Gender



To answer this question, SPSS was used to conduct an independent-sample *t* test. According to Green and Salkind (2005), the independent-sample *t* test evaluates the difference between the means of two mutually exclusive groups, which in this case were students with remedial and non-remedial backgrounds. More specifically, the *t* test assessed whether the mean value of *NoREMGPA* of initial college-level courses for remedial students differed significantly from the mean value of *NoREMGPA* of initial college-level courses for non-remedial students.

In SPSS, the COMPARE MEANS and INDEPENDENT-SAMPLES T TEST subcommands of ANALYZE were used to perform the *t* test. Table 22 provides group statistics for students with remedial and non-remedial backgrounds. Because *Remedial Background* was a dummy variable, *Remedial* represented students with a remedial background (n = 311) and *Non Remedial* represented students with a non-remedial background (n = 190). Students with a remedial background had a mean GPA of 2.2655

(SD = 1.2984) in initial college-level courses, while students with a non-remedial background had a mean GPA of 2.5537 (SD = 1.44787).

Table 22: Group Statistics

Remedial Background		N	Mean	Std. Deviation	Std. Error Mean
NoREMGPA	Remedial	311	2.2655	1.29864	.07364
	Non Remedial	190	2.5537	1.44787	.10504

Because the test was significant at the .05 level, equality of variance assumption made by Levene's test of significance was violated. Moreover, the variances and sample sizes for remedial and non-remedial backgrounds were different. Thus, the *t* value for unequal variances was reported. The results of the *t* test (see Table 23) were significant at the .05 level, $t(366.467) = -2.246$, $p = .025$. The eta-square index, which evaluated the effect size for the independent-sample *t* test was computed using the following formula: $\eta^2 = \frac{t^2}{t^2 + (N_1 + N_2 - 2)}$ and was found to be $\eta^2 = 0.01$. Therefore, a student's remedial background accounted for 1 percent of the variance of *NoREMGPA*. In sum, students with a non-remedial background had higher GPAs, on the average, in initial college-level courses than students with a remedial background.

Table 23: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
NoReMGPA	Equal variances assumed	3.898	.049	-2.306	499	.022	-.2882	.12496	-.5337	-.0427
	Equal variances not assumed			-2.246	366.467	.025	-.2882	.12828	-.5404	-.0359

Research Question 4

Do three-year retention rates differ between students with a remedial background and those with a non-remedial background when the effects of select student characteristics are controlled?

Frequency distributions and crosstabulations were performed to investigate retention patterns on a per-semester basis for the entire cohort regardless of remedial background. Additionally, data was categorized into *Drop/Transfer, Stop Out*, and *Persisted* for the three-year period under investigation. The *Drop/Transfer* indicated that students either dropped completely and did not return anytime during the three-year period or transferred to another institution. Unfortunately, specific reasons to help determine whether students dropped or transferred were not provided with the data

given to the researcher. *Stop Out* referred to students who had at least a one-semester gap in attendance sometime during the three-year period. *Persisted* referred to students who remained continuously enrolled between fall 2002 and spring 2005.

Originally, the cohort consisted of 488 (25.6 percent) students who required remedial education and 1,418 (74.4 percent) students who did not need remedial education. Table 24 illustrates that after completion of the fall 2002 semester, 790 (41.4 percent) of the 1,906 students in the original cohort remained enrolled during the spring 2003 semester. Of the students with a remedial background, 68 percent remained enrolled compared to 32.3 percent of the students without a remedial background after fall 2002.

Table 24: S03Enr * Remedial Background Crosstabulation

		Remedial Background		
		Non-Remedial	Remedial	Total
S03Enr	Not Enrolled	960	156	1116
	Enrolled	458	332	790
Total		1418	488	1906

According to data in Table 25, nearly half (49 percent) of the students with a remedial background remained enrolled after completion of the spring 2003 semester. The corresponding statistic for students without a remedial background was 17.6 percent. Those data represented 29 percent and 46 percent decreases in enrollment for remedial and non-remedial students, respectively, from spring 2003 to fall 2003.

Table 25: F03Enr * Remedial Background Crosstabulation

		Remedial Background		
		Non-Remedial	Remedial	Total
F03Enr	Not Enrolled	1169	251	1420
	Enrolled	249	237	486
Total		1418	488	1906

Table 26 illustrates that the decrease in the number of students with a remedial background was not as drastic between the fall 2003 and spring 2004 semesters. Nearly 43 percent of the students with a remedial background remained enrolled, a 12.2 percent decrease. For students with a non-remedial background, nearly 12 percent were still enrolled during the spring 2004 semester. That reflected a 31.7 percent decrease between the fall 2003 and spring 2004 semesters, a significant reduction when compared to students with a remedial background.

Table 26: S04Enr * Remedial Background Crosstabulation

		Remedial Background		
		Non-Remedial	Remedial	Total
S04Enr	Not Enrolled	1248	280	1528
	Enrolled	170	208	378
Total		1418	488	1906

Between the spring 2004 and fall 2004 semesters, 32 percent of the students with a remedial background remained enrolled, while 7.8 percent of those without a remedial background were still enrolled (see Table 27). Those data reflected 25 percent

and 35 percent decreases in enrollment between spring 2004 and fall 2004 for remedial students and non-remedial students, respectively.

Table 27: F04Enr * Remedial Crosstabulation

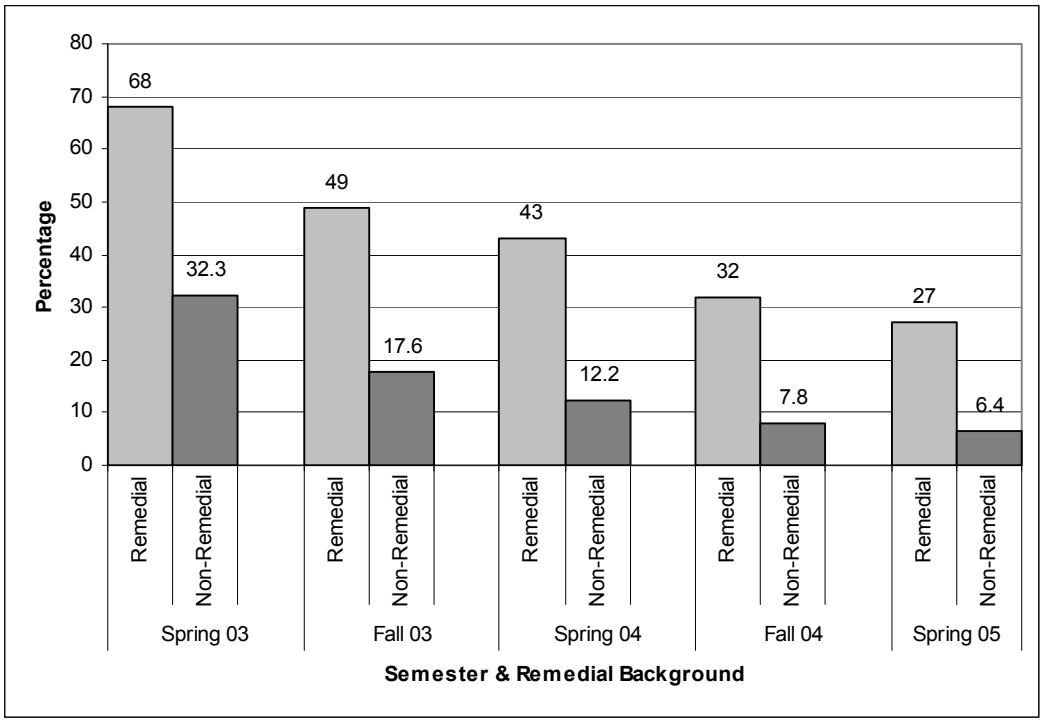
		Background		
		Non-Remedial	Remedial	Total
F04Enr	Not Enrolled	1307	332	1639
	Enrolled	111	156	267
Total		1418	488	1906

Table 28: S05Enr * Remedial Background Crosstabulation

		Remedial Background		
		Non-Remedial	Remedial	Total
S05Enr	Not Enrolled	1327	356	1683
	Enrolled	91	132	223
Total		1418	488	1906

In the final semester of this study, 27 percent of the students with a remedial background remained enrolled, while only 6.4 percent of the students with a non-remedial background were still enrolled (see Table 28). Between the fall 2004 and spring 2005 semester, students with a remedial background decreased in enrollment by 18 percent, while their non-remedial counterparts decreased by 15 percent. Figure 9 provides a semester-by-semester summary of retention rates for students with and without remedial backgrounds.

Figure 9: Semester Retention Rates According to Remedial Background



According to data in Table 29, nearly 84 percent of the cohort either dropped out of Central Arizona College (CAC) or transferred to another institution. More than 11 percent of the students in the cohort stopped out for a period of at least one semester some time during the three-year period under investigation. After three years, 4.7 percent of the original cohort remained enrolled at CAC.

Table 29: Cohort Persistence from Fall 2002 to Spring 2005

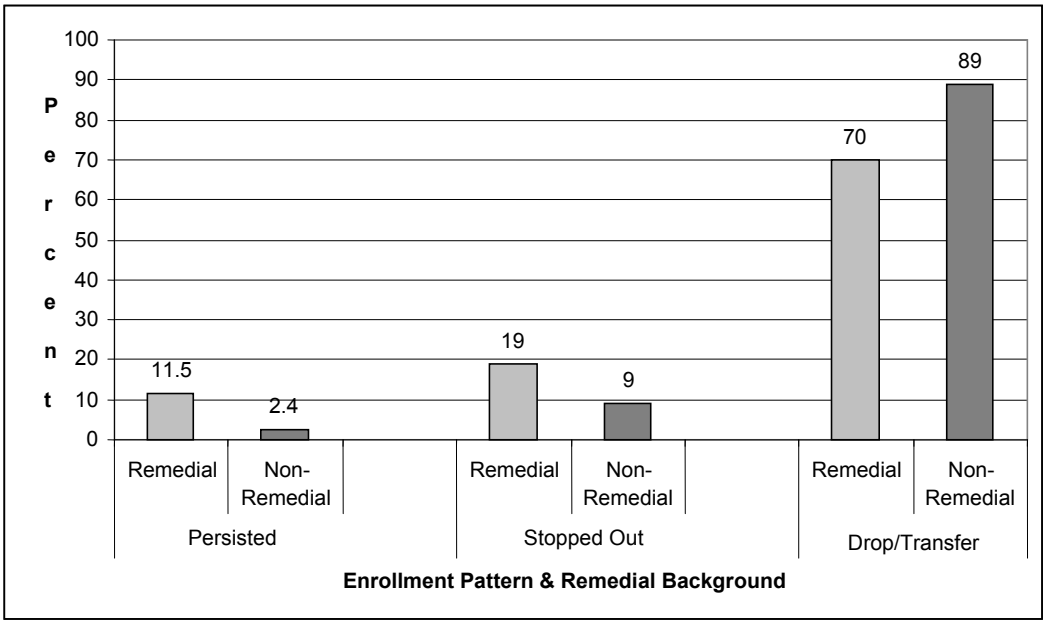
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Drop/Transfer	1596	83.7	83.7	83.7
	Stop Out	220	11.5	11.5	95.3
	Persisted	90	4.7	4.7	100.0
	Total	1906	100.0	100.0	

Table 30 provides disaggregated retention data to differentiate between students with remedial and non-remedial backgrounds. For students with a remedial background, nearly 70 percent either dropped out of school or transferred to another institution, 19 percent stopped out for a period of at least one semester, and 11.5 percent persisted and were continuously enrolled at CAC throughout the period under study. For students with a non-remedial background, nearly 89 percent either dropped or transferred, 9 percent stopped out, and 2.4 percent persisted and were continuously enrolled (see Figure 10).

Table 30: Remedial Background * Persistence Crosstabulation

		Persistence			Total
		Drop/Transfer	Stop Out	Persisted	
Remedial Background	Non Remedial	1256	128	34	1418
	Remedial	340	92	56	488
Total		1596	220	90	1906

Figure 10: Enrollment Trends Over Three-Year Period by Remedial Background



Research Question 5

Which select student characteristics best predict academic success in initial college-level course for students who took one or more remedial course?

To answer this question, SPSS was used to perform discriminant function analysis and included the independent variable *Campus, Gender, Ethnicity, Age, Enrollment, Residency, CLC Visits, FinAid, Athlete,* and *REMGPA*. The dependent variable *ColOutcome* was created to distinguish between students who were academically successful and not academically successful based on the previously used variable *NoREMGPA*, which equaled students' grade point average (GPA) in all initial

college-level courses. Because of the dichotomous nature of *ColOutcome,* students were either classified as *Non-Success* (GPA<2.0) or *Academic Success* (GPA ≥ 2.0).

In SPSS, under the menu of ANALYZE, CLASSIFY, followed by DISCRIMINANT, was selected to complete the analysis. Table 31 provides the pooled within-groups matrices for correlation. From an examination of these data, the strongest significant correlation occurred between the variables *FinAid* and *Enrollment* (r = .430), *Residency* and *Enrollment* (r = .417), and *Residency* and *Ethnicity* (r = .308). Coincidentally, those correlations were positive relationships. The strongest significant negative correlations occurred between the variables *Age* and *Enrollment* (r = -.347), *Age* and *Residency* (r = -.266), and *Age* and *FinAid* (r = -.171).

The following tables demonstrate the significance and strength of the discriminant analysis and actually provided answers to research question five. For example, Table 32 provides the standardized canonical coefficients and pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions. The variables are ordered by absolute size of pooled within-group correlations within the discriminant function and describe the strength of the relationship that existed between the actual student data and the score yielded by the discriminant function. For instance, *REMGPA* had a value of .952, which indicated that there existed a strong correlation between the GPA of remedial courses of the cohort and the discriminant function scores for the cohort. Independent variables that correlated

well with discriminant function scores included *CLC Visits* (.162) and *Ethnicity* (-.127), and *Enrollment* (-.126).

Table 31: Pooled Within-Groups Matrices

	Campus	Gender	Ethnicity	Age	Enrollment	Residency	CLC Visits	FinAid	Athlete	REMGPA
Campus	1.000									
Gender	.006	1.000								
Ethnicity	.004	.025	1.000							
Age	-.009	-.135	-.055	1.000						
Enrollment	.085	.199	.156	-.347	1.000					
Residency	.145	.181	.308	-.266	.417	1.000				
CLC Visits	.141	.119	.118	-.096	.238	.215	1.000			
FinAid	.048	-.072	.094	-.171	.430	.259	.103	1.000		
Athlete	.054	.069	.191	-.085	.161	.261	.116	.182	1.000	
REMGPA	-.019	-.062	-.111	.048	-.160	-.159	-.071	-.123	-.057	1.000

After examination of the standardized canonical coefficients, the variable *REMGPA* yielded the strongest positive influence on predicting academic success in initial college-level course with a discriminant function value of .970. *CLC Visits* (.251) and *Residency* (-.127) influenced academic success but not nearly as much as *REMGPA*. *Enrollment*, *Campus*, and *Gender* had the next strongest negative influence on academic success with discriminant function values of -.102, -.097, and -.074, respectively.

Table 32: Standardized Canonical Coefficients and Pooled Within-Groups Correlations between Discriminating Variables and Standardized Canonical Discriminant Functions (Variables ordered by absolute size of correlation within function)

Variables	Standardized Canonical Coefficients	Pooled Within-Groups Correlations
REMGPA	.970	.952
CLC Visits	.251	.162
Ethnicity	-.068	-.127
Enrollment	-.102	-.126
Gender	-.074	-.109
Campus	-.097	-.070
Athlete	-.054	-.066
Residency	.114	-.048
Age	-.066	-.037
FinAid	.103	-.009

The Wilks' Lambda significance test was performed to determine whether there were significant differences among groups across the independent variables. According to data in Table 33, the Wilks Lambda was found to be significant,

$\Lambda = .780, \chi^2(10, N = 302) = 73.376, p < .001,$ indicating that independent variables differentiated well between the *Academic Success* and *Non Success* groups. Additionally, the high chi-square value indicated that the function discriminated well.

Table 33: Summary of Canonical Discriminant Function: Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.780	73.376	10	.000

The eigenvalues presented in Table 34 provide the strength-of-the relationship for the discriminant analysis. The discriminant function yielded an eigenvalue of .282 and a canonical correlation of .469. Additionally, squaring the canonical correlation gave an *eta* square equal to .220, which indicated that approximately 22 percent of the variability in this analysis was explained by differences between *Academic Success* and *Non-Success* groups.

Table 34: Summary of Canonical Discriminant Functions: Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.282	100.0	100.0	.469

As mentioned previously, the primary purpose of discriminant analysis was to create the ability to discriminate between two groups such as *Academic Success* and *Non-Success*. Coefficients from Table 35 were used to generate the function D = -1.707 - .130(*Campus*) - .153(*Gender*) - .072(*Ethnicity*) - .008(*Age*) - .211(*Enrollment*) +

.265(*Residency*) + .014(*CLC Visits*) + .130(*FinAid*) - .266(*Athlete*) + .946(*REMGPA*). That function computed discriminant scores used by SPSS to classify each case. The discriminant function accurately classified 72.5 percent of the cases from the cohort. Therefore, the function's ability to predict membership for non-cohort students, given their characteristics, was very good.

Table 35: Canonical Discriminant Function Coefficients (Unstandardized Coefficients)

Variable	Canonical Discriminant Coefficients
Campus	-.130
Gender	-.153
Ethnicity	-.072
Age	-.008
Enrollment	-.211
Residency	.265
CLC Visits	.014
FinAid	.130
Athlete	-.266
REMGPA	.946
(Constant)	-1.707

Table 36 provides a summary of the classification results for the original cohort and a cross-validated sample. The function accurately classified 62 (66.7 percent) in the *Non Success* group and 157 (75.1 percent) in the *Success* group. For cross validation, the leave-one-out technique was used to evaluate how well the classification procedure would predict group membership given a new sample. SPSS reported that 71.5 percent of prospective cases would be correctly classified. The function accurately classified 61

(65.6 percent) in the *Success* group and 155 (74.2 percent) in the *Non Success* group during cross validation.

Table 36: Classification Results: Original and Cross Validated

ColOutcome			Predicted Group Membership		Total
			Non-Success	Academic Success	
Original	Count	Non-Success	62	31	93
		Academic Success	52	157	209
		Ungrouped cases	120	57	177
	%	Non-Success	66.7	33.3	100.0
		Academic Success	24.9	75.1	100.0
		Ungrouped cases	67.8	32.2	100.0
Cross-validated	Count	Non-Success	61	32	93
		Academic Success	54	155	209
	%	Non-Success	65.6	34.4	100.0
		Academic Success	25.8	74.2	100.0

Statistical analysis in this research question showed that REMGPA and CLC Visits were the student characteristics that best predicted academic performance in initial college-level courses. The mean REMGPA for the Non-Success group was 1.7827, while the Success group had a REMGPA of 2.9027, a difference of 1.12 grade points. Additionally, the students who were not successful visited the CLC on average 7.3 times, while the successful students visited 10.6 times on average.

Research Question 6

Is academic success in exit remedial courses a predictor of academic success in initial college-level course when the effects of select student characteristics are controlled?

To answer this question, multiple regression analysis and crosstabulations were performed several times in order to address the variety of combinations in which students completed exit remedial and initial college-level courses. Initially, independent variables were entered into regression analysis by forced entry. However, two of the four analyses were not statistically significant at the .05 level according to ANOVA results. In those cases, a stepwise procedure was used where statistically significant variables were the only variables allowed to enter the regression model.

MAT121 and MAT141—Regression Analysis. Intermediate Algebra (MAT121) was considered the exit remedial course for mathematics before students entered either College Mathematics (MAT141) or College Algebra (MAT151) as their initial college-level course. For the purposes of this particular analysis, student letter grades were converted to their respective numerical values that were used to compute grade point averages (GPA). Thus, A = 4, B = 3, C = 2, D = 1, and WP, WF, or F = 0. Regression analysis was chosen because it can be used to predict outcomes or to measure the extent to which independent variables influence a dependent variable (Kachigan, 1991). To analyze the relationship between the dependent and independent variables, *MAT141* was entered as the dependent variable and *MAT121, FinAid, CLC Visits, Age, Ethnicity,*

Gender, Enrollment, and *Residency* were entered as independent variables using the forced entry method. Other than *MAT121*, those variables were identical in nature to those used in previous questions. Here, *MAT121* and *MAT141* represented students' numerical grade earned in the course. SPSS reported that *Campus, Remedial,* and *Athlete* were deleted from analysis because the variables were missing correlations.

Related to academic performance in *MAT141*, the regression model was not statistically significant at the .05 level, $R^2 = .762$, $R^2_{adj} = .446$, and F(8,6) = 2.407, p = .15 (See Tables 37 and 38). Although the model was not statistically significant, unstandardized beta coefficients provided direction for closer analysis of certain independent variables. According to the results listed in Table 39, *Gender* (β = -.989), *FinAid* (β = .791), and *Enrollment* (β = -.571) were most influential. *MAT121* (β = .110) ranked sixth among the eight variables.

Table 37: Multiple Linear Regression: Model Summary (Forced Entry)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.873	.762	.446	1.097

Table 38: Test of Significance: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23.178	8	2.897	2.407	.150
	Residual	7.222	6	1.204		
	Total	30.400	14			

Table 39: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.936	2.635		.735	.490
	MAT121	.110	.335	.099	.329	.753
	Gender	-.989	.772	-.347	-1.280	.248
	Ethnicity	-.214	.291	-.181	-.735	.490
	Age	.057	.037	.428	1.523	.178
	Enrollment	-.571	1.106	-.177	-.517	.624
	Residency	.233	1.069	.081	.218	.835
	CLC Visits	.004	.017	.057	.206	.844
	FinAid	.791	.545	.378	1.452	.197

Because the model was not statistically significant at the .05 level, regression analysis was performed using the stepwise method of entry for the same set of independent variables. The criteria for the independent variables to enter the model was for the F probability to be less than or equal to .05 and greater than or equal to .10 for removal. After examination of the data (see Tables 40 and 41), the model was found to be statistically significant, $R^2 = .509$, $R^2_{adj} = .471$, and $F(1, 13) = 13.473$, $p < .01$. The multiple correlation coefficient suggested that 50.9 percent of the variance of the grade from *MAT141* was accounted for by the independent variables that were allowed to enter the model.

Table 40: Multiple Linear Regression: Model Summary (Stepwise Entry)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.713	.509	.471	1.072

Table 41: Test of Significance: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.471	1	15.471	13.473	.003
	Residual	14.929	13	1.148		
	Total	30.400	14			

Gender (β = -2.036) was the only variable allowed to enter the model under the set criteria (see Table 42). Additionally, *Gender's t* value was -3.671, $p < .01$. In Table 42, the bivariate correlation between *Gender* and *MAT141* was negative and statistically significant at the .05 level. The partial correlation between *Gender* and *MAT141* was also negative and statistically significant at the .05 level. The bivariate and partial correlation value of -.713 indicated that 51.8 percent of the variance in *MAT141* was accounted for by *Gender* (see Table 43). Thus, when students matriculated into MAT 141 after completing MAT 121, academic success in MAT 121 did emerge as a reliable indicator of academic success in MAT141. *Gender*, however, proved to be the best predictor of academic success in MAT141.

Table 42: Coefficients

Model		Undstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.786	.859		5.570	.000
	Gender	-2.036	.555	-.713	-3.671	.003

Table 43: The Bivariate and Partial Correlations of the Variables with MAT141

Variables	Correlation between each variable and MAT141	Correlation between each variable and MAT141 controlling for all other variables
Gender	-.713	-.713

MAT121 and MAT141—Crosstabulation. Crosstabulation analysis was performed to further analyze the performance of students who were in *MAT121* and enrolled in *MAT141* as their initial college-level math course. According to the data in Table 44, only one student was able to pass *MAT141* after either withdrawing from or failing *MAT121*. Eighty percent of the students who were academically successful (earned a C or higher) in MAT 121 were able to complete MAT 141 successfully. The mean numerical grade was 1.80 (SD = 1.474) for *MAT141*. Findings from the regression analysis conflicted with crosstabulation results. That is, findings from crosstabulation suggested that performance in MAT121 was a stronger predictor of performance in MAT141 than led to believe by regression analysis.

Table 44: MAT121*MAT141 Crosstabulation

		MAT141					Total
		WP,F,WF	D	C	B	A	
MAT 121	WP,F,WF	1	2	1	0	0	4
	D	1	0	0	0	0	1
	C	1	0	3	0	1	5
	B	1	0	1	0	2	4
	A	0	0	0	1	0	1
Total		4	2	5	1	3	15

MAT121 and MAT151–Regression Analysis. For this section of analysis, *MAT151* was entered as the dependent variable and *MAT121, FinAid, CLC Visits, Age, Ethnicity, Gender, Enrollment,* and *Residency* were entered as independent variables using the forced entry method. SPSS reported that *Remedial* was removed from analysis because the variable had missing correlations. Again, *MAT121* represented students' numerical grade in the course.

Table 45: Multiple Linear Regression: Model Summary (Forced Entry)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.528	.279	.178	1.245

Table 46: Test of Significance: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	43.077	10	4.308	2.780	.006
	Residual	111.574	72	1.550		
	Total	154.651	82			

Table 47: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.882	1.730		-.510	.612
	Campus	.278	.453	.063	.614	.541
	Gender	.111	.309	.040	.361	.720
	Ethnicity	-.076	.157	-.056	-.484	.630
	Age	.042	.023	.207	1.862	.067
	Enrollment	-.582	.489	-.172	-1.190	.238
	Residency	.447	.339	.163	1.318	.192
	CLC Visits	.007	.008	.090	.849	.399
	FinAid	.118	.211	.073	.562	.576
	Athlete	.104	.555	.020	.187	.852
	MAT121	.516	.123	.463	4.211	.000

Related to student performance in MAT 151, the regression model was statistically significant, $R^2 = .279$, $R^2_{adj} = .178$, $F(10,72) = 2.780$, $p < .01$ (see Tables 45 and 46). According to the results listed in Table 47, *Enrollment* ($\beta = -.582$), *MAT121* ($\beta = .516$), and *Residency* ($\beta = .447$), were most influential, but *MAT121* ($t = 4.211$, $p < .001$) was the only statistically significant independent variable. Thus, when students matriculated into MAT 151 after completing MAT 121, academic performance in MAT 121 was a reliable predictor of academic success in MAT 151.

MAT121 and MAT151—Crosstabulation. Crosstabulation analysis was executed to analyze the relationship between performance in MAT121 and MAT151. According to data in Table 48, nearly 81 percent of the students who were academically successful (earned C or higher) in MAT121 were successful in MAT151. After withdrawing from

or failing MAT121, more than 27 percent of the students were able to complete MAT151 successfully despite performance in MAT121. Crosstabulation analysis supported findings from regression analysis that demonstrated performance in MAT121 was a predictor of performance in MAT151.

Table 48: MAT121 and MAT151—Crosstabulation

		MAT151					Total
		WP, WF, F	D	C	B	A	
MAT121	WP, WF, F	5	0	0	2	0	7
	D	2	1	1	0	0	4
	C	2	3	7	6	2	20
	B	5	1	5	10	1	22
	A	3	0	4	12	11	30
Total		17	5	17	30	14	83

ENG100 and ENG101—Regression Analysis. English Composition II (ENG100) was the exit remedial course that students completed before they enrolled in English Composition III (ENG101), the initial college-level English course. Again, student letter grades were converted to their numerical values that are used to compute grade point averages (GPA). For this particular section of analysis, *ENG101* was entered as the dependent variable and *ENG100, Age, CLC visits, Athlete, Gender, FinAid, Ethnicity, Campus, Enrollment,* and *Residency* were entered as independent variables using the forced entry method. SPSS reported that the independent variable *Remedial* was deleted from analysis because the variable was missing correlations.

Table 49: Multiple Linear Regression: Model Summary (Forced Entry)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.385	.148	.026	1.252

Related to academic performance in *ENG101*, the regression model was not statistically significant at the .05 level with the given set of independent variables, $R^2 = .385$, $R^2_{adj} = .026$, and F(10,70) = 1.216, p = .296 (See Tables 49 and 50). Although the model was not statistically significant, coefficients in Table 51 provided direction for closer analysis of specific independent variables that influenced *ENG101* performance. For example, *Enrollment* (β = .605), *Residency* (β = .587), and *Gender* (β = -.467) were most influential. Academic performance in the exit remedial course, *ENG100* (β = .323) ranked fourth among the ten independent variables.

Table 50: Test of Significance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.045	10	1.905	1.216	.296
	Residual	109.646	70	1.566		
	Total	128.691	80			

Table 51: Coefficients

Model 1	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.218	.937		1.299	.198
Campus	-.059	.204	-.035	-.287	.775
Gender	-.467	.298	-.184	-1.568	.121
Ethnicity	.000	.156	.000	.002	.998
Age	.010	.019	.062	.526	.601
Enrollment	.605	.388	.200	1.558	.124
Residency	.587	.375	.215	1.566	.122
CLC Visits	-.002	.007	-.028	-.228	.820
FinAid	-.126	.213	-.071	-.593	.555
Athlete	.035	.585	.007	.060	.952
ENG100	.323	.136	.287	2.381	.020

Because the previous analysis was not statistically significant at the .05 level, regression analysis was performed using the stepwise method of entry for the independent variables. In order for independent variables to enter the model, the F probability had to be less than or equal to .05. If the F probability was greater than or equal to .10, then variables were removed from analysis. After examination of the data (see Tables 53 and 53), the model was found to be statistically significant, $R^2 = .055$, $R^2_{adj} = .043$, and $F(1, 79) = 4.622$, $p < .05$. The multiple correlation coefficient suggested that 5.5 percent of the variance of the grade from *ENG101* was accounted for by the independent variable allowed to enter the model.

Table 52: Multiple Linear Regression—Model Summary (Stepwise Entry)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.235	.055	.043	1.241

Table 53: Test of Significance—ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.114	1	7.114	4.622	.035
	Residual	121.578	79	1.539		
	Total	128.691	80			

According to the data in Table 54, the only variable allowed to enter the model under the set criteria was *ENG100* (β = .264). *ENG100*'s *t* value was 2.150, p < .05. In Table 55, the bivariate correlation between *ENG100* and *ENG101* was positive and statistically significant at the .05 level. The partial correlation between *ENG100* and *ENG101* was also positive and statistically significant at the .05 level. The bivariate and partial correlation value of .235 indicated that 5.5 percent of the variance in *ENG101* was accounted for by *ENG100*.

Table 54: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.256	.346		3.630	.001
	ENG100	.264	.123	.235	2.150	.035

Table 55: The Bivariate and Partial Correlations of the Variables with ENG101

Variables	Correlation between each variable and ENG101	Correlation between each variable and ENG101 controlling for all other variables
ENG100	.235	.235

ENG100 and ENG101-Crosstabulation. To analyze further the relationship between the performance of students who were in *ENG100* and subsequently enrolled in *ENG101*, a crosstabulation analysis was performed. According to the data in Table 56, seven (58 percent) students were able to pass *ENG101* after either withdrawing from or failing *ENG100*. Additionally, approximately 73 percent of the students who earned a C or higher in *ENG100* were able to complete *ENG101* successfully. The mean numerical grade for *ENG101* was 1.94 (SD = 1.268). The regression model and crosstabulation analysis indicated that academic performance in the exit remedial course, ENG100, was indeed a reliable predictor of performance in the initial college-level course, ENG101.

Table 56: ENG100*ENG101 Crosstabulation

		ENG101					
		WP, F, WF	D	C	B	A	Total
ENG100	WP, F, WF	2	1	2	1	0	6
	D	1	1	4	0	0	6
	C	6	1	10	3	1	21
	B	5	3	6	14	3	31
	A	4	0	5	5	3	17
Total		18	6	27	23	7	81

RDG100 and CIS120—Regression Analysis. Unless students tested out of remedial reading, Reading for Reasoning (RDG100) was the exit remedial course before students could take any course at Central Arizona College that counted toward degree completion or university transfer. Remedial reading, however, did not correspond with a particular college-level course as did remedial math and English. Therefore, the most widely taken course that had RDG100 as a prerequisite and was not ENG101, MAT141, or MAT151 was used as the course to measure student performance in an initial college-level course. Data showed that Survey of Computer Information Systems (CIS120) satisfied that criteria.

Initially, independent variables were entered using the forced entry method, and as in previous analyses within research question six, ANOVA results showed that the results were not statistically significant at the .05 level, $R^2 = .495$, $R^2_{adj} = .214$, and $F(10, 18) = 1.761$, $p = .142$ (see tables 57 and 58). Two of the ten variables, however, had unstandardized coefficients that were statistically significant. *RDG100* ($\beta = .721$)

had a t value equal to 2.648 and p <.05 and *Campus* (β = -3.697) had a t value of -2.412 and p < .05 (see table 59).

Table 57: Multiple Linear Regression—Model Summary (Forced Entry)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.703	.495	.214	1.145

Table 58: Test of Significance—ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23.088	10	2.309	1.761	.142
	Residual	23.601	18	1.311		
	Total	46.690	28			

Because the initial regression analysis produced results that were not statistically significant at the .05 level, the analysis was repeated using stepwise method of entry for the independent variables. Independent variables that entered the model had to have a probability of F less than or equal to .05 and were removed if probability of F was greater than or equal to .10. According to the data in Table 60 and 61, the analysis was significant at the .01 level using the stepwise method, $R^2 = .356$, $R^2_{adj} = .307$, and F(2, 26) = 7.198, p < .01.

Table 59: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	14.485	5.727		2.529	.021
Campus	-3.697	1.533	-.532	-2.412	.027
Gender	-.681	.611	-.248	-1.115	.279
Ethnicity	-.196	.239	-.198	-.823	.421
Age	-.036	.031	-.284	-1.184	.252
Enrollment	-.697	.927	-.208	-.752	.462
Residency	.415	.695	.159	.598	.557
CLC Visits	-.007	.015	-.093	-.441	.665
FinAid	-.296	.378	-.172	-.783	.444
Athlete	-.016	.739	-.004	-.022	.982
RDG100	.721	.272	.589	2.648	.016

Table 60: Multiple Linear Regression—Model Summary (Stepwise Entry)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.597	.356	.307	1.075

Table 61: Test of Significance—ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.639	2	8.319	7.198	.003
	Residual	30.051	26	1.156		
	Total	46.690	28			

RDG100 and *Campus* were the only two variables allowed to enter analysis based on the set criteria (see Table 62). *RDG100* had a *t* value equal to 3.230 ($p < .01$) and $\beta = .624$, while *Campus's t* value was equal to -2.248 and $\beta = -2.468$ ($p < .05$). In Table 63, the bivariate correlation (.481) between *RDG100* and *CIS120* was positive

and statistically significant ($p < .01$). The bivariate correlation (.313) between *Campus* and *CIS120* was negative and statistically significant at the .05 level. The partial correlation (.535) between *RDG100* and *CIS120* was positive and statistically significant at the .01 level. Finally, the partial correlation (-.403) between *Campus* and *CIS120* was negative and statistically significant at the .05 level. The bivariate value of -.481 indicated that 23.1 percent of the variance in *CIS120* was accounted for by *RDG100* performance, while *Campus* accounted for the remaining 12.5 percent (35.6 percent—23.1 percent) variance in *CIS120*.

Table 62: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.001	3.333		2.400	.024
	RDG100	.624	.193	.510	3.230	.003
	Campus	-2.468	1.098	-.355	-2.248	.033

Table 63: The Bivariate and Partial Correlations of the Variables with CIS120

Variables	Correlation between each variable and CIS120	Correlation between each variable and CIS120 controlling for all other variables
RDG100	.481	.535
Campus	-.313	-.403

Table 64: RDG100*CIS120 Crosstabulation

		CIS120				Total
		WP, F, WF	C	B	A	
RDG100	WP, F, WF	2	0	0	0	2
	D	1	0	0	0	1
	C	0	7	2	1	10
	B	3	4	2	2	11
	A	0	1	3	1	5
Total		6	12	7	4	29

RDG100 and CIS120—Crosstabulation. Crosstabulation analysis was performed to investigate the performance of students who were in *RDG100* and then enrolled in *CIS120* as his or her initial college-level course. According to the data in Table 64, nearly 89 percent of the students who were academically successful (earned a C or higher) in RDG100 were able to complete CIS120 successfully. The mean numerical grade for *CIS120* was 2.10 (SD = 1.291). According to the regression model and crosstabulation, academic performance in the exit remedial course, RDG100 was indeed a valid predictor of success in an initial college-level course such as CIS120.

Summary

The major purpose of this study was to investigate the relationship that existed between remedial education, academic performance and retention of students at Central Arizona College. This chapter provided in-depth descriptions and approaches for each statistical procedure used to complete the study. Additionally, findings from statistical analysis for each of the six research questions were reported. The following chapter

will present the conclusions and recommendations based on the findings from this chapter.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

Remediation in higher education is a multifaceted problem.

—Roueche & Roueche, 1999

Introduction

The purpose of this study was to examine the relationship that existed between remedial education, academic performance, and retention of students at Central Arizona College (CAC). The previous chapters introduced the study, reviewed the literature, outlined the methodology, and provided findings from statistical analyses performed on data associated with the fall 2002 cohort of first-time, degree-seeking students. This final chapter will include discussion on conclusions and recommendations based largely on findings from Chapter Four.

In the subsequent sections, a brief summary of the study will be provided followed by a report of any major findings and conclusions specific to each question. After major findings are reported, implications for further research will then be discussed. The final sections of this chapter will include overall conclusions and discussion of strategies that Central Arizona College and similar institutions may consider implementing to improve academic performance and retention for students in remedial education.

Study Summary

In order to explore the relationship between remedial education, academic performance, and retention of students at Central Arizona College (CAC), this study examined how need and success in remedial education varied according to select student characteristics such as gender, ethnicity, and enrollment status. Additionally, this study compared rates of academic success and student retention for students with a remedial background to those with a non-remedial background. This study also identified which student characteristics served as predictors for successful academic performance in remedial courses and subsequent college-level courses. Finally, this study examined whether grades in remedial courses predicted successful academic performance in subsequent college-level courses. The following sections will discuss the major findings and conclusions of each research question.

Research Question 1

How does need, as measured by the number of students who enroll in one or more remedial courses, vary by select student characteristics at Central Arizona College (i.e., when data are disaggregated)?

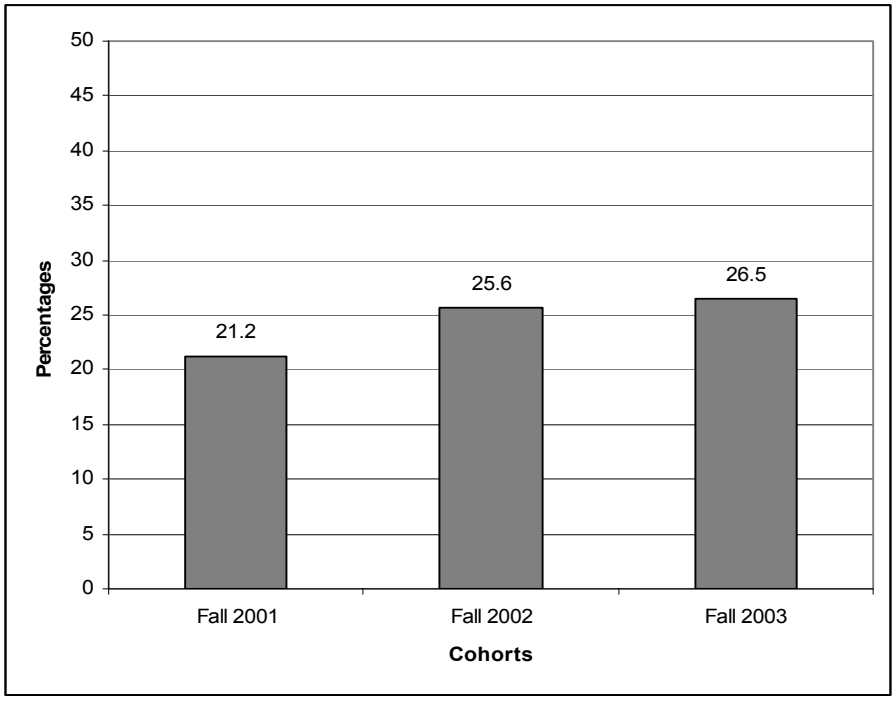
The purpose of this question was to determine whether a consistent pattern of student characteristics would emerge from the cohort that might help to identify a typical student in remedial education at Central Arizona College (CAC). Once student characteristics were identified, then programs, services, and outreach could be targeted to those special populations prior to their entrance or once they arrived on campus.

Major Findings

First, that only 25.6 percent of the cohort required remedial education raised suspicion for the researcher. As reported in Chapter Two of this study, according to the National Center for Educational Statistics, nationwide 42 percent of community college freshman enrolled in one or more remedial courses (Remedial Education, 2003). Additionally, because the cohort contained a large proportion of Hispanic, Black, and Native American students, which studies consistently reported as ethnic groups who disproportionately required remedial education, the researcher expected a higher than average percentage of students who needed remedial education. Several possibilities exist that may explain CAC's low enrollment in remedial education.

First, the possibility that the fall 2002 cohort was simply an anomaly and that previous and subsequent cohorts were typical of national trends for remedial education enrollment was investigated. Using the same defining criteria for the fall 2001 and fall 2003 cohorts, data exhibited that both cohorts had similar population sizes. For example, the fall 2001 cohort had 2,377 students and 504 students enrolled in one or more remedial course in a three-year period, which means that 21.2 percent of the cohort required remediation. For the fall 2003 cohort, 523 students out of 1,977 took at least one remedial course in a three-year period, which means that 26.5 percent of the cohort required remediation (see Figure 11). Therefore, the fall 2002 cohort used for this study was not an anomaly, but in fact typical of other cohorts.

Figure 11: Proportion of Cohort that Required Remediation



Second, as mentioned previously in Chapter Three, CAC uses ASSET and COMPASS placement exams to gauge levels of college readiness in the areas of math, reading, and writing. The advising and testing center adopted "cut scores" that were based on recommendations from ACT, faculty, and other institutions. Advisors used cut scores to determine whether students needed remedial education or were ready for college-level courses. Thus, there existed a strong possibility that unreliable cut scores caused advisors to place students into remedial courses inaccurately. Prior research indicated that a significantly higher proportion of students should have theoretically needed remedial education at CAC. Therefore, the need for review and recalibration of existing cut scores may be necessary.

Third, nearly ten years ago, the state of Arizona instituted the high school graduation requirement of passing the Arizona Instrument to Measure Standards (AIMS) exam. After years of struggle to implement and enforce the new requirement, all schools in Arizona now have adjusted curriculum at all grade levels to help students perform satisfactory on the AIMS exam. Thus, for ten years, school districts throughout Arizona have increased instructional attention in the areas of math, reading, and writing with a strongest emphasis placed on reading. Perhaps that explains the low percentage of students who required remediation at CAC given that the vast majority of CAC students came from Arizona schools. The researcher recommends this area for further research.

Finally, perhaps the low percentage of students who required remediation at CAC was explained by the possibility that the high percentage of students in the county who would normally test into remedial courses were simply not enrolling. Of course, none of the explanations provided above may be correct and the possibility that CAC consistently enrolls 20 percent to 30 percent of its students in at least one remedial course may be reality. This overall phenomenon, however, warrants further investigation.

In addition to posting lower percentages of need for remediation, the cohort also exhibited lower percentages of academic deficiency in each remedial subject area. For instance, McCabe (2000) reported that for students who required remediation, 62 percent needed math, 38 percent needed reading, and 45 percent needed writing. For

the cohort, the corresponding statistics were 43 percent for math, 24 percent for reading, and 34 percent for writing. Although those percentages were much lower, the cohort's greatest need for remediation was in math followed by writing, which was similar to national trends.

A second major finding that emerged from answering this question was related to age of students. Although the average age of students in the cohort who required remediation was equal to the average age of 23 reported by Saxon and Boylan (1999), the percentage of traditional age students in the cohort (70.2 percent) was lower than the 80 percent reported by Breneman and Haarlow (1998) in the National Study of Developmental Education. However, 47 percent of the students in the cohort who were traditional age required remediation, whereas only 12 percent of the students in the cohort who were non-traditional age required remediation. Therefore, nearly half of the students who had recently completed high school were most likely to require remediation at CAC. Consequently, during discriminant analysis, age surfaced as a student characteristic that had the strongest negative influence as a predictor of need for remediation. That is, the younger the student, the more likely that student required remediation.

A third major finding worth noting was that minority students at CAC disproportionately enrolled in remedial courses when compared to findings from national studies. For instance, Saxon and Boylan (1999) reported that minorities comprised 39 percent of students in remedial education nationwide. For CAC,

minorities in the fall 2002 cohort made up nearly half of the students who took at least one remedial course. Ironically, ethnicity did not materialize as a dependable predictor of need for remedial education during discriminant analysis.

Although Hispanic students reflected the largest percentage of minorities that required remediation, Black students at CAC required remedial education at a rate nearly two and half times that of other ethnic groups, a statistic that mirrored the findings of one particular nationwide study (Snow, 1997). Overall, 61.2 percent of the Blacks that entered CAC in the fall of 2002 required remediation. Black females (64 percent) were most likely of any student at CAC to require remedial education. In terms of gender, females made up the largest percentage of all students who required remedial education. However, findings showed that Hispanic and Native-American males were more likely to require remedial education within their respective ethnic groups.

Enrollment status (i.e., part-time or full-time) did emerge as the most reliable predictor of need for remediation as a result of discriminant analysis. For the fall 2002 cohort, 55 percent of students in remedial courses were enrolled full time, which was less than the 68 percent reported by Saxon and Boylan (1999). Enrollment status was followed closely by financial aid status in discriminant analysis and *Remedial Background*Enrollment*AgeClass*FinAid* crosstabulation demonstrated that nearly 70 percent of the students in the fall 2002 cohort who received some form of financial aid were also in remedial courses. Nationally, that corresponding statistic was 40 percent.

Therefore, students in remedial courses at CAC were more likely to be enrolled part time and need financial assistance when compared to their counterparts nationwide.

Conclusions for Research Question 1

The purpose of this question was to examine how student characteristics interacted with need for remedial education. In other words, would the results of the findings provide a description for a "typical" remedial student that other researchers suggested was elusive (McCabe & Day, 1998; Roueche & Roueche, 1999; Saxon & Boylan, 1999)? Many of the findings for this question aligned to results of the Community College Survey of Student Engagement (CCSSE), which reported that community colleges students in remedial education were more likely to exhibit characteristics such as delayed entry into college, attend on a part-time basis, demonstrate financial need, and work at least part time (Evelyn, 2005). Nevertheless, findings of this study verified that a *typical* remedial student was difficult to define as reported by previously mentioned studies (McCabe & Day, 1998; Roueche & Roueche, 1999; Saxon & Boylan, 1999). Nevertheless, this study made it possible to identify who was most likely to require remedial education at CAC. According to the findings for this study, Black females who were traditional age, enrolled part time, and exhibited financial need were most likely to require remedial education, followed very closely by Black males.

One of the outcomes of discriminant function analysis was the discriminant function or model for remedial classification that predicted need for remedial education

based on student characteristics inputted for analysis: D = .101 + .078(*Campus*) - .132(*Gender*) + .025(*Ethnicity*) - .022(*Age*) + 1.544(*Enrollment*) + .051(*Residency*) + .782(*FinAid*) - .897 (*Athlete*). Students with discriminant scores less than .369 would be classified as non-remedial, while those with scores greater than or equal to .369 would be classified as remedial. That model should accurately place 82.3 percent of the cases. However, the model should be used in conjunction with other means to assess student need for remediation.

Research Question 2

How does student academic success vary by select student characteristics for students in remedial courses at Central Arizona College (i.e., when data are disaggregated)?

This question was exploratory in nature and its purpose involved the identification of influential student characteristics relative to academic performance in remedial courses. Coupled with results from research question one, findings from this question aided in generating recommendations for program development centered on addressing specific student characteristics.

Major Findings

Overall, nearly 40 percent of the cohort did not have grade point averages (GPA) of 2.0 or higher in remedial courses. Remedial English proved to be the most difficult subject area for students. In terms of specific courses, RDG095 had the lowest pass

rate, followed by RDG091 and MAT081. Findings showed that students in the cohort tended to be more successful in latter remedial courses, which may be explained by the possibility that less academically able students did not continue on to those courses or that lower remedial courses actually prepared students to succeed in subsequent remedial courses or a combination of both reasons.

One of the major conclusions drawn in research question one was that females, and specifically Black females, who were enrolled part time and exhibited need for financial assistance were most likely to require remediation. Yet findings from research question two demonstrated that females tended to be more successful when compared to males. In fact, 64 percent of all females were successful in remedial courses. However, crosstabulation and multiple regression analysis produced findings similar to those found in research question one related to gender and ethnicity. Regression analysis confirmed that gender and ethnicity were relevant student characteristics that both had negative influence on student performance in remedial courses. When crosstabulation was performed for *Ethnicity, Gender,* and *Performance*, findings illustrated that Black females were least likely to experience success followed very closely by Native American females when compared to other ethnic groups. Those findings suggest that Hispanic and White female academic success rates compensated for low success rates of Blacks and Native-Americans, and, thus, explained why females outperformed males.

Proportionally, part-time students were more likely to experience success, which explained why students who lived on campus were less likely to be successful in remedial courses—students must be enrolled full time to live on campus at CAC. At CAC, part-time students tended to be non-traditional students as well. Crosstabulation analysis between *AgeClass* and *Enrollment* confirmed that 73 percent of all part-time students were non-traditional age. The findings related to enrollment and age supported the common perception that non-traditional students were more focused on academic achievement than were their younger counterparts.

In addition to ethnicity, gender, and enrollment status, the campus location of where students completed remedial courses mattered. For example, students who took remedial courses at Aravaipa Campus (AVC) were more likely to be academically successful. One possible explanation for that observable fact was that Hispanic (42 percent) and White (54 percent) students made up the total student population at AVC—there were no Black or Native American students in the cohort at AVC. Previous findings from the cohort showed that Hispanics and Whites were most likely to experience academic success. Thus, evidence that supported that AVC provided better remedial instruction than the other campuses was inconclusive and was more likely related to ethnicity of students.

The final major finding for research question two involved the relationship between the number of visits to the Cooperative Learning Center (CLC) and academic performance in remedial courses. The findings illustrated that students visited the CLC

10 times, on average, but those who visited the CLC at least 20 times throughout the semester were most likely to experience success. However, the group with the largest percentage of students who were academically successful turned out to be students who did not visit the CLC at all.

Conclusions for Research Question 2

The purpose of this question was to identify the most influential student characteristics relative to academic performance in remedial courses. Perhaps the most important finding from this question demonstrated that Black and Native American females were least likely to experience academic success in remedial courses. Second, the number of visits to the CLC appeared to influence performance outcomes. Students whose academic performance exhibits a need for academic assistance should be encouraged to visit the CLC at least 20 times during their educational career at CAC. Once again, findings for traditional-age students demonstrated a need for extra attention in remedial education—not only were they more likely to require remediation, they were more likely to be unsuccessful.

As a result of the regression analysis performed in research question two, a model that predicted academic performance in remedial courses emerged: *REMGPA* = 2.816—0.166(*Ethnicity*)—0.260(*Gender*). This model should not be used as a sole mechanism to predict grade point averages in remedial courses because it considers only two independent variables. However, when used in conjunction with other tools to evaluate performance, the results may be more accurate and informative.

Research Question 3

How do rates of academic success in initial college-level course for students with a remedial background compare to students with a non-remedial background when the effects of select student characteristics are controlled?

The purpose of this question was to determine whether possessing a remedial background gave students an advantage in initial college-level courses over students who did not have a remedial background. Although several studies reported in Chapter Two provided data on performance of students in initial college-level courses when possessing a remedial background, research on comparisons made between remedial and non-remedial groups was limited to just a few major studies. Most major studies reported what percentage of students with a remedial background passed initial college-level courses (Boylan, 2002; McCabe, 2000).

Major Findings

Grade point averages (GPA) were computed in initial college-level courses for remedial and non-remedial groups. Findings from the previous chapter illustrated that students without a remedial background had an average GPA of 2.55, while students with a remedial background had an average GPA of 2.27. The t-test for independent samples demonstrated that difference between the means of the two groups was statistically significant at the .05 level, thereby suggesting that the difference between the two groups was not due to sampling error. Saxon and Boylan (1999) reported that during a 3.5-year period, students in remedial courses had a mean GPA of 2.28, which

was very close to the GPA mentioned above. Nevertheless, students without a remedial background were indeed more likely to outperform students with a remedial background in initial college-level courses.

The findings in this section did not agree with a study documented in Chapter Two that found that students with remedial backgrounds performed as well as students with a non-remedial background in college-level courses (Kolajo, 2004). The researcher in that study also reported that the two groups had equivalent mean grade point averages upon graduation. Researchers in a study performed statewide in Ohio reported similar results—regardless of remedial background, students achieved comparable results in college-level courses (Bittinger & Long, 2005). However, those researchers found that students with remedial backgrounds posted higher mean grade point averages when compared to students without remedial backgrounds.

Conclusions for Research Question 3

One or more reasons may explain why a remedial background hindered academic achievement in initial college-level courses for the cohort, but perhaps the most appropriate explanation for this study may relate to curriculum alignment. That is, general learning outcomes for remedial courses may not have aligned properly to the learning outcomes of initial college-level courses. As a result of the misalignment in curriculum, students may not have received adequate preparation in remedial courses for subsequent college-level courses. Fortunately, since 2001, CAC has revamped its

curriculum through mandatory three-year program review processes, which requires academic departments to update course standards and objectives.

Research Question 4

Do three-year retention rates differ between students with a remedial background and those with a non-remedial background when the effects of select student characteristics are controlled?

The purpose of this question was to determine whether having a remedial background influenced rate of retention for students. The most efficient method was to compare remedial retention rates to non-remedial retention rates and to hold all other student characteristics constant. Because of the inconsistent nature of student attendance, analysis of data was performed on a semester-by-semester basis. Additionally, data were disaggregated to subcategories referenced as *Drop/Transfer*, *Stop Out*, and *Persisted* to provide additional insight on retention patterns for the two groups.

Major Findings

Typical of community college retention rates, nearly half of the cohort did not return to CAC for the spring 2003 semester. However, students with a remedial background were more likely to return following their first semester of college. In fact, 68 percent of the students with a remedial background returned for the spring 2003 semester, which was more than twice that of students returning who did not have a

remedial background. Those findings paralleled the results of the Achieving the Dream institutions report, where McClenney (2006) reported that between 82.9 and 86.2 percent of the students who successfully completed a remedial course in the fall semester persisted to the spring semester. McClenney also reported that, in general, students who took one or more remedial courses were more likely to persist over the long term than students who did not take any remedial courses.

With the exception of the final semester of this study, the remedial group posted higher retention rates each semester. For each group, the first semester proved to be the semester where the highest percentage of students was not retained. On average, the remedial group reduced its size each semester by more than 20 percent compared to nearly 32 percent for the non-remedial group. At the conclusion of the study, 6.4 percent of the non-remedial group remained enrolled whereas 27 percent of the remedial group did. Thus, over the course of the study, students with a remedial background were more likely to post higher retention rates.

When data were disaggregated to the subcategories *Drop/transfer*, *Stop Out*, and *Persisted*, a clearer picture of each group's attendance pattern emerged. As indicated in previous paragraphs and by a margin of 20 percent, a higher percentage of students with a non-remedial background were more likely to have dropped or transferred to another institution over the course of the study. Unfortunately, with the dataset provided to the researcher, data could not be disaggregated further to determine whether students dropped or transferred. In either instance, they were no longer enrolled at CAC.

Students in the remedial group were twice more likely to stop out for at least one semester during the three-year period. However, a larger percentage of the remedial group persisted each semester over the duration of the six semesters than the non-remedial group, which aligned to findings reported by Bittinger and Long's (2005) study on remedial education in Ohio.

Conclusions for Research Question 4

Retention rates are difficult statistics to compute and unfair assessments of community colleges' overall success. As open-door institutions, community colleges accept students who exhibit a plethora of academic goals and abilities. For instance, some students fully intend to transfer to a four-year institution within a specific number of semesters, while others intend to take only an assortment of courses that do not lead to transfer or some credential. Findings from this question, coupled with the results of previous questions, suggested that while students with a remedial background were less likely to perform as well academically, they were more likely to persist. If transferring to other institutions explained why less non-remedial students persisted, then there was really lack for concern. However, the absence of data to measure either outcome was indeed cause for concern.

Because the requirement to enroll in one or more remedial courses generally prolongs the length of time to complete community college programs, finding that students with a remedial background were more likely to persist to the third year of the study was no surprise. However, finding that students with a remedial background were

more likely to persist from one semester to the next was a surprise. Nevertheless, previous studies that were cited in Chapter Two supported that same conclusion. Regardless of academic preparedness, the first semester appeared to be the most crucial for both groups. Further investigation is needed to determine precisely when and why so many students chose to depart during the first semester.

Research Question 5

Which select student characteristics best predict academic success in initial college-level course for students who took one or more remedial course?

The purpose of this question was to focus solely on the remedial group and to determine which student characteristics best predicted academic success in first college-level courses such as MAT141, MAT151, ENG101, and the most widely taken course with a RDG100 prerequisite, which turned out to be CIS120. Additionally, findings from this question also produced a model that allowed one to predict academic success based on student characteristics inputted for analysis. The set of variables used in this question were identical to research question three.

Major Findings

The variables that emerged as the most influential student characteristics were *REMGPA*, *CLC Visits*, *Residency*, and *Enrollment*. Of those variables, *REMGPA* was by far the strongest predictor of academic success in initial college-level courses. As mentioned previously, *REMGPA* equaled the computed grade point average for all

remedial courses taken by each student. As discovered in research question three, students with a remedial background were less likely to be successful in initial college-level courses when compared to students without a remedial background. However, findings in this question suggested that good remedial preparation gave remedial students the greatest advantage for academic performance in initial college-level courses. Other researchers such as Boylan (2002), McCabe (2000), Roueche, Ely, and Roueche (2001), and Bettinger and Long (2005) supported those findings.

The emergence of *CLC Visits* as the next best predictor of academic success in initial college-level courses was supported in Roueche, Ely, and Roueche's (2001) study on the Community College of Denver (CCD). In that study, college officials reported that substantial success in remedial education was mostly attributable to the implementation of a learning assistance center with a comprehensive approach to helping students achieve academic success in remedial courses. Results of this study demonstrated that students who visited the Cooperative Learning Center (CLC) on at least 20 different occasions were most likely to excel in remedial courses. Therefore, students at CAC would benefit from a program that encouraged or required students to attend workshops or tutoring sessions at the CLC on a regular basis.

As reported in the previous chapter, nearly one-fourth of the students who took at least one remedial course lived on campus. That statistic equaled four times the national figure reported by Saxon and Boylan (1999). Finding that *Residency* influenced academic performance in initial college-level courses for students with a

remedial background was not the best result for CAC, especially given that the relationship between the two variables was positive, which suggested that students who lived on campus were more likely to experience academic success. Although that finding related primarily to academic performance in initial college-level courses, it was interesting, nevertheless, because students who lived on campus were shown in research question three to be less likely to experience academic success in remedial courses.

Naturally, students who lived on campus had convenient access to academic services intended to assist them, which may explain why *Residency* positively influenced academic performance. Additionally, academic maturation and higher levels of social integration may explain why on-campus students improved academic performance in transition from remedial to college-level courses. Increasing the number of students who live on campus may be problematic for CAC, however, because only full-time students may live on campus and physical space is limited, and because the negative relationship between *Enrollment* and academic success in initial college-level courses indicated that students who attended CAC part time were least likely to experience success. That finding was supported by the results found in the Community College Survey of Student Engagement (CCSSE), which reported that full-time students demonstrated an academic advantage over part-time students (McClenney, 2006). Thus, further investigation is necessary to determine what variables influence students' decision to attend college full time or part time and address how to increase student's ability to enroll full time. The researcher posits that personal financial

situation and employment status would emerge as the greatest contributors to student decisions to attend full or part time.

Another major finding of this question was that certain student characteristics reported in other research and findings from previous research questions in this study suggested as exerting influence on academic performance did not emerge during analysis. For instance, in this study, although gender and ethnicity played a large role in determining need for remedial education, the two variables were somewhat insignificant influences on academic performance in initial college-level courses. As suspected, however, gender and ethnicity did negatively influence academic performance, which suggested that minority women were more likely to experience difficulty in initial college-level courses. Those findings aligned with conclusions reported by Roueche, Roueche, and Ely (2001) and McCabe (2000), which indicated that minority students exhibited higher need for remediation and lower rates of academic success in remedial and college-level courses.

Conclusions for Research Question 5

Discovering that *REMGPA* and *CLC Visits* emerged as the two most influential variables create opportunity for attainable improvement without necessity for major change. However, given that *Enrollment* and *Residency* were variables that also influenced academic outcome in initial college-level courses for students with a remedial background may prove to be more challenging to accommodate.

Recommendations for improvement in these areas will be the subject of subsequent sections.

One byproduct of the statistical analysis used to answer this question was the generation of a model that accurately discriminated between students who were academically successful and students who were not. Overall, the function accurately classified 72.5 percent of the cases in cohort with a remedial background. Specifically, the model correctly classified nearly 67 percent into the *Non Success* group and 75 percent into the *Success* group. On the cross-validated example, the model maintained its predictive strength. Although this model was more accurate at classifying students into the *Success* group, this model may be used in conjunction with other mechanisms to predict likelihood for success given selected student characteristics.

Research Question 6

Is academic success in exit remedial courses a predictor of academic success in initial college-level courses when the effects of select student characteristics are controlled?

The purpose of this question was to determine whether successful academic performance in MAT121, ENG100, and RDG100 served as a reliable predictor of success in subsequent, initial college-level courses. Additionally, if student characteristics from the previous research question emerged as influential variables for this question, then such an occurrence would strengthen the validity of findings from both questions. By holding all variables constant, except academic performance in exit

remedial courses, the analysis and thus the results focused solely on evaluating the effectiveness of remedial education.

Major Findings

MAT121 to MAT141. For the math subject area, MAT121 Intermediate Algebra was the exit remedial course before students chose either MAT141 College Mathematics or MAT151 College Algebra as their initial college-level math course. According to the findings reported in the previous chapter, academic performance in MAT121 was not a strong predictor of success in MAT141. Those findings were the result of multiple regression analysis using the stepwise method of entry for all variables. In fact, *Gender* emerged as the variable that was the greatest predictor of academic success in MAT141.

The relationship between *Gender* and performance in MAT141 was very strong and negative. Further exploration of that relationship showed that females were more likely to be successful in MAT141 after completing MAT121. Nearly 63 percent of males who took MAT121 were not successful in MAT141. Despite findings that MAT121 was not a strong predictor of success in MAT 141, crosstabulation was performed to analyze the relationship that existed between the two variables.

The results of crosstabulation supported the possibility that MAT121 was perhaps a stronger predictor of success of MAT141 than found during regression analysis. For instance, 80 percent of the students who earned a grade of C or higher in MAT121 were able to achieve similar levels of success in MAT141. Those findings

aligned with Boylan's (2002) research where nearly 77 percent of the students who were successful in terminal remedial courses were also successful in initial college-level courses. Additionally, 80 percent of the students who attempted MAT141 after failing or withdrawing from MAT121 were not successful.

MAT121 to MAT151. When initial multiple regression analysis was performed using the forced entry method of entering variables, *MAT121* emerged as the strongest positive predictor of academic success in MAT151. Thus, higher grades in MAT121 naturally translated to better performance in MAT151. Overall, the best predictor of satisfactory academic performance in MAT151 was *Enrollment*. Furthermore, the relationship between those two variables was negative, which suggested that students who were enrolled part time were less likely to succeed in MAT 151 after successful completion of MAT121. That finding, however, was not statistically significant. That *Enrollment* and *Residency* emerged as strong predictors of academic success for students matriculating from MAT121 to MAT151 was supportive of the findings from the previous research question.

Results from the crosstabulation between MAT121 and MAT151 solidified findings from regression analysis indicating that academic performance in MAT121 was indeed a predictor of success in MAT151. In their study of Community College of Denver, Roueche, Ely, and Roueche (2001) found that 75.6 percent of developmental students (students with remedial background) experienced subsequent success in college algebra. At CAC, the rates of academic success were higher, 81 percent of the

students who were successful in MAT121 were also successful in MAT151. McCabe (2000) reported similar findings in his study where 82 percent of developmental students were able to experience subsequent success in college algebra.

ENG100 to ENG101. When all of the variables were entered into regression analysis, the model was found not to be statistically significant at the .05 level and *Enrollment, Gender*, and *Residency* emerged as the most influential variables. Although ENG100 ranked fourth among the variables, it was the only statistically significant variable at the .05 level. However, when the stepwise entry method was used, ENG100 emerged as the greatest predictor of academic performance in ENG101. Furthermore, the positive directional relationship found between variables ENG100 and ENG101 indicated that higher grades in ENG100 translated into higher grades in ENG101.

Findings from the crosstabulation between ENG100 and ENG101 affirmed the results of regression analysis. Approximately 73 percent of the students who were successful in ENG100 were also successful in ENG101, which was slightly more than the 71.7 percent success rate reported by Roueche, Ely, and Roueche (2001), but substantially less than the 88 percent success rate reported by McCabe (2000). Because 58 percent of the students who failed or withdrew from ENG100 were able to experience success in ENG101 is cause for concern, and thus warrants further exploration.

RDG100 to CIS120. Because there was not a specific course in which RDG100 provided remediation, the most widely taken course with RDG100 as a prerequisite was

chosen as the typical route of matriculation. For obvious reasons, the selected course could not be ENG101, MAT141, or MAT151. Under those criteria, CIS120 Survey of Computer Information Systems emerged as the most widely taken course by members of the cohort.

As was the case with other analyses performed for this research question, the regression model was not statistically significant at the .05 level when forced entry was used as the method to enter the independent variables. However, *RDG100* and *Campus* emerged as variables that were independently statistically significant at the .05 level. Therefore, when the stepwise method was used to enter the variables into the regression model, discovering that *RDG100* and *Campus* were the only variables allowed to enter the model was not surprising. Nevertheless, academic performance in RDG100 was a reliable predictor of academic performance in CIS120. Because the relationship between those two variables was positive, students who performed well in RDG100 were most likely to perform well in CIS120. Given that *Campus* emerged as an influential variable and essentially suggested that whichever campus students enrolled in RDG100 affected academic performance deserves additional attention.

Crosstabulation analysis supported findings of regression analysis demonstrating that academic performance in RDG100 influenced performance in CIS120. For instance, 89 percent of the students who were successful in RDG100 were later successful in CIS120. None of the students who failed or withdrew from RDG100 and then attempted CIS120 were successful, another indication that performance in remedial

reading affected outcome in initial college-level reading courses. Those findings were similar to subsequent college-level course success rates reported by Saxon and Boylan (1999).

Conclusions for Research Question 6

In general, the findings for this research question were closely aligned to findings of studies previously performed and discussed in the literature review (Boylan, 2002; Saxon & Boylan, 1999; McCabe, 2000; Roueche & Roueche, 1999; Roueche, Ely, & Roueche, 2001). The most significant overarching conclusion that arose from the findings for this research question was that with the exception of the transition from MAT121 to MAT141, successful academic performance in exit remedial courses was the strongest predictor of success in initial college-level courses. Moreover, poor academic performance was also a predictor for poor academic performance in initial college-level courses as indicated by the results of crosstabulations. However, because so many students were able to succeed in ENG101 after either failing or withdrawing from ENG100, similar conclusions could not be drawn with comparable confidence for that particular transition.

Summary of Conclusions and Implications

The intent of this study was to examine the relationship that existed between remedial education, academic performance, and retention of students at Central Arizona College (CAC). The results of this study demonstrated that CAC was similar to many

institutions that researchers have studied in the past. Nevertheless, results also showed that CAC exhibited unique qualities related to remedial education. Similar to other institutions, ethnicity and gender played a significant role in determining who needed remedial education and how those students performed in remedial and initial college-level courses. At CAC, it was the traditional age, Black female with high level of financial need who was most likely to require remediation and to be considered "at-risk" once enrolled. Overall, minority students at CAC exhibited higher need for remediation and less academic success in remedial and initial college-level courses. Because CAC is located in the seventh fastest growing county in the United States and given that minority populations are outpacing Whites, numerous implications exist (Christie, 2006).

Perhaps the most significant implication is that Pinal County is located in the southwestern region of the United States where the Hispanic population is proportionately higher than other regions in this country. As mentioned in the literature review, Hispanics and Blacks are the fastest growing minority populations in the U.S. and are expected to nearly double in population size within 50 years. Thus, CAC should expect a large influx of minority students, particularly Hispanics, over the next several years. As the number of minority students increases, this study and previous research indicate that demand for expanded services related to remedial education will also increase.

Age also was a factor that emerged as a significant characteristic for CAC students in remedial education. Although the average age of the cohort was 32 years, the average age of students in remedial education was considerably lower at 22 years. That more than half of all remedial students were traditional age also has implications for CAC. Recently, one study reported that this year's high school freshman class is the largest class ever in Pinal County ("Research and Evaluation," 2006). Therefore, CAC should once again expect increasing demand for remedial education and all of the services associated with it as that cohort eventually enters college.

Enrollment status played a role in determining need for remedial education and academic performance in initial college-level courses. That is, students who were enrolled part time were less likely to require remedial education and more likely to succeed in remedial courses than did full-time students. This is both good news and bad news for CAC. The goods news is that the proportion of part-time students attending CAC is much higher than full-time students. The bad news, however, is that expected enrollment growth is most likely to come from traditional age students; and traditional age students are more likely to enroll full time, according to cohort data. Thus, increased demand for academic services such as tutoring and advising for remedial students should be expected to increase for CAC over the next several years.

As reported in previous research, the first semester proved to be crucial for the cohort regardless of remedial background (McClenney, 2006; Pascerella & Terrenzini, 2005). Given that students with a remedial background returned for the spring 2003

semester at twice the rate of students without a remedial background suggested that CAC should not only do more to improve retention for remedial students but investigate why so many non-remedial students fail to return each semester. That such a high percentage of remedial students returned for the spring semester was not unusual—McClenney (2006) found similar results in her study of Achieving the Dream institutions.

Deciding whether remedial education at CAC "works" is difficult and depends largely on the context in which such a decision is made. For instance, comparing the performance in initial college-level courses of students with a remedial background to students without a remedial background demonstrated that by a slight margin, students without a remedial background outperformed students with a remedial background in initial college-level courses. That finding did not align with the results of previous research reported by Saxon and Boylan (1999) and Roueche, Ely, and Roueche, (2001) who both found that students with remedial backgrounds performed better than or as well as students without remedial backgrounds.

From the perspective of academic performance in exit remedial courses compared to initial college-level courses yields findings that might lead one to conclude that remedial education works at CAC. In all but the transition from MAT121 to MAT141, academic performance in exit remedial courses was the single best predictor of academic performance in initial college-level courses. Of the three remedial subjects, reading appeared to prepare students better for initial college-level courses.

Because students in the cohort exhibited difficulty passing math and English college-level courses, regardless of their academic preparedness, credibility is given to the notion that math and English continue to be "gatekeeper" courses for community college students as identified by some researchers (Boylan, 2002; McCabe, 2000; Roueche & Roueche, 1999). Researchers referred to college-level English and math courses as gatekeeper courses because students commonly fail to progress and eventually complete credentials after attempting those courses. Approximately one-fourth of students in the cohort were not successful in college-level math and English.

The above conclusions and implications lend themselves to discussion for solutions and additional research. The following sections include recommendations for further research and strategies that CAC and other institutions may consider implementing to improve their institution's remedial program.

Recommendations for Further Research

In the research question conclusions sections, some recommendations for further research were mentioned briefly. Those were areas where the research question had been answered sufficiently, but the researcher desired to learn more about whatever particular topic was discussed. The subsequent sections discuss in more detail those previously mentioned areas for further research. Although the following recommendations for further research are related specifically to CAC, they may be generalized to other institutions as well.

Recommendation 1: Cut Scores

Cut scores were defined in this study as pre-determined ranges where student assessment scores were used to enroll students in appropriate courses. Similar to many institutions, CAC developed their cut score ranges based on input from surrounding institutions, ACT, and feedback from professors. Institutions are seldom aware of how effective their cut score ranges are when enrolling students. Therefore, the researcher recommends additional research on the effectiveness of cut scores in accurately placing students into remedial and college-level courses. The objective of the research would be to identify the institution with proven methods for student placement and use that institution as a benchmark or model institution.

Recommendation 2: Traditional Age Students

Similar to many institutions, CAC disproportionately enrolls traditional age students into remedial courses. In fact, many of those students have completed high school as recently as the semester prior to the start of their college career. As a matter of opinion, students who recently finished high school are the group who should be least likely to require remediation. Therefore, additional research that attempts to uncover why so many students arrive academically underprepared for college-level work is needed. Findings of that research may help to mitigate the number of students who require remediation by pinpointing specific populations or student characteristics that are prone to exhibit academic deficiencies.

Recommendation 3: Ethnicity

CAC enrolls higher than average proportions of minority students into remedial courses based on national studies (McCabe, 2000; Saxon & Boylan, 1999). Further research is needed to determine precisely when in the educational careers of minority students they begin to lag behind their White counterparts. Additionally, further research may also provide a group of common characteristics that appear to hinder the academic progress of minority students. Those findings may identify characteristics specific to each minority group, which is where most large-scale studies fall short. That is, minorities tend to be lumped rather than disaggregated in remedial education studies.

Recommendation 4: Effects of Modality, Scheduling, and Size

One of the important factors that this study did not consider during analysis was the various modalities used to deliver remedial education by CAC instructors. In fact, recent research describing how course modality affects student academic performance in remedial courses was virtually non-existent. Moreover, research on how times and days of when courses are scheduled affects academic performance was also limited. Thus, further research in those two areas is recommended.

CAC currently offers remedial courses in various formats; students may enroll in online, interactive television (ITV), hybrid (a combination of any of the other offerings), and, of course, traditional face-to-face courses. Further research on how professor's level of experience and full-time or part-time status possibly affects academic student performance in remedial courses is also recommended. Findings from that research, for

example, may indicate that online delivery by veteran part-time instructors is most effective for remedial English. Institutions may then use those findings to develop schedules that address student needs and to determine where professional development for faculty and staff would be most effective.

Community colleges often boast of their small class sizes compared to four-year colleges. However, limited research was available to substantiate community college's claim that smaller is indeed better. Lower teacher-to-student ratios are the goal for most institutions, but at what point does maximization occur? In other words, further research may provide the ideal class size for remedial courses where maximum academic performance is achieved.

Recommendation 5: Other Student Characteristics

Numerous student characteristics were used in this study, but were selected mainly because data were available for only those characteristics. Therefore, in addition to characteristics used in this study, many other important variables need to be explored as well. For example, level of parent education, detailed financial position, high school grade point average, employment status, existence of mentoring relationships, and grades in high school courses by subject area are several student characteristics or conditions that inform decisions regarding effectiveness of remedial education.

Recommendation 6: Qualitative Analysis

This study was strictly quantitative in nature. Studies that include a qualitative perspective and address research questions similar to the questions used in this study are recommended for further research. Allowing instructors and students to offer input may yield insight that quantitative analysis cannot fully provide.

The aforementioned recommendations for further research, if pursued, complement the findings of this study. The following section outlines strategies that CAC and institutions with similar populations may implement to improve their remedial programs.

Strategies for Central Arizona College and Similar Institutions

After completing this study, the researcher identified strategies that other studies have recognized as "best practices" for remedial education programs (Boylan, 2002; Grubb, 2001; Roueche & Roueche, 1999; Roueche, Ely, and Roueche, 2001; McCabe, 2000). The strategies discussed below were not randomly selected—they had to meet certain criteria. Primarily, the strategies had to relate to findings of this study. That is, strategies were recommended if the results of this study exhibited that either CAC completely lacked the recommended strategy or displayed need for improvement with that particular strategy. Strategies are organized according to the following categories: (a) institutional philosophy and practices, (b) evaluation, (c) institutional outreach, (d) program components, and (e) instructional practices related to remedial education.

Institutional Philosophy and Practices

Centralization. CAC currently manages remedial education under the decentralized model that Boylan (2002) described as programs where little or no coordination occurs between departments that offer remedial courses. Decentralized programs also lack designated personnel to oversee remedial programs. Before efforts to improve remedial education practices at CAC are implemented, college officials must consider adoption of the centralized model for remedial education. Research has repeatedly demonstrated that centralized developmental programs achieve higher levels of success compared to decentralized programs (Grubb, 2001, Roueche & Roueche, 1999). Restructuring the organizational chart may be a necessary task in order to achieve centralization.

The greatest attribute of the centralized model is the opportunity for high levels of coordination and communication between people and departments. However, in the event that CAC cannot fully centralize its remedial program, then efforts to increase coordination between key individuals must be made. One way that some colleges increase coordination is through the creation of an advisory council.

Advisory council. A remedial education advisory council made up of professors, business members, public school officials or teachers, learning assistance center staff, and students can provide guidance necessary for continuous program improvement. A subcommittee of the advisory council that consists entirely of full-time and adjunct professors who teach remedial courses should be formed and required to meet regularly.

The committee would meet to discuss student progress, identify and attempt to solve common problems, and to provide professional support by sharing personal triumphs and failures and difficulties in the classroom. With leadership from the coordinator for remedial education, the advisory council could also assume an active role in the evaluation of the program.

Evaluation

Benchmarking. After centralizing its remedial program or committing to improve coordination efforts among those involved in remedial instruction or academic assistance services, the college should identify at least one institution that has already achieved high levels of success with similar student populations. CAC could employ select components from identified institutions to redesign its own remedial program. Teams could visit those institutions to witness firsthand the practices utilized and to speak with personnel responsible for the model remedial program. Once modifications are fully made, comprehensive evaluations will be needed to continue to improve the college's remedial education program.

Formative evaluation. According to Boylan (2002), formative evaluation is the key to improvement for remedial courses and academic services. Professors and staff who are directly involved with students in remedial courses are best suited to perform this type of evaluation. Boylan (2002) suggests that institutions establish baseline data before beginning formative evaluation. Baseline data can be obtained by finding average values of any outcomes for the previous three years. If data signifies drops in

any area where baseline data has been collected, then the college knows specifically where to improve.

Summative evaluation. This type of evaluation is used to determine the effectiveness of remedial programs through measure of objectives and outcomes—much like this study (Boylan, 2002; Grubb, 2001). Grubb (2001) warns that when performed alone, summative evaluation often produces shortsighted results. However, when used in conjunction with formative evaluation coupled with feedback from advisory committees, informed decisions can be made that guide an institution's remedial program.

Data collection and dissemination. Data collection is a cumbersome task, but necessary for many different reasons to institutions. How data is disseminated is equally challenging for many institutions. CAC must streamline data collection techniques, but most importantly, must make results easily accessible to decision makers on campus. Current practices at CAC are effective and mostly accurate, but require much time and effort on the part of requestor and programmers to acquire data. Once data become available to decision makers, institutional research staff should provide professional development for remedial program faculty and staff to demonstrate how to effectively use data to inform decision-making and evaluate program efficacy.

Institutional Outreach

Early testing. As with other studies cited within this study, traditional age students at CAC were found to need remediation at levels disproportionate to non-

traditional students, which meant that students who recently graduated from high school were not ready for college-level work. An immediate practice that CAC can implement is early assessment testing. In cooperation with high schools within Pinal County, CAC can assess college readiness of high school students at the end of their sophomore or junior year. If students demonstrate that they are indeed prepared for college-level work, then this becomes an excellent recruiting tool for getting a jump-start on their college career. On the other hand, if students find that they are not prepared, then early testing acts as an early-detection mechanism. By realizing early on that they are not prepared for college, students still have the time necessary in high school to overcome their academic deficiencies before entering college.

Students arriving prepared for college-level work are a benefit to the institution and the student. For students, time and money are saved. In some instances, students must spend up to three semesters in college before they have the ability to enroll in college-level courses. For the institution, when students arrive to campus ready for college-level courses, funds that are spent to provide remediation and academic services become freed up for entrepreneurial activities or academic enrichment.

Expand Interactive Television. CAC currently has ITV infrastructure in place that is not utilized to its fullest capabilities. This strategy is tied to the previous strategy in that a mechanism exists to deliver college-level courses to high school students on their respective campuses. Through ITV, courses can be taught from CAC or some

other location such as a high school and then be transmitted to every participating high school within the county or state with relative ease.

Through use of ITV, CAC expresses a commitment to improving surrounding communities by providing a college curriculum to students who do not have to leave their respective campuses. Additionally, CAC expands funding capacity by generating low-cost, full-time student equivalency (FTSE), a factor used by the state legislature to determine levels of appropriations.

Expand P-16 efforts. CAC has collaborated with public schools within the county in the past to improve the transition from public school to higher education. However, a concerted and comprehensive effort to ensure seamless transition from preschool to CAC has never fully materialized. Research suggested that institutions with P-16 initiatives were more likely to improve the quality of education and increase the number of college-ready students (Merisotis & Phipps, 2000). Because CAC has the staff and resources necessary to facilitate the alignment of curriculum in math, reading, and writing from kindergarten to twelfth grade within Pinal County, they must also be the entity to initiate the endeavor.

The idea behind this and the two previous strategies is reducing the need for remedial education prior to college entrance. Implementing such strategies permits CAC to reach out and help students arrive on campus prepared for college-level work upon high school graduation, a win-win situation for all invested parties.

Program Components

Supplemental Instruction. One of the prescribed attributes of centralizing remedial education is to involve learning assistance centers on campus (Boylan, 2002; Roueche and Roueche, 1999). Fortunately, CAC has the Cooperative Learning Center (CLC), an established center where students receive free tutoring in most subject areas. Through use of supplemental instruction (SI) and learning assistance centers such as the CLC, some institutions have achieved high levels of success with remedial and non-remedial students alike (Ogden, Thompson, Russell, & Simons, 2003; Wright, Wright, & Lamb, 2002). Additionally, institutions increased levels of retention and persistence rates as a result of using SI.

SI involves the use of peer tutors who work closely with instructors to design sessions that students in remedial or regular courses volunteer to attend. Professors generally recruit SI leaders directly from the class where other students struggle to learn the material. Based on instructor's recommendation, the SI leader may re-teach specific areas, assist with homework, or help to prepare students for quizzes and exams. Researchers attribute success of SI to improve academic performance and retention rates to Tinto's theories that both social and academic integration into institutions of higher learning impact student persistence (Ogden, et. al, 2003). That is, SI sessions become another avenue for students to integrate themselves into the institution socially and academically with the added benefit of learning material again.

Placement tools and cut scores. One of the first actions that CAC should take to modify the college's remedial program is to examine existing cut scores. This study found that only 25 percent of the students required remediation, which was proven not to be an anomaly when compared to previous and subsequent cohort percentages. CAC should elicit the assistance of ACT, which creates and maintains the COMPASS placement exam used by the college. ACT provides the ACT Compass/ESL course placement service to analyze cut scores, which allows institutions to validate current cut scores, select new cut scores, or study local placement test scores.

Creative funding. Because the proportion of funding from state and local appropriations continue to dwindle despite rising demand for higher education, creative sources of funding must be sought to meet needs. CAC should pursue grant efforts that support improvement to remedial education and learning assistance centers. Given CAC's large minority population, grants that provide resources to assist those special populations in higher education should be readily available.

Institutional Policy

This study demonstrated that students who were enrolled full-time and lived on campus achieved higher levels of success and retention. Therefore, CAC should concentrate efforts on means to get more students to live on campus. Research has also shown that students who live on campus are more likely to engage and, therefore, are more likely to integrate into the institution, which increases academic performance and retention (Astin, 1993; Tinto, 1993). As more rooms are available for students to live

on campus, the college should consider policy that allows part-time students to live on campus. One stipulation of this policy could be that part-time students who live on campus must work on campus up to 19 hours per week. Considering that the average age of students at CAC is approximately 32 years, the college may even consider adding affordable family housing units on campus.

Conclusion of Study

Underneath the title of this chapter was placed a simple and direct quote that read, "Remediation in higher education is a multifaceted problem" (Roueche & Roueche, 1999, p. 7). That statement suggests that traditional methods of fighting remedial education primarily in the classroom are no longer a viable option for improving remedial programs. Thus, any attempt to solve problems associated with remedial education must include a multifaceted approach. As institutions begin to address issues related to remedial programs, two overarching goals must be set: first, reducing need for remediation; and second, improving current remedial programs.

The findings in this study demonstrate that the relationship between remedial education, academic performance, and retention is complex and gives a daunting impression of attaining those goals listed above. However, research has proven that even minimal efforts to improve remedial education correlate directly with increased academic performance, student retention, and reduced need for remediation, which places CAC and similar institutions at the crossroads of opportunity and inactivity.

Fortunately, this study has delineated the facts and strategies that enable CAC to take the high road of opportunity. With the rapidly changing economic and demographic conditions of the county in which the college is situated and the data presented in this study, CAC cannot ignore its moral obligation to better serve the academically underprepared.

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VITA

Steven Ray Gonzales was born to Ray and Frances Gonzales on February 26, 1973 in Sierra Vista, AZ. He moved to Coolidge, AZ at a very young age and attended K-12 in the Coolidge Unified School District. After earning his high school diploma from Coolidge High School, in 1991, he entered Northern Arizona University. In the spring semester of 1996, he received a Bachelor of Science in Secondary Education - Mathematics. Steven returned to his high school alma mater to teach math and coach wrestling.

Steven taught high school math for the next two years and in 1998 was hired as the Developmental Education Specialist for Mathematics at Central Arizona College located in Coolidge, AZ. During that same year, he entered graduate school at Northern Arizona University. In 2000, he earned a Master of Arts in Teaching Mathematics. Steven became a full math professor at CAC later that year.

For the subsequent five years, Steven continued to teach various math courses and helped form a peer-mentoring program at CAC. In the spring of 2004, he was recognized as an outstanding community college professor by CAC and the National Institute for Staff and Organizational Development (NISOD). He was bestowed with the George Fridell Teaching Excellence Award and the NISOD Excellence in Teaching Award. He began exploring doctoral studies at Arizona State University by enrolling in courses in the fall 2003 and spring 2004 semesters. In the fall of 2004, Steven was accepted to The University of Texas at Austin in the Community College Leadership

Program. While at the University of Texas, Steven received the University Preemptive Fellowship Award and completed his doctoral studies with Distinction.

In spring 2007, Steven was promoted to Associate Dean of Academic Services for Central Arizona College's Signal Peak Campus. Steven is married to Jenni, and has a son, Austin Ray, and a daughter, Jenna Rae whom all have become devout Longhorns.

Permanent address: 930 S. Picacho St., Coolidge, Arizona 85228

This treatise was typed by the author.