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Examining Retention and Academic Success Among Community College Developmental Algebra I Students

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EXAMINING RETENTION AND ACADEMIC SUCCESS

AMONG COMMUNITY COLLEGE DEVELOPMENTAL ALGEBRA I

STUDENTS

by

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ABSTRACT

EXAMINING RETENTION AND ACADEMIC SUCCESS
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An increasing number of community college matriculants enter college needing remediation in mathematics. This study examined factors that may affect student retention and academic success in a developmental Algebra I course at a community college, including demographic variables, life demand variables, pre-enrollment academic characteristic, self-regulated learning characteristics, and instructional methodology.

The study ran for two consecutive semesters and included 154 participants. Self-report measures were used to gain demographic information and information about students' beliefs about math and their self-regulated learning characteristics at the beginning of the semester. An elementary algebra pre-test was administered at the beginning of the semester with an elementary algebra post-test administered during the final week of the semester. A variety of measures were used to analyze the data: descriptive analysis, logistic regression, multiple regression, chi-square analysis, and ANCOVA.

Several results of the study were contrary to the hypotheses. Results indicated that of the demographic variables, noncognitive variables, and high school grade point average (GPA), only age and GPA may be predictors of retention in developmental Algebra I; none of the variables showed a statistically significant relationship with success. There were no statistically significant relationships for students' beliefs about

math or their self-regulated learning characteristics with retention and success. Results indicated that statistically significant differences exist in both retention and success as a result of instructional methodology.

The contrary findings may be attributed to the constructs and/or instruments used to measure the constructs or to the research design. Further research is needed.

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TABLE OF CONTENTS

Page

LIST OF TABLES vii

CHAPTER

I. INTRODUCTION 1
DEFINITION OF DEVELOPMENTAL EDUCATION 2
RESEARCH PROBLEM 3
PURPOSE OF THE STUDY 4
SIGNIFICANCE OF THE STUDY 4
RESEARCH QUESTIONS 6
METHOD 6

II. REVIEW OF LITERATURE 9
THEORIES OF COLLEGE STUDENT ADJUSTMENT, RETENTION AND SUCCESS 9
RESEARCH RELATED TO COMMUNITY COLLEGE POPULATION 13
DEMOGRAPHIC CHARACTERISTICS 15
AGE 15
GENDER 17
LIFE DEMANDS 18
ENROLLMENT STATUS 18
EMPLOYMENT STATUS AND DEPENDENTS 20
PRE-ENROLLMENT CHARACTERISTICS 22
SELF-REGULATED LEARNING CHARACTERISTICS 23
STUDENTS' BELIEFS AND MOTIVATIONS IN DEVELOPMENTAL MATH 29
INSTRUCTIONAL METHODOLOGY 33
RESEARCH QUESTIONS 38
HYPOTHESES 39
QUESTION 1 39
QUESTION 2 40
QUESTION 3 40
SUMMARY 40

III. METHOD 43
SETTING 43
PARTICIPANTS 44
PRELIMINARY ANALYSIS 49
COURSE DESCRIPTION 53
MEASURES 53
INDEPENDENT VARIABLES 54

CHAPTER Page

SELF-REPORT INFORMATION SHEET 54
INDIANA MATHEMATICS BELIEFS SCALES 55
LEARNING AND STUDY STRATEGIES INVENTORY 56
DEPENDENT VARIABLES.. 58
ASSET 58
RETENTION 59
DATA COLLECTION PROCEDURE.. 59
DATA ANALYSIS PROCEDURE 64

IV. RESULTS 65
OVERVIEW 65
PRESENTATION OF RESEARCH FINDINGS 65
RESEARCH QUESTION 1 65
STEP 1: PEARSON PRODUCT-MOMENT CORRELATIONS 66
STEP 2: LOGISTIC REGRESSION AND MULTIPLE REGRESSION ANALYSES 69
RESEARCH QUESTION 2 75
STEP 1: PEARSON PRODUCT-MOMENT CORRELATIONS 75
STEP 2: LOGISTIC REGRESSION AND MULTIPLE REGRESSION ANALYSES 79
RESEARCH QUESTION 3 81
CHI-SQUARE ANALYSIS 82
ANALYSIS OF COVARIANCE 83

V. DISCUSSION 87
OVERVIEW 87
DISCUSSION OF RESEARCH FINDINGS 87
RESEARCH QUESTION 1 87
RESEARCH QUESTION 2 90
RESEARCH QUESTION 3 95
IMPLICATIONS FOR RESEARCH AND PRACTICE 97
LIMITATIONS 99
GENERALIZABILITY OF FINDINGS 99
RESEARCH DESIGN 100
RECOMMENDATIONS FOR FUTURE RESEARCH 101
LIMITATIONS 101
RECOMMENDATION 1 102
RECOMMENDATION 2 102
RECOMMENDATION 3 102
RECOMMENDATION 4 103
CONCLUSION 103

CHAPTER Page

REFERENCES 104

APPENDICES
A. COURSE PLAN FOR MTH 03 (LECTURE) 119
B. COURSE PLAN FOR MTH 03 (MEDIATED LEARNING) 126
C. STUDENT INFORMATION SHEET 136
D. INDIANA MATHEMATICS BELIEFS SCALES 138
E. LEARNING AND STUDY STRATEGIES INVENTORY 140
F. ASSET TEST FORM B2 142
G. ASSET TEST FORM C2 144
H. PRESIDENT'S LETTER 146
I. INFORMED CONSENT FORM 148

VITA 150

LIST OF TABLES

Table Page

1. Independent and Dependent Variables with Corresponding Measures 8
2. Age of Participants by Semester 45
3. Demographic, Life Demands, and Pre-Academic Characteristics Data for Participants...46
4. Group Differences for Fall Semester Participants and Spring Semester Participants for Mean Scores on Continuous Variables 50
5. Group Differences for Participants in Traditional Lecture Sections and Participants in Computer-Assisted Instruction (CAI) Sections for Mean Scores on Continuous Variables..52
6. Group Differences for Retained Participants and Non-Retained Participants for Mean Scores on Continuous Variables 63
7. Intercorrelations for Demographic Variables, Life Demand Variables, Pre-Enrollment Academic Characteristic Variable, and Retention 67
8. Intercorrelations for Demographic Variables, Life Demand Variables, Pre-Enrollment Academic Characteristic Variable, and Success 68
9. Summary of Logistic Regression Analysis of Demographic, Life Demand, and Pre-Enrollment Academic Characteristic Variables for Predicting Retention 71
10. Unstandardized Regression Coefficients for Regression of Demographic Variables, Life Demand Variables, Pre-Enrollment Academic Characteristic Variable, and Self-Regulated Learning Characteristics Variables on Success......73
11. Means, Standard Deviations, and Intercorrelations for Self-Regulated Learning Characteristics Variables and Retention 77
12. Means, Standard Deviations, and Intercorrelations for Self-Regulated Learning Characteristics Variables and Success 78
13. Summary of Logistic Regression Analysis of Self-Regulated Learning Characteristics Variables for Predicting Retention..80
14. Distribution of Participants by Instructional Method and Retention Status 83

Table | Page

15. Pre- and Post-test Mean Scores, Standard Deviations, and Adjusted Mean Scores as a Function of Method of Instruction 85

16. Analysis of Covariance of Post-test Scores as a Function of Method of Instruction, With Pre-test Scores as Covariate 86

CHAPTER I

INTRODUCTION

Recent literature suggests that an increasing number of community college, college, and university matriculants are academically underprepared for college success. Correspondingly, post-secondary institutions increasingly provide remedial courses as a bridge between entry academic skills and the learning skills required for success with regular coursework. For example, Wirt et al. (2004) indicate that 28% of beginning first-year college students enrolled in remedial courses and that 42% of students entering public two-year college enrolled in remedial courses in fall 2000. Of the institutions offering remedial education, 63% of the public 2-year institutions reported that students average a year or more in remedial courses.

Among community college learners, the need for remedial instruction is well documented. Community colleges provide the largest number of developmental programs as they are open access institutions serving more than 11 million people each year (Boylan, 1997). At these institutions, 41% to 63% of new students required remedial education in some area of academic study (Lewis & Farris, 1996; McCabe, 2000; Venezia, Kirst, & Antonio, n.d.). In turn, most community colleges place increased emphasis on remedial course offerings. In fact, over 95% of two-year institutions offer remedial education in the basic skills areas of reading, writing, and mathematics (Lewis & Farris, 1996; McCabe, 2000). Of these three areas, community colleges provide significantly more remediation in the area of mathematics than in the areas of reading or writing (Lewis & Farris, 1996), and mathematics is the greatest challenge for underprepared students (McCabe, 2000). Of the students who began their postsecondary education in community colleges during the 1990s, 44% of them had not taken math at a level as high as Algebra II in high school (Adelman, 2005). In this way, community colleges attempt to provide a successful first step for underprepared learners as they enter higher education (Rooney, 2003).

Definition of Developmental Education

The extant literature refers to both "remedial" and "developmental" coursework, and these terms often appear to be used interchangeably (Boylan, 1995; Casazza, 1999; Higbee, n.d.; Kozeracki, 2002). Early uses of the term "remedial" focused on student deficiencies and advocated a practice of correcting these academic deficiencies of students. Proponents of the term "developmental," however, describe the courses from a more holistic approach, incorporating human development theories that consider a variety of factors influencing student success, such as motivation, self-confidence, attitudes, and study habits (Boylan, 1995; Casazza, 1999; Chickering, 1969; Erikson, 1968; Higbee, n.d.; Kozeracki, 2002).

For purposes of this study, the term "developmental" was used to characterize the math courses studied because they approach student success from a broader perspective. This language is congruent with the institution's descriptions, follows from the field's assumptions about developmental courses, and seems to describe more closely the courses as offered. For example, Casazza (1999) identifies four assumptions distinguishing developmental work from remediation: (1) Developmental education is a comprehensive process; (2) developmental education focuses on the social and emotional development as well as on the intellectual development; (3) developmental education believes that learners have talents and that it is the responsibility of educators to find those talents and help students build on them; and (4) developmental education is not limited to only the basic competencies or to one level of learning. The courses examined follow these assumptions because they address remediation as only one aspect of a much more complex and integrated process.

Research Problem

New River Community College (NRCC), a two-year public institution operating as part of the Virginia Community College System, offers developmental courses "designed to prepare people for admission to college transfer and occupational/technical courses of study in the community college. These courses are designed to assist the person with basic skills and knowledge needed to succeed in other community college programs" (New River Community College, 2004, p. 11). An analysis of five-year (fall 1998 through spring 2003) enrollment data at NRCC showed that the total number of developmental students made up approximately 15% to 16% of enrollment during the fall semesters and 11% to 12% during the spring semesters. Sixty-one percent of the developmental enrollments were in math classes (Wynn, Conner, Lockard, & Smolova, 2004b). NRCC data (Wynn, Conner, Lockard, & Smolova, 2004a) also showed that for the college as a whole, the success rate, determined by the number of students who complete the course with a grade of "S" ("Satisfactory"), is the lowest for developmental math. This review of data revealed a 52% success rate overall for developmental math students from fall 1998 through spring 2003.

NRCC offers seven levels of developmental math, ranging from basic arithmetic to developmental trigonometry. Most enrollments are in Algebra I (MTH 03). This course is a prerequisite for students who do not meet placement guidelines for university-parallel math courses or for certain math courses required in the occupational-technical areas, such as architecture specialization, computer-aided drafting and design, electrical engineering technology, electronics technology, instrumentation, or networking specialization (New River Community College, 2004). From the fall 1998 to fall 2004 semesters, 2,194 students enrolled in MTH 03 during the regular academic year (fall or spring semesters); of these, 1,095 students completed the course successfully (grade of "S") for a success rate of 49.9% (*Distribution of MTH 03 Grades*, 2005).

Purpose of the Study

The purpose of this research was to examine the factors that affect student retention and academic success in a developmental Algebra I course at a community college, including basic demographic variables of age and gender; life demands of enrollment status, employment status, number of dependents; and the pre-college academic characteristic of high school GPA; self-regulated learning characteristics; and the mode of course delivery.

Significance of the Study

Growing issues of accountability at both the national and state levels require institutions to examine more closely their effectiveness in educating students (Ewell & Boyer, 1988; Guskin, 1997). Although developmental education has been a component of American higher education since its beginning, most of the organized research regarding its practices has appeared only in the last three decades (Boylan & Saxon, 1999). An extensive review of the last 30 years of literature revealed approximately 600 books, articles, and technical reports, approximately 200 of which could be considered strong research studies (Boylan & Saxon, 1999). Researchers in the field advocate more empirical research and more systematic approaches to studying developmental programs (Boylan & Bonham, 1992; Boylan & Saxon, 1999; Grubb, 2001; Kozeracki, 2002; McCabe, 2000; Spann, 1996).

McCabe (2000) conducted a comprehensive national study of remedial education in community colleges and found that only 43% of community college remedial education students actually completed their programs of study successfully. He also cited mathematics as the greatest hurdle for these students with 62% of developmental students showing deficiencies in math. McCabe further contended that students' successful completion of developmental education is the best gauge of the program's effectiveness. Two of his findings from this national study provide specific justification for examining the factors that affect student retention and success in developmental math:

- Successful remedial education students experience positive life developments after completing a remedial program.
- Following successful remediation, underprepared students do as well in college-level courses as do students who entered college academically prepared. (p. 52)

The Virginia Community College System (VCCS) as a whole has adopted *Dateline 2009*, a statement of and commitment to seven strategic goals, for moving the VCCS to a "world-class" status by the year 2009. Two of these goals specifically address issues related to student retention and success:

- To expand its capacity and provide greater economic opportunity, by 2009, the VCCS will rank in the top ten percent in the nation with regard to:
    - Graduation rates
    - Retention rates
    - Job placement rates

- The VCCS will triple the number of graduates who successfully transfer to four-year institutions. (Virginia Community College System, 2004)

An important strategy for accomplishing these goals at both a system level and institutional level is to identify factors that impact student retention and success so that appropriate interventions may be implemented to ensure students remain enrolled and succeed in achieving their educational goals.

Research Questions

This study asked three research questions about student retention and academic success in a developmental Algebra I course at New River Community College. The first question focused on the demographic characteristics of students; the second focused on the self-regulated learning characteristics of students; the third focused on the instructional methodology used in the classroom. The three questions are:

1. To what degree do (a) age and gender, (b) life demands, and (c) high school grades predict retention and success in a developmental Algebra I course?
2. To what degree do learners' (a) beliefs about math and (b) academic self-regulation predict retention and success in a developmental Algebra I course?
3. What differences exist in (a) retention and (b) academic success in developmental Algebra I courses as a function of enrollment in lecture versus computer-assisted formats?

Method

Two types of data were collected for this quantitative study in order to examine factors that may affect student retention and academic success in a developmental Algebra I course at a community college: self-reported data and pre-test/post-test scores. The study used self-reported data to examine the degree to which demographic characteristics and self-regulated learning characteristics predict student retention and academic success. The self-reported data included age and gender extracted from the student's record in the student information system and used a student information sheet for enrollment status, employment status, number of dependents, and high school grade point average. The study used the Indiana Mathematics Beliefs Scales (Kloosterman & Stage, 1992) to examine students' beliefs about learning mathematics and used the Learning and Study Strategies Inventory (Weinstein, Palmer, & Schulte, 2002) to examine students' metacognitive behaviors. The study used pre-test/post-test scores to determine if there were differences in student retention and academic success as a function of the instructional methodology. The study's variables and measures are summarized in Table 1.

Students were not randomly assigned to sections, and there was not a control group and a treatment group. Rather, students self-selected a particular class section, and the reasons they selected a particular section are not necessarily known. Times for the classes were indicated in the class schedule along with the type of class (lecture vs. computer-assisted instruction). This nonexperimental, quantitative study used descriptive, correlational, and comparative methods to analyze the data.

Table 1

Independent and Dependent Variables with Corresponding Measures

Variable	Measure
	Independent Variables
	Demographics
Age	Student Record
Gender	Student Record
	Life Demands
Student Status	Self-report Information Sheet
Employment Status	Self-report Information Sheet
Number of Dependents	Self-report Information Sheet
	Pre-Enrollment Academic Characteristics
High School Grade Point Average	Self-report Information Sheet
	Self-Regulated Learning Characteristics
Difficult Problems	Indiana Mathematics Beliefs Scales (IMBS)
Steps	IMBS
Understanding	IMBS
Word Problems	IMBS
Effort	IMBS
Concentration	Learning and Study Strategies Inventory (LASSI)
Self-Testing	LASSI
Study Aids	LASSI
Time Management	LASSI
	Instructional Methodology
Traditional Lecture	
Computer-Assisted Instruction	
	Dependent Variables
Retention	Enrollment Status
Success	ASSET (Pre-test/Post-test Scores)

CHAPTER II

REVIEW OF LITERATURE

This literature review begins with an introduction to the college-student-adjustment construct as it impacts student retention and academic success among college students generally. A more specific discussion follows, describing how demographic and self-regulated learning characteristics affect student retention and academic success for community college and underprepared math students. The chapter concludes with a review of the literature concerning computer-assisted instruction as a mode of course delivery as this methodology is being used more frequently for underprepared math students.

Theories of College Student Adjustment, Retention and Success

The extant literature includes several well-established theories and models of student development and student adjustment and their interactions with and influence on student retention and success (Astin, 1984, 1993; Banning, 1989; Chickering, 1969; Chickering & Gamson, 1987; Chickering & Reisser, 1993; Levitz & Noel, 1989; Pascarella & Terenzini, 1991; Terenzini, Pascarella, & Blimling, 1999; Tinto, 1975, 1993; Upcraft & Gardner, 1989). For example, Chickering's (1969) early theory as well as the subsequent revision by Chickering and Reisser (1993) focuses on identity development of students, tying together intellectual, emotional, interpersonal, and ethical development. Similarly, Astin (1984) based his student development theory on student involvement, believing that the more students are involved in college the more they will learn and the greater will be their personal development. Astin's two major educational postulates related to this theory are as follows:

- The amount of student learning and personal development associated with any educational program is directly proportional to the quality and quantity of student involvement in that program.
- The effectiveness of any educational policy or practice is directly related to the capacity of that policy or practice to increase student involvement. (p. 298)

Astin (1984) referred to his 1975 longitudinal study of college dropouts in which he determined that students who were more involved were more likely to persist. Some of the findings from Astin's 1975 study as they relate to this research study are as follows:

- Residential students were less likely to drop out;
- Students who participate in extracurricular activities were less likely to drop out;
- Students who work part-time on campus were less likely to drop out;
- Students who work full-time off campus were more likely to drop out;
- Students enrolled in two-year colleges were more likely to drop out than those enrolled in four-year colleges.

Tinto (1975, 1993) studied student departure from college and based his model of student departure on Durkheim's (1961) theory of suicide. Tinto (1975) argued that when students enter college, they bring with them a variety of attributes, backgrounds, and experiences that affect performance. These characteristics combined with the students' abilities to integrate themselves into the academic and social systems of the college directly relate to students' persistence. A summary of some of Tinto's synthesis of a variety of research studies related to dropout behavior, as the research relates to this study, is as follows:

- Past grade performance of students are the best predictors of a student's success in college.
- Males are more likely to finish degree programs than are females, even though females tend to have more "voluntary withdrawals" than "academic dismissals."
- A student's commitment to the goal of completing college is an influential factor in persistence.
- Grade performance is an important factor in persistence.
- Public institutions have higher dropout rates than private institutions.
- Two-year colleges have higher dropout rates than four-year colleges.

A significant body of empirical evidence exists supporting the influence of noncognitive factors on college student experiences. For example, Liu and Liu (1999), in applying Tinto's (1975) model at a medium-sized Midwestern commuter campus, examined the independent variables of grade point average, sex, race, age, and native freshmen status versus transfer student status and found that race and age both appeared to have an impact on attrition and that those younger students had higher graduation rates, although age was less of a factor when it interacts with other demographic variables, such as race and sex. Another general finding was that gender was not significantly related to retention and that time required for degree completion was the same for both sexes.

Pickering, Calliotte, and McAuliffe (1992) conducted a longitudinal project at a four-year public university to examine the effects of demographic, cognitive, and noncognitive factors on academic performance and retention of first-year college students. They designed and tested a freshman survey to measure attitudes, behaviors, traits, or other circumstances believed to affect academic success and retention. The cognitive predictors included high school grade point average, high school rank, and the verbal and quantitative SAT scores. Demographic variables included gender, race, socio-economic status, first-generation status, and factors related to enrollment status. Noncognitive variables included factors related to student goals and intentions. The researchers found that "between cognitive, demographic, and noncognitive predictors of academic difficulty, noncognitive predictors alone were better than either cognitive or demographic predictors used alone and almost as good alone as any of the combinations" (p. 20). After more than 12 years of development, revision, and use, the researchers conducted a factor analysis on the survey items to determine 10 broad factors related to academic difficulty. A stepwise logistic regression of these factors found four to be significantly related to academic performance. The following factors were found to have a significant, negative relationship with academic success: (a) Socializing Focus, identified by items such as "partying" or "popularity with the opposite sex" and (b) Lack of College Commitment, identified by students' perceptions that they would "Fail one or more courses" or "Be placed on academic probation." The following factors were found to have a significant, positive relationship with academic success: (a) Student Role Commitment, identified by items such as "I expect to work hard at studying in college" and "It is important to me to be a good student" and (b) Self Confidence, rated by items such as "General academic ability" and "Drive to achieve" (Policy Center on the First Year of College, 2002-2003).

Other researchers (Tross, Harper, Osher, & Kneidinger, 2000; Wilkie & Redondo, 1996) examined a variety of characteristics related to student performance and retention. Wilkie and Redondo (1996) developed and validated the *Behavioral and Attitudinal*

Predictors of Academic Success Scale (BAPASS) to assess the attitudes and behaviors towards social, academic, involvement, and psychological variables of students at a four-year university. A regression analysis indicated that Academic Behaviors and Motivators (ABM), Alcohol and Parties (A&P), and Stressors (STR) contributed significantly to the prediction equation with ABM being the strongest distinguishing factor between successful and unsuccessful students. ABM accounted for 23% of the variance in students' final academic status (Wilkie & Redondo, 1996).

Using a sample of first-year students, Tross et al. (2000) studied the characteristics of achievement, conscientiousness, and resiliency, as well as high school grade point average (GPA) and total Scholastic Assessment Test (SAT) to predict college GPA and retention. These researchers defined conscientiousness as "the tendency to carry out tasks in a careful manner until their completion" (p. 324) and resiliency as "the tendency to demonstrate commitment to a course of action when challenged, remain calm and emotionally stable when faced with unexpected circumstances, and rebound when faced with adversity" (p. 324). After controlling for the effect of high school GPA and total SAT score, the researchers found that conscientiousness accounted for an additional 7% of variance in predicting college GPA and accounted for 3% variance in predicting retention. Tross et al. (2000) found that of the five independent variables (high school GPA, total SAT, achievement, conscientiousness, and resiliency), conscientiousness was the only variable predictive of retention.

Research Related to Community College Population

While much of the existing research has focused primarily on student adjustment, development, retention, and success in four-year, residential higher education institutions

(Astin, 1984, 1993; Chickering, 1969; Chickering & Reisser, 1993; Pascarella & Terenzini, 1991; Tinto, 1975, 1993), a recent, growing body of literature exists examining two-year campus experiences (Bers & Smith, 1991; Borglum & Kubala, 2000; Halpin, 1990; Napoli & Wortman, 1998; Summers, 2003). This literature is predominantly based on earlier theories. Halpin (1990) applied Tinto's (1975) model and developed a questionnaire based on one authored by Pascarella and Terenzini (1991) to analyze persistence among first-year, full-time students in a rural community college and found the academic integration construct to be a significant predictor of persistence, withdrawal, and academic dismissal among community college students. Using discriminant function analyses, his study determined that the factors of Faculty Concern for Teaching and Student Development, Academic and Intellectual Development, and Interaction with Faculty made the greatest contribution to the first discriminant function followed by Institutional and Goal Commitments and Interactions with Faculty for the second function after controlling for background and environmental factors. Halpin (1990) concluded that a key to increasing student integration and persistence in a community college is maximizing student/faculty interaction. On the other hand, Borglum and Kubala (2000) applied Tinto's (1975, 1993) model and found no correlation between academic or social integration and student withdrawal rates at an urban community college. In this study students indicated a high regard for faculty, but few students interacted with faculty outside the classroom. The researchers found that the best predictors for student success appeared to be students' goals and intention. Bers and Smith (1991) also found that students' educational objectives and intentions discriminated more powerfully between persisters and nonpersisters at a suburban community college although academic and social integration also differentiated persisters from nonpersisters. Bers and Smith (1991) suggested that students' educational objectives/intent along with precollege characteristics and employment status provide greater significance for persistence than either students' academic or social integration. The integration construct becomes significant only within the context of these other findings. Summers (2003) cited several studies related to students' academic adjustment and persistence in community colleges. His summary of findings is that students who were less prepared for college coursework would be less likely to persist while a student's desire to become a student and his/her commitment to academic success would be key variables for predicting student success. According to Summers (2003), the research indicates that "if a student was able to identify his or her enrollment goal more clearly, indicate a high level of commitment to that goal, and generally report a positive outlook on his or her educational experience, that student was less likely to drop out" (p. 71).

Demographic Characteristics

Age

A variety of studies have focused on how demographic variables affect student persistence and academic success in community colleges (Adelman, 2005; Bailey, 2004; Brooks-Leonard, 1991; Burley, Butner, & Cejda, 2001; Cofer & Somers, 2000; Feldman, 1993; Griffin, 1980; Horn & Ethington, 2002; Polinsky, 2002-2003). Adelman's (2005) analysis of data from two national databases showed that "the first-to-second year 'retention' rate. . . declines in a more-or-less direct relationship to the age of the student at the point of entry to the postsecondary system" (p. 157). For example, for students younger than 21 who began postsecondary education in a community college in fall of the 1995-96 academic year, 74% were retained for 1996-97. For students aged 21 to 23, the percentage of those retained was 67.1; and for students aged 24 to 29, only 46.7% were retained. Feldman's (1993) study of first-time students enrolled in a rural community college found that students between the ages of 20 and 24 were more likely to drop out than those 19 and younger while those 25 and older were less likely to drop out than the younger students. Burley et al. (2001) found that the best predictor for continuous enrollment for developmental education students from a cohort of first-time-in-college students enrolled in Texas community colleges was students' age with younger students remaining longer; the researchers noted that as the age of the student increased so did the number and severity of remedial needs of students. Brooks-Leonard (1991) also found age to be related to retention with students over the age of 40 at a greater risk for attrition than the younger students. Griffin, (1980) in studying students at both a technical institute and a community college, found that the demographic variables of age, sex, and race collectively accounted for 8% of the variance in the quality point ratio (QPR) for first quarter curriculum-placed students.

In reviewing studies concerning demographics related specifically to underprepared math students, Saxon and Boylan (1999) concluded that the research is very limited. One of the more exhaustive studies with demographics is Penny and White's (1998) study that examined the relationships among the characteristics of faculty teaching developmental mathematics students and the characteristics of the developmental mathematics students themselves. Penny and White (1998) conducted an *ex post facto* study of 1,475 developmental mathematics students who completed the highest level of developmental mathematics and then completed college algebra at three Southern universities. The demographic variables were gender, ethnicity, age, and enrollment status. A correlation analysis showed that student age was positively correlated with student performance in both the developmental courses and the college algebra courses. A regression analysis showed that "student age had a significant, positive direct effect on students' performance in the last developmental mathematics course" (p. 8). However, the researchers caution that "the positive effect of age on performance in this sample should not be interpreted to mean that students well beyond traditional college age performed better than their younger, more traditional-aged counterparts" (p. 10). The age range for students in this study was 17 to 63 years. The mean age for students in developmental mathematics was 23.1 years; the mean age for students in college algebra was 23.8 years.

Umoh, Eddy, and Spaulding (1994) used Tinto's (1975) model of student retention to conduct a study of developmental mathematics students at an urban, comprehensive community college. They examined several variables, including age, on student's retention and success in developmental mathematics courses and found no statistically significant differences for the variables in their study. However, their sample included only 41 students who had successfully completed developmental mathematics and who were enrolled in college-level mathematics.

Gender

Studies concerning the relationships between gender and performance for developmental mathematics have produced mixed findings (Eldersveld & Baughman, 1986; Griffin, 1980; House, 1993; Penny & White, 1998; Stage & Kloosterman, 1991, 1995; Umoh, Eddy, & Spaulding, 1994). Two studies showed no statistically significant relationship between these variables (Penny & White, 1998; Umoh, Eddy, & Spaulding, 1994). By comparison, when Eldersveld and Baughman (1986) examined the relationship between student self-perception/attitude variables and final grades in four different levels of mathematics courses, one of which was elementary algebra at a large suburban community college, they looked at a variety of demographic variables, including gender. For the students in elementary algebra, approximately 14% of the variance in final grade was explained by a combination of the following: subjects' expected performance, time interval since last mathematics course, and subjects' gender with a gender-grade correlation indicating that the higher the grade the more likely the participant to be a male. Griffin (1980) revealed that 8% of the variance in quality point ratio (QPR) was accounted for by collective demographic variables of age, sex, and race.

Stage and Kloosterman (1991, 1995) examined the beliefs that remedial students had about the nature of mathematics and the beliefs they held about themselves as mathematics students, using samples of students in a remedial college mathematics courses at a public research university. They found that beliefs about mathematics were significantly related to the measure of achievement in final grades for women but not for men. Similarly, House (1993) investigated the relationships between academic self-concept and academic expectations for academically underprepared adolescent students. In his sample of 191 residential, low-income, first-generation college students at a large public university, House (1993) found that females earned significantly higher mathematics course grades than did males.

Life Demands

Enrollment Status

A common finding among several studies examining community college student experience is that full-time students are more likely to experience success and to persist than are part-time students (Bailey, 2004; Brooks-Leonard, 1991; Cofer & Somers, 2000; Feldman, 1993; Fralick, 1993; Horn & Ethington, 2002). Horn and Ethington (2002), using data from a subset of the national administration of the *Community College Student Experience Questionnaire* (Friedlander, Pace, & Lehman, 1990) also found that full-time students perceived greater gains than part-time students in personal and social development. Bailey (2004) confirmed these findings through an analysis of nationally representative data collected by the Community College Research Center, part of which focused on factors that impact student success. Bailey (2004) reported that "the most important factors affecting outcome success are the background characteristics and educational preparation that students bring to their post-secondary education, as well as the enrollment pattern in which students engage while in school" (p. 2). Full-time students are more likely to complete their outcome objective than are part-time students or are students who leave college for a period of time or who delay enrollment after high school.

Similar findings exist for developmental students. Penny and White (1998) examined the enrollment status of underprepared math students in relation to performance and discovered that students' part-time enrollment status at the time they took the last developmental course was negatively correlated with their performance in college algebra. A regression analysis showed that students' part-time enrollment status had a significant negative direct effect on students' performance in the last developmental mathematics class. Further analysis showed that the full-time developmental students subsequently performed better in college algebra than did those part-time developmental students who subsequently enrolled in college algebra. Overall, the strongest predictor of students' subsequent performance in college algebra was their performance in developmental mathematics.

Employment Status and Dependents

Of the students who entered two-year public institutions in the 1995-96 academic year, 35% to 44% had left without a degree and had not returned to postsecondary education by spring 1998 (Bradburn & Carroll, 2002). Two-year colleges have the lowest retention rates of all higher education institutions with the greatest attrition occurring between first and second term (Brooks-Leonard, 1991). Risk factors for attrition for community college students include attending part-time, working full-time, being financially independent and having dependents (Cohen & Brawer, 2003). A longitudinal study by the National Center for Education Statistics (Bradburn & Carroll, 2002) also confirmed that students who worked part-time or not at all were less likely to leave college without completing their academic program than those who worked full-time.

Further, Brooks-Leonard (1991) found employment status to be statistically related to student attrition from first to second term at a public technical institution with students working full-time less likely to be retained than those students employed part-time or not employed. From a sample of 796 first-term students, 43.5% of students who worked full-time were retained; 72.1 % of students working part-time were retained, and 62.1% of students not employed were retained. Statistical analysis did not reveal any significant interaction between the employment status and the academic variable of first-term GPA.

Studies suggest a link between these life demands that community college students face and their retention and success (Bonham & Luckie, 1993; Fralick, 1993; Miller, Pope, & Steinmann, 2005; Parker, 1998; Sydow & Sandel, 1998). For example, Bonham and Luckie (1993) conducted a study of 399 nonreturning students at a community college in Texas to learn why students dropped out; however, survey responses indicated that only 11 of the 399 respondents considered themselves as "dropouts." The majority of students (73%) characterized themselves as "stopouts;" the researchers shifted their focus and defined "stopouts" as "persons who have not accomplished their goals but plan to do so in the future" (p. 258). Bonham and Luckie (1993) developed six major categories for student responses: accomplishment of learning goals, lack of money, lack of time, other events in students' lives, dissatisfaction with classes, and dissatisfaction with something else about school. The two most common reasons for students' not returning were lack of money and lack of time. In the Lack of Money category, a combination of expenses for child care and care of someone other than a child together ranked fifth out of 11 subcategories. In the Lack of Time category, work-related responsibilities and home responsibilities were major influences in students' not returning. Miller, Pope, and Steinmann (2005) studied the challenges or stressors that community college students face by surveying 300 students at 6 different community colleges: 2 urban community colleges, 2 suburban community colleges, and 2 rural community colleges. The survey asked students to rate 14 different challenges to success that they faced in community college enrollment. Three of the highest rated items ("academic success," "balancing academic and personal life," and "paying for college") each had a mean score of greater than 4.5 on a 6-point scale.

Fralick (1993) analyzed attrition rates at a community college in California where a withdrawal rate from fall to spring semester was 55%. Of the 1,000 randomly selected nonreturning students surveyed, 23% said they left school because of work; of the nonreturning students, 82% said they had worked while going to school with 72% of these working full-time. Five percent of the nonreturning students said they had left because of child-care issues. A study of attrition related to minority students attending community colleges in New York found that job and family responsibilities were at the top of the list of seven primary barriers to retention (Parker, 1998).

Correspondingly, Sydow and Sandel (1998) analyzed withdrawal rates and reasons for withdrawal at a Virginia community college that had a first-to-second year attrition rate of 50%. Using written surveys and follow-up telephone surveys, Sydow and Sandel (1998) cited two major reasons for their withdrawals: work and family. For both the written withdrawal forms and telephone interviews, approximately 33% of the students listed work conflicts as their reason for withdrawal. More than 60% of the students interviewed on the telephone indicated they had been employed while attending school. For the written withdrawal forms, 32% of the students listed personal or family illness as their reason for withdrawal; and from the telephone interviews, 24% said personal or family conflicts were the reason for their withdrawals.

Pre-Enrollment Academic Characteristics

Some researchers have reported correlational relationships between students' pre-enrollment academic characteristics and student success and retention in community colleges (Armstrong, 2000; Borglum and Kubala, 2000; Burley, Butner, and Cejda, 2001; Feldman, 1993). Armstrong (2000) found a student's previous performance in school, the grade in the last English or mathematics course, and the number of years of English or math taken in high school to be better predictors of student success than standardized test scores. Similarly, Feldman (1993) found that the lower the high school grade point average (GPA), the more likely it would be that the student would drop out.

Researchers also have examined students' background skills and success rates as measured by retention and/or GPA (Borglum & Kubala, 2000; Brooks-Leonard, 1991;

Burley, Butner, & Cejda, 2001). Borglum and Kubala (2000) correlated students' scores on the Computer Placement Tests (CPT) in the areas of math, reading, and writing with withdrawal rates and found a significant relationship between students' background skills and the number of withdrawals. Students who had lower mean scores on the algebra, college math, and writing placement tests were more likely to withdraw. Burley et al. (2001) found that students with no skill deficiencies performed better than those with one or more deficiencies and that as the age of the student increased so did the number and severity of remedial needs; students' continuous enrollment patterns were the best predictors of student success as measured by a student's GPA. On the other hand, Brooks-Leonard (1991) found that placement test scores and remediation status were not significantly related to retention.

Studies of the relationship between high school or college grade point average and student academic success and retention in developmental math courses have reported mixed results (Goolsby, Dwinell, Higbee, & Bretscher, 1988; Umoh, Eddy, & Spaulding, 1994). Goolsby et al. (1988) tested the significance of the high school grade point average for predicting the math grade in a developmental algebra course at a large state university and found that for the entire group of students and for females as a subgroup, the high school grade point average was significantly related to the first quarter mathematics grade. Umoh et al. (1994) conducted a *post hoc* analysis of students who were retained through a developmental mathematics course and who subsequently enrolled in college-level mathematics; their findings were not significant.

Self-Regulated Learning Characteristics

Generally, college student development researchers assert that affective development of students is a major factor in college student success (Glover, 2000;

Roueche, 1981); however, research to confirm this finding with developmental students is limited (McCabe, 2003). The research appears to show that "remedial students have more difficulty identifying with an academic environment and regulating learning strategies" (McCabe, p. 46). Self-regulated learners are active participants who use a variety of personal attributes and psychological processes to control and direct their own learning (Boekaerts, Pintrich, & Zeidner, 2000; Hofer, Yu, & Pintrich, 1998; Montalvo & Torres, 2004; Pape, 2002; Zimmerman, 1994, 1998). "Self-regulation is a very difficult construct to define theoretically as well as to operationalize empirically" (Boekaerts et al., 2000, p. 4). Montalvo and Torres (2004) analyzed research surrounding self-regulated learning and listed the following as characteristics of such learners:

1. They are familiar with and know how to use a series of cognitive strategies (repetition, elaboration and organization), which help them to attend to, transform, organize, elaborate and recover information.
2. They know how to plan, control and direct their mental processes toward the achievement of personal goals (*metacognition*).
3. They show a set of motivational beliefs and adaptive emotions, such as a high sense of academic self-efficacy, the adoption of learning goals, the development of positive emotions towards tasks (e.g. joy, satisfaction, enthusiasm), as well as the capacity to control and modify these, adjusting them to the requirements of the task and of the specific learning situation.
4. They plan and control the time and effort to be used on tasks, and they know how to create and structure favorable learning environments, such as finding a suitable place to study, and help-seeking from teachers and classmates when they have difficulties.

5. To the extent that the context allows it, they show greater efforts to participate in the control and regulation of academic tasks, classroom climate and structure (e.g. how one will be evaluated, task requirements, the design of class assignments, organization of work teams).

6. They are able to put into play a series of volitional strategies, aimed at avoiding external and internal distractions, in order to maintain their concentration, effort and motivation while performing academic tasks.

In summary, if we narrow down what characterizes these students, it is that they see themselves as agents of their own behavior, they believe learning is a proactive process, they are self-motivated and they use strategies that enable them to achieve desired academic results. (pp. 3-4)

Researchers (Hofer, Yu, & Pintrich, 1998; Levitz & Noel, 1989; McCabe, 2003) have postulated that a variety of characteristics of developmental students may prevent them from mastering the skills of self-regulation. For example, Hofer et al. (1998) wrote that underprepared students' lack of basic reading, writing, or mathematical skills may prevent them from achieving self-regulation because these students focus almost totally on basic comprehension; self-regulation is a more complex process. McCabe (2003) asserted that developmental students may further lack academic direction and ability to establish and achieve goals because they may lack these higher-order thinking skills. Levitz and Noel (1989) similarly suggested that a key to increasing student retention and success is to "help students move toward goal-directed thinking and behaviors" (p. 73), to help them achieve self-regulated behaviors. However, Hofer et al. (1998) proposed that helping college students change their strategies and behaviors may be more difficult than helping younger students because college students may already be committed to certain ineffective behaviors or strategies.

Voorhees and Zhou (2000) studied the goal commitment and attainment aspect of self-regulated learning with students across 11 community colleges, examining the relationships among demographic variables, students' academic status, and institutional type variables with students' perceptions of their goal attainment. From a sample of 3,219 usable responses, Voorhees and Zhou (2000) measured perceptions of goal attainment, students' initial intentions, and their intentions at the time of the survey. Their findings suggest "relatively stable student intentions" (p. 231) among community college students with younger students indicating a higher level of goal attainment. Other research studies suggest significant relationships between students' goals and objectives and their retention and academic success (Brooks-Leonard, 1991; Napoli & Wortman, 1998) with the best predictors for student success appearing to be students' goals and intentions (Borglum & Kubala, 2000).

Another trait of self-regulated learners is their high level of self-efficacy (Montalvo & Torres, 2004). According to Bandura (1977), "efficacy expectations determine how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences" (p. 194). The higher the levels of self-efficacy or beliefs in their own abilities, the longer people will persist with a task. According to Schunk (1991), when students believe they are successful in learning material or mastering a task, they become more motivated. Success raises students' self-efficacy whereas failure lowers it. "Self-efficacy theory holds that the best predictors of behavior in specific situations [e.g., mathematics] are individuals' self-perceptions within those situations" (p. 212). Lent, Brown, and Larkin (1984) investigated this theory with students entering science and engineering majors in a technical college and found that students who reported higher ratings for measures of self-efficacy maintained higher grades and were retained longer than those students who reported lower ratings. All of the students with high ratings were retained for four subsequent quarters whereas approximately 50% of the students with lower ratings were retained.

Schunk (1998) described his earlier research in teaching elementary students mathematical skills and self-regulatory behaviors. His hypothesis was that models could teach students important self-regulatory skills that would increase their self-efficacy and thus their achievement. His findings supported his hypothesis as he also found that cognitive modeling, "which incorporates modeled explanation and demonstration with verbalization of the model's thoughts and reasons for performing actions" (p. 146), produced greater accuracy among the students in their work. Similarly, Schunk's (1998) research in teaching students self-reflective practices and self-monitoring skills also produced positive findings related to students' achievement, persistence, and self-efficacy.

Schunk's (1991) review of relevant research concerning children's motivation for and success in learning math showed that providing students with a short-range goal increased their motivation, their self-efficacy, and their attainment of skills more than providing them with a long-range goal. In mathematics instruction, difficult goals raised the students' motivation more than did easier goals. Likewise, Schunk (1991) affirmed that allowing students to set their own goals increased goal commitment; those who set their own goals as well as those for whom goals were set for them demonstrated greater motivation than did those who had no goals.

Related research yields a variety of results about the influence of students' attitudes toward learning and their learning behaviors and motivation on their social and academic integration and persistence (Astin, 1993; Bonham & Luckie, 1993; Borglum & Kubala, 2000; Griffin, 1980; Napoli & Wortman, 1998). Borglum and Kubala (2000) found no correlation between academic or social integration and withdrawal rates of students at a community college, but Napoli and Wortman (1998) found that social and academic integration "exert both direct and indirect effects on persistence through goal commitment and institutional commitment" (p. 444). These researchers found that students' psychological well-being and their self-esteem were directly related to both their social and academic integration.

Griffin (1980) examined a variety of characteristics and demographic variables that correlate with the academic success of community college and technical institute students to develop a model of conditions for underachieving students. Griffin (1980) measured nine affective variables (academic self-concept, locus of control, delay avoidance, work methods, study habits, teaching acceptance, educational acceptance, study attitudes, study orientation) against the dependent variable of academic success as determined by first quarter quality point ratio (QPR) with a QPR of 2.0 defined as academic success. Of the nine affective variables, six of them together (delay avoidance, academic self-concept, locus of control, work methods, study habits, education acceptance) accounted for 19% of the variance in QPR. Griffin (1980) concluded that although a significant correlation does not mean a causal relationship, "the findings of this study . . . indicate that students' personality and biographical characteristics are important to their academic success" (pp. 17-18).

Astin (1993) used survey data from the Cooperative Institutional Research Program (CIRP), an annual survey of approximately 250,000 first-year college students, to develop an empirical typology of undergraduate students. Astin (1993) categorized students into one of seven different typologies with each typology designed "to capture some of the uniqueness and individuality of students as personalities by utilizing information on their values, attitudes, beliefs, self-concept, and behavior" (p. 36). Approximately 39% of the students did not fit the criteria for one of seven student types. These students he labeled as "No Type" students; he found these students mostly in community colleges. Astin (1993) described these No Type students in the following way:

> Students who failed to qualify as one of the seven types come from families with less education and lower incomes than any of the types. They also have by far the lowest degree aspirations and, except for the Hedonists, the poorest academic records from high school. . . . No Type students are heavily concentrated in community colleges and underrepresented in public universities and all types of private institutions. (p. 44)

In summary, Astin's (1993) findings suggest that "the No Type students show a lower degree of involvement in their undergraduate experience than any other student type" (p. 44)

Students' Beliefs and Motivations in Developmental Math

Research specifically focusing on students' beliefs and/or motivations related to their success in developmental math courses has occurred mostly in four-year colleges and universities and has produced varying results (Bassarear, 1991; Goolsby, Dwinell, Higbee, & Bretscher, 1988; House, 1993, 1995; Ironsmith, Marva, Harju, & Eppler, 2003; Stage & Kloosterman, 1991, 1995). Bassarear (1991) found that the strongest predictors of students' performance were the students' predicted grade and their beliefs about their intelligence. Bassarear (1991) referred to beliefs and attitudes as affective variables, but he acknowledged that affective variables are "significant but weak predictors of performance" (p. 50).

Additionally, some studies suggest that significant correlations exist between students' levels of math anxiety and student success in developmental math courses (Goolsby, Dwinell, Higbee, & Bretscher, 1988; Higbee & Thomas, 1999; Ironsmith, Marva, Harju, & Eppler, 2003). Ironsmith et al. (2003) suggest that students who are more oriented toward a learning goal rather than a performance goal may actually perform better with less anxiety. This suggestion is consistent with Montalvo and Torres' (2004) conclusion that students who adopt learning goals instead of performance goals use deeper cognitive and metacognitive strategies, are more adaptive in their learning, are more persistent in their studies, and are more likely to seek academic help when they need it.

Other studies suggest correlations exist between students' confidence in learning mathematics and their success in developmental mathematics (Goolsby, Dwinnell, Higbee, & Bretscher, 1988; House, 1993, 1995; Ironsmith, Marva, Harju, & Eppler, 2003; Stage and Kloosterman, 1991, 1995). Generally, students who were more confident about their abilities in math and about themselves as learners of mathematics were more likely to achieve success (Hall & Ponton, 2005; House, 1993, 1995). Ironsmith et al. (2003) write:

> When we examined how mathematics confidence and achievement goals related to final course grades, it became apparent that the more confident students did

> better. . . . Students with low confidence achieve better grades in a challenging course if they focus on mastering the material rather than on performance goals. (p. 283)

Hall and Ponton (2005) tested the beliefs of students about their abilities in math and analyzed the differences between students enrolled in a developmental intermediate algebra course and students enrolled in calculus. They found a significant difference between the groups with the students enrolled in calculus demonstrating greater self-efficacy than the developmental students.

Stage and Kloosterman (1991) concluded that remedial math students "did not have a good perception of the rigors of college mathematics and thus could be destined for failure" (p. 33). Stage and Kloosterman (1995) contend that mathematics educators should not discount the importance of students' beliefs about their success in developmental mathematics. Other significant correlations exist between effectance motivation and final course grade (Ironsmith et al., 2003) and between students' perceptions of math usefulness and final course grade (Higbee & Thomas, 1999; Ironsmith et al., 2003). Higbee and Thomas (1999) found a significant positive correlation between the measure of academic autonomy and course grade and concluded: "The primary implication of this research is that developmental educators cannot ignore affective barriers to mathematics achievement" (p. 12).

House's (1995) study found that students' self-concept about their overall academic ability, their mathematical ability, and their drive to achieve were significantly correlated with their final grade in an introductory mathematics class with the strongest correlation between students' self-rating of mathematical ability and their achievement in the class. House's earlier study (1993) showed that "students with low academic self-concept earned mathematics course grades that were significantly lower than did students with high academic self-concept" (p. 65) in a college algebra course. This study had used a cohort of first-generation college students who were from low-income families, similar in nature to many community college students.

In addition to these studies at four-year institutions, the early study by Eldersveld and Baughman (1986) was conducted at a large suburban community college. The study included 13 independent variables measured against the students' final course grade. The researchers ran correlation analysis and then used regression analysis to identify variables related to the final grade. For the elementary algebra group, approximately 14% of the variance in final grade was explained by the combination of the following: subjects' expected performance, time interval since last mathematics course, subjects' sex. Eldersveld and Baughman (1986) noted that in three of the four different levels of mathematics, the students' expected performance was high on the list of predictor variables, which "points to the importance of reinforcing students' expectation of their performance, thereby possibly influencing their performance" (p. 214).

Goolsby et al. (1988) had also found that the affective variable of students' perceptions of teacher's attitudes toward the students as learners of mathematics was significantly related to students' achievement in a developmental algebra course at a southern university. Eldersveld and Baughman (1986) also assessed students' perceptions of teachers' attitudes toward them in four different levels of developmental mathematics and found that as the level of mathematics increased so did the students' perceptions of the teachers' attitudes toward them as mathematics students. However, the researchers found that the variables were not statistically related to final grade.

Instructional Methodology

As advancements are made in instructional technology, educators are utilizing an increasing variety of instructional methods, including computer-assisted instruction (CAI), one form of which shifts the classroom from a teacher-centered focus to a student-centered focus. Students work through a sequence of computer-generated learning modules with the instructor functioning more as a coach and/or personal assistant as students need help.

A variety of studies have examined the use of computers to aid instruction in math classes. Some of these studies (Askar, 1993; Bishop, Belby, & Bowman, 1992; Owens & Waxman, 1994; Plomp, Pilon, & Reinen, 1991) have focused on the use of computer-assisted instruction in a university setting for both remedial and college-level courses, while others have focused on a target population of middle-school-aged youth (Taylor, 1999; Underwood, Cavendish, Dowling, Fogelman, & Lawson, 1996).

For example, Ganguli (1992) evaluated the use of the computer as a demonstration aid in college intermediate algebra (remedial) classes at a large midwestern state university. Two experimental sections were taught with the aid of a computer, and there were two control groups. Students were interviewed about their perceptions toward math and generally admitted strong negative feelings. There was no actual hands-on computer use by the students; instead, students viewed the graphic displays on the computer screen and completed the calculations and work in their notebooks. For this unit of study in math, the researcher concluded that using the computer as a teaching aid influenced students' attitudes positively toward both the subject matter and the instructors. As a result, the students developed a more positive self-concept in mathematics and greater motivation to do mathematics.

Harris and Harris (1987) asked a similar question about computer-assisted instruction as a tool for reducing mathematics anxieties. They proposed that CAI may help students gain self-confidence because the computer can bypass students' negative attitudes and shows no prejudice against students. Likewise, CAI may add variety to classroom instruction and help students retain facts and procedures through repeated exercises. CAI provides immediate feedback to the students, but the writers caution that the quality of the instruction is only as good as the quality of the available programs. In essence, Harris and Harris (1987) believe that computers can be a vital resource for lessening mathematics anxiety and an important tool in the mathematics curriculum.

The use of computers as a learning aid versus the use of computers by instructors as a teaching aid was examined at the University of Botswana (Plomp, Pilon, & Reinen, 1991). In this study, researchers evaluated the use of the Mathematics and Science Computer Assisted Remedial Teaching (MASCART) software for students enrolled in the Pre-Entry Science Course, a course whose algebra component helps students to remediate particular topics within basic algebra. In this case, students used MASCART as a supplement to the traditional lecture session. Students using MASCART showed statistically significant increases over the control group from pre-test to post-test scores. However, the researchers could not determine if it was the actual software program that could have contributed to the gains or simply the extra time that students had devoted to supplementing classroom lecture. The researchers did determine that students felt positive about using the MASCART program for personal tutoring because they could work individually at their own pace; but the researchers also pointed out that since this was the first time students had used this method, a rival explanation was the novelty of the approach.

Other studies (Askar, 1993; Owens & Waxman, 1994) presented favorable findings about the use of computer-assisted instruction in math classes, although Askar (1993) indicates the need for more research in this area. Askar (1993) believes that the use of CAI is a very complex process that deals with much more than just the software; other variables, such as the type of courseware, teacher training, and other elements, all play a role in program success. This researcher's study included 30 first-year students in an introductory math course at Middle East Technical University in Turkey; 14 students were randomly assigned to CAI, and the other 16 formed the control group. The study assessed students' attitudes toward mathematics, their attitudes toward computers, and their mathematical achievement by pre-test and post-test measures. Askar (1993) found that 42% of the variance in achievement was attributed to CAI and concluded that it appeared that CAI made a positive contribution to achievement. However, he also encouraged further study.

Owens and Waxman (1994) conducted a study in a developmental mathematics course of 231 first-year African-American students. The study compared pre-test and post-test scores for computer-assisted instruction with conventional instruction (CI) methods for the students randomly assigned to either CAI or CI classes. Analysis of covariance from pre-test to post-test measures determined that post-test scores for geometry achievement were significantly higher for the CAI group, but that there was only a slight, nonsignificant difference favoring the CAI group for algebra. However, students' attitudes toward math were significantly more favorable in the CAI group than in the CI group.

A more extended study over a six-month period evaluated the use of CAI for primary and secondary students, aged 8 to 13, in nine schools in the United Kingdom

(Underwood, Cavendish, Dowling, Fogelman, & Lawson, 1996). The study examined the use of Integrated Learning System (ILS), a type of computer-assisted instruction that integrates the courseware with management software on a networked system. Using a summative evaluation model, the researchers found that children using the ILS performed significantly better in mathematics than did children in the control group, and that these students experienced the equivalent of 20-months growth in the six-month period. Likewise, Underwood et al. found indications that the work practices from the ILS classroom were being transferred to the standard classroom. These findings suggest that CAI can be an effective approach to teaching and learning, but the researchers indicate there may have been a ceiling effect because all students scored relatively high in the ILS group. Further research is needed to test the sustainability of this apparent advantage for student learning.

A similar study by Taylor (1999) focused on the use of an integrated learning system on the mathematical skills of students during their first year of high school, again in the United Kingdom, and supported the earlier findings of Underwood et al. (1996). Using multiple regression analysis, Taylor (1999) found significant improvement in performance on the end-of-year mathematics exam for students using ILS. A focus of the study was the amount of time a student used ILS in comparison with performance on the examination. Taylor (1999) concluded that the way a student uses the system could be an important factor in determining its effectiveness and recommended further research be conducted to determine how the amount of time spent on the system affects learning outcomes.

Bailey (1990) tested CAI's use for students with an experimental group receiving classroom instruction and CAI as compared to students receiving only the conventional classroom instruction at Miami-Dade Community College, which uses two methods of CAI for preparing students to take the College Level Academic Skills Test (CLAST), a required test that students must pass before they can receive their associate degrees and continue their college education. She found a statistically significant difference between the CLAST scores of the experimental group and the control group. Although there were limitations to the study in that the experimental group was not a random sample and there were not enough students in the subgroups to use formal statistical treatment, Bailey (1990) proposed both formal and informal results showing that the use of CAI had positive results for student outcomes on CLAST.

Results of these studies concerning computer-assisted instruction suggest that investigating the effectiveness of this mode of instructional delivery for developmental mathematics students in a community college setting may provide empirical evidence for future curriculum and instructional decisions. The review of literature indicates that research was conducted in the early years of incorporating technology into the classroom. However, as technology has advanced and as it continues to advance, particularly in relation to computer-assisted packages for student learning, the research needs to continue. More of the literature about computer-assisted instruction, though, seems to be focused at either the public school level or at the four-year college or university level. It is the community college that provides most of the developmental work in mathematics, but the mission and focus of the community college are not directed toward research; thus, there may be a gap between the decisions made for curricular issues and the research to support those decisions.

Research Questions

Three research questions provided the framework for this study:

1. To what degree do (a) age and gender, (b) life demands, and (c) high school grades predict retention and success in a developmental Algebra I course?
2. To what degree do learners' (a) beliefs about math and (b) academic self-regulation predict retention and success in a developmental Algebra I course?
3. What differences exist in (a) retention and (b) academic success in a developmental Algebra I course as a function of enrollment in lecture versus computer-assisted formats?

Based on the extant literature, several factors were identified as possible predictors of retention and academic success for developmental Algebra I students. Demographic variables of age and gender were identified as predictors of retention and success (Adelman, 2005; Brooks-Leonard, 1991; Burley, Butner, & Cejda, 2001; Eldersveld & Baughman, 1986; Feldman, 1993; Griffin, 1980; House, 1993; Penny & White, 1998) as were other noncognitive factors of life demands of enrollment status (Bailey, 2004; Brooks-Leonard, 1991; Cofer & Somers, 2000; Feldman, 1993; Fralick, 1993; Horn & Ethington, 2002; Penny & White, 1998), employment status, and number of dependents (Bonham & Luckie, 1993; Brooks-Leonard, 1991; Cohen & Brawer, 2003; Fralick, 1993; Miller, Pope, & Steinmann, 2005; Parker, 1998; Sydow & Sandel, 1998). The pre-academic characteristic of high school grade point average was also identified as a predictor of retention and success (Armstrong, 2000; Feldman, 1993; Goolsby, Dwinell, Higbee, & Bretscher, 1988). A review of literature further identified students' beliefs about math (Bassarear, 1991; Goolsby, Dwinell, Higbee, & Bretscher, 1988; Hall & Ponton, 2005; House, 1993, 1995; Stage & Kloosterman, 1991) and students' self-regulated learning characteristics (Brooks-Leonard, 1991; Griffin, 1980; Hofer, Yu, & Pintrich, 1998; Levitz & Noel, 1989; Napoli & Wortman, 1998; Schunk, 1991, 1998) as predictors of retention and academic success. In addition, a review of the literature showed a potential for differences in retention and success based on instructional methodology (Askar, 1993; Bailey, 1990; Ganguli, 1992; Harris & Harris, 1987; Owens & Waxman, 1994; Plomp, Pilon, & Reinen, 1991; Taylor, 1999).

Hypotheses

Based on findings in the literature, the following hypotheses were derived from the research questions:

Question 1

A. Younger students will be more likely to be retained and achieve greater success than older students.

B. Males will be more likely to be retained and to achieve greater success than females.

C. Full-time students will be more likely to be retained and to achieve greater success than part-time students.

D. Students who are not employed will be more likely to be retained and to achieve greater success than students who are employed.

E. Students with fewer dependents will be more likely to be retained and achieve greater success than students with more dependents.

F. Students with higher high school grade point averages will be more likely to be retained and achieve greater success than students with lower high school grade point averages.

Question 2

A. Students with more positive beliefs about math and about themselves as math students will be more likely to be retained and achieve greater success than students with more negative beliefs.

B. Students with stronger self-regulation will be more likely to be retained and achieve greater success than students with weaker self-regulation.

Question 3

Students enrolled in computer-assisted instruction courses will be more likely to be retained and experience greater success than students enrolled in traditional lecture courses.

Summary

This chapter presented a review of the literature related to factors affecting student retention and academic success, comprising four sections. The first section of this chapter presented an overview of college student adjustment and success, citing both the relevant theories and studies that have tested these theories. General findings were that student retention and academic success are related to more than the cognitive abilities of students. A variety of noncognitive factors may also play an important role in these concepts.

The second section discussed student retention and academic success, focusing on demographic characteristics. Once again, a range of factors appeared to affect student retention and academic success, particularly since community colleges attract such an eclectic group of students. The most important of these appeared to be age, enrollment status, and life demands. Younger students appeared to persist at a higher rate for greater academic success. The same appeared to hold true for students working part-time or not at all as opposed to those working full-time and for those students with fewer life demands.

The third section discussed how students' self-regulated learning characteristics may affect student retention and academic success. On the whole, developmental students may lack the self-regulated learning behaviors that promote academic success.

The fourth section, in reviewing literature and research findings surrounding computer-assisted instruction, a relatively new method of instructional delivery, suggested that generally there is a need for more research concerning this methodology. With the emergence of new instructional technologies, instruction may be moving away from the more traditional forms of instruction, and more empirical evidence may be needed to evaluate the long-term effectiveness of these methodologies.

This review of literature provided the background for this study. The research questions and hypotheses previously stated were drawn from this literature.

In summary, the review of literature suggests that a single snapshot view of an underprepared, or developmental, math student in a community college may not exist. Indeed, a general review of the literature reinforces the idea that there may not be a single program or single approach to use for ensuring retention and success of underprepared math students. Rather, a multitude of factors, such as demographic characteristics, self-regulated learning characteristics, or methods of instruction may interact with and affect this very diverse population of students. Because community colleges are increasingly becoming the pathway to higher education for students of all ages and all academic and psychosocial backgrounds, more research is needed to better understand the phenomena surrounding student retention and academic success. Evaluating and understanding these phenomena may help institutions to develop programs and strategies to ensure greater retention and success. Thus, the purpose of this study, which was organized around three research questions and suggested hypotheses drawn from the existing literature, was to examine factors that affect student retention and academic success in a developmental Algebra I course at a community college.

CHAPTER III

METHOD

This chapter describes the research design used to answer three research questions about factors that affect student retention and academic success in a developmental Algebra I course at a community college. The study was designed to examine basic demographic variables of age and gender; life demands of student status, employment status, and number of dependents; pre-college academic characteristic of high school GPA; self-regulated learning characteristics; and the mode of course delivery. The chapter describes the study's setting and participants, the measures and procedures used for collecting the data, and the statistical procedures used to analyze the data.

Setting

The study was conducted at New River Community College (NRCC), a public two-year community college within the Virginia Community College System (VCCS), a system of 23 community colleges located throughout the state. NRCC serves four rural counties and one city in the New River Valley. Offering both occupational/technical and university parallel/college transfer programs, NRCC has an open door admissions policy. The college has an annualized headcount of approximately 4,000 students and approximately 2,700 annualized full-time equivalent students (FTEs). Founded in 1959 as a vocational/technical institute, the college evolved into a community college in 1969 as a result of the 1966 General Assembly legislation that formed the Virginia Community College System (New River Community College, 2004). Since its official beginning as a community college, NRCC has offered developmental courses (Wynn, 2002) with a goal "to prepare people for admission to college transfer and occupational/technical courses of study in the community college" (New River Community College, 2004, p. 11).

Participants

All students who enrolled in either the traditional lecture sections or the computer-assisted instruction (CAI) sections of the developmental Algebra I (MTH 03) course during fall 2005semester and spring 2006 semester at New River Community College were invited to participate in this study. Students who enrolled in Algebra I were underprepared for standard college level mathematics as indicated by their scores on the COMPASS (American College Testing, 1996) or ASSET (American College Testing, 1997) test, the mathematics component of the college placement examination. Students self-selected the class section and thus the instructional methodology in which they enrolled. Class sizes ranged from 8 to 28 students.

Six sections, three of which were traditional lecture sections and three of which were computer-assisted instruction sections, were included in the sample for fall 2005 semester. Four of the sections were day sections (between 8 a.m. and 5 p.m.); two of the sections were evening sections (after 5 p.m.). One evening section was offered off campus at the college's Montgomery County site. Four sections, three of which were traditional lecture sections and one of which was a CAI section were included in the sample for spring 2006 semester. Three of the spring sections were day sections; one was an evening section. One evening section during the spring was offered off campus at the Montgomery County site.

During the fall semester 114 students enrolled in the course; 96 (84.21%) participated in the study. During the spring semester, 70 students enrolled in the course; 58 (82.86%) participated. The total enrollment for the year was 184; a total of 154 students (83.70%) made up the sample for the study. A variety of faculty, both full-time and adjunct, taught these classes.

Tables 2 and 3 provide detailed information about participant demographics. As seen in Table 2, the mean age of the 154 participants was 22.18 years (*SD* = 5.91; range = 17 - 46). As seen in Table 3, the majority of participants were male (57.1%) and white (91.6%). Likewise, a majority of participants were full-time students (81.8%). The employment status of participants varied with the greatest percentage (35.7%) reporting no employment. Similarly, the self-reported household income levels varied with the greatest percentage (26.6%) reporting a household income of less than $10,000. A majority (83.8%) of respondents also reported no dependents. The self-reported high school grade point averages ranged from a low of 1.0 to 1.4 (1.9%) to a high of 3.5 to 4.0 (3.2%) on a scale of 0 to 4; the mid-range of 2.5 to 2.9 had the highest recordings (31.2%).

Table 2

Age of Participants by Semester

Semester	Range	*M*	*SD*	*N*
Fall Semester	17 - 46	21.26	5.26	96
Spring Semester	18 – 41	23.71	6.63	58
Summary for Year	17 – 46	22.18	5.91	154

Table 3

Demographic, Life Demands, and Pre-Academic Characteristics Data for Participants

	Fall Semester		Spring Semester		Total	
Category	n	%	n	%	N	%
	Demographics					
Gender						
Male	53	55.2	35	60.3	88	57.1
Female	43	44.8	23	39.7	66	42.9
Ethnicity[a]						
White	93	96.9	48	82.8	141	91.6
Black	1	1	7	12.1	8	5.2
Hispanic	1	1	1	1.7	2	1.3
Asian	1	1	0	0	1	.6
Did not Report	0	0	2	3.4	2	1.3
	Life Demands					
Student Status						
Full-Time	83	86.5	43	74.1	126	81.8
Part-Time	13	13.5	15	25.9	28	18.2
Employment Status[b]						
Do not Work	28	29.2	27	46.6	55	35.7
1-10 hrs./wk	5	5.2	5	8.6	10	6.5
11-20 hrs./wk.	16	16.7	5	8.6	21	13.6
21-30 hrs./wk.	20	20.8	5	8.6	25	16.2

Table 3 continued

	Fall Semester		Spring Semester		Total	
Category	n	%	n	%	N	%
31-40 hrs./wk.	20	20.8	13	22.4	33	21.4
> 40 hrs./wk.	7	7.3	3	5.2	10	6.5
Annual Household Income[a]						
<$10,000	27	28.1	14	24.1	41	26.6
$10,000-$19,999	19	19.8	11	19.0	30	19.5
$20,000-$29,999	12	12.5	7	12.1	19	12.3
$30,000-$39,999	2	2.1	3	5.2	5	3.2
$40,000-$49,999	7	7.3	2	3.4	9	5.8
$50,000-$59,999	5	5.2	3	5.2	8	5.2
$60,000-$69,999	6	6.3	5	8.6	11	7.1
$70,000-$79,999	3	3.1	2	3.4	5	3.2
$80,000-$89,999	2	2.1	1	1.7	3	1.9
$90,000-$99,999	2	2.1	0	0	2	1.3
>$100,000	4	4.2	7	12.1	11	7.1
Did not Report	7	7.3	3	5.2	10	6.5
Dependents[b]						
0	86	89.6	43	74.1	129	83.8
1	4	4.2	10	17.2	14	9.1
2	3	3.1	2	3.4	5	3.2
3	2	2.1	2	3.4	4	2.6
4	1	1.0	1	1.7	2	1.3

Table 3 continued

	Fall Semester		Spring Semester		Total	
Category	n	%	n	%	N	%
Pre-Academic Characteristics						
High School GPA[b]						
1.0-1.4	1	1.0	2	3.4	3	1.9
1.5-1.9	11	11.5	7	12.1	18	11.7
2.0-2.4	24	25.0	14	24.1	38	24.7
2.5-2.9	34	35.4	14	24.1	48	31.2
3.0-3.4	18	18.8	16	27.6	34	22.1
3.5-4.0	4	4.2	1	1.7	5	3.2
Did not Graduate	1	1.0	3	5.2	4	2.6
Home-Schooled	2	2.1	0	0	2	1.3
Did not Report	1	1.0	1	1.7	2	1.3

[a]Not used for analysis; collected for reporting purposes only

[b]For purposes of analysis, some categories of variables have been collapsed and/or recoded

Preliminary Analysis

To determine if there were major differences between the two groups of participants (fall semester and spring semester), a set of independent-samples *t* tests was conducted to compare the mean scores for student characteristics. Table 4 presents the results of this analysis. A statistically significant difference in means was found for age between fall semester participants ($M = 21.26$, $SD = 5.26$) and spring semester participants [$M = 23.71$, $SD = 6.63$; $t(152) = -2.39$, $p = .02$] with the average age for spring semester participants being approximately two years greater than the average age for fall semester participants. A statistically significant difference in mean scores was also found for the pre-test scores between fall semester participants ($M = 9.76$, $SD = 3.58$) and spring semester participants [$M = 8.53$, $SD = 3.16$; $t(152) = 2.15$, $p = .03$] on the Elementary Algebra portion of the ASSET (American College Testing, 1997) test. Spring semester participants' mean score was 1.23 points lower than fall semester participants' mean score. From a total possible score of 25 on the pre-test, 1.23 points was not was not a significant difference in practical terms. The mean scores also showed that both groups failed to answer even 50% of the questions correctly. Although there was a statistically significant difference in both age and pre-test scores, the difference in means was relatively small. The *t* tests were conducted to see if one of the groups would unduly influence the results or effect on the dependent variables; these small differences in statistical significance would suggest that would not be the case. Therefore, the two groups (fall semester and spring semester) were collapsed. No other statistically significant differences were found between these two groups.

Table 4

Group Differences for Fall Semester Participants and Spring Semester Participants for Mean Scores on Continuous Variables

	Fall Semester		Spring Semester		
Variable	M	SD	M	SD	t (152)
Age	21.26	5.26	23.71	6.63	-2.39*
High School GPA	2.58	.53	2.56	.57	.23
IMBS					
Difficult Problems	20.48	4.69	21.34	3.46	-1.22
Steps	14.13	3.05	14.22	2.70	-.20
Understanding	24.11	3.73	23.90	3.71	.35
Word Problems	17.69	2.86	18.24	2.84	-1.17
Effort	23.84	3.94	23.36	4.13	.72
LASSI					
Concentration	25.11	5.83	26.26	5.97	-1.17
Self-Testing	23.32	6.15	23.91	6.46	-.57
Study Aids	22.35	5.24	23.59	5.48	-1.39
Time Management	24.28	6.20	24.12	6.58	.15
Pre-Test	9.76	3.58	8.53	3.16	2.15*

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

To determine if there were major differences between participants in the traditional lecture method of instruction sections and participants in the computer-assisted instruction sections, a set of independent-sample *t* tests was conducted to compare the mean scores for student characteristics. Table 5 presents the results of this analysis. A statistically significant difference in means was found for age between participants in the traditional lecture sections ($M = 22.75$, $SD = 6.48$) and participants in the computer-assisted instruction sections [$M = 20.75$, $SD = 3.88$; $t(152) = 2.36$, $p = .02$] with the average age of participants in the traditional lecture sections being two years greater than the average age of participants in the computer-assisted instruction sections. The *t* tests were conducted to see if one of the groups would unduly influence the results on the dependent variables. The difference in means was relatively small, suggesting there would not be undue influence on the dependent variables. No other statistically significant differences were found between participants in the two different methods of instruction.

Table 5

Group Differences for Participants in Traditional Lecture Sections and Participants in Computer-Assisted Instruction (CAI) Sections for Mean Scores on Continuous Variables

	Lecture		CAI		
Variable	M	SD	M	SD	t (152)
Age	22.75	6.48	20.75	3.88	2.36*
High School GPA	2.57	.52	2.56	.59	.13
IMBS					
Difficult Problems	21.04	4.50	20.23	3.63	1.06
Steps	14.09	3.01	14.34	2.69	-.48
Understanding	23.78	3.65	24.66	3.83	-1.33
Word Problems	17.81	2.86	18.11	2.86	-.60
Effort	23.74	3.67	23.48	4.78	.36
LASSI					
Concentration	25.79	6.22	24.93	5.00	.90
Self-Testing	23.43	6.56	23.84	5.49	-.37
Study Aids	22.90	5.40	22.61	5.29	.30
Time Management	24.47	6.86	23.59	4.71	.91
Pre-Test	9.16	3.47	9.64	3.48	-.76

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Course Description

Students followed the departmental Course Plans for Algebra, (Appendix A; Appendix B) which outlined course objectives and expectations. These plans and accompanying syllabi outlined instructional methods, course assignments, test dates, grading criteria, and timeline for completion of assignments. Students in the traditional lecture method classes used the textbook *Introductory and Intermediate Algebra* (Wright, 2005). Students in the computer-assisted instruction sections used a multimedia course series called Mediated Learning Systems with accompanying textbook/workbook *Interactive Mathematics: Elementary Algebra* (Kinney & Robertson, 1994-2004).

Interactive Mathematics, also referred to as Mediated Learning, is a learner-centered and faculty-guided method following a model of instruction that allows students to move through modules of content at their own pace with immediate assistance and feedback as they need it. This assistance was provided by the software itself, by the accompanying print material, by the instructor, or by a lab assistant whose function was to assist students with the technology. This lab assistant has a baccalaureate degree in mathematics.

Measures

Table 1 (p. 8) summarizes the study's variables and the instruments used to measure them. Age and gender were collected from the students' records in the student information system. Student status, employment status, number of dependents, and high school grade point average were measured by a self-report information sheet completed at the beginning of the semester. Students' self-regulated learning characteristics were measured by the Indiana Mathematics Beliefs Scales (IMBS) (Kloosterman & Stage, 1992) and the Learning and Study Strategies Inventory (LASSI) (Weinstein, Palmer &

Schulte, 2002), also collected at the beginning of the semester. Instructional methodology was measured by the method of course delivery. Retention was measured by enrollment status at the end of the course, and success was measured by a change in score from pre-test to post-test on the ASSET tests (American College Testing, 1997).

Independent Variables

Self-Report Information Sheet

Participants completed a self-report information sheet (Appendix C). Items related to life demands of the student (student status, employment status, number of dependents) and high school grade point average (GPA). Student status was a dichotomous variable; the others were categorical. Information concerning age and gender was obtained from the students' records in the student information system.

The categorical data for employment status were transformed for analysis into dichotomous variables that measured employment in terms of 1 – 20 hours per week, 21 – 30 hours per week, and more than 30 hours per week. Students who did not work were the omitted category. Few students reported having dependents; thus, those data were transformed into a dichotomous variable of dependents or no dependents. Students had self-reported their high school grade point average (GPA) by selecting the range of their GPA; students would more easily identify the range of their average than remember the specific GPA. High school transcripts are not required for admission to the community college nor are students required to be high school graduates. The categorical variable of high school grade point average was transformed into a continuous variable using the midpoint for each category. Eight students (5.2%) did not report GPA, thus requiring a mean substitution for these missing values.

Indiana Mathematics Beliefs Scales

Beliefs about math were measured using the Indiana Mathematics Beliefs Scales (IMBS) (Kloosterman & Stage, 1992) (Appendix D). The IMBS, a paper and pencil measure, is "a set of belief scales for measuring secondary school and college students' beliefs about mathematics as a subject and about how mathematics is learned" (Kloosterman & Stage, 1992, p. 109). The five scales "measure beliefs which are related to motivation and thus achievement on mathematical problem solving" (p. 109). Two of the scales ("Steps" and "Word Problems") measure participants' beliefs about mathematics as a discipline; three of the scales ("Difficult Problems," "Understanding," and "Effort") measure the participants' beliefs about themselves as learners of mathematics (Kloosterman & Stage, 1992).

Each of the five scales contains six items. Participants rated each item on each scale using a 5-point Likert-type scale according to how much they agreed with the statement. Responses ranged from "strongly agree" to "strongly disagree." Sample items include, "Learning computational skills is more important than learning to solve word problems" and "If I can't solve a math problem quickly, I quit trying" (Kloosterman & Stage, 1992).

At the time the IMBS was developed, there were no other measures available to measure students' beliefs about mathematics; the scales were developed and validated with college students. To establish content validity, after the scales were developed, six mathematics educators reviewed them "to ensure that they related to the intended constructs" (Kloosterman & Stage, 1992, p. 111). The instrument was pilot tested by a group of 61 first-year college students in a remedial mathematics course. The final version of the IMBS was administered to 517 college students, 273 of whom were remedial students, to obtain appropriate ranges. Reliabilities for the scales, using Cronbach's Alpha, are as follows: .77 for Difficult Problems, .67 for Steps, .76 for Understanding, .54 for Word Problems, and .84 for Effort. The lower score for Word Problems may be attributed to a variation in wording across items in the scales or inconsistencies by math textbooks and instructors in defining word problems; these inconsistencies may have caused students to give inconsistent responses (Kloosterman & Stage, 1992). Six of the ten inter-scale correlations were statistically significant ($p < .05$) although the correlations were relatively small (less than .30) (Kloosterman & Stage, 1992).

Learning and Study Strategies Inventory

Students' self-regulated learning characteristics were measured using four scales from the Learning and Study Strategies Inventory (LASSI) (Weinstein, Palmer, & Schulte, 2002) (Appendix E). This measure, consisting of 80 items arranged in 10 scales, assessed "students' awareness about and use of learning and study strategies related to skill, will and self-regulation components of strategic learning" (Weinstein & Palmer, 2002, p. 4). Four of the LASSI scales ("Concentration," "Self-Testing," "Study Aids," and "Time Management") relate to the construct of self-regulation for strategic learning (Weinstein & Palmer, 2002). Each of these four scales contains eight items for a total of 32 items related to self-regulation.

Using a paper and pencil version of the measure, participants rated each item according to how closely the item reflected their behaviors or thoughts. Item responses ranged from "not at all typical of me" to "very much typical of me" on a 5-point Likert-type scale. Sample items include, "My mind wanders a lot when I study," "To check my understanding, I make up possible test questions and try to answer them," "I try to find a study partner or study group for each of my classes," and "I find it hard to stick to a study schedule" (Weinstein & Palmer, 2002).

The first edition of LASSI was developed over a period of nine years (Blackwell, 1992) and field-tested over a two-year period (Weinstein & Palmer, 2002). Items were written, reviewed, and analyzed by content experts and judges and psychometricians. The authors report "a number of different approaches were used to examine the validity of the LASSI" (Weinstein & Palmer, 2002, p. 15), including comparing scores against other similar measures for concurrent validity, validating the scales against performance measures for predictive validity, and repeated testing. The field testing for the first edition occurred at more than 30 colleges and universities. The specific validity data have not been published. The second edition of LASSI was developed in consultation with developmental educators, educational psychologists, and educational psychometricians with expertise in diagnostic and prescriptive assessments. Following a series of pilot tests and modifications to the first edition, the field test and norming version was administered to 1,092 students at institutions in 12 different geographical regions. These institutions included community colleges and technical institutions as well as four-year colleges and universities. Item statistics were computed for the individual items in each scale; each scale contained 8 items. Coefficient Alphas for measuring internal consistency for each of the eight items in each scale range as follows: Concentration, .84 to .87; Self Testing, .82 to .85; Study Aids, .69 to .73; Time Management, .82 to .85. Scale statistics were also computed for the final version of each scale. Coefficient Alphas for these four scales are as follows: Concentration, .86; Self-Testing, .84; Study Aids, .73; Time Management, .85. Other results or specific data have not been published (Weinstein & Palmer, 2002).

Dependent Variables

ASSET

The Elementary Algebra test, Forms B2 (Appendix F) and C2 (Appendix G) of the ASSET tests (ACT, 1997) were used as pre-test and post-test measures for academic success for this study. Developed specifically for use by community and technical colleges by the American College Testing Program (ACT), the Elementary Algebra test contains 25 items in a paper and pencil format. The test contains the following content areas: algebraic expressions, simplification of algebraic expressions, solutions of quadratic equations by factoring, operations with polynomials, integer exponents, rational expressions, and solution of linear equations. Although the test, when used for actual placement purposes, has a 25-minute time limit (ACT, 1997), this study did not adhere to a time limit. Participants were allowed to use calculators for completing the Elementary Algebra test as endorsed by ACT, effective January 1, 2000 (ACT, 2002). ASSET corresponds to COMPASS, Computer-Adaptive Placement Assessment and Support System (ACT, 1996), the computer-generated test used for initial placement by the college.

The *ASSET Technical Manual* (ACT, 1994) provides extensive details about the test's psychometric properties. Writers for the test items were secondary and postsecondary faculty who received specific guidelines for writing for the content areas. Writers first submitted sample items for review by ACT test development staff, and the writers worked closely with ACT test specialists throughout the item writing process. Each unit of items was reviewed by ACT staff and by a content test specialist. Test items were also reviewed by consultants for both soundness and fairness. ACT conducted two Differential Item Functioning Analyses for item bias. Kuder-Richardson Formula 20 reliability estimates of internal consistency for the Elementary Algebra unit are .66 for Form B2 and .78 for Form C2. Test-retest reliabilities over a two-to-three week period were .84 for Form B2 and .81 for Form C2.

Retention

The final grade in the course, recorded by the instructor, was used as a measure of retention. Students who completed the course (retention) received grades of either "S" for "satisfactory," "U" for "unsatisfactory," or "X" for "audit." Students who withdrew from the course or who were withdrawn by the instructor during the first 60% of the course received a grade of "W." Students who withdrew or were withdrawn after 60% of the course had elapsed received a grade of "U;" instructors verified the status of all "U's" as "unsatisfactory but retained" or "unsatisfactory and withdrawn."

Data Collection Procedure

The study was conducted during fall 2005 and spring 2006 semesters. Approval to conduct the study at New River Community College (NRCC) was obtained from the president of the community college (Appendix H). Permission to conduct the study and administer the measures was obtained from the Human Subjects Review Committee of the Darden College of Education at Old Dominion University. The purpose and process for this study were explained to the Math Department at NRCC so as to gain faculty support in conducting the study in the classes. Students were advised of the voluntary nature of their participation and were asked to sign an Informed Consent Form (Appendix I) as part of their participation. For participants under the age of 18, parental consent was obtained on the Informed Consent Form. Participants were offered light refreshments during the data collection process.

NRCC operates on a 14-week semester, the first 2 weeks of which constitute the Add/Drop period. Developmental Algebra I day classes met 5 days each week for 55 minutes for each class meeting. The evening classes met twice a week for 135 minutes for each session.

Initial data collection occurred during the Add/Drop period of each semester. This data collection required two class periods for day classes and one class period for the evening classes. The process was administered by a community college professional under the supervision of a researcher/professor from Old Dominion University's College of Education. For the day classes, during the first data collection period, students received an information sheet describing the study and signed a consent form to participate. They completed the Self-Report Information Sheet and received a packet of measures that they completed during the class period. These measures consisted of the Indiana Mathematics Beliefs Scales (IMBS) (Kloosterman & Stage, 1992) and the Learning and Study Strategies Inventory (LASSI) (Weinstein, Palmer, & Schulte, 2002). During the second data collection day, which was the next day, students took the Elementary Algebra test, Form B-2, from the ASSET (ACT, 1997) battery of tests during the class period. Students enrolled in the evening sections completed all of the measures during one class period. Students who were absent on these days or who enrolled in the class after these initial data collection days completed these measures on the day they returned to or enrolled in the class; 32 (20.8%) of the students were absent on the initial data collection day.

All measures and tests were administered in pencil-and-paper formats. Average completion time for each day section was approximately 30 minutes for a total completion time of approximately 60 minutes. Average completion time for each evening section was approximately 60 minutes.

Students computed the raw scores for the LASSI (Weinstein, Palmer, & Schulte, 2002) scales using the scoring guidelines that accompanied the measure. The IMBS (Kloosterman & Stage, 1992) scales were hand scored by the administrator, and the ASSET (ACT, 1997) pre-tests were machine scored using the ASSET Scantron Answer Sheets purchased from the company.

During the 14th week (the final week) of the semester, students in both day and evening classes again took the Elementary Algebra test, Form C-2, from the ASSET (ACT, 1997) battery of tests during the class period. This post-test was administered in pencil-and-paper format and was machine scored using the ASSET Scantron Answer Sheets purchased from the company.

The sample included 154 students who initially agreed to participate. Of these, 108 (70.1%) students were retained throughout the semester; of the 108 students who were retained, 90 (83.3%) students took the post-test. The 90 students who took the post-test represent 58.4% of the original sample.

A set of independent-samples *t* tests was conducted to compare the mean scores for student characteristics between students who were retained throughout the semester and those who were not. Table 6 presents the results of this analysis. A statistically significant difference in means was found for age between retained participants (M = 22.80, SD = 6.37) and those not retained [M = 20.74, SD = 4.39; $t(152) = -2.31$, $p = .02$] with the average age for retained participants being approximately two years greater than the average age for those not retained. A statistically significant difference in mean scores was found for the high school grade point average for participants who were retained ($M = 2.63$, $SD = .51$) and those not retained [$M = 2.43$, $SD = .60$; $t(152) = -2.14$, $p = .03$] with the average GPA for retained participants being approximately .2 of a point greater than the average GPA for those not retained, on a 4-point scale. A statistically significant difference in mean scores was found for the Understanding scale on the Indiana Mathematics Beliefs Scales (IMBS) (Kloosterman & Stage, 1992) for participants who were retained ($M = 24.43$, $SD = 3.41$) and those not retained [$M = 23.11$, $SD = 4.23$; $t(152) = -2.04$, $p = .04$] with the average score for retained participants being approximately 1.3 points greater than the average score for those not retained, on a 30-point scale. A statistically significant difference in mean scores was found for the Concentration scale on the Learning and Study Strategies Inventory (LASSI) (Weinstein, Palmer, & Schulte, 2002) for participants who were retained ($M = 26.09$, $SD = 5.60$) and those not retained [$M = 24.26$, $SD = 6.40$; $t(152) = -1.78$, $p = .08$] with the average score for retained participants being approximately 1.8 points greater than the average score for those not retained, on a 40-point scale. No other statistically significant differences were found between these two groups.

The data and signed consent forms were kept in a secure location; the data were coded to ensure confidentiality for the participants.

Table 6

Group Differences for Retained Participants and Non-Retained Participants for Mean Scores on Continuous Variables

	Retained		Non-Retained		
Variable	M	SD	M	SD	t (152)
Age	22.80	6.37	20.74	4.40	-2.31*
High School GPA	2.63	.51	2.43	.60	-2.14*
IMBS					
Difficult Problems	21.05	4.13	20.24	4.60	-1.07
Steps	14.04	2.80	14.46	3.18	.82
Understanding	24.43	3.41	23.11	4.23	-2.04*
Word Problems	18.06	2.58	17.52	3.42	-.95
Effort	23.96	3.61	22.96	4.77	-1.43
LASSI					
Concentration	26.09	5.60	24.26	6.40	-1.78^{+}
Self-Testing	24.00	6.29	22.48	6.10	-1.39
Study Aids	23.23	5.29	21.85	5.42	-1.48
Time Management	24.77	6.30	22.93	6.26	-1.66
Pre-Test	9.56	3.34	8.70	3.73	-1.41

$^{+}p < .10$. $*p < .05$. $**p < .01$. $***p < .001$.

Data Analysis Procedure

This nonexperimental, quantitative study used descriptive, correlational, and comparative methods to analyze the data. The study is nonexperimental because there was no control over or manipulation of independent variables; its purpose was to study what occurs "naturally" in a real-world setting, such as in a classroom (McMillan & Wergin, 2002).

Several types of analysis were used to analyze the data. Descriptive analyses were first conducted to gain an overall picture of the sample being studied. This method was appropriate in that descriptive analysis uses simple statistics to describe the data and summarize results (McMillan & Wergin, 2002); its purpose was to describe what exists (Trochim, 2001).

Two types of regression analyses were used to answer the first two research questions; chi-square analysis and analysis of covariance techniques were used to answer the third research question. Regression analyses were appropriate statistical techniques because they provided the ability to assess the relationship between a single dependent variable and several independent variables (Tabachnick & Fidell, 2001). Regression techniques were also appropriate to use because of their flexibility in "real-world" situations for survey research where variables are not manipulated as in pure experimental designs (Tabachnick & Fidell, 2001). The chi-square analysis was an appropriate technique for nominal data that focused on group/category membership with a statistical focus on percentages (Huck, 2004). Analysis of covariance was an appropriate technique that "is ideally suited for analyzing differences between in-tact groups" (Kachigan, 1986, p. 338) while controlling for differences in the groups (Kachigan, 1986).

CHAPTER IV

RESULTS

Overview

The goal of this study was to examine several factors potentially affecting student retention and academic success in a developmental Algebra I course at a community college, including basic demographic variables of age and gender; life demands of enrollment status, employment status, number of dependents; and the pre-college academic characteristic of high school GPA; self-regulated learning characteristics; and the mode of course delivery. Two types of data, self-reported data and pre-test/post-test scores, were used to examine the research questions.

Presentation of Research Findings

Research Question 1

To what degree do (a) age and gender, (b) life demands, and (c) high school grades predict retention and success in a developmental Algebra I course?

To assess the relationships between the independent variables in the study and the dependent variables of retention and success, the data were examined in two steps. The first step was to conduct Pearson product-moment correlations to assess the strength of the relationships between the predictor variables and the criterion variables. The second step was to conduct logistic and multiple regression analyses to assess the unique contribution of each predictor variable to the prediction of the criterion variables.

Logistic regression techniques were used to answer the part of the question related to retention by analyzing the degree to which the independent variables (age, gender, life demands—student status, employment status, number of dependents—and pre-enrollment academic characteristic of high school grade point average) predict the dependent variable of student retention. Logistic regression was appropriate because of its ability to describe the relationship between a dichotomous dependent variable (retained/not retained) and a mix of independent variables that were dichotomous, categorical, and continuous (Tabachnick & Fidell, 2001). Standard multiple regression techniques were used to investigate the relative contribution of each of the independent variables for predicting success in developmental Algebra I. Multiple regression was an appropriate analytical tool to use because its objective was "to assess the relative importance of the various predictor variables in their contribution to variation in the criterion variable" (Kachigan, 1986, p. 239).

Step 1: Pearson Product-Moment Correlations

Pearson product-moment correlations were conducted between the predictor variables and retention. Table 7 presents the results of this analysis. As can be seen, statistically significant relationships were found between retention and age ($r = .16, p < .05$), between retention and gender ($r = .14, p < .10$), and between retention and high school GPA ($r = .17, p < .05$).

Pearson product-moment correlations were also conducted between the predictor variables and the criterion variable of success. Table 8 presents descriptive statistics for the variables and results of this analysis. As can be seen, no statistically significant relationships emerged.

Table 7

Intercorrelations for Demographic Variables, Life Demand Variables, Pre-Enrollment Academic Characteristic Variable, and Retention

		1.	2.	3.	4.	5.	6.	7.	8.	9.
1.	Age	---								
2.	Gender	.00								
3.	Student Status	-.25**	-.20*							
4.	Employment (1-20 hrs./wk.)	-.22**	-.01	.20*						
5.	Employment (21-30 hrs./wk.)	-.04	.08	-.11	-.22**					
6.	Employment (> 30 hrs./wk.)	.18*	-.07	-.35***	-.31***	-.27**				
7.	Dependents	.33***	.26**	-.16^{+}	-.09	.09	.04			
8.	High School GPA	.04	.16*	-.11	.05	.01	.02	-.06		
9.	Retention	.16*	.14^{+}	-.05	-.10	-.02	.06	.06	.17*	---

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 8

Intercorrelations for Demographic Variables, Life Demand Variables, Pre-Enrollment Academic Characteristic Variable, and Success

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Age	---								
2. Gender	.00								
3. Student Status	-.25**	-.20*							
4. Employment (1-20 hrs./wk.)	-.22**	-.01	.20*						
5. Employment (21-30 hrs./wk.)	-.04	.08	-.11	-.22**					
6. Employment (> 30 hrs./wk.)	.18*	-.07	-.35***	-.31***	-.27**				
7. Dependents	.33***	.26**	-.16+	-.09	.09	.04			
8. High School GPA	.04	.16*	-.11	.05	.01	.02	-.06		
9. Success	-.09	-.03	.01	-.09	-.09	.11	-.14	.07	---

+$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Step 2: Logistic Regression and Multiple Regression Analyses

Logistic regression was used to assess the degree to which each predictor variable contributed to the criterion variable of retention. Preliminary checks were conducted to ensure there were no violations of the assumptions of logistic regression (sample size, multicollinearity, outliers). The independent variables included the demographic variables of age and gender; the life demand variables of student status, employment status, and number of dependents; and the pre-enrollment academic variable of high school GPA; the dependent variable was retention.

Commonly selected levels of statistical significance are .10, .05, and .01, with .05 being the most frequently used level (Huck, 2004; Pallant, 2005); for this study the alpha level was set at .10. The more liberal significance level was used to minimize the possibility of a Type II error (Huck, 2004; Pallant, 2005; Trochim, 2001), which is to assume there is not a statistically significant difference when a statistically significant difference actually exists. Type II errors may be more hazardous in educational research than Type I errors (Deng, 2005; Goehring, 1981). A significance level of .10 was also used to increase the power of the test (Glass & Stanley, 1970; Pallant, 2005; Schloss & Smith, 1999), particularly with a relatively small sample size ($N = 154$). Larger sample sizes may more easily produce a statistically significant finding (Huck, 2004). A balancing act exists among sample size, significance level, and power with a trade-off between significance level and power: the lower the significance level, the lower the power (Trochim, 2001). Without the ability to increase sample size, the more liberal alpha level would produce greater power (Huck, 2004; Schloss & Smith, 1999; Trochim, 2001). It is also appropriate in exploratory studies for researchers to set the alpha level at .10 (Garson, 2002; Ravid, 2000). "After all, statistical significance at a particular level

[.05] does not dictate importance or practical significance" (Ott & Longnecker, 2001, p. 227).

Table 9 presents the results of this analysis. Holding all other variables constant, two predictor variables, the demographic variable of age and the pre-enrollment academic characteristic of high school grade point average, emerged as statistically significant predictors of retention at the levels set for the analysis. Age was positively associated with a higher probability of retention ($B = .07, p < .10$), meaning that the older the student, the more likely it would be that the student would be retained. Similarly, high school grade point average was positively associated with a higher probability for retention ($B = .65, p < .10$), meaning that the higher the GPA, the more likely it would be that the student would be retained.

Table 9

Summary of Logistic Regression Analysis of Demographic, Life Demand, and Pre-Enrollment Academic Characteristic Variables for Predicting Retention

Variable	B	SE	Odds Ratio	Wald statistic
Age	.07	.04	1.08	2.81^{+}
Sex	.62	.42	1.86	2.23
Student Status	.32	.57	1.37	.31
Employment (1-20 hrs./wk.)	-.47	.50	.63	.87
Employment (21-30 hrs./wk.)	-.22	.56	.80	.15
Employment (> 30 hrs./wk.)	.07	.51	1.07	.02
Dependents	-.14	.58	.87	.06
High School GPA	.65	.35	1.92	3.39^{+}

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Standard multiple regression analysis was performed to assess the degree to which the independent variables of age, gender, life demands, and high school grades predict success. Success was defined as the gain score from pre-test to post-test; using the gain score is an option for a quasi-experimental design (Schloss & Smith, 1999). "The gain score analysis determines differences in the amount gained (or lost). . . . This is usually the information that one is interested in when implementing a study using the pretest-posttest design" (Gliner & Morgan, 2000). Preliminary checks were conducted to ensure there were no violations of the assumptions of multiple regression (sample size, multicollinearity, singularity, outliers, normality, linearity, homoscedasticity, and independence of residuals). Age was the only variable that indicated a possibility for abnormality, that being with skewness and linearity. The age variable was checked with the dependent variable success for a curvilinear relationship; the relationship was not curvilinear. Because the variable did not have a statistically significant relationship with the dependent variable of success, it was left in the natural rubric for easy interpretation. Model 1 of the regression analysis included the demographic variables of age and gender; the life demand variables of student status, employment status, and number of dependents; and the pre-enrollment academic variable of high school GPA. Table 10 records the unstandardized regression coefficients and their standard errors for each variable used in the model. As a block, the demographic variables, life demand variables, and pre-enrollment academic variable did not yield a statistically significant model for predicting success in developmental Algebra I; the coefficient of determination (R^2) was .07, indicating that these variables explained only 7% of the variance in the dependent variable. Similarly, no statistically significant relationships emerged between the individual predictor variables and the criterion variable.

Table 10

Unstandardized Regression Coefficients (standard errors in parentheses) for Regression of Demographic Variables, Life Demand Variables, Pre-Enrollment Academic Characteristic Variable, and Self-Regulated Learning Characteristics Variables on Success

Variable	Success Model 1	Success Model 2	Success Model 3
Demographics			B (sd)
Age	-.06 (.08)		-.06 (.09)
Gender	.25 (1.04)		-.40 (1.12)
Life Demands			
Student Status	.59 (1.39)		.02 (1.48)
Employment (1-20 hrs./wk.)	-.93 (1.36)		-.46 (1.42)
Employment (21-30 hrs./wk.)	-.12 (1.66)		.03 (1.76)
Employment (>30 hrs./wk.)	1.20 (1.28)		1.11 (1.31)
Dependents	-1.57 (1.53)		-1.28 (1.66)
Pre-Enrollment Academic Characteristic			
High School GPA	.47 (.92)		1.01 (1.02)
Semester[a]	1.41 (1.04)		1.52 (1.12)
Self-Regulated Learning Characteristics			
Difficult Problems		-.16 (.13)	-.21 (.14)
Steps		.01 (.18)	.08 (.21)
Understanding		.19 (.17)	.25 (.18)
Word Problems		.11 (.18)	.10 (.19)
Effort		.23 (.14)	.23 (.16)
Concentration		.23[+] (.12)	.16 (.13)

Table 10 continued

Variable	Success Model 1	Model 2	Model 3
Self-Testing		.13	.18
		(.10)	(.11)
Study Aids		-.09	-.12
		(.12)	(.13)
Time Management		-.26*	-.22
		(.12)	(.13)
Semester[a]		.91	
		(.96)	
Model Statistics			
R^2	.07	.15	.20

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

[a]Semester was included to test for differences between the 2 samples (fall and spring); the test was not significant.

Research Question 2

To what degree do learners' (a) beliefs about math and (b) academic self-regulation predict retention and success in a developmental Algebra I course?

To assess the relationships between the independent variables in the study and the dependent variables of retention and success, the data were examined in two steps. The first step was to conduct Pearson product-moment correlations to assess the strength of the relationships between the predictor variables and the criterion variables. The second step was to conduct logistic and multiple regression analyses to assess the unique contribution of each predictor variable to the prediction of the criterion variables.

Logistic regression was used to analyze the relationship between the dependent variable of retention and the independent variables related to beliefs about math and academic self-regulation. Standard multiple regression was used to analyze the degree to which the independent variables of participants' beliefs about mathematics and participants' academic self-regulation characteristics predict the dependent variable of academic success.

Step 1: Pearson Product-Moment Correlations

Pearson product moment correlations were conducted between the predictor variables and the criterion variable of retention. Table 11 presents descriptive statistics for the variables and results of this analysis. As can be seen, statistically significant relationships were found between retention and Understanding ($r = .16, p < .05$) and between retention and Concentration ($r = .14, p < .10$).

Pearson product moment correlations were also conducted between the predictor variables and the criterion variable of success. Table 12 presents descriptive statistics for the variables and the results of this analysis. As can be seen, statistically significant relationships were found between success and Understanding ($r = .18, p < .10$) and between success and Effort ($r = .18, p < .10$).

Table 11

Means, Standard Deviations, and Intercorrelations for Self-Regulated Learning Characteristics Variables and Retention

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	Mean	20.81	14.16	24.03	17.90	23.66	25.55	23.55	22.82	24.22	
	Std. Dev.	4.28	2.91	3.71	2.85	4.01	5.89	6.25	5.35	6.32	
1.	Difficult Problems	---									
2.	Steps	-.28**									
3.	Understanding	.48***	-.47***								
4.	Word Problems	.10	-.16*	.28***							
5.	Effort	.41***	-.41***	.51***	.15+						
6.	Concentration	.41***	-.23**	.26**	.12	.21**					
7.	Self-Testing	.23**	-.27**	.14+	.06	.25**	.41***				
8.	Study Aids	.30***	-.18*	.13	.11	.25**	.45***	.70***			
9.	Time Management	.43***	-.28***	.28***	.15+	.25**	.76***	.58***	.55***		
10.	Retention	.09	-.07	.16*	.09	.12	.14+	.11	.12	.13	---

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 12

Means, Standard Deviations, and Intercorrelations for Self-Regulated Learning Characteristics Variables and Success

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	Mean	20.81	14.16	24.03	17.90	23.66	25.55	23.55	22.82	24.22	
	Std. Dev.	4.28	2.91	3.71	2.85	4.01	5.89	6.25	5.35	6.32	
1.	Difficult Problems	---									
2.	Steps	-.28**									
3.	Understanding	.48***	-.47***								
4.	Word Problems	.10	-.16*	.28***							
5.	Effort	.41***	-.41***	.51***	.15+						
6.	Concentration	.41***	-.23**	.26**	.12	.21**					
7.	Self-Testing	.23**	-.27**	.14	.06	.25**	.41***				
8.	Study Aids	.30***	-.18	.13	.11	.25**	.45***	.70***			
9.	Time Management	.43***	-.28***	.28***	.15+	.25**	.76***	.58***	.55***		
10.	Success	-.02	-.08	.18+	.08	.18+	.10	.00	-.04	-.01	---

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Step 2: Logistic Regression and Multiple Regression Analyses

Logistic regression was used to gain an understanding of the degree to which each predictor variable contributed to the criterion variable of retention. Preliminary checks were conducted to ensure there were no violations of the assumptions of logistic regression. Table 13 presents the results of this analysis. As can be seen, none of the independent variables emerged as statistically significant predictors of retention.

Standard multiple regression analysis was performed to assess the degree to which the independent variables predict success. Preliminary checks were conducted to ensure there were no violations of the assumptions of multiple regression. Model 2 of the regression analysis included the belief variables for Difficult Problems, Steps, Understanding, Word Problems, and Effort; and the academic self-regulation variables for Concentration, Self-Testing, Study Aids, and Time Management.

Table 13

Summary of Logistic Regression Analysis of Self-Regulated Learning Characteristics Variables for Predicting Retention

Variable	B	SE	Odds Ratio	Wald statistic
Difficult Problems	-.03	.05	.98	.24
Steps	.04	.07	1.04	.29
Understanding	.09	.07	1.09	1.82
Word Problems	.03	.07	1.03	.17
Effort	.02	.05	1.02	.13
Concentration	.04	.05	1.04	.52
Self-Testing	.02	.05	1.02	.11
Study Aids	.02	.05	1.02	.13
Time Management	-.00	.05	1.00	.00

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 10 (p. 73) presents the unstandardized regression coefficients and their standard errors for each variable used in the model. As a block, the belief variables and academic self-regulation variables did not yield a statistically significant model for predicting success; the coefficient of determination (R^2) was .15, indicating that these variables explained 15% of the variance in the dependent variable. Within that model, Concentration marginally yielded a statistically significant, positive relationship with success ($B = .23, p < .10$), meaning that each unit increase in the predictor variable measure for Concentration would yield a .23 increase in the criterion variable of success.

Time Management also marginally yielded a statistically significant relationship with success, but that relationship was negative ($B = -.26, p < .05$), meaning that each unit of increase on the predictor variable measure for Time Management would yield a .26 decrease in the criterion variable of success on a scale of 0 to 25.

Model 3 of the regression analysis included all of the predictor variables from the study: demographics, life demands, pre-enrollment academic characteristics, beliefs about math, and self-regulated learning characteristics.

Table 10 (p. 73) presents the unstandardized regression coefficients and their standard errors for the variables in this model. Similar to the other two models, the third model did not yield a statistically significant model for predicting success. The coefficient of determination (R^2) for Model 3 was .20, suggesting that all of the variables together explained 20% of variance in the dependent variable. Likewise, none of the predictor variables in this model reached statistical significance individually. When both Models 1 and 2 were combined in Model 3, the coefficients for the Concentration variable and the Time Management variable were reduced and rendered statistically non-significant, suggesting that the interaction of the demographic variables, the life demand variables and the pre-academic characteristic variable would suppress the effect of both the Concentration and Time Management variables.

Research Question 3

What differences exist in (a) retention and (b) academic success in a developmental Algebra I course as a function of enrollment in lecture versus computer-assisted formats?

To assess differences in retention and academic success as a result of the method of course delivery, two different types of analyses were conducted. Chi-square analysis assessed retention; analysis of covariance (ANCOVA) assessed success.

An independent-samples chi-square test was used to compare the percentage split between the two categories (retained/not retained) of the criterion variable of retention for students enrolled in lecture versus computer-assisted instruction sections of MTH 03. The chi-square test was appropriate because the data were nominal for group/category membership for both independent and dependent variables (Huck, 2004). Analysis of covariance (ANCOVA) was used to compare the difference in success between participants enrolled in traditional lecture sections and participants enrolled in computer-assisted instruction sections. ANCOVA was an appropriate technique to use in that it allowed for the adjustment of post-test scores on the basis of variability in pre-test scores, thus controlling for differences between the two groups on the pre-test. (Huck, 2004; Trochim, 2001). ANCOVA is used in applied research in the social sciences where intact groups are used with non-experimental designs to take into account the concomitant variables on which two groups are known to differ (Kachigan, 1986). This comparative design was appropriate with respect to the two instructional methodologies because it examined the differences between the two groups; its purpose was not to establish cause but to identify differences (McMillan & Wergin, 2002).

Chi-Square Analysis

An independent-samples chi-square test was conducted to explore the relationship between the method of instruction and the rate of retention in developmental Algebra I. The categorical independent variable was the method of instruction (lecture vs. computer-assisted instruction); the categorical dependent variable was the retention status of the student (retained vs. not retained). A preliminary check was conducted to ensure the assumption of expected frequencies in the cells had not been violated. Table 14 presents the results of this analysis. Using Yates' Correction for Continuity, the chi-square analysis indicated a statistically significant difference, $X^2(1, N = 154) = 2.88, p < .10$, between the two groups. The traditional lecture method retained 75% of the students; the computer-assisted instruction method retained 59% of the students.

Table 14

Distribution of Participants by Instructional Method and Retention Status

	Instructional Method			
	Lecture		Computer-Assisted Instruction	
Retention Status	n	%	n	%
Retained	82	74.5	26	59.1
Not Retained	28	25.5	18	40.9
Total	110	100.0	44	100.0

Note: $X^2(1, N = 154) = 2.88, p < .10$

Analysis of Covariance

A one-way between-groups analysis of covariance (ANCOVA) was conducted to explore the relationship between the method of instruction and the degree of success in developmental Algebra I. The independent variable was the method of instruction (lecture vs. computer-assisted instruction); the dependent variable was the score on the post-test administered at the end of the semester. Participants' scores on the pre-test administered at the beginning of the semester were the covariate in this analysis. To determine if there were differences in the pre-test scores between participants enrolled in the traditional lecture sections and participants enrolled in computer-assisted instruction sections, an independent samples t test was conducted to compare the mean scores on the pre-test. There was no statistically significant difference in scores for the lecture sections ($M = 9.16$, $SD = 3.47$) and the CAI sections, $M = 9.64$, $SD = 3.48$; $t(152) = -.76$, $p = .45$, suggesting that the participants in both groups appeared to be alike on the pre-test scores. The magnitude of the differences in the means was also very small ($d = .14$). Preliminary checks were conducted to ensure that there was no violation of the assumptions of ANCOVA (normality, linearity, homogeneity of variances, homogeneity of regression slopes, and reliable measurement of the covariate). Tables 15 and 16 present the results of the ANCOVA. After controlling for pre-test scores, the analysis revealed a statistically significant difference in post-test scores between the two groups, $F(1, 87) = 3.15$, $p = .08$. The computer-assisted instruction group had a larger adjusted mean ($M = 14.82$) than the traditional lecture group ($M = 12.97$). The strength of the relationship between the grouping factor and the dependent variable of success produced a moderate effect ($d = .38$).

Table 15

Pre- and Post-test Mean Scores, Standard Deviations, and Adjusted Mean Scores as a Function of Method of Instruction

		Lecture		Computer-Assisted Instruction	
	Maximum possible	Mean (SD)	Adjusted Mean	Mean (SD)	Adjusted Mean
Pre-test	25	9.16 (3.47)		9.64 (3.48)	
Post-test	25	12.87 (4.55)	12.97	15.14 (5.16)	14.82

Table 16

Analysis of Covariance of Post-test Scores as a Function of Method of Instruction, With Pre-test Scores as Covariate

Measure	df	SS	MS	F	*d*
Covariate	1	434.03	434.03	25.10***	.14
Method of Instruction	1	54.52	54.52	3.15^{+}	.38

$^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

CHAPTER V

DISCUSSION

Overview

The purpose of this study was to examine factors that affect student retention and academic success in a developmental Algebra I course at a community college. These factors included basic demographic variables of age and gender; life demand variables of enrollment status, employment status, and number of dependents; the pre-enrollment academic characteristic of high school GPA; self-regulated learning characteristics; and the method of course instruction/delivery. Examination of these variables for this study was organized around three research questions. This final chapter includes a summary and discussion of the findings for each research question. This chapter also includes a discussion of the implications for research and practice as well as a discussion of the limitations of the study and recommendations for future research.

Discussion of Research Findings

Research Question 1

To what degree do (a) age and gender, (b) life demands, and (c) high school grades predict retention and success in a developmental Algebra I course?

Based on the extant literature, the following reasonable hypotheses were established:

A. *Younger students will be more likely to be retained and achieve greater success than older students.*

B. *Males will be more likely to be retained and achieve greater success than females.*

C. *Full-time students will be more likely to be retained and achieve greater success than part-time students.*

D. *Students who are not employed will be more likely to be retained and achieve greater success than students who are employed.*

E. *Students with fewer dependents will be more likely to be retained and achieve greater success than students with more dependents.*

F. *Students with higher high school grade point averages will be more likely to be retained and achieve greater success than students with lower high school grade point averages.*

General findings from the research literature suggest that as the age of the student increases so do the chances that the student will withdraw (Adelman, 2005; Brooks-Leonard, 1991; Burley, Butner, & Cejda, 2001; Feldman, 1993; Liu & Liu, 1999), that males are more likely to earn higher grades in elementary algebra than females (Eldersveld & Baughman, 1986), that full-time students are more likely to persist and experience success (Bailey, 2004; Brooks-Leonard, 1991; Cofer & Somers, 2000; Feldman, 1993; Fralick, 1993; Horn & Ethington, 2002), that students who neither work nor have dependents are more likely to persist and be successful (Bradburn & Carroll, 2002: Bonham & Luckie, 1993; Cohen & Brawer, 2003; Fralick, 1993; Miller, Pope, & Steinmann, 2005; Parker, 1998; Sydow & Sandel, 1998), and that students with higher grade point averages from high school may be more likely to persist and be successful (Armstrong, 2000; Feldman, 1993).

While this study confirmed a statistically significant relationship between age and retention, the direction of the relationship was contrary to findings in the research literature; in this study age was positively associated with a higher probability of retention, meaning that the older the student, the more likely he/she would be retained. One possibility for this contrast in findings may be the operational definition of retention used in this study. The literature generally defines retention in terms of semester-to-semester retention; a student is retained if he/she returns the subsequent semester. However, this study defined retention as perseverance in and completion of a single course. Increasing age may be a predictor of retention in a single course while it may be a predictor of attrition from one semester to the next.

This study supported findings in the research literature (Armstrong, 2000; Burley, Butner, & Cejda, 2001; Pickering, Calliotte, & McAuliffe, 1992) that high school grade point average may be a predictor for retention; Feldman (1993) also found that high school grade point average may be a predictor for retention in a developmental math course. However, the study found that the other noncognitive variables did not show a statistically significant relationship with retention. Again, the definition for retention may be considered; the studies are generally based on retention from semester to semester whereas this study defined retention within a single course within a single semester.

The present finding that the demographic and life demand variables and the cognitive variable of high school GPA did not show a statistically significant relationship with success in a developmental Algebra I course is contrary to what was hypothesized. All of these independent variables together accounted for only 7% of the variance in the dependent variable success in the regression model, and none of the predictor variables individually showed a statistically significant relationship with success with this study defining success as the gain score from pre-test to post-test. The difference in findings from this study and findings from the other studies may be partially explained by the size of the sample. This sample included a total of 154 participants who took the pre-test, but only 90 (58.44%) participants took the post-test, yielding a relatively small sample for the number of variables tested. The samples for the studies (House, 1993; Penny & White, 1998; Tross, Harper, Osher, & Kneidinger, 2000) that had produced statistically significant findings regarding noncognitive variables had much larger samples with one study of more than 1,400 participants; large samples may be more sensitive for yielding statistical significance (Huck, 2004). Other studies showing statistically significant findings using noncognitive variables (Pickering, Calliotte, & McAuliffe, 1992) had been longitudinal with collection of data and refinement of analyses over 12 years of testing. However, at least one previous study (Umoh, Eddy, & Spaulding, 1994) had shown no statistically significant findings for demographic variables. In light of these findings, further investigation may be necessary to more fully understand the relationships among these variables.

Research Question 2

To what degree do learners' (a) beliefs about math and (b) academic self-regulation predict retention and success in a developmental Algebra I course?

Based on the extant literature, the following reasonable hypotheses were established:

A. *Students with more positive beliefs about math and about themselves as math students will be more likely to be retained and achieve greater success than students with more negative beliefs.*

B. Students with stronger self-regulation will be more likely to be retained and achieve greater success than students with weaker self-regulation.

Research concerning self-regulated learning characteristics for developmental students is limited (McCabe, 2003), but researchers (Hofer, Yu, & Pintrich, 1998; Levitz & Noel, 1989; McCabe, 2003) assert developmental students' academic weaknesses (reading, writing, mathematical computation) may prevent them from developing self-regulated learning characteristics that enable them to persist and succeed. Research indicates that students' self-efficacy may correlate with retention and success (Bandura, 1977; Lent, Brown, & Larkin, 1984; Schunk, 1991).

Limited research with developmental math students generally indicates students' beliefs about their intelligence and their predictions about their grades (Bassarear, 1991; Eldersveld & Baughman, 1986; Stage & Kloosertman, 1995), students' anxiety toward math (Goolsby, Dwinell, Higbee, & Bretscher, 1988; Higbee & Thomas, 1999), students' goal orientation toward learning (Ironsmith, Marva, Harju, & Eppler, 2003), and students' confidence in learning math (Hall & Ponton, 2005; House, 1993, 1995) may correlate with their success.

Findings from this study were contrary to the hypotheses. The contradiction regarding retention may be attributed to the time frame for this study; researchers (Bandura, 1977; Hofer, Yu, & Pintrich, 1998; Lent, Brown, & Larkin, 1984; Levitz & Noel, 1989; McCabe, 2003) in general have operationally defined retention from a semester-to-semester basis whereas this study operationally defined retention within a single course within a single semester basis. Factors that may predict retention from one semester to the next may not necessarily predict retention within a single course.

The finding that the belief variables and the academic self-regulation variables did not show a statistically significant relationship with success in a developmental Algebra I course is contrary to what was hypothesized. It was expected that the regression model including these noncognitive variables would show a statistically significant relationship with success. All of the independent variables together accounted for only 15% of the variance in the dependent variable success. However, Pearson product-moment correlations for the belief variables and the dependent variable of success did show two statistically significant, positive, but weak, correlations: Understanding ($r = .18, p < .10$), referring to students' perceived importance of understanding mathematical concepts, and Effort ($r = .18, p < .10$), referring to students' beliefs that greater effort on their parts will produce greater results. These findings are supported by findings from other studies (Bassarear, 1991; Goolsby, Dwinell, Higbee, & Bretscher, 1988; House, 1993) that have shown statistically significant relationships between students' beliefs/confidence in doing math and their success in developmental math courses.

Similarly, even though the model as a whole did not yield a statistically significant result as had been hypothesized, two of the academic self-regulation variables within the model did yield statistically significant, marginal relationships with success. Concentration, which refers to students' abilities "to focus their attention on school-related activities, such as studying and listening in class, rather than on distracting thoughts, emotions, feelings, or situations" (Weinstein & Palmer, 2002, p. 10), yielded a statistically significant, positive relationship with success ($B = .23, p < .10$). This finding is supported by Montalvo and Torres (2004) who assert that self-regulated learniners are those who can control their mental processes and develop strategies to maintain that concentration to achieve success. On the other hand, Time Management, which refers to students' abilities "to create and use schedules" (Weinstein & Palmer, 2002, p. 13), yielded a statistically significant, negative relationship with success ($B = -.26, p < .05$), suggesting that the better able the student is at managing demands on his/her time, the less successful he/she would be. Montalvo and Torres (2004) argue that self-regulated learners are able to manage their time and tasks required to achieve success. This study's finding is the antithesis of what one would expect, but the finding may speak more to other compensation factors of the participants. The earlier logistic regression analysis showed that age was positively associated with retention, meaning that the older the student, the more likely he/she would be retained. If that were the case, it would be the older students who would have been retained and who would have completed the post-test. The mean age of all participants, those who took the pre-test, was 22.18 (SD = 5.91); the mean age of the participants who were retained and took the post-test was 23.18 (SD = 6.62), one year older. Because the sample was older than the traditional-aged college student, it may be that even though the participants do not perceive themselves as effective managers of their time, as measured by the instrument in this study, they have learned to compensate in other ways or use other strategies to achieve success. Because of their age, this sample of students may also have unique characteristics that were not present in the norming sample for LASSI (Weinstein, Palmer & Schulte, 2002), the instrument used to measure this characteristic. For this study's sample, 52.7% of the participants were 20 years or older as compared to 34.8% of participants who were 20 years or older in the LASSI (Weinstein, Palmer & Schulte,

2002) norming sample for the measure for Time Management (Weinstein & Palmer, 2002).

When all of the predictor variables (demographics, life demands, pre-academic enrollment characteristic, beliefs about math, and academic self-regulation) were entered into the full model for the multiple regression analysis, the model did not yield statistical significance for predicting success and accounted for only 20% of the variance in success. The coefficients for Concentration and Time Management were both reduced and rendered statistically non-significant in this third model. This phenomenon of change in statistical significance might suggest that these variables in the second model were absorbing variance from other variables because when the other demographic and noncognitive variables from the first model were factored back in for the third model, they dropped out; in other words, something else may have been influencing these variables. Such a phenomenon is possible since regression analysis is correlational in nature and not causal in nature (Huck, 2004).

The fact that the full model accounted for only 20% of the variance in success may at first seem weak; however, in terms of practical significance and in light of other research findings (Basserear, 1991; Eldersveld & Baughman, 1986; House, 1995) this finding is relevant. Less than 25% of the variance in final grades (success) in these other studies was attributed to a combination of demographic and/or noncognitive variables. From a statistical perspective, these percentages may be weak; from a practical perspective, these percentages are noteworthy, implying that researchers should not ignore demographic and/or noncognitive variables that may contribute to or hinder student success in developmental algebra.

Research Question 3

Are there differences in (a) retention and (b) academic success in a developmental Algebra I course as a function of enrollment in lecture versus computer-assisted formats?

Based on the extant literature, the following reasonable hypothesis was established:

Students enrolled in computer-assisted instruction courses will be more likely to be retained and experience greater success than students enrolled in traditional lecture courses.

Research, although limited, suggests that using computers to support and/or deliver instruction in developmental math may enhance student self-concept and motivation for learning math (Ganguli, 1992; Plomp, Pilon, & Reinen, 1991), may reduce mathematics anxieties for students (Harris & Harris, 1987), and may generate more positive attitudes among students for learning math (Owens & Waxman, 1994). These positive attributes of computer-assisted instruction would suggest that greater student retention and success would follow. Limited research supports the theory of greater student success (Askar, 1993; Bailey, 1990; Owens & Waxman, 1994; Plomp, Pilon, & Reinen, 1991; Taylor, 1999; Underwood, Cavendish, Dowling, Fogelman, & Lawson, 1996) but does not analyze patterns of retention. For example, Askar (1993) found that 42% of the variance in an introductory college math course was attributed to computer-assisted instruction. Bailey (1990), in studying community college math students, found statistically significant differences in achievement scores between students in computer-assisted instruction classes and those in traditional instruction classes.

Findings from this study supported the hypothesis that statistically significant differences exist in both retention and success as a result of the instructional methodology. However, the direction of the difference for retention was contrary to what had been supposed with the traditional lecture method of instruction producing a greater retention rate (75%) than the computer-assisted instruction method (59%). The statistically significant difference for success supported the hypothesis with a larger adjusted mean ($M = 14.82$) for the computer-assisted group than for the traditional lecture group ($M = 12.97$). One explanation for the higher mean for the computer-assisted group may relate to the fewer number retained; the ones who were retained may have been a more select group of students. In summary, students may experience greater success in the computer-assisted instruction classes, but fewer may be retained using this instructional method.

The contrary findings for retention may be linked to the individualized approach of the computer-assisted instruction methodology. Student development theory (Astin, 1984; Tinto, 1975, 1993) is grounded in the belief of student involvement and academic and social integration with peers and/or faculty. The computer-assisted instruction approach is more individualized with almost no interaction among students. Faculty work one-on-one with students in this approach, but faculty intervention/involvement is mostly at the request of the student. This study did not directly assess academic and social integration constructs; therefore, more research may be necessary to further explain the findings for retention related to this research question.

Implications for Research and Practice

The results of this study have implications for both researchers and practitioners in the field of developmental math education. A major implication of this study is the need for more research. In light of some contradictory findings, results of this study suggest that identifying factors that affect student retention and academic success in a developmental Algebra I course at a community college may be a complex process. Trying to isolate the influencing variables, particularly with a student body of such diverse cognitive and noncognitive backgrounds as found in a community college, may require a research design of longer than two semesters. Factors affecting retention and success have been studied extensively at four-year institutions (Astin, 1984, 1993; Banning, 1989; Chickering, 1969; Chickering & Gamson, 1987; Chickering & Reisser, 1993; Levitz & Noel, 1989; Pascarella & Terenzini, 1991; Terenzini, Pascarella, & Blimling, 1999; Tinto, 1975, 1993; Upcraft & Gardner, 1989) but have only more recently been studied in community colleges (Bers & Smith, 1991; Borglum & Kubala, 2000; Halpin, 1990; Napoli & Wortman, 1998; Summers, 2003). While studies with community college students (Adelman, 2005; Burley, Butner, & Cejda, 2001; Brooks-Leonard, 1992) have generally shown that younger students are more likely to be retained and achieve success, the present study contradicted those findings. Other studies have generally suggested that full-time students are more likely to persist and experience success (Bailey, 2004; Brooks-Leonard, 1991; Cofer & Somers, 2000; Feldman, 1993; Fralick, 1993; Horn & Ethington, 2002) and that students who do not work and who do not have dependents are more likely to persist and experience success (Bradburn & Carroll, 2002; Bonham & Luckie, 1993; Cohen & Brawer, 2003; Fralick, 1993; Miller, Pope, & Steinmann, 2005; Parker, 1998; Sydow & Sandel, 1998), but the present study contradicted those findings. Likewise, only recently has empirical research been focused on developmental courses (Boylan & Bonham, 1992; Boylan & Saxon, 1999; Grubb, 2001; Kozeracki, 2002; McCabe, 2000; Spann, 1996).

Findings from this study failed to confirm statistically significant relationships between any of the noncognitive variables, or any of the self-regulated learning characteristics, and retention. Interestingly, this outcome is contrary to the findings of previous research studies (Adelman, 2005; Bailey, 2004; Bandura, 1977; Brooks-Leonard, 1991; Burley, Butner, & Cejda, 2001; Cofer & Somers, 2000; Fralick, 1993; Horn & Ethington, 2002; Lent, Brown, & Larkin, 1984; Schunk, 1991). This suggests that there may be other variables affecting retention, that there may be unique characteristics about this sample of students, or that the instruments in this study did not adequately measure these constructs for this sample of students. Further research with retention and developmental math students may be necessary. Tinto (2006) states: "The fact is that despite our many years of work on this issue [retention], there is still much we do not know and have yet to explore" (p. 2).

Further, although the findings suggest that noncognitive variables and students' self-regulated learning characteristics may account for only a small amount of variance in student success in developmental Algebra I, an implication for practice is that instructors should not ignore these variables when planning and delivering instruction. McCabe (2003) asserts that students in developmental courses have greater difficulty with self-regulation; instructors may use strategies that will help students become active learners, thereby developing greater self-regulation. Using measures to assess a variety of noncognitive and self-regulated learning characteristics that may affect student learning could provide further insight for instructors in supporting students in a developmental math course.

Results of this study also point to an interesting phenomenon related to instructional methodology. While students enrolled in the computer-assisted instruction sections of developmental Algebra I appeared to achieve greater success, fewer students were retained in these sections. Questions arise as to why this phenomenon occurred, implying that a trade-off may occur with the use of computer-assisted instruction methodology. Students who enroll in computer-assisted instruction sections may achieve greater success, but fewer may be retained; students who enroll in traditional lecture sections may be retained at a greater rate but with less success. Research studies (Askar, 1993; Bailey, 1990; Owens & Waxman, 1994; Plomp, Pilon, & Reinen, 1991; Taylor, 1999; Underwood, Cavendish, Dowling, Fogelman, & Lawson, 1996) have generally examined student success with computer-assisted instruction, but the findings may be incomplete without also examining course retention.

Limitations

This study had several limitations. These limitations were associated with the ability to generalize the findings and the research design, including issues concerning the assignment to the two instructional conditions (i.e., modes of instruction).

Generalizability of Findings

The ability to generalize the results of this study to all developmental math courses may be limited. This study was conducted during two semesters at one community college using one level of developmental math. The population served at this community college may be different from the populations in other areas. Likewise, the sample size itself may be a cause for concern with generalizability. Even though the sample represented 83.70% of all students enrolled in developmental Algebra I during the academic year, the study began with only 154 participants, 110 (71.43%) of whom were retained, and 90 (58.44%) of whom took the post-test. Results of the study may have been different had all 110 participants who were retained throughout the semester chosen to take the post-test. Generalizing the results to an entire population of developmental Algebra I students may not be plausible given these small numbers and the number of variables tested.

Research Design

The study was further limited by the research design. The study was non-experimental and correlational in design; therefore, results can only be interpreted to show that relationships exist. No determination about causality can be drawn from the findings. One purpose of the study was to determine if there were differences in retention and/or success that could be attributed to the mode of instruction. However, random assignment of subjects was not employed, resulting in possible selection bias. The sample consisted of the entire population of students who self-selected enrollment in either the traditional lecture classes or the computer-assisted instruction sections of MTH 03. Achievement levels of the participants at the beginning of the study were similar, based on their placement assessments; however, students' selection of method of instruction may have signaled potential differences in the groups based on learning preferences. Students may also have chosen a section based on their scheduling needs instead of on instructional needs. Random assignment of participants to the sections may have produced stronger findings, but assignment of participants to sections was not under the researcher's control. As occurs often in educational research, the study used the intact groups that occur naturally in educational settings (McMillan & Wergin, 2002; Schloss & Smith, 1999; Trochim, 2001). There may also have been a maturation threat in that students may have learned at different rates.

Students' self-selection of class may have produced variation in class sizes, resulting in a possibility for different treatment of students based on the ratio of students per instructor; class size varied from 8 to 28 students. Class size was not under the researcher's control; it also was dictated more by student need for a class at a particular time during the day. Different instructors taught the different sections, creating the possibility for different treatment of students and different levels of interaction/engagement among instructors and students. However, this limitation was minimized since all instructors followed a departmental course plan prescribing a uniform set of course objectives.

Another issue related to the instructional mode was the assignment of a lab assistant for the computer-assisted courses but not for the traditional lecture courses. While the lab assistant primarily provided assistance with the technology, she does have a baccalaureate degree in mathematics and would assist students with math questions. Students in a lecture class did not receive the added help of a lab assistant.

Recommendations for Future Research

This study provides one perspective for examining retention and academic success among community college developmental Algebra I students. Continuing research with these complex and sometimes contradictory issues is needed. Replication of the study could strengthen and/or expand these findings. The following recommendations for further study are suggested:

Recommendation 1

This study should be replicated at other community colleges with both similar and more diverse populations. A comparison among the findings could be useful to check for consistency among the findings and to determine if factors vary in their influence based on student diversity.

Recommendation 2

The portion of the study related to instructional methodology should be replicated with a sample that is more equal in size. The sample for the present study had 154 participants; 110 (71.43%) students enrolled in the lecture method, and 44 (28.57%) students enrolled in the computer-assisted instruction method. Variability in the sample sizes may have influenced the findings. A future study could also test a hybrid approach to instruction with traditional lecture that is supplemented by computer-assisted instruction. Perhaps the lecture segment could enhance retention, as suggested by the present study, while the computer-assisted segment could enhance success, also suggested by the present study.

Recommendation 3

The study should be replicated with other developmental math courses. Algebra I is only one level of developmental math. Replicating the study in arithmetic courses, pre-algebra courses, and Algebra II courses may provide a more holistic view of factors affecting developmental math students.

Recommendation 4

The study should add a qualitative component. Focus groups could be conducted with students enrolled in developmental math with questions designed to address the following points: students' attitudes toward the subject of math, students' beliefs about their abilities and performance in math, and strategies students use for learning math. This qualitative component, in conjunction with the quantitative data, may help to round out the description and analysis of developmental math students.

Conclusion

The purpose of this study was to examine factors that affect student retention and academic success in a developmental Algebra I course at a community college, including demographic variables, life demand variables, pre-enrollment academic characteristic, self-regulated learning characteristics, and instructional methodology. This study was based on a relatively small sample of students at one community college. Its findings provide basis for future studies and highlight the complex nature of trying to isolate the factors that contribute to retention and success. Findings from this study would indicate that there may not be one single variable or set of variables that may affect student retention and success; instead, there may be a multitude of variables, some of which may not yet be identified, that affect retention and academic success for developmental Algebra I students.

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APPENDIX A

Course Plan for MTH 03 (Lecture)

NEW RIVER COMMUNITY COLLEGE

DUBLIN, VIRGINIA

COURSE PLAN

Course Number and Title: MTH 03 – Algebra I - Lecture

Prepared by: Math Department (Instructor) — Fall, 2005 (Date)

Approved by: ______________________ (Dean) — Fall, 2005 (Date)

I. Course Description

Covers the topics of Algebra I including real numbers, equations and inequalities, exponents, polynomials, factoring, Cartesian coordinate system, rational expressions, and applications. Develops the mathematical proficiency necessary for selected curriculum entrance. Credits not applicable toward graduation. Prerequisites: a placement recommendation for MTH 03 and Arithmetic or equivalent. Contact 5 hours per week.

II. Introduction

In addition to developing a strong base of algebra skills, this course is intended to help you learn "how to learn" mathematics. It is intended to help relieve your anxiety and build your confidence in your mathematics skills. With the mathematics and study skills you will develop in MTH 03, you should be able to move to the next mathematics course with a higher expectation of success.

III. Course Content

Chapter 1 Real Numbers

1.1 The Real Number Line and Absolute Value
1.2 Addition with Integers
1.3 Subtraction with Integers
1.4 Multiplication and Division with Integers
1.5 Exponents, Prime Numbers, and Order of Operations
1.6 Multiplying and Dividing Fractions
1.7 Adding and Subtracting Fractions
1.8 Decimal Numbers and Change in Value
1.9 Properties of Real Numbers

Chapter 2 Algebraic Expressions, Linear Equations, and Applications

2.1 Simplifying and Evaluating Algebraic Expressions
2.2 Translating English Phrases and Algebraic Expressions
2.3 Solving Linear Equations: $x + b = c$ and $ax = c$
2.4 Solving Linear Equations: $ax + b = c$
2.5 Applications: Number Problems and Consecutive Integers
2.6 Applications: Percent Problems

Chapter 3 Formulas, Applications, and Linear Inequalities

3.1 Working with Formulas
3.2 Formulas in Geometry
3.3 Applications
3.4 Ratios and Proportions
3.5 Linear Inequalities

Appendix A.1 Absolute Value Inequalities

Chapter 4 Straight Lines and Functions

4.1 The Cartesian Coordinate System
4.2 Graphing Linear Equations in Two Variables
4.3 The Slope-Intercept Form: $y = mx + b$
4.4 The Point-Slope Form: $y - y_1 = m(x - x_1)$
4.5 Introduction to Functions and Function Notation
4.6 Graphing Linear Inequalities in Two Variables

Chapter 5 Exponents and Polynomials

5.1 Exponents
5.2 More on Exponents and Scientific Notation
5.3 Identifying and Evaluating Polynomials
5.4 Adding and Subtracting Polynomials
5.5 Multiplying Polynomials
5.6 Special Products of Polynomials
5.7 Dividing Polynomials

Appendix A.2 Synthetic Division

Chapter 6 Factoring Polynomials and Solving Quadratic Equations

6.1 Greatest Common Factor and Factoring by Grouping
6.2 Special Factoring Techniques I
6.3 Special Factoring Techniques II
6.4 Solving Quadratic Equations by Factoring

IV. Instructional Materials

Textbook: Introductory and Intermediate Algebra. by D. Franklin Wright, 1st

Edition, ISBN: 0-918091-90-X

Calculator: A scientific calculator is recommended. A graphing calculator will not be needed for this course. Calculators on mobile phones are not allowed to be used in class.

Other Materials: Graph paper *(For chapters 3 and 8)*
Pencils *(Note: Pen should NOT be used)*
Paper to take notes on.

Additional resource materials for some New River Community College classes can be found on the NRCC Web-based learning site at nr.edu/learninglinks.

V. Evaluation/Grading

Quizzes: There will be approximately 12 quizzes, over homework problems throughout the semester, two quizzes before each test. **Quizzes cannot be made up. Any missed quiz will receive the score of "0". (See Class Work below.)** *The average of all quiz grades will count as 15% of the course grade.*

Tests: There will be 6 tests. **Tests cannot be made up. Any missed test will receive the score of "0". (See Final Exam below.)** *The average of all tests will count as 50% of the course grade.*

In-class work: Occasionally problems will be assigned to do in class and will be taken up for a grade. The average of your in-class work will replace your lowest quiz grade. In-class work cannot be made up.

Homework: Homework will be assigned to be done using the Hawks Learning System software that comes with the textbook. Details about this will be given out later. *Homework will count as 15% of the course grade.*

Final Exam: There will be a comprehensive final exam. The final may also be used to replace the lowest test score. *The final counts as 20% of the course grade. If a student has a 95% average on all work prior to the final, that student will be exempt from the Final Exam.*

Course Grade:

(0.15)(Quiz Avg) + (0.50)(Test Avg) + (0.15)(Hmwk)+ (0.20)(Final) = Course Average

S = Satisfactory: You must have a course average of 75% or higher.
U = Unsatisfactory: You have a course average below 75%.
I = Incomplete: 80% of the course must be completed with an average of 75 or higher. Therefore, an "I" grade can only be given if a student has an average of 75 or higher, and is unable to take the Final Exam.
W = Withdrawal: The college Withdrawal Policy will be followed

VI. Class Procedures

During tests students should have nothing on their desk except the materials permitted for the test. All other books, papers and notebooks must be in the floor. Only instructor provided scratch paper and formula sheets are allowed.

All cell phones should be turned off or turned to silent during class.

No food or drinks the class room.

VII. Cheating Policy

The giving or receiving of any help on any graded portion of the course is considered cheating and will not be tolerated. The use of books, notes, electronic devices, cell phone calculators or any other unauthorized material during tests or quizzes is considered cheating. Any student found cheating will receive a grade of "0" on that portion and possibly a "F" for the course. This "0" will not be replaced by the final exam score.

VIII. Attendance and Withdrawal Policies

Attendance

Attendance will be taken at the beginning of each class meeting. Students missing class are responsible for any material covered and assignments made in their absence. Graded in-class work cannot be made up. Students arriving late should come in quietly. They are responsible to inform the instructor *after* class that they were present.

Student Initiated Withdrawal Policy:
(Taken from p. 28-29 of NRCC Catalog 2005-2006)

A student may drop or withdraw from a class without academic penalty during the first sixty percent (60%) of a session. For purposes of enrollment reporting, the following procedures apply:

a. If a student withdraws from a class prior to the termination of the add/drop period for the session, the student will be removed from the class roll and no grade will be awarded.

b. After the add/drop period, but prior to completion of sixty percent (60%) of a session, a student who withdraws from a course will be assigned a grade of "W." A grade of "W" implies that the student was making satisfactory progress in the class at the time of withdrawal, that the withdrawal was officially made before the deadline published in the college calendar, or that the student was administratively transferred to a different program.

c. After that time, if a student withdraws from a class, a grade of "F" will be assigned. Exceptions to this policy may be made under documented mitigating circumstances if the student was passing the course at the last date of attendance.

A retroactive grade of "W" may be awarded only if the student would have been eligible under the previously stated policy to receive a "W" on the last date of class attendance. The last date of attendance for a distance education course will be the last date that work was submitted.

Late withdrawal appeals will be reviewed and a decision made by the Coordinator of Student Services.

Instructor Initiated Withdrawal Policy:
(Taken from p. 28-29 of NRCC Catalog 2005-2006)

A student who adds a class or registers after the first day of class is counted absent from all class meetings missed. Each instructor is responsible for keeping a record of student attendance in each class.

Students who have not attended class by the last day to drop class and receive refund must be deleted by the instructor during the following week. No refund will be applicable.

When a student's absences equal twice the number of weekly meetings of a class (equivalent amount of time for summer session), the student may be dropped for unsatisfactory attendance in the class by the instructor.

When an instructor determines that absences constitute unsatisfactory attendance, a Faculty Withdrawal Form should be completed and submitted to the Admissions and Records Office within five days of when the student met the withdrawal criteria. The last date of attendance must be documented. A grade of "W" will be recorded during the first sixty percent (60%) period of a course. Students withdrawn after the sixty percent (60%) period will receive a grade of "F" except under mitigating circumstances when a letter of appeal has been submitted by the student. A copy of this documentation must be placed in the student's academic file.

The student will be notified of the withdrawal by the Admissions and Records Office. An appeal for reinstatement into the class may be approved only by the instructor.

Since attendance is not a valid measurement for Independent and Distance Learning (DE) courses, students may be withdrawn due to nonperformance. Students should refer to his/her DE course plan for the instructor's policy.

APPENDIX B

Course Plan for MTH 03 (Mediated Learning)

NEW RIVER COMMUNITY COLLEGE

DUBLIN, VIRGINIA

COURSE PLAN

Course Number and Title: MTH 03 - Algebra I (5 credits) - Mediated Learning

Prepared by: Math Dept. (Instructor) — Fall, 2005 (Date)

Approved by: ____________ (Dean) — Fall, 2005 (Date)

I. Course Description

Covers the topics of Algebra I including real numbers, equations and inequalities, exponents, polynomials, factoring, Cartesian Coordinate System, and applications. Develops the mathematical proficiency necessary for selected curriculum entrance. Credits not applicable toward graduation. Prerequisites; a placement recommendation for Mth 03 and arithmetic or equivalent.

II. Introduction

In addition to developing a strong base of algebra skills, this course is intended to help students learn "how to learn" mathematics. It is intended to help relieve their anxiety and build their confidence in their mathematics skills. With the mathematics and study skills they will develop in MTH 03, they should be able to move to the next mathematics course with a higher expectation of success.

III. Instructional Procedures

MTH 03 uses the Basic Algebra software called "Mediated Learning Systems" from Academic Systems. The algebra curriculum from Academic Systems is a comprehensive, individualized program. It has been designed to help students advance at their own speed for understanding and applying algebra. Students will be able to progress at their own rate through the software to complete the objectives for the course. Within each topic there are lessons. The student should complete and pass each lesson in the order listed in the attached "Assignment Schedule". This Assignment Schedule is intended to help monitor and record progress and to help keep the student on track for course completion.

IV. Instructional Materials

Textbook: The Personal Academic Notebook (PAN)
These are provided as part of user fee.

The student will be supplied The Personal Academic Notebook for each of the topics in this course. Homework is an important component of this course. Each online lesson has a corresponding lesson in the Personal Academic Notebook. The Notebook allows students access to the course materials when they are away from the computer. The Notebook contains the following features:

- Topic diskettes (including an "Install" diskette). Replacement diskettes will be available from your instructor for $3.00 each.
- Summaries of all lesson concepts
- Worked and partially worked sample problems.
- Homework problems (assigned by the computer or you may wish to do all of them) which give you an opportunity to practice while away from the computer.
- A lesson practice test which helps you prepare for the final lesson quiz or test.
- Answers to the odd-numbered problems.

Calculator: A scientific calculator is required. It is recommended that the student purchase (and use) a scientific calculator; specifically a Texas Instrument TI36 or higher. For higher level courses a TI83 is recommended and the student may elect to purchase this calculator now.

Other Materials: Pencils
Colored Pens (optional)
Individual Earphones

Additional resource materials for some New River Community College classes can be found on the NRCC Web-based learning site at nr.edu/learninglinks.

V. Instructional Materials

1. Handouts as needed
2. Access to the Academic Systems Management System
3. Access to the "Mediated Learning" lessons available to students.

VI. Specific Objectives

The student will be able to:

1. Determine when fractions are equivalent and find equivalent fractions.
2. Add, subtraction, multiply, and divide fractions.
3. Add, subtract, multiply and divide rational numbers.
4. Use exponential notation.
5. Use the order of operations to evaluate numerical expressions.
6. Identify the subsets of the real numbers.
7. Graph numbers on the real number line.
8. Use the correct ordering symbol to demonstrate the relationship between a pair of real numbers.
9. Find the absolute value of a real number.
10. Evaluate numeric expression containing grouping symbols.
11. Evaluate expressions involving the order of operations and exponents.
12. Use prime factorization to find the greatest common factor and the least common multiple.
13. Add, subtract, multiply, and divide rational numbers.
14. Identify the following laws:
    Commutative Law
    Associative Law
    Distributive Law
    Additive and Multiplicative Identities
    Inverses
15. Simplify algebraic expressions
16. Evaluate algebraic expressions.
17. Evaluate algebraic expression and formulas when the value of the variable(s) is given.
18. Solve first degree equations in one unknown.
19. Solve formulas for a particular unknown.

20. Translate words into algebraic expressions.

21. Solve a variety of word problem using algebraic techniques.

22. Graph the solutions of inequalities in one variable.

23. Solve first degree inequalities in one unknown.

24. Graph and read the ordinates of points in the rectangular coordinates system.

25. Define and use the terms:
    x-axis
    y-axis
    x-coordinate(abscissa)
    y-coordinate(ordinate)
    quadrant

26. Find the slope of a line using the concept of rise over run.

27. Use the Pythagorean Theorem.

28. Use the formula for the distance between two points.

29. Use the equation of a circle to find the center and radius.

30. Graph a linear equation in two variable using:
    table of values
    x- and y-intercepts
    slope-intercept form of the equation
    a point and the slope

31. Graph horizontal and vertical lines.

32. Find the slope of a line and interpret the result.

33. The slope of two lines to determine if they are parallel or perpendicular.

34. Find the equation of a line when given:
    the slope and a point
    it is horizontal
    it is vertical
    two points
    a point on a line that is either perpendicular or parallel to another line

35. Write the equation of a line in:
    standard form

slope intercept form
point-slope form

36. Graph first degree inequalities in two variables.

37. Solve systems of two first degree equation in two unknown using:
    graphing
    substitution
    elimination

38. Use systems of two first degree equations in two unknowns to solve a variety of word problems.

39. Use and define the following terms:
    exponent(power) base
    polynomial
    monomial
    binomial
    trinomial
    degree of a polynomial

40. Use the following properties to simplify problems involving exponents:
    multiplication property
    division property
    power raised to a power property

41. Evaluate expressions involving exponents including the exponent of zero.

42. Simplify polynomial expressions using the operations of addition, subtraction, multiplication and division.

43. Factor polynomial using the following methods:
    greatest common factors
    trinomial factoring
    factoring by grouping
    difference of two squares
    sum of two cubes
    difference of two cubes

44. Solve quadratic equations in one unknown using factoring.

45. Add, subtract, multiply, and divide rational expressions.

46. Use negative exponents.

VII. <u>Course Content</u>

Topic 1 Real Numbers (7 hours)

Topic 2	Solving Linear Equations and Inequalities (16 hours)
Topic 3	Introduction to Graphing (3 hours)
Topic 4	Graphing Linear Equations (14 hours)
Topic 5	Solving Linear Systems (12 hours)
Topic 6	Exponents and Polynomials (6 hours)
Topic 7	Factoring (10 hours)
Topic 8.1 & 8.2	Rational Expressions (7 hours)

VIII. Grading

There will be six factors in grading - attendance (tardies), computer time, computer evaluates, quizzes, tests, and a comprehensive final exam.

Attendance - The NRCC attendance policy will be followed. See the attached Withdrawal Policy. Regular attendance is necessary to succeed in this and any other course. Student must use class time wisely to work on the computer, get individual or group instruction, or take any form of evaluation. There are no excused or unexcused absences. All absences regardless of the reason will be recorded.

Tardiness: It is the student's responsibility to inform the instructor when tardy. Failure to report this will result in an absence being recorded. Two (2) tardies or early departures will be counted as one absence from class. If you are more than 15 minutes late for class it is considered an absence.

Computer Time - The amount of time the student must spend using the computer will vary. Each student must use his or her own judgement as to the amount of time needed to successfully complete this course. However, a **minimum** of 38 hours is required in order to receive an "I" grade.

Computer Evaluates - After each section there is an Evaluate. The students have two opportunities to earn the desired grade. The highest grade will be recorded and included in the final average. These Evaluates are an excellent learning tool. They help students judge their strengths and weaknesses within a given section Use these as a learning tool. When a student starts an Evaluate, he or she must complete it. Evaluates are 10% of the final grade.

An Evaluate can only be taken during class unless other arrangements are made with your instructor.

Quizzes - There are twelve (12) written quizzes. Each quiz will consist of 5 to 10 questions. The student takes this when he or she thinks he is ready. There are no second tries on quizzes. A Quiz must be completed once it is started. The quiz average counts as 10% of your grade.

Tests - There are six (6) 100-point tests. These will be averaged and will count as 60% of the final grade. These will be averaged and will count as 60% of the final grade. They must be taken and finished during class time and on the scheduled day. Tests may be taken early but not later than the scheduled day. There are no make-up tests given.

Final Comprehensive Exam - There is a final comprehensive 100-point exam. This counts as 20% of the final grade. If a student has a **95%** average on all work, the student will be exempt from the final exam.

IX. Cheating

Giving or receiving any help from another student or unauthorized individual during any type of evaluation - Evaluate, Quiz, or Test - is cheating.

Use of books, notes, or any other type of unauthorized material during **ANY** type of evaluation is cheating.

If you have a question, ask your instructor or a lab assistant.

If either your instructor or a lab assistant asks you to stop using any unauthorized assistance you must do so immediately and your grade on the evaluation will be zero.

Cheating in any form may result in dismissal from class and a grade of "U" for this course.

X. Final Grade

When you complete the course the following formula will be used to determine your average:
.1 (evaluates) + .1 (quiz average) + .6 (test average) + .2 (final exam) = average

Note: These weights are determined by each instructor.
The final exam grade may be used to replace the lowest test grade if the exam grade is higher. Only one test score may be replaced.

S - Satisfactory — You must have a final average of 75 or higher and have completed all required work.

U - Unsatisfactory — You have a final average of 74 or less and do not qualify for an "I".

I - Incomplete — You have fulfilled the following conditions:
(1) At **least 38 hours** have been spent on the computer.
(2) You have completed all work **except Test #6** and the Final Exam.
(3) You have at least a 75% using the following method of computation:
.2 (evaluate) + .8 (five tests plus quiz average) 75%
(4) You have an extreme emergency as a reason for not

finishing.
You must complete the required material during the next semester. Failure to complete the material will result in a "U" being recorded. You **do not** have to enroll in MTH 03 again.

W - Withdrawal — The college withdrawal policy will be followed.

XI. Withdrawal Policy

STUDENT INITIATED WITHDRAWAL POLICY

A student may drop or withdraw from a class without academic penalty during the first 60 percent of a session. For purposes of enrollment reporting, the following procedures apply:

A. If a student withdraws from a class prior to the termination of the add/drop period for the session, the student will be removed from the class roll and no grade will be awarded.

B. After the add/drop period, but prior to completion of 60 percent of a session, a student who withdraws from a class will be assigned a grade of "W." A grade of "W" implies that the student was making satisfactory progress in the class at the time of withdrawal, that the withdrawal was officially made before the deadline published in the college calendar, or that the student was administratively transferred to a different program.

C. After that time, if a student withdraws from a class, a grade of "F" will be assigned. Exceptions to this policy may be made under documented mitigating circumstances if the student was passing the course at the last date of attendance.

A retroactive grade of "W" may be awarded only if the student would have been eligible under the previously stated policy to receive a "W" on the last date of class attendance.

The last date of attendance for a distance education course will be the last date that work was submitted.

Late withdrawal appeals will be reviewed and a decision made by the Coordinator of Student Services.

INSTRUCTOR INITIATED WITHDRAWAL POLICY

A student who adds a class or registers after the first day of class is counted absent from all class meetings missed. Each instructor is responsible for keeping a record of student attendance in each class.

Students who have not attended class by the last day to drop the class and receive a refund must be deleted by the instructor during the following week. No refund will be applicable.

When a student's absences equal twice the number of weekly meetings of a class(equivalent amount of time for summer session), the student may be dropped for unsatisfactory attendance in the class by the instructor.

When an instructor determines that absences constitute unsatisfactory attendance, a Faculty Withdrawal Form should be completed and submitted to the Admissions and Records Office within five days of when the student met the withdrawal criteria. The last date of attendance must be documented. A grade of "W" will be recorded during the first sixty percent (60%) of a course. Students withdrawn after the sixty percent (60%) period will receive a grade of "F" except under documented mitigating circumstances when a letter of appeal has been submitted by the student. A copy of this documentation must be placed in the student's academic file.

The student will be notified of the withdrawal by the Admissions and Records Office. An appeal for reinstatement into the class may be approved only by the instructor.

Since attendance is not a valid measurement for Independent and Distance Learning (IDL) courses, students may be withdrawn due to non-performance. Students should refer to his/her IDL course plan for the instructor's policy.

XI. COURTESY

Turn off your cell phone before entering class.

APPENDIX C

Student Information Sheet

NAME ______________________________ **Section Number** ________

Empl ID ______________________________

Social Security No. ______________________

Student Information Sheet
MTH 03: Examining Retention and Academic Success

Please respond to the following questions by either checking the appropriate box or writing the appropriate answer in the blank provided.

1. Student Status
   [ ] Full-time Student (enrolled for a minimum of 12 hours)
   [ ] Part-time Student (enrolled in fewer than 12 hours)

2. Employment Status
   [ ] Do not work
   [ ] Work 1 – 10 hours per week
   [ ] Work 11 – 20 hours per week
   [ ] Work 21 – 30 hours per week
   [ ] Work 31 – 40 hours per week
   [ ] Work more than 40 hours per week

3. Number of Dependents (includes children and/or adults under your everyday care)
   [ ] 0 [ ] 4
   [ ] 1 [ ] 5
   [ ] 2 [ ] More than 5: please specify how many _____
   [ ] 3

4. Your final high school grade point average
   [ ] A- to A (3.5 – 4.0) [ ] C- to C (1.5 – 1.9)
   [ ] B to A- (3.0 – 3.4) [ ] D to C- (1.0 – 1.4)
   [ ] B- to B (2.5 – 2.9) [ ] D- to D (0.5 – 0.9
   [ ] C to B- (2.0 – 2.4) [ ] Did not graduate from high school

5. Estimated yearly household income
   [ ] Below $10,000 [ ] $60,000 to $69,999
   [ ] $10,000 to $19,999 [ ] $70,000 to $79,999
   [ ] $20,000 to $29,999 [ ] $80,000 to $89,999
   [ ] $30,000 to $39,999 [ ] $90,000 to $99,999
   [ ] $40,000 to $49,999 [ ] more than $100,000
   [ ] $50,000 to $59,999

Thank you for your participation!

APPENDIX D

Indiana Mathematics Beliefs Scales

The Indiana Mathematics Beliefs Scales (IMBS) may not be reproduced at the request of the author. For more information regarding the IMBS, please see the following article:

Kloosterman, P., & Stage, F. K. (1992). Measuring beliefs about mathematical problem solving. *School Science and Mathematics, 92,* 109-115.

APPENDIX E

Learning and Study Strategies Inventory

The Learning and Study Strategies Inventory (LASSI) (Weinstein, Palmer, & Schulte, 2002) is protected by copyright from reproduction in this document. For more information regarding LASSI, contact H & H Publishing Company, Inc., 1231 Kapp Drive, Clearwater, FL 33765.

APPENDIX F

ASSET Test Form B

The ASSET Elementary Algebra Test, Form B2, (American College Testing, 1997) is protected by copyright from reproduction in this document. For more information regarding ASSET Elementary Algebra Test, Form B2, contact ACT Publications, P. O. Box 168, Iowa City, Iowa 52243-0168.

APPENDIX G

ASSET Test Form C2

The ASSET Elementary Algebra Test, Form C2, (American College Testing, 1997) is protected by copyright from reproduction in this document. For more information regarding ASSET Elementary Algebra Test, Form C2, contact ACT Publications, P. O. Box 168, Iowa City, Iowa 52243-0168.

APPENDIX H

President's Letter

New River
COMMUNITY COLLEGE
COMMUNITY COLLEGE

P.O. Box 1127 **Dublin, Virginia 24084**

Phone (540) 674-3600
Or (540) 674-3619 (TDD)

FAX (540) 674-3642

May 4, 2005

Pat Huber
Interim Vice-President for Instruction and Student Services
New River Community College
P. O. Box 1127
Dublin, VA 24084

Dear Pat:

This is to confirm my earlier conversations with you concerning your proposed research project here at New River Community College. I understand that you plan to conduct this study to support your dissertation in partial fulfillment of the requirements for a doctoral program at Old Dominion University.

You and I have talked on several occasions about your proposed study, and I am aware that you will be focusing on the noncognitive factors that affect student retention and academic success in developmental math, specifically MTH 03 (Algebra I). You know from our conversations that this issue holds great importance for me, and I will be most interested in your findings. I appreciate the fact that you have already presented your proposed study to the Academic Success Committee and to math faculty and that you have gained their support for this project.

Therefore, I pledge to you my support and the college support as you embark on this next phase in your doctoral program. I extend to you my best wishes.

Sincerely,

Jack M. Lewis, President
New River Community College

APPENDIX I

Informed Consent Form

New River Community College
Learner Survey Packet

IMPORTANT STUDENT INFORMATION FOR YOU TO READ BEFORE YOU COMPLETE THE QUESTIONNAIRE PACKET!

This packet contains a series of questionnaires related to thoughts and feelings you have about yourself, your studies, and the subject of math at New River Community College. The time and effort you put into this project will help us look at the issues affecting how our students learn math and how we may help students to achieve greater success in math.

Your answers will be completely confidential. This form, information sheet, and packets will be stored in a locked file cabinet in a secure room. Your instructor will not see your responses.

Your participation is voluntary. Although it is important to us that you complete the entire packet, you can choose to stop participation at any point. Your participation today will in no way affect your grades or the services you receive here at NRCC.

There are no right or wrong answers in this first packet, so please just make your honest and best judgment. (A second packet will contain a short math assessment whose answers would be either right or wrong.) Although the questions are in no way intended to prove distressful, if you do have questions or concerns related to the questions, please consult with the proctors.

Please be sure to answer every item. It is important to choose an answer for every question and not leave any blank.

Please sign here to indicate that you understand and are ready to participate:

____

Signature

____

Parent/Legally Authorized Representative's Signature (required only if you are 17 or younger)

Now please follow the directions that are given for completing each part of the packet.

Thank you for your participation!

VITA

Patricia B. Huber was born in 1954 in Smyth County, Virginia. She graduated from Wytheville Community College in Wytheville, Virginia, with an Associate in Arts Degree in 1974 and graduated from Emory & Henry College in Emory, Virginia, in 1976 with a Bachelor of Arts in English. She earned a Master of Arts in Education from West Virginia University in Morgantown, West Virginia, in 1983. She taught high school English for 15 years. In 1988, she began teaching at New River Community College in Dublin, Virginia, as an adjunct instructor and was hired as a full-time instructor in 1992. She was appointed dean of arts and sciences in 2000. Currently she serves as interim vice-president for instruction and student services and holds the rank of associate professor.

She lives in Pulaski, Virginia, with her husband, Peter.