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Computer-Based Instruction And Remedial Mathematics: A Study Of Student Retention At A Florida Community College

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Computer-Based Instruction And Remedial Mathematics: A Study Of Student Retention

At A Florida Community College

by

Carol A. Zavarella

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
Department of Higher Education
College of Education
University of South Florida

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Dedication

I dedicate this work to my parents, Artorige and Joanne Zavarella, who instilled in their children the value of an education; to my husband, Glenn Counts, who supported and encouraged me throughout this process; and to my children, Andrea and Philip, both of whom exhibited enormous amounts of patience and understanding when “wait a minute” turned into several hours later.

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Computer-Based Instruction and Remedial Mathematics: A Study of Student Retention at
a Florida Community College

Carol A. Zavarella

ABSTRACT

Computer-based instruction including distance learning is fast becoming an integral part of higher education. Much of the current research has found that computer-based instruction is as effective as lecture-based instruction. Despite the wealth of studies that purport that students enrolled in computer-based instruction perform equally well as compared to their lecture-based counterparts, there is a high dropout rate associated with computer-based instruction including distance learning.

The purpose of this study was to examine the differences in students' withdrawal and completion rates in classes delivered via different instructional formats (distance learning, hybrid, or traditional) to determine if student learning style and/or student reasons for choosing an instructional format have an effect on the dropout rate in a remedial mathematics course. This non-experimental quantitative study employed logistic regression to estimate the probability of withdrawal from a Basic Algebra (MAT 0024) course based on student learning style, student reasons for selecting the instructional format, and CPT scores.

Learning styles and their relationship to completion status within the three instructional delivery formats were examined. It was determined that those students who

were enrolled in a hybrid or distance learning course had greater odds of withdrawing as compared to students enrolled in a lecture-based course. It was also determined that learning style did not impact the completion or withdrawal of students regardless of the delivery format.

Student reasons for enrolling in a particular delivery method and the relationship to completion or withdrawal within the three instructional delivery formats was also examined. It was determined that those students who enrolled in the course based upon personal factors had greater odds of completing the course without distinction to a particular instructional delivery method. Those students who enrolled in the course because of their perceived learning needs had greater odds of withdrawing from the course without distinction to a particular instructional delivery method.

CPT scores and their relationship to completion or withdrawal within the three learning styles were examined. Based on the data, there is no relationship between students' CPT scores and their withdrawal or completion in a particular delivery format.

Chapter One

Introduction and Background

The advent of the Internet has profoundly changed both the way people communicate information and the ease with which such communication occurs, creating what truly can be called a world without borders. Friedman (2005) coined the phrase “the world is flat” to describe the effects of globalization, which has had profound political and economic implications for many nations, including the United States. As more manufacturing jobs move offshore and employment opportunities become more service orientated, a college education is deemed a necessity. For the United States to compete in a global world, our higher education system must have an emphasis on “professional education and on continuous education,” which includes a “comparative and international dimension” that an educated diverse population can provide (DeWit, 1999, p. 17).

In part because of globalization and the concomitant need for a college degree, enrollment in higher education continues to increase. The National Center for Educational Statistics (NCES) reports that the number of full-time and part-time students at both two and four-year institutions will continue to reach a new high from 2006 until 2015 (NCES, 2006). Many of these students, for a variety of reasons, will be required to take remedial coursework before enrolling in college credit courses.

Remedial education has always been a highly debated topic of discussion for all persons interested in education. Two of the most contentious issues include who should pay for remediation and who should perform remediation. Ignash (1997) states

“Legislators and the public are upset over the perception that they are paying twice for the same education: once in high school and once again in college” (p. 7). As a result, funding for remedial education is often a controversial issue for many institutions of higher education. In addition, there is debate about who should be providing the function of remedial/developmental education. Community colleges lament that they are overburdened with providing almost all of the remedial education and, consequently, other equally important functions of the community college are at risk. Universities claim that it is inappropriate to offer noncollegiate courses at four-year institutions and that offering remedial studies will bring down the prestige of their degrees (Ignash, 1997).

In the State of Florida, the legislature has responded to this debate by requiring that all remediation be administered at the community college. Title XLVIII under Florida statute (2002) states “public postsecondary educational institution students who have been identified as requiring additional preparation pursuant to subsection (1) shall enroll in college-preparatory or other adult education pursuant to s. [1004.93](#) in community colleges to develop needed college-entry skills” (Assessment and Accountability, Chapter 1008, 4a). The three main subject areas in which students usually require remediation are reading, writing, and mathematics. Of these three main subject areas, mathematical remediation is required by the majority of students needing remediation.

As community colleges struggle with limited resources to meet the needs of their student population, the advances in technology may have offered a possible solution. Faced with fiscal constraints, space limitations, and a burgeoning population of students

needing remediation, community colleges are investing in computer-based instruction including distance learning to meet students needs.

Distance learning has been defined in many ways, but in general it “is a species of education characterized by one structural characteristic – the noncontiguity of teacher and student” (Garrison, 1989, p. 8). Even though students and teacher rarely meet face to face, it is essential that there exist a means of communication, which, within distance learning, can be either synchronous or asynchronous. Phipps & Meritosis (1999) state that synchronous communication “occurs when teacher and students are present at the same time during instruction—even if they are in two different places—and asynchronous communication...occurs when students and teachers do not have person-to-person direct interaction at the same time or place” (p. 11). The focus of this study was asynchronous communication within distance learning.

Distance learning is fast becoming an integral part of higher education. Most colleges and universities offer at least one distance-learning course. Among its many advantages, distance learning reaches “a broader student audience, better addresses student needs, saves money, and more importantly uses the principles of modern learning pedagogy” (Fitzpatrick, 2001 as cited in Tucker, p. 1).

Many studies have examined the success of students enrolled in distance learning courses as compared to students enrolled in lecture-based courses. Much of the current research on the effectiveness of computer-based instruction has found that computer-based instruction is as good as lecture-based instruction (Lesh & Rampp, 2000; Perez & Foshay, 2000; Tucker, 2001). These studies focused mainly in areas that examined student outcomes, student attitudes and overall student satisfaction (Phipps & Merisotis,

1999). Despite the wealth of studies that purport that students enrolled in computer-based instruction perform equally well as compared to their lecture-based counterparts, there is a high dropout rate associated with computer-based instruction including distance learning. Phipps & Merisotis (1999) and Kozeracki (1999) state that the current research fails to explain why there is a high dropout rate for distance learners. Moreover, Bendickson (2004) found the retention rates for remedial mathematics in the computer-based courses are as low as or lower than the retention rates in the traditional lecture based courses. More research is needed to examine the issue of the high dropout rate in computer-based instruction with respect to remedial mathematics education.

Statement of the Problem

The large number of students requiring remediation continues to be a concern for all those involved in higher education. The NCES reports that “about 42 percent of community college freshman and 20 percent of freshman at four-year institutions enroll in at least one remedial course That is almost a third of all freshman” (as cited in Dembicki, 2006, p.1). The NCES report further states, “[o]f college freshmen taking remedial courses, 35 percent are enrolled in math” (as cited in Dembicki, p. 10).

As mentioned earlier, Florida state law prohibits four-year colleges and universities from providing remedial education; therefore, the Florida Community College System (FCCS) bears the responsibility of serving our unprepared students. The Florida Department of Education reports that of all community college students who are entering college for the first time (FTIC), “approximately 65% fail at least one entry level test in reading, writing, or math” (2005, p. 1). This suggests that of every five FTIC

students enrolled in a Florida community college at least three will require remediation to enter college level courses.

The site for this study was a large, urban, multi-campus community college located in the state of Florida whose course offerings includes both computer-mediated and distance learning courses. Beginning Fall 1999, in an effort to meet students' needs and improve student retention and success rates, the college began offering computer-based instruction via an interactive hybrid course. The hybrid course required that students attend class but receive instruction through traditional style mini-lectures combined with computer-based instruction. As of Fall 2002, computer-based instruction was expanded to include remedial courses offered through distance learning.

In general, the research on computer-based instruction focuses mainly on areas of student success (Cannon, 2006; Perez & Foshay, 2000; Tucker, 2001; Weems, 2002), student attitudes (Weems, 2002), and overall student satisfaction (Phipps & Merisotis, 1999; Weems, 2002). Proponents of computer-based instruction point to the wealth of studies that show computer-based instruction is as effective as lecture-based instruction. In 1999, Thomas L. Russell published an annotated bibliography titled *The No Significant Difference Phenomenon*. The book "is a fully indexed, comprehensive research bibliography of 355 research reports, summaries and papers that document *no significant differences* (NSD) in student outcomes between alternate modes of education delivery" (WCET, 2007, ¶ 1). More recently, the Sloan Consortium (2006) reported that "most Chief Academic officers believe that the quality of online instruction is equal to or superior to that of face-to-face learning" (p. 7).

Critics claim, however, that the studies are flawed and that there are gaps in the research. Kozeracki points out that The Institute for Higher Education Policy criticized many of the studies referenced in Russell's bibliography by "arguing that much of the original research on the effectiveness of DE suffers from methodological flaws" (1999, p. 96). Phipps and Merisotis (1999) and Kozeracki (1999) state that the research fails to explain why there is a high dropout rate for distance learners. Carr (2000) found that while course-completion varies among institutions, "several administrators concur that course-completion rates are often 10-20 percentage points higher in traditional courses than in distance offerings" (p. 2). Bendickson (2004) found the retention rates for remedial mathematics in the computer-based courses are as low as or lower than the retention rates in the traditional lecture-based courses. At one large, southern, multi-campus community college, the dropout rate for Beginning Algebra (MAT 0024) students enrolled in a lecture-based course, hybrid course, and distance learning course during Fall 2006 was 44%, 52%, and 68% respectively. More research is needed to examine the issue of the high dropout rate in computer-based instruction within remedial mathematics.

The high dropout rate is a well-documented characteristic of computer-based instruction in general, and in particular, within distance learning courses and programs (Carr, 2000; Diaz, 2002; Phipps & Merisotis, 1999; Parker, 1999). There is, however, limited research designed to understand why the dropout rate is higher in computer-based instruction as compared to traditional instruction. The high dropout rate has prompted critics of distance learning to question whether it is an appropriate delivery method for every student and/or for every subject area. Some researchers posit that success and/or

retention in computer-based instruction is affected by the particular learning style of the student (Boles, Pillay, & Raj, 1999; Diaz & Carnal, 1999; Gee, 1990; Grasha & Yangarber-Hicks, 2000; Sherry, 1996; Terrell, 2005; Tucker, 2001). Other researchers claim that student choice of instructional delivery format may be related to the high dropout rate within computer-based instruction (Berg, 2001; Kinney, 2001; Roblyer, 1999). Several studies designed to measure student perception of computer-based instruction found that students perceive that the use of a computer will help them to understand the material and that courses delivered via computer-based instruction will be less time consuming (Lesh, 2000).

Of the few studies that examine learning style and student choice within computer-based instruction, none focused on the remedial student enrolled in a community college. It is important that more research be conducted on this population in an effort to improve retention in computer-based instruction, a group that has been documented as high risk for dropout (Roueche & Roueche, 1993; Tinto, 1996).

This study attempted to examine the differences in students' withdrawal and completion rates in classes delivered via different instructional formats (distance learning, hybrid, or traditional) to determine if student learning style and/or student reasons for choosing an instructional format have an effect on the dropout rate in a remedial mathematics course.

Significance of the Problem

Persistence is an important issue for institutions of higher education. A large number of students enrolling in college require at least one remedial math course. It is important for both the student and the college that most of these students complete and

successfully pass their remedial courses in a timely manner. Student retention and college graduation rates are at an alarmingly low rate, and the college is investing enormous amounts of money, time, and energy to discover ways to increase student retention and success both generally and particularly in preparatory courses and gateway courses, such as intermediate algebra and college algebra.

According to a recent report on state accountability measures, the college in this study was approximately 10% below other state community colleges in success and approximately 9% below other state community colleges in retention. Considering that the retention and success rates on average across Florida are already low, these percentages are of particular concern to the college's faculty and administration because state funding is based in part on the success and retention rates of individual community colleges. It is imperative that the college improve its success and retention rates wherever possible.

Institutions spend thousands of dollars to recruit students to enroll in courses and programs, and they expect to retain those students for the remainder of their program. Students who dropout result in financial loss. Persistence in college has direct implications for students as well. Batzer, (1997), McCabe & Day, (1998), and Schoenecker, Bollman, & Evens, (1996), have shown that remedial students who complete their program are as successful in college-level work as those who were academically prepared (as cited in Young, 2002). In addition, the high dropout rates represent a lost opportunity for other students who wished to enroll but found the course filled at registration.

The mission of the American community college is to provide open access to higher education for students who hold a high school diploma or equivalent or who have the ability to benefit from a postsecondary education. Technology has made it possible to provide access to an even greater number of students. If a large number of these students who are enrolled in computer-based remedial instruction are not completing their courses, then the goal of increasing access is not being attained.

Purpose

The purpose of this study was to examine the differences in students' withdrawal and completion rates in classes delivered via different instructional formats (distance learning, hybrid, or traditional) to determine if student learning style and/or student reasons for choosing an instructional format have an effect on the dropout rate in a remedial mathematics course.

Research questions. To support this research, the specific research questions were:

- 1) Is there a relationship between students' learning styles and their completion or withdrawal from a remedial math course (MAT 0024) by a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning)?
- 2) Is there a relationship between students' reasons for choosing a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning) and their completion or withdrawal from a remedial math course (MAT 0024)?
- 3) Is there a relationship between students' College Placement Test (CPT) mathematics score and their completion or withdrawal from a particular

instructional delivery format (i.e. lecture-based, hybrid, or distance learning) of a remedial math course (MAT 0024)?

Hypotheses. Based on the literature pertaining to distance learning theories, the relevant research conducted involving computer-based instruction and the community college student, and research involving student learning styles and student reasons for choosing computer-based instruction, the researcher expected to find the following results to the research questions in this study:

- 1) There is a relationship between students' learning style and their completion or withdrawal from their chosen instructional delivery format in a remedial math course (MAT 0024).
- 2) There is a relationship between students' reasons for choosing a particular instructional delivery format and their completion or withdrawal from a remedial math course (MAT 0024).
- 3) There is a relationship between students' College Placement Test (CPT) mathematics score and their completion or withdrawal from their chosen instructional delivery format of a remedial math course (MAT 0024).

Definition of terms. Definitions for terms throughout this study are as follows:

- 1) *College credit courses*—Courses for which credit toward a degree/certificate is awarded, including courses that are transferable to another institution or courses that offer institutional credit only and are not transferable.
- 2) *Computer-based instruction (defined for this study)*—An inclusive term that includes online courses and/or computer-mediated instruction where the

delivery format requires a computer and a packaged software product to deliver the content of the course.

- 3) *Completion by attendance*—Students attend all classes, complete all assigned work, but did not earn a grade of at least a “C” and are not eligible to sit for the State Exit Exam.
- 4) *Computer-mediated instruction*—An instructional delivery format that requires a computer and a packaged software product to deliver the content of the course. The course meets on campus, and the role of the instructor is as a facilitator who offers personalized instruction as needed. The instructor may or may not deliver mini-lectures, but the majority of the content is delivered via the computer.
- 5) *Hybrid course*—A course delivered by computer-mediated instruction.
- 6) *Lecture-based courses*—Courses whose content is primarily delivered through the traditional lecture style format in face-to-face classroom settings.
- 7) *MAT 0024*—The content of this remedial Beginning Algebra course includes
“1. Language and operation on sets 2. Operations on signed numbers 3. Solving linear equations and inequalities in one variable 4. Adding, subtracting, and multiplying polynomials 5. Factoring: greatest common factor, difference of squares, trinomials, and by grouping 6. Applications of factoring: solving equations and reducing algebraic fractions 7. Integer exponents: definitions, properties, and simplifying expressions with negative and zero exponents 8. Simplifying, multiplying, adding, and subtracting square roots of monomial expressions 9. Graphing ordered pairs and lines;

determining intercepts of lines 10. applications of the above topics” (Florida, DOE, Statewide Course Numbering System section).

- 8) *Persistence*—Completion of a course, sequence of courses, or program.
- 9) *Remedial coursework*—Courses that do not award credit toward a degree/certificate. These courses are designed for students who lack the knowledge and/or skill necessary for a regular postsecondary curriculum.
- 10) *Remedial education*—Instructional courses designed for students who are academically underprepared for college credit courses.
- 11) *Successful completion (defined for this study)*—The student earned a grade of at least a “C”. In the case of MAT 0024, a passing score on the State Exit Exam is also required.

Limitations and delimitations

The study was limited by the responses of students enrolled in MAT 0024 Beginning Algebra at two of the five campuses of the community college in this study. The study was also limited by the number of surveys returned and the candor of the responses to the survey items.

The students were not randomly assigned but self-selected into the instructional delivery format of their choice. The mathematics cluster chose Interactive Mathematics as the computer software package to be used for the hybrid and distance learning classes for the MAT 0024 course.

The instructors were not randomly assigned to the delivery formats. There is only one instructor who teaches MAT 0024 Beginning Algebra through distance learning, so that instructor taught all three sections of the course.

Another limitation was the sample size. All remedial mathematics courses are capped at twenty-five students, which limited the total possible number of students participating to $N = 225$.

A delimitation of this study related to the population being studied. The study was limited to remedial mathematics students enrolled at a large, southern, urban, multi-campus community college and registered in MAT 0024 Beginning Algebra. The results may not be generalized to other courses or non-remedial students at different types of institutions.

In addition, the study's time period was the Fall 2007 term. The Fall term was chosen over the Spring or Summer terms because enrollment is generally higher during this term.

Summary

The purposes of this research were as follows: (1) to determine if a relationship exists between students' learning styles and their persistence in a remedial math course; (2) to determine if a relationship exists between students' reasons for choosing an instructional delivery format and their persistence in a remedial math course; and (3) to determine if a relationship exists between students' CPT mathematics score and their persistence in a remedial math course.

Chapter Two reviews the relevant literature that supported this study. The literature review will focus on three main areas: theories on computer-based instruction and its effectiveness; theories on persistence as it relates to computer-based instruction and the community college remedial student; and theories related to learning style and choice within computer-based instruction.

Chapter Three discusses the methods designed for this study, including student population, instrument selection, detailed procedural processes, and the statistical analysis methods. Chapter Four reports the results from the study and Chapter Five summarizes the data, discusses implications as a result of the data, and suggests recommendations for practice and further research.

Chapter Two

Review of the Literature

Introduction

Distance education has been in existence for over 100 years, but the method has evolved from pencil and paper correspondence courses to computer-based instruction including Internet courses. Despite the change in method, distance education continues to struggle with high dropout rates that have plagued it since its conception.

The purpose of this study was to examine the differences in students' withdrawal and completion rates in classes delivered via different instructional formats (distance learning, hybrid, or traditional) to determine if student learning style and/or student reasons for choosing an instructional format have an effect on the dropout rate in a remedial mathematics course.

The review of the related literature contains an overview of distance learning theories, a discussion of the effectiveness of computer-based instruction including dissenting viewpoints, and an examination of the high dropout rate within distance learning including factors that may contribute to, as well as help to identify, this phenomena.

Theories of Distance Learning

This section will discuss the relevant theories within distance learning as they relate to the concepts of access and quality, dominant and emerging paradigms, and teaching and learning.

Brief History of Distance Learning

Distance learning or distance education, terms which are often used interchangeably, has many different definitions, depending upon the researcher using the term, the program or course studied, the audience targeted, or the instructional format proposed. Despite the various definitions, the three premises that underpin any definition of distance learning are: (1) separation of the teacher and student in space and time (Garrison, 1993); (2) autonomous learning by the student (Garrison); and (3) “the majority of educational communication between (among) teacher and student(s) occurs noncontiguously” (Garrison, 1989, p. 6).

Although distance learning theories are relatively new in education, the use of distance learning has a long history. The earliest forms of distance learning can be traced to correspondence schools in Europe that date back to the middle 17th century (Holmberg, 2002; Sherry, 1996). The roots of distance education in the United States can be traced to correspondence schools that date back 150 years. According to MacKenzie & Christensen (1971), the Correspondence School of Hebrew, a school that was founded by William Rainey Harper, opened in 1881. Harper was also instrumental in developing correspondence schools at both Chautauqua University and the University of Chicago. Because of these foundational events, Harper is considered the father of correspondence education (as cited in Garrison, 1989). These early attempts at distance learning focused

on the adult population, which is a trend that continues today. Holmberg (1980) states that distance learning “could be regarded as a special kind of adult education” (as cited in Garrison, 1989, p. 112).

Notwithstanding the long-standing practice of distance education, the theory of distance learning is comparatively new. Keegan (1993) wrote that Günter Dohmen, “through the Deutsches Institut für Fernstudium in Tübingen, the world’s first distance education research centre”, (p. 2) first studied the elements of distance learning in Germany in 1967. In 1973, Michael G. Moore stated the need for a theoretical foundation in distance learning in *The Journal of Higher Education*. Moore expressed the need to describe and define the field, discriminate between the various components of the field, identify critical elements of the various forms of teaching and learning, and build a theoretical framework that would encompass this new area of education (Keegan). The theory of distance learning is underpinned by the concepts of “quality and accessibility, dominant and emerging paradigms, the teaching-learning transaction, independence and interaction, and communication technologies” (Garrison, 1993, p. 10). The remaining portion of this section on distance learning will discuss each didactic underpinning as it relates to the theory of distance learning.

Access and Quality

Much of the literature on distance learning refers to access as one of the “promises” of online courses and programs (Galusha, 1997; Garrison, 1989; Keegan, 1993; Kozeracki, 1999; Sherry, 1996, Stumpf, McCrimon, & Davis, 2005; Moore, 1989; Valentine, 2002; Yee, 1998). Garrison (1993) describes the access-driven design and delivery model of distance learning as a way to “instruct as many students as possible regardless of time

and location” (p. 11). Moore (1989) extols distance learning and its ability to provide access by describing it as a “means of empowerment . . . for the person of any walk of life who wishes to continue in academic study” (p. 8). As distance learning became more prevalent, educators began to shift their focus from the quantity of distance education opportunities to the quality of distance learning. Garrison warns that many proponents of distance learning are overly concerned with access that can “blind these educators to issues of quality . . . in how distance education is conceptualized and practiced” (p. 10). Garrison distinguishes between quality of printed materials and quality of the educational transaction while attempting to strike a balance between the issues of access and quality.

Garrison (1993) concedes that quality is difficult to measure because each distance educator has different values, perceptions, and perspectives of what constitutes quality. As an example, Garrison states that those educators who are working in online institutions may base quality on the prepackaged media material while those distance educators who teach in a traditional institution may judge quality by the amount of two-way communication between teacher and student. Garrison extends this notion by citing a study for the support of university distance learning by faculty (Black, 1992) where the issue of quality was found to be specifically related to the degree of communication between teacher and student. Black states, “The faculty interviewed believed that dialogue and academic discourse are necessary features of education that must be assured in distance education in order to achieve quality” (as cited in Garrison, 1993, p. 11). The study by Black also supports the view of Garrison and Shale (1990), “who argue that improving the quality of the educational process through increased two-way

communication is likely to have the most significant impact upon the effectiveness of learning” (as cited in Garrison, 1993, p. 11).

Dominant and Emerging Paradigms

The dominant paradigm in distance learning has been access, both in how many students are taught and how the information is presented. Garrison (1989) argues for a shift in paradigms away from access and toward instructional quality within the educational transaction. Garrison is concerned that too much emphasis is placed on accessing information and not enough on inducing knowledge. He states

In distance education greater efforts generally are put into preparing or packaging content (i.e. structure) and much less effort is given to the crucial element of the educational transaction (i.e. the interactive dialog for the purpose of negotiating objectives and pursuing meaning). Without the opportunity for sustained two-way communication the emphasis will be on preparing and transmitting content, and negotiation for restructuring content to suit the learner is restricted. (p. 19)

Garrison’s (1989, 1993) assumption is that education is based upon two-way communication. The quality of the educational transaction within distance learning is affected by the degree of the two-way communication. Garrison (1993) also cautions that distance learning educators should not remain within the “dominant paradigm of prescribed and pre-packaged course materials and simply using two-way communications as optional ‘add-ons’” (p. 12) as this can negatively affect the quality of the educational transaction. When the main objective of the prepackaged learning materials is to support and sustain self-instruction by employing a skill and drill model with corrective feedback, this model approaches a behaviorist orientation. Winn (1990) suggests that the behavioral “approach is inappropriate to teach higher-level cognitive strategies based upon understanding of complex and ill-structured content areas” (as cited in Garrison, 1993, p.

12). Garrison (1993) suggests that a cognitive/constructivist approach within distance learning will maximize “explanatory feedback which encourages the integration and construction of new knowledge structure—knowledge structures that are not uncritically assimilated in a superficial manner Cognitive learning theory reflects understanding as a valued objective—not just as an observable and measurable behavior” (p. 12). According to Winn, the challenge is to “monitor and adapt to unpredicted changes in student behavior as instruction proceeds” (as cited in Garrison, 1993, p. 12). Garrison contends that this can only be achieved by enhanced and continual two-way communication.

Access and quality must be carefully defined within distance education. The definition of quality must include enhanced and sustainable two-way communication. Access to information without two-way communication reduces the quality and effectiveness of the educational transaction. No less important, a balance must be maintained between the two in order for distance education to be effective.

Teaching and Learning

Distance learning theorists often define distance education as education at a distance (Garrison, 1989; Moore, 1993). This definition places the emphasis on education rather than the distance, or separation between student and teacher. Moore (1993), the first to define distance education and develop a theory of distance education in English, later referred to this theory as the theory of transactional distance. The theory of transactional distance essentially states that distance learning is not only a separation in time and/or space of teacher and student, but is primarily concerned with pedagogical issues as a result of the inherent separation. As an example of one such issue that results

from the inherent separation, Moore states, “In distance education, learners are nearly always alone, and there are no verbal or non-verbal cues from either the instructor or other learners to indicate the value of the learner’s ideas and creations” (1989, p. 9). Moore wrote that transactional distance describes “the universe of teacher-learner relationships that exist when learners and instructors are separated by space and/or by time” (p. 22). Because of the separation between student and instructor, different patterns of instruction and teaching are utilized to achieve an effective educational transaction.

In order to discuss the different patterns of instruction and teaching within distance learning, it is necessary to distinguish between educational learning and learning in general. Garrison (1993) defines educational learning as “an interaction between teacher and student for the purpose of identifying, understanding, and confirming worthwhile knowledge” (p. 13). Garrison points out that in order for educational learning to take place, a respectful relationship must exist between teacher and student. If meaningful learning is to take place and a concomitant mutually respectful relationship is to be developed and maintained, two-way communication is vital to the educational transaction. According to Garrison (1989), Garrison & Shale (1990), and Keegan (1990), the quality of the education transaction in distance learning is influenced by educators’ views of two very different concepts: independence and interaction.

Independence and Interaction

Independence and interaction play different roles depending on the individual distance educator’s philosophy. The most dominant paradigm states that course materials “maximize independence and concomitantly reduce the need for interaction” (Garrison, 1993, p. 14). Within this dominant paradigm, *independence* is defined as the freedom to

study when and where the student wishes. *Interaction* is defined as how the student responds to course materials. From this standpoint, independence and interaction form an inverse relationship, “which severely limits the nature and amount of interaction which may occur” (as cited in Garrison, p. 14). Based on the earlier definition of educational learning, one can reason that interaction between teacher and student is a necessary condition for learning higher-order skills and concepts. According to Garrison, the role of interaction is to facilitate the construction of meaning by engaging in two-way communication to explain, negotiate, and discuss the skills, concepts, and ideas found in higher-order learning.

To facilitate cognitive learning, an emerging paradigm changes the role of independence to reflect student control and responsibility to participate in “constructive meaning in a collaborative or interactive setting” (Garrison, 1993, p. 16). Within the emerging paradigm, independence and interaction move from an inverse relationship to more of a direct relationship. The aim of the emerging paradigm is to create a quality educational transaction within distance learning by supporting independence by engaging in two-way interaction and communication.

The quality of the educational transaction of both computer-based instruction within distance learning and computer-mediated instruction should be of concern to all educators. The effectiveness of computer-based instruction is currently under debate. Proponents of computer-based instruction claim that this method is just as effective as a lecture-based course, while critics point to inherent flaws in many of the studies and the high dropout rate of students using computer-based instruction.

Effectiveness of Computer-Based Instruction

Computer-based instruction, including distance learning, has become an integral part of higher education throughout the United States. A report by the Sloan Consortium (2006) states that 3.2 million students enrolled in at least one online course during the fall 2005 term, which represents a growth rate of 35% from the fall 2004 term. The “size of the higher education student population is estimated to be 17 million with online students now representing 17 percent of all higher education students” (Allen & Seaman, 2006, p. 5). Interestingly, the report found that although the population of online students is representative of the general higher education population, the type of institution where they study is not. Slightly more than half of these students are undergraduates studying at institutions that award the two-year Associate’s degree. Online students studying at institutions that offer Master’s and Doctoral Degrees represent slightly less than half the total number, with the remaining students (less than 1%) studying at institutions offering only the Baccalaureate or specialized degrees.

The report also found that institutional size affects the number of offerings of online courses and programs. Approximately 96% of large institutions (defined as those schools with more than 15,000 in total student enrollment) offer some courses and/or programs online, which, according to the report, is double the rate of offerings at smaller institutions. One possible explanation for this relationship is that the larger institutions offer more online courses and programs in an effort to conserve classroom space while continuing to meet student demand. Another advantage of offering online courses is the ability to increase access to those students who would otherwise be unable to attend college. Although computer-based instruction has many advantages for both students and

institutions, it is not without challenges. One issue is the current debate regarding the effectiveness of computer-based instruction within distance learning.

Distance Learning – A viable educational alternative

There is evidence that computer-based instruction is as effective as lecture-based instruction when analyzing student achievement, student satisfaction, and cost effectiveness (Cannon, 2006; Weems, 2002; Lesh & Rampp, 2000; Perez & Foshay, 2000; Phipps & Merisotis, 1999; Tucker, 2001; Moore, M.G., Thompson, M.M., Quigley, B.A., Clark, G.C., & Goff, G.C., 1990). Lesh & Rampp reviewed research on the effectiveness of a variety of instructional modes including but not limited to computer-assisted instruction (CAI) as a supplement to the lecture-based course, computer-assisted instruction as a stand-alone instructional format, and web-based instruction.

Two studies involved CAI as a supplement to a lecture-based course. The first study involved first and second year physical therapy students at a university. The experiment employed CAI in the form of animated graphics and sound as a supplement to the lecture, whereas the control group was presented with the same material delivered via lecture supplemented with static overheads. The researcher found no significant difference in pre or post-test scores depending on the instructional format, although it was determined that the second year students did better than the first year students regardless of which instructional format was used. The researcher concluded that regardless of instructional format, post-test scores were higher than pre-test scores indicating learning did result from both methods.

A second study evaluated student achievement by employing CAI that was designed to reinforce the classroom lectures as well as provide periodic self-assessment.

In addition, this study examined student perception of the usefulness of the CAI. The treatment group utilized CAI as a supplement to the lecture while the control group received only lecture-based instruction. The results indicated that there was a significant difference between all students in the pre-test and post-test scores. In addition, there was a significant difference between post-test scores between the two groups with the CAI group tending to have higher scores than the control group. With respect to its usefulness, 87% reported that the CAI was useful or very useful. Interestingly, the CAI students initially perceived that this mode of instruction would be less time-consuming; ultimately, students spent more time with CAI than anticipated.

Another study examined the effectiveness of CAI as a stand-alone instructional format compared to a lecture-based format involving physical therapy students. Results showed that there was no significant difference in post-test scores when type of instruction was considered although the CAI group “completed the same task with the same effectiveness in 24% less time than the instructor led counterpart” (Lesh & Rampp, 1990, p. 31).

Lesh & Rampp conclude there is an abundance of research supporting the effectiveness of computer-based instruction; in other words, this delivery format is as viable as other traditional forms of education.

Tucker (2001) conducted a study of 47 undergraduate students enrolled in a business communications course at a large, urban research university in North Carolina to determine if distance education is better than, worse than, or equivalent to traditional face-to-face instruction. The face-to-face course included 23 students ranging in ages from 19-33 while the distance-learning course contained 24 students ranging in age from

22-51. The author (who was also the researcher) compared pre/post test scores, homework grades, research project grades, final exam scores, overall course grade, age, and learning style of the two groups. There was no significant difference between the two groups in pre-test scores, homework grades, research projects grades, or final course grade. There was a significant difference in post-test scores, final exam grades, and age, with the distance-learning students scoring higher than the traditional students. Overall, the researcher concluded that because there was no significant difference in overall course grade, it cannot be concluded that distance learning is superior to face-to-face instruction. However, the findings do support the literature stating that distance learning is equivalent to face-to-face instruction and should be considered as an acceptable alternative.

Thomas L. Russell made a significant addition to the literature base that supports distance learning as an equivalent form of education with his bibliography titled *The No Significant Difference Phenomenon*. The book “is a fully indexed, comprehensive research bibliography of 355 research reports, summaries and papers that document *no significant differences* (NSD) in student outcomes between alternate modes of education delivery” (WCET, 2007, ¶ 1).

There is a plethora of research supporting the argument that distance learning is as effective as face-to-face instruction; however, there are critics who claim that this conclusion should be viewed with caution and the research examined in more detail. The Institute for Higher Education Policy, at the behest of the National Education Association and the American Federation of Teachers, reviewed the literature on the effectiveness of distance education and reported shortcomings in the methodology of the research as well

as gaps within the research that require further study. Phipps and Merisotis state that the research does not address important questions such as “does distance education... work better for some academic subjects than others? Does it work better for some students than others? Is there more of a dropout problem with distance education?” (1999, p. 6). The next section addresses the first two questions posed by Phipps & Merisotis by discussing several studies that have shown that distance learning may not be an effective alternative to traditional education for all students in all disciplines.

Distance Learning – an equal opportunity for all students?

The type of institution, the academic level of the student, and the level of coursework may, individually or in combination, play a role in the effectiveness of computer-based instruction. Critics of computer-based instruction claim that there is a paucity of original research and have questioned the validity and reliability of the research that supports the no significant difference theory. In addition, critics state that the research fails to answer important questions such as “does distance education . . . work better for some academic subjects than others? Does it work better for some students than others?” (Phipps & Merisotis, 1999, p. 6). In general, critics have suggested that many studies claiming the effectiveness of computer-based instruction are inconclusive.

The majority of the research regarding distance education is focused on students, courses, and programs at four-year universities and colleges. In fact, most of the studies discussed in the previous section were conducted using students enrolled in college courses at either a four-year university or college. There is very little research on the effectiveness of computer-based instruction at the two-year community college in

general, and even less on remedial courses in particular. In addition, much of the current research on the effectiveness of distance learning focuses on student success, attitudes, and cost effectiveness but does little to explain the high withdrawal rates in distance learning courses. Phipps & Merisotis (1999) argue that much of the research on the effectiveness of distance education excludes “these dropouts—thereby tilting the student outcome findings toward those who are ‘successful’” (p.32). Studies conducted at the community college have not produced the same “no significant difference” results as the studies conducted at the four-year universities and colleges.

Cannon (2005) conducted a study involving community college students enrolled in a developmental mathematics course and their achievement, retention, persistence, and success rates. Achievement was examined using final exam grades and overall course grades in Elementary Algebra during the fall 2002 semester. Achievement was defined as earning an A, B, or C in a mathematics course. Retention was examined by tracking those students who moved from Elementary Algebra in Fall 2002 to Intermediate Algebra in Spring 2003. Persistence measured those students who moved from Elementary Algebra in Fall 2002, to a subsequent mathematics course in Spring 2003, then persisted with their mathematics education by registering for a mathematics course in summer or fall of 2003. Success was studied using students who enrolled in Elementary Algebra in Fall 2002 and continued with the sequence to enroll and complete a college-level mathematics course by Fall 2003. Cannon defined success as earning either an A, B, or C in a college-level mathematics course. One group was taught using a computer-mediated instructional format while the second group participated in a lecture-based classroom environment. While there was no significant difference in the success, retention, and persistence rates,

there was a significant difference in the achievement rate between the two groups. The lecture-based format group had achievement rates significantly higher than the computer-mediated group. The mean score of the final exam grades for the lecture-based group and the computer-mediated group were 79 (SD = 15.5) and 74 (SD = 14.9), $z = 2.25$, $p = 0.012$ respectively. The achievement rate (passing with an A, B, or C) was 60% for the lecture-based group and 37% for the computer-mediated group.

The high dropout rate in distance learning is supported by a study conducted by Searcy and Others (1993) who studied students at John C. Calhoun State Community College in Alabama to determine if there is a difference in GPA scores between the two groups. The total number of participants was 972 students, with 604 students enrolled in 18 telecourse sections and 368 students enrolled in 18 traditional sections. Although there was no significant difference in the average GPA scores between the telecourse sections (2.64) and the traditional sections (2.86), the data indicated that there may be a difference in the completion rates between the two groups. The completion rate for the traditional sections may have been higher than the completion rate in the distance learning sections, leading to a recommendation that more research be conducted.

Retention was a factor in another study by Kaplan (2004), who examined student success in remedial English and mathematics as defined by GPA, course completion, and retention at a public community college. The two main groups of remedial English and remedial mathematics students were then subdivided into groups that received additional hours of tutoring, computer-based instruction, a combination of the two methods, or neither as a supplement to their regular class format. T-tests were used to compare variables, and a .05 level of significance was used for the inferential statistics.

The author found that the retention rates for the remedial students who participated in tutoring alone were significantly higher than those who received only computer-based instruction. The study further showed that those students who received both tutoring and computer-based instruction had significantly higher retention rates than those students who received computer-based instruction exclusively. In addition, those students who received tutoring alone had higher grades and retention than those students who received computer-based instruction alone. The author further stated that “while not rising to the level of statistical significance, there were indications that the exclusive use of computer based instruction as the only instructional support component used may have had a detrimental impact upon student grades and retention” (Kaplan, 2004, p. 7).

Bendickson (2004) found similar results after researching the use of technology and its possible detrimental impact on the success of remedial mathematics community college students. The study examined the effectiveness of computer-based instruction for remedial mathematics students within Florida community colleges. It investigated the relationship between student success in remedial mathematics and the instructional delivery format that included lecture-based, hybrid, and distance learning. In addition, the study questions if such a relationship exists when controlling for college placement scores. For this study, success was defined as completion of the remedial sequence and successful completion of the Statewide Exit Exam. Bendickson observed that students in the lecture-based courses performed as well as or better than those students enrolled in the hybrid and distance-learning courses. In addition, the author concluded that those students who had higher college placement scores “were clearly more successful in courses delivered via traditional instruction” (p. vii).

The studies discussed above have indicated that computer-based instruction may not be as effective in the areas of achievement and retention as lecture-based instruction for students enrolled in remedial courses at two-year community colleges.

The effectiveness of distance learning for remedial mathematics students outside of the two-year community college population should also be examined. Weems (2002) studied freshman enrolled in two remedial mathematics courses at an urban university in the mid-South. The study compared two sections of beginning algebra: one taught online and one taught on campus in a lecture format. There were 25 students enrolled in the online section and 23 enrolled in the lecture section. The dependent variables were mathematics achievement and attitude toward mathematics. Mathematics achievement was measured four times, with a teacher-constructed pretest administered on the first day of class as well as three teacher-constructed exams. The exams for both groups were combined and graded together to avoid grading bias. Attitude toward mathematics was measured using the “Scale of Attitudes Toward Mathematics” (p. 11). The exam scores were measured using a repeated measures design, and the results showed that the main effect of treatment was not significant, $F(1,31) = 0.168, p = 0.684$. However, the interaction between test occasion and treatment was significant, $F(2, 62) = 3.257, p = .045$ revealing a “significant decline in performance by the online group while the performance by the onsite group remained relatively stable” (p. 14). There were no significant differences regarding student attitudes toward mathematics. The dropout rate for the online and lecture based sections was 36 and 32 percent respectively. The author posits an explanation for the significant decline between the first and last exams by suggesting that the specific content being taught may not have been conducive to online

instruction. She states, “it is possible that factoring polynomials might be better taught traditionally or that the instructional materials used for factoring in this study need revision” (p. 14).

These studies support Phipps & Merisotis’ questions concerning whether or not distance learning is equitable for all students at all institutions and in particular, for those students who need more guidance and interaction with faculty (Parrot, 1995).

Distance Learning and Community Colleges

As stated previously, the Sloan report stated that over fifty percent of online students are undergraduates studying at institutions that award a two-year Associate’s degree. The mission of most community colleges is to serve and support their local communities, yet the two-year community college has been the leader in developing and implementing distance education courses (Kozeracki, 1999; Parrot, 1995; Stumpf, McCrimon, & Davis, 2005; Yee, 1998). The ability to offer distance education courses combined with an open access policy offers the community college the opportunity to reach millions of students worldwide. However, the community college must be cognizant of the issues and challenges related to distance learning that, if not addressed, may threaten its continued success (Stumpf, etal). Because the community college educates both remedial and college ready students, it is challenged not only to provide access to higher education, but also to ensure that the education accessed will be in an instructional format from which all students can profit.

Characteristics of Distance Learning & Remedial Students

One possible explanation of the inconsistent findings between studies conducted at a four-year university or college as opposed to those conducted at a community college

is the academic preparedness of the population being examined. The hallmark of the community college is the policy of open access. Any student who has the ability to benefit from higher education is afforded the opportunity to enroll in community college courses. As a result, the student population is a diverse mix of returning students, academically unprepared students, and students of lower social economic status, many of whom need remediation before enrolling in college courses. According to the NCES, “about 42 percent of community college freshman . . . enroll in at least one remedial course” (as cited in Dembicki, 2006, p. 1). The report further states, “of college freshman taking remedial courses, 35 percent are enrolled in math” (as cited in Dembicki, p. 10). Florida state law prohibits four-year colleges and universities from providing remedial education; therefore, the Florida community college system bears the responsibility of serving its unprepared students. In an effort to meet the needs of the large number of students needing remediation, many community colleges offer remedial course work through distance learning. The problem with offering remedial coursework through distance learning to the academically unprepared community college student can be traced to the theoretical underpinnings of distance education and the characteristics of the successful distance learner.

As stated previously, distance learning theory is closely connected to theories related to adult education. Holmberg (1980) states that distance learning “could be regarded as a special kind of adult education” (as cited in Garrison, 1989, p. 112). Moore (1993) discusses transactional distance with a primary focus on learner autonomy and the needs and desires of the adult learner. Garrison (1993) and Shale & Baynton (1993) discuss the central concept of the educational transaction, which, according to Amundsen

(1993) is influenced by principles of adult education. According to Knowles (1980), “the most important learning of all . . . is learning how to learn, the skills of self-directed inquiry” (p.41). Self-directed learning is one of the characteristics of a successful distance learner.

The characteristics of the successful distance learner have been well documented. Perry & Ford (1994) state that “mature, independent students, a sophisticated computer system, and a well-equipped computer lab” are integral to the success of a computer-assisted educational system (as cited in Keup, 1998, p 4). Perez & Foshay (2002) conclude that “learners who demonstrated a sense of motivation, time management and program/academic goals were more successful in the project than those who transferred from more traditional courses and wanted to avoid class meetings” (p. 24). Similarly, Hardy & Boaz (1997) report that “compared to most face-to-face learning environments, distance learning requires students to be more focused, better time managers, and to be able to work independently and with group members (as cited in Valentine, 2002, p. 7). Threkeld & Brzoska (1994) claim that the successful distance learner student “needs to have a number of characteristics such as tolerance for ambiguity, a need for autonomy, and an ability to be flexible” (as cited in Valentine, 2002, p. 7). Finally, Phipps & Merisotis (1999) have compiled a list of student characteristics that have been identified as success factors in computer-based instruction. Note that, in their study, success was defined as students who passed their first course using computer-based learning.

- Students who rated themselves highly on various measurers of persistence related to taking on new projects;
- Married students;
- Students who rated the consequences of not passing as serious;

Students who rated their chances of succeeding in their studies higher than non-completers;
Students who did not need support from others to complete difficult tasks and did not find it important to discuss course work with other students;
Students with high literacy levels;
Students who rated themselves as well organized in terms of time management skills and said they generally had the time to do what they intended to do;
Students who rated their formal and informal learning as high in terms of preparing them for university studies; and
Female students. (p. 23)

The general characteristics of the remedial student have also been well documented. Batzer (1997) found “more than fifty percent of these students are women and about sixty percent of them are twenty-four years of age or younger. About one third of developmental college students are from a minority group and about one half are financially independent but making less than \$20,000 a year” (as cited by Young, 2002, p. 4). Saxon & Boylan (1999) reviewed 18 studies (both regional and national) with the intent to glean characteristics that describe the community college remedial student. The authors list the following characteristics of the remedial community college student:

there is a slightly higher proportion of females;
they are about 23 years old;
they are White;
they are single;
they provide for themselves financially;
they live and educate themselves on less than \$20,000 a year;
their high school grades, standardized test scores, and financial condition are sufficiently low that their access to and opportunity in higher education is limited;
they commute;
they attend college full-time;
they claim to be seeking degrees;
they typically do not receive financial aid;
they are motivated for college work, but possess low self-efficacy. (p 7-8)

Low self-efficacy is a common characteristic found in the literature pertaining to remedial students. Self-efficacy is defined as “the personal belief about one’s capabilities

to learn or to perform skills at a designated level” (Ley & Young, 1998, p. 44). Various researchers explain that low-efficacy is common among remedial students. Thompson (1998) “indicated that remedial students were typically uncertain about their goals and had low self-efficacy toward some academic tasks (as cited in Saxon & Boylan, 1999, p. 6). According to Carr, Borkowski, & Maxwell (1991), “low self esteem, immature attributional beliefs, and poor metacognitive knowledge have characterized underachievers” (as cited in Ley & Young, 1998, p. 47).

Self-efficacy is one of the five learning behaviors of the self-regulated learner. Self-regulation, in an educational context, occurs when one uses his or her own self-developed processes to engage, monitor, and control his or her own learning. Zimmerman (1994) and Zimmerman & Paulsen (1995) state the “hallmarks of a self-regulated learner, often defined by teachers and fellow classmates, are goal directedness, academic time management, meaningful and directed practice, the appropriate use of cognitive and metacognitive strategies, and a sense of self-efficacy (as cited by Ley & Young, 1998, p. 43). Ley and Young refer to the evidence that shows that the self-regulated learning processes such as self efficacy and goal setting are significantly related to academic success, but that “most studies have not included participants from the one third of the entering college students who must take remedial college courses” (p. 42). The authors conducted a study that examined the self-regulated behaviors between regular admission students and underprepared students. The study employed discriminant function analysis to test the predictive ability of three measures of self-regulated behaviors. The results indicated that underprepared and regular admission students differed significantly in their

self-regulatory strategies. The authors concluded that self-regulation may be a distinguishing characteristic between some remedial and regular admission students.

In another study conducted by Grimes & David (1999), 500 freshmen who were enrolled in a north west Florida community college provided data by completing a Student Information Form. This survey was developed by the Cooperative Institutional Research Program (CIRP) to gather data on over “200 demographic, experiential, or attitudinal data elements including (a) demographic characteristics . . . ; (b) previous academic performance . . . ; (c) enrollment status; (d) degree aspirations; (e) goals and values; (f) reasons for college enrollment; (g) self ratings of abilities; (h) past year’s activities; (i) student opinions; and (j) future activities” (p. 77). The entering students were classified into two groups based on College Placement Test cutoff scores. Just over 50% were identified as college-ready and the remaining 48% were classified as academically underprepared. The authors employed chi square procedures for the categorical variables and multivariate procedures for the linear variables.

The results indicated no significant differences between the two groups in age or major family demographics, and the chi square analysis found no significant difference in gender or part-time versus full-time status. However, the findings indicated that “underprepared students in this study demonstrated significant difficulties compared to college-ready students in each person-environment interaction area with significantly lower high school GPAs, weaker coursework in some academic areas, lower self-ratings of ability, and lower predictions of future accomplishments” (Grimes & David, 1999, p. 86). Based on the results of the study, the authors suggest that psychological theories be considered when developing programs for underprepared students. These theories include

motivational theory, self-efficacy, and attribution theory, including locus of control. According to the researchers, “addressing specific discipline content without considering psychological theory might be effective for highly-motivated, goal-oriented students with a strong support structure but is less likely to be effective with previously less successful students” (p. 86). The characteristics of the self-regulated learner are very similar to those found in the successful distance learner student.

While successful online students and typical community college students share a few common traits, remedial student characteristics tend to differ from the characteristics of the successful distance learner and the regular admission student. It has already been established that Florida community colleges bear the responsibility of remedial education. However, based upon the research presented, the majority of community college remedial mathematics students may not have their needs best met by a computer-based instructional delivery format. Inherent student traits may play a large role in the success or failure of a student in a particular instructional format and may possibly explain the high dropout rate found within the computer-based format as compared to the lecture-based format.

The remaining portion of the literature review focuses on the potential link of how learning style and student choice of instructional delivery method may impact the retention rate within these courses.

High dropout rates are characteristic of computer-based instruction. Carr (2000) found that dropout rates are typically “10 to 20 percent higher in distance-learning classes as opposed to the traditional classroom” (p. 2). Parker (2003) cautioned “with the growth of distance-education has come the problem of exceedingly high attrition rates” (p. 1).

However, there is evidence, as stated earlier, suggesting that some remedial mathematics students are successful in computer-based instruction. Who are these students, and how can they be identified? Students' learning styles may indeed indicate how self-directed or passive any individual is. McMillan, Parke, & Lanning (1997) state, "learning styles of developmental students tend to be more passive than those of their peers in college-level academic programs. One exception may be adult learners, who are accustomed to self-direction in other aspects of their lives, and who may accept a great deal of responsibility for their learning" (p. 26). James & Galbraith (1985) state, "by concentrating on the dominant learning styles, learners can increase their skills in utilizing appropriate methodologies for self-directed learning efforts" (p. 21). There are a limited number of studies that explore the learning styles of students and fewer still that examine remedial mathematics students and their completion rate in computer-based courses.

Learning Styles and Computer-Based Instruction

The literature contains varying definitions and descriptions of learning styles. For example, Higbee & Ginter (1991) state that learning may refer to personality type, cognitive processes, environmental factors, or affective variables. Despite the differences in the definition of learning style, Galbraith & James (1984) and Ginter, Brown & Scalise (1988) agree that "there is consensus that a person's learning style is directly related to ability to process and retain information" (as cited in Higbee & Ginter, 1991, p. 5). However, if learning style is to be utilized effectively as a method of enhancing academic performance, it is imperative that the individual's preference be identified correctly. Gee (1990) states that while there is an abundance of studies that connect positive academic achievement when "teaching correlates with students' preferred learning style (Dunn,

Beaudry, & Klavas, 1989; Dunn, Dunn, & Price, 1977, Michler & Zeppert, 1987; Miller, Always, & McKinly 1987)...These studies have focused on student achievement and perception in the traditional classroom setting” (as cited in Gee, 1990, p. 3). In contrast, detailed research on learning style within computer-based instruction is limited.

Of the few studies that have been published, the learning style inventories mentioned in connection with distance learners are the Canfield Learning Styles Inventory (CLSI), the Cognitive Style Analysis (CSA), the Group Embedded Figures Test (GEFT), the Kolb Learning Style Inventory (LSI), and the Grasha-Riechmann Student Learning Style Scale (GRSLSS).

Canfield Learning Styles Inventory

Gee (1990) used the CLSI inventory to examine the impact of students’ preferred learning style in a distance education course. The study focused on 26 graduate education majors who self selected into either an on-campus classroom or a remote classroom off-site. The on-campus classroom consisted of nine students, while the remote classroom contained 17 students. Both groups were taught simultaneously, with the instructor physically present in the on-campus classroom. The students in the remote classroom received instruction using a two-way television system. In addition to the CLSI, students were also administered the Student Data Profile Survey and a pre-test to collect baseline data.

The CLSI results found that the learning style preferences of students learning at a distance affected academic achievement. In the on-campus classroom, those students who were tagged as Social/Applied (1) had the highest mean score, and those who were identified as Conceptual (2) had the lowest mean score. In the remote classroom, the

Independent/Conceptual (1) students had the highest mean score, while the Social/Conceptual (4) students had the lowest mean score. The author acknowledges that because the sample size was small and all participants were female, additional studies with more subjects were needed.

Tucker (2001) used the CLSI to assess learning styles as part of a study that sought to determine if distance education was as effective as traditional education. Tucker cites Sherry (1996), who states, “student preference for a particular mode of learning is an important variable in learning effectiveness, and effective learning required knowledge of learner styles (as cited in Tucker, 2001, p. 3).

The study involved 47 undergraduate students at a large, urban university in North Carolina. The students were enrolled in a business communications class. Twenty-three students enrolled in the traditional course, and 24 enrolled in a comparable distance learning course. The same instructor was used for both sections. In addition to age, homework grades, research paper grades, final exam scores, final course grades, and subject matter knowledge as measured by a pre/post test, the learning style preferences for both groups were obtained. Tucker (2001) grouped the 21 subscale variables found in the CLSI into four major categories:

1. Conditions for Learning (Peer, Organization, Goal Setting, Competition, Instructor Detail, Independence, Authority) – constitutes about two-fifths of the items in the inventory. These items, phrased in typical classroom situations, are designed to measure student motivational qualities. These motivational areas center on affiliation, structure, eminence, and achievement.
2. Area of Interest (Numeric, Qualitative, Inanimate, People) measures students’ preferred subject matter or objects of study.
3. Mode of Learning (Listening, Reading, Iconic, Direct Experience) concentrates on identifying the specific modality through which students learn best.

4. Expectation for Course Grade (A, B, C, D, and Total Expectation) is designed to predict the failure or success of a learner. The A-toD-Expectation scales reflects the level of performance anticipated. (p. 5).

Tucker (2001) found that both groups preferred well-organized course work, meaningful assignments, and a logical sequence of activities. Both groups least preferred the Numeric scale which measures students' preferred subject matter or objects of study. In addition, Tucker found that "distance education students also preferred working with People and Direct Experience whereby they can have direct contact with materials, topics, or situations. They least preferred Authority and Listening" (p. 8). The traditional students preferred Inanimate and Iconic. These students enjoyed working with things, and interpreting information. They did not prefer Independence and Reading.

Based on results that did not include completion rates, Tucker concluded that distance learning is as good as traditional delivery, but she could not state that the evidence gathered supported the superiority of distance education over traditional education. She posited that other factors may have influenced the effectiveness of the distance learning course. She identified learning style as one of those influencing factors by noting that the distance learning course catered to those students' particular learning style. In other words, the students enrolled in distance learning "preferred Direct Experience, and the structure of the course allowed for considerable hands-on experience in learning course content. They least preferred Authority, and the structure of the course allowed them the freedom to work Independently on course material" (p. 9).

Cognitive Style Analysis

In a study conducted by Boles, Pillay, & Raj (1999), Cognitive Style Analysis (CSA) software was used in a computer-based electrical engineering course delivered

through computer-based instruction. The goal was to match cognitive style to computer-based instructional material to enhance learning. CSA software divides cognitive styles into four bimodal components: wholist/verbalizer (WV), wholist/imager (WI), analytic/verbalizer (AV), and analytic/imager (AI). The authors point to “evidence from research on the effect of cognitive styles on learning suggests that cognitive style characteristics such as perception and processing of information enhance learning outcomes” (p. 372). They concede that most of the studies on the effect of cognitive styles on learning involve students in a traditional classroom but posit that this approach may reveal similar outcomes if used within computer-based instruction.

The study included 134 third-year undergraduate students enrolled in an electrical engineering course at the Queensland University of Technology. Students were tested during their normal class time (three-hour lecture). After two hours of lecture, the students were asked to learn the remaining portion of the lesson via computer. The students then logged onto the CSA software program, which measured their preferred cognitive style. The instructional materials presented were then “matched” to the individual’s preferred cognitive style. After a specified amount of time, the program would present instructional material that was a “mismatch” to the individual’s preferred cognitive style. This was accomplished by the program’s ability to “alternate between matched and mismatched instructional material when allocating instructional material, giving no control to students on the choice of instruction material” (Boles, etal, 1999, p. 377).

The study focused on examining the results on two dimensions; the first dimension investigated the effect of matching/mismatching students to their cognitive

styles and the second dimension compared student performance based on their learning styles. For the first dimension, students' scores on test tasks for matched and mismatched cognitive style were compared. There was no significant difference reported on total scores $F(1,119) = 2.795, p = 0.05$ or on sub-tasks. However, the mean score of all sub-tasks for the matched group were consistently higher, and the time to complete the work was faster for the matched group.

The second dimension, comparing student performance based on learning styles, showed a significant difference between the four learning styles $F(3,119) = 4.450, p = 0.05$. The wholist/verbalizer group performed better than the three other groups. The authors report no significant difference in interaction between the different cognitive styles and the matched and mismatched treatment. The authors conclude that "it appears that certain test tasks were favoured by certain cognitive styles" (Boles, et al, 1999, p. 379).

Group Embedded Figures Test (GEFT)

GEFT is an instrument designed by Witkin, Oltman, Raskin & Karp (1971) to measure the cognitive style of an individual by determining if the individual is either field-dependent or field-independent. "Field dependent students are more likely to have difficulty learning information that requires them to establish their own mediation styles, and they will need more explicit instruction in problem-solving strategies than field independent students" (Brenner, 1997, p. 5).

Brenner (1997) conducted a study to determine if a relationship exists between a student's cognitive style and achievement in a telecourse. In addition, Brenner sought to determine if levels of achievement differed in male and females and traditional age (18-

22) and non-traditional (23 and above) age students. The study involved all students (318) who enrolled during the summer 1996 term at Southwest Virginia Community College. Of all students asked to complete the GEFT survey, 154 volunteered. These students were enrolled in a range of courses from academic transfer to orientation courses.

Chi-square analysis was employed on the variables of gender, age, and achievement. The author reported that only two of the eleven hypotheses tested had results that were statistically significantly different. There was a significant difference between males and females. Data indicated that females (80.2%) were more likely to be field dependent than males. Among traditional aged males and females, the traditional aged females were more likely to be field dependent than traditional aged males. With respect to the achievement variable on the remaining nine hypotheses, the results “indicated no significant differences in achievement for asynchronous distance education students through an analysis of the variables: field independent-dependent students, traditional aged students, nontraditional students, males and females” (p. 7). The author concluded that cognitive style does not impact a student’s ability to successfully complete a distance learning course.

Kolb Learning Style

The Kolb Learning Style (LSI) inventory is designed to measure a student’s learning preference from the following discrete bipolar dimensions: Concrete Experience versus Abstract Conceptualization and Reflective Observation versus Active Experimentation (Terrell, 2005). According to Dille and Mezack (1991) “over time, learners develop a preference for either concrete experiences when learning or a

preference for engaging in abstract or conceptual analyses when acquiring skills and knowledge. They also may emphasize interest in turning theory into practice by active experimentation, or they may prefer to think about their experiences by reflective observation” (as cited in Diaz & Cartnal, 1999, p. 1). A combination of the scores from each of these two scales identifies a learner’s preferred style of Diverger, Converger, Assimilator, or Accommodator.

Berg (2001) writes that Dille and Mezack (1991) employed LSI to identify predictors of high risk among community college students enrolled in telecourses. The diverger is described as a learner high on the abstract and reflective dimensions. This learner prefers to observe and enjoys group activities including brainstorming.

“Accommodators and convergers, who ranked highest in telecourse success, were found to have higher active experimentation scores” (as cited in Berg, p.58). Berg also notes that Dille & Mezack reported that unsuccessful students had higher than average concrete scores and suggested that those students enroll in face-to-face instruction. Diaz & Cartnal (1999) agree that individuals who have higher scores on concrete experience tend to exhibit a “greater sensitivity to feelings and thus would be expected to require more interactions with peers and the teacher” (p. 1).

A later study by Terrell (2005) focused on attrition at the program level. The population studied was doctoral students at a large, private, metropolitan university in southeastern Florida enrolled in an education/technology program. The author states that while the national attrition rate for doctoral programs is 50%, the attrition rate for the program in the study is 62.4%. The author hypothesized that according to Kolb, “a given individual’s occupation tends to reflect their [*sic*] personal learning style” (as cited in

Terrell, 2005, p. 3), therefore the majority of the students would fall either into the Converger or Assimilator categories. Furthermore, “because of a learner’s distinct talents and needs, learning style would be a significant predictor of success” (Terrell, p.3).

The study began with 216 doctoral students who entered the program between 1993 and 1998. All students had either graduated or left the program by 2003. The LSI was administered as part of their coursework. The results indicated that the majority of students (77.3%) did fall into either the Converger or the Assimilator categories. Of the students in either of these two categories, 37.1% graduated. For the 49 students who scored into the Diverger or Accommodator categories, 40.8% graduated. The comparison of graduation rate by learning style was not found to be significant. The author also reports a large -2 Log likelihood of 281.796, indicating that this model is a poor predictor of attrition. The author points out that although the attrition rate of graduate students was not affected by learning style or demographics, these findings cannot be generalized to other levels. In addition, the possibility that learning style may change over long periods of time must be considered. He also suggests post-hoc data be examined in an attempt to determine other causes of attrition.

Grasha-Riechmann Student Learning Style Scales

The Grasha-Riechmann Student Learning Style Scales (GRSLSS) is an instrument specifically designed to assess the learning styles of senior high school and college students. The measurement scales focus on the interaction between students, peers, instructor, and learning. According to Riechmann (1980) and Grasha (1981), this interaction between students, peers, instructor, and learning, “fall into the general learning style category of social-interaction models as opposed to other categories of

learner differences such as cognitive styles or developmental-stage models” (as cited in Hruska & Grasha, 1982, p. 81). It has already been established that interaction and two-way communication are important concepts for effective distance learning, but these crucial elements are often lacking in the implementation of distance learning courses. The GRSLSS uses measurement scales designed to address one of the key characteristics in distance learning: the lack of social interaction between teacher and student and between student and their peers (Diaz & Cartnal, 1999).

The GRSLSS contains six categories or measurement styles: Independent, Dependent, Participant, Avoidant, Collaborative, and Competitive. Every student will have some combination of each of the six styles; however, there will be strong preferences for some styles over others. No student will prefer one style exclusively (Hruska & Grasha, 1982).

Research findings from the application of GRSLSS have shown notable differences between two and four-year college students. Grasha (1979) found that two-year college students have a tendency toward roles that are more dependent, competitive, and participant than students from four-year institutions (Hruska & Grasha, 1982).

The GRSLSS was the instrument selected for a study conducted by Diaz & Cartnal (1999). In this California study, the researchers examined the relationship between learning style and student success in an online course and an equivalent on-campus course. The population consisted of 108 health education students enrolled in a medium-sized community college on the central coast of California. The distance education group consisted of students ($n=68$) from two online sections, and the comparison group ($n=40$) was selected from four on-campus sections. The results of the

study indicated that the online students preferred the independent learning style while the on-campus students were significantly more dependent. After analyzing correlation data, the authors also found a second learning style difference between the two groups. The on-campus group preferred a collaborative learning style while the online group employed a collaborative style only when the instructor expected them to use this style.

As part of a wider study of English Composition students enrolled at a community college in Florida, Berg (2001) questioned if the learning styles of telecourse students differed from the learning styles of students enrolled in lecture-based courses. A second dimension of the study examined which achievement differences between the two groups, if any, may have been attributed to learning styles. A total of 179 students, comprised of five sections of telecourse students and five sections of lecture-based students, were administered the GRSLSS during the spring 2001 term.

Berg concluded that students with high collaborative learning style scores most often enrolled in the lecture-based courses. Students with high collaborative learning style scores were significantly correlated to continued enrollment in English Composition courses. In addition, students with high participant learning styles were more likely to have higher scores in English Composition whereas students with high avoidant learning styles were likely to earn lower grades.

There are many learning style inventories that have been used within distance learning, and the choice of which instrument to use depends on the requirements of individual distance learning courses or programs. Diaz and Cartnal (1999) suggest that researchers carefully define the data that is to be collected and then match the instrument

to its intended use. In addition, they point out factors such as reliability and validity, administration issues, and cost of the instrument.

While learning style is a factor that must be considered when examining completion rates in computer-based instruction, student choice of instructional format should also be taken into account. To date, there is little data on student choice of instructional format in the current body of research.

Student Choice of Instructional Delivery Format

Student reasons for choosing a delivery format are an often-overlooked area within distance learning. Most studies concentrate on the demographics of who chooses computer-based instruction over the traditional lecture-based format. An equal number of studies examine the identifying characteristics of those students who are successful in the computer-based format. There is a paucity of research that examines why students choose a particular instructional format over another. Roblyer (1999) argues that as administrators begin to consider replacing traditional formats with distance learning formats, “we need to know more about the impact on students of this lack of choice” (p. 3). In addition, if a preference for distance learning is found in a certain type of student “(e.g. students at certain educational levels, with more experience using technology, or with greater academic commitment)” (p. 3), this profile will help institutions determine who will successfully take advantage of distance learning.

Roblyer (1999) conducted a study designed to test the hypothesis that students who choose the DL format would have higher Likert-scale ratings of logistical factors (e.g., convenience) and control factors (e.g., choosing when to do instructional activities than to other factors such as degree of interaction with other students); and Students who choose FTF [face-to-face] formats would rate interaction factors higher. (p. 4)

The population for this study was community college students. Roblyer did disclose that the dropout rate was significant at 32% for the community college. Despite repeated attempts by the instructors to collect the data, the students who dropped out did not complete the survey. Thus, results are limited to course completers.

For her study, Roblyer looked at community college students enrolled in two sections of earth science each taught by the same instructor; however, one section was online and the other was taught in the classroom. The survey instrument used to collect the data consisted of 14-item Likert-type scale designed to measure the factors students considered as the most important in their decision to enroll in a particular delivery format as well as demographic questions. The final question was open-ended to solicit their comments.

The analysis of the community college data as it related to both hypotheses was only partially supported by the data. The results revealed that control over the pace and timing were significantly more important to the distance learning students ($t=2.03, p < .05$). Personal interaction was significantly more important to the face-to-face students ($t=2.77, p < .01$). Roblyer found no significant difference between choice of delivery system and any of the demographic or personal factors that would predict choice of delivery format. Roblyer concludes that there is some support to continue to offer students a choice between delivery formats for most courses and programs. In addition, the author stated that more research is needed from the students who have dropped out of the courses to determine if they differ in some systematic way from course completers.

Berg (2001) also examined choice of instructional method and its relationship to withdrawal or continuance in an English Composition course. A total of 179 students, comprised of five sections of telecourse students and five sections of lecture-based students enrolled in a community college in Florida were administered a demographic survey that included a question pertaining to their motivation for choosing the particular instructional format. The student responses were grouped into two categories: preferred choice or no other option. Berg concluded that there was no significant relationship between student motivation for choosing a particular instructional format and retention in that course. Berg concedes that her results conflict with much of the literature regarding choice in distance learning. She cites Hoffman and Novak (1998) and Thomerson and Smith (1996) who report that choice was indeed a factor in success and retention among distance learners. Both studies suggested that many of the students lacked the technological skills necessary for distance learning (as cited in Berg, 2001).

Berg's study may not have supported the majority of the literature because her study involved telecourse students who require less technological skills than those who are engaging in computer-based instruction.

Summary and Synthesis

Computer-based instruction, including distance learning, continues to grow as an alternative form of education. There is an abundance of literature stating that computer-based instruction is as effective as traditional classroom instruction. However, critics point to the flaws in many of these studies including the persistent problem of high dropout rates within computer-based instruction. Indeed, much of the literature pertaining to distance education fails to even mention student completion rate.

Several factors have been posited as possible causes of the elevated dropout rates in computer-based classes. Many researchers argue that the high dropout rate is related to the effectiveness of distance learning in terms of quality of the educational experience. Some researchers conclude that it is the specific student population (community college versus four-year institutions) that plays a significant role in retention in computer-based courses. Others contend that dispositional factors, including learning style and choice of mode of instruction, are mediating factors in the overall retention of students in computer-based instruction. What is apparent is that more specific research—focusing on those students who drop out of computer-based courses—is needed. The goal of improving the completion rates in computer-based courses at the community college may be met by matching particular student characteristics to an appropriate instructional format.

Chapter Three

Method

The purpose of this study was to examine the differences in students' withdrawal and completion rates in classes delivered via different instructional formats (distance learning, hybrid, or traditional) to determine if student learning style and/or student reasons for choosing an instructional format have an effect on the dropout rate in a remedial mathematics course. This study attempted to answer the following research questions:

- 1) Is there a relationship between students' learning styles and their completion or withdrawal from a remedial math course (MAT 0024) by a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning)?
- 2) Is there a relationship between students' reasons for choosing a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning) and their completion or withdrawal from a remedial math course (MAT 0024)?
- 3) Is there a relationship between students' College Placement Test (CPT) mathematics score and their completion or withdrawal from a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning) of a remedial math course (MAT 0024)?

Design of the Study

The high withdrawal rate of students enrolled in computer-based instruction in general, and in distance learning instruction in particular, has been documented in the literature. Researchers have suggested several factors that may contribute to this phenomenon including characteristics of the delivery format and the characteristics of the distance learner. Much of the research has been limited to the study of undergraduate/graduate students at four-year institutions; very few studies have examined students at two-year institutions. This non-experimental quantitative study examined the relationship between student learning styles, student reasons for choosing a particular delivery format, and entering college students' math placement test scores on the College Placement Test and the completion or withdrawal from a particular format (traditional, hybrid, or distance learning) of a remedial mathematics course at a community college. The research questions were examined using data collected from student records, a learning style survey, and a student reasons for selecting a delivery format survey.

Population and Sample

The site of the study was a large, urban, multi-campus community college located in the state of Florida. The office of Institutional Research at the college reported a total enrollment of 24,499 students for the Fall 2006 term. Approximately 57% of the students were female and 43% were male. The ethnicity of the population was 19% Black, non-Hispanic, 4.2% Asian, .4% American Indian/Alaskan, 21.7% Hispanic, and 54.6% White, non-Hispanic. Approximately 60% were younger than 25 years old while 40% were 25 years of age and above. The office reports that 17% of the students were enrolled on a full-time basis.

Population

The population of this study included students who were enrolled in different sections of the same remedial math course, offered in a traditional lecture-based format, a hybrid format, and a distance learning format. The study was limited to students who were enrolled at two of the five campuses because these were the only two campuses that currently offered all three methods of delivery instruction. One campus is the main campus with the highest enrollment (12,710 as of Fall 2006) and the other campus is a smaller campus (7,090 as of Fall 2006) located in an historical, urban setting. The remedial course studied was limited to MAT 0024 Beginning Algebra because it was the only remedial course offered in all three instructional formats.

Sample

The sample consisted of three groups: (a) 69 students enrolled in three sections of a Basic Algebra (MAT 0024) traditional lecture-based course on the two campuses, (b) 67 students enrolled in three sections of a Basic Algebra (MAT 0024) hybrid course on both campuses, (c) 56 students enrolled in three sections of a Basic Algebra (MAT 0024) course through distance learning. Random sampling was not possible for this study because students self-selected into their courses. A non-probability (purposive) sampling technique was used to choose the sections involved in the study in an effort to obtain a sample that was as representative as possible of the population being studied. The sample breakdown is shown in Table 1.

Table 1

Study Sample: Basic Remedial Algebra Course Selection by Campus, Delivery Format, and Instructor (N = 192)

	Campus I	Campus II	Off-Site
Traditional			
Section 1 ($n=21$)	Instructor A		
Section 2 ($n=18$)	Instructor B		
Section 3 ($n=30$)		Instructor C	
Hybrid			
Section 1 ($n=20$)	Instructor A		
Section 2 ($n=23$)	Instructor B		
Section 3 ($n=24$)		Instructor C	
Distance Learning			
Section 1 ($n=19$)			Instructor D
Section 2 ($n=19$)			Instructor D
Section 3 ($n=18$)			Instructor D

Because the study involved nine sections of varying formats at different locations, four different instructors taught the courses. As indicated in Table 1, instructor D is teaching all three sections of the distance learning format. This particular instructor is a full-time faculty member with over 25 years of teaching experience. The remaining instructors involved in the study have previous experience teaching Basic Algebra (MAT 0024). Instructor C is also a full-time professor with a minimum of 15 years of teaching experience, and the other two instructors are part-time adjunct instructors possessing 10

years and three years of teaching experience respectively. Additionally, in an effort to ameliorate instructor bias, the full-time faculty members and the researcher met together before the semester began to write a common syllabus and four common tests that would be administered to all nine sections of the course at approximately the same time during the semester. All Beginning Algebra (MAT 0024) students received the same form of the state exit exam.

All the sections involved in this study had a cap of 25 students. Historically, these sections have met the cap each semester; therefore the researcher was expecting a total sample size of $N = 225$. Because the data was not collected until after the drop/add period and not every student was in attendance on the day of data collection, the total sample size was $N = 192$. This sample was examined during the fall semester of 2007.

The students enrolled in the computer-based sections were taught using the Plato Learning Interactive Mathematics software and accompanying book for Elementary Algebra. The software was customized to match the objectives of the lecture-based course. The students enrolled in the lecture-based sections were taught using Pre-Algebra & Introductory Algebra, 2nd edition by Lial, Hestwood, Hornsby & McGinnis. The same objectives were taught across all sections of Beginning Algebra (MAT 0024). As previously stated, all Beginning Algebra (MAT 0024) students were administered the same chapter tests at approximately the same time during the semester.

All students have access to free tutoring as provided by the college through the math lab. The math lab has both evening and weekend hours to accommodate students' needs. Each instructor involved in the study is required to hold at least ten office hours each week with at least eight of those hours to be held on campus. The distance learning

instructor reported that distance learning students rarely come to campus during office hours. The instructor states that the “average is about two per week out of my 215 students. Students are more likely to come after a test to go over their results than before a test to prepare for it” (L. Fox, personal communication, December 20, 2007). The math lab reports several visits from distance learning students per week, but the students are using the lab to access the computers rather than for tutoring services.

Instrumentation

This section will discuss the instrumentation that was used to address research questions 1 and 2. The first instrument was designed to address learning styles and the second instrument was designed to address student reasons for choosing a delivery format.

Grasha-Riechmann Student Learning Style Scale (GRSLSS)

The Grasha-Riechmann Student Learning Style Scales (GRSLSS) was the instrument used to determine the learning styles of the students involved in the study. For over 20 years, the GRSLSS has “been used to identify the preferences learners have for interacting with peers and the instructor in classroom settings” (Grasha, 1996, p. 127). The GRSLSS was selected for this study because “the scales fall into the general learning style category of social-interaction models ... as opposed to other categories of learner differences such as cognitive styles or developmental-stage models” (Hruska & Grasha, 1982, p. 81). While several other learning style instruments have been used in research involving distance learning including the Kolb Learning Style Inventory, and the Canfield Learning Styles Inventory, “the GRSLSS focuses on how students interact with the instructor, other students, and with learning in general” (Diaz & Cartnal, 1999, p. 2).

Social interaction is an important scale to include in distance learning research since one of the defining characteristics of distance learning is “the separation of teacher and student” (Garrison, 1989, p. 2). Therefore, the GRSLSS addresses “one of the key distinguishing features of a distance class, the relative absence of social interaction between instructor and student and among students” (Diaz & Cartnal, p. 2). In addition, the GRSLSS “is one of the few instruments designed specifically to look at student differences in senior high school and college/university classrooms” (Hruska & Grasha, 1982, p. 81).

According to Hruska & Grasha (1982), the items were designed using a rational approach. One set of high school seniors and college/university students generated possible items based on Grasha’s six styles. Another set of high school seniors and college/university students further refined the items by sorting them into the category they thought most appropriate. The items sorted into a given category that had at least 70% consistency were used in the original version of the instrument. “Factor analysis data have since confirmed the quality of the scales” (as cited in Hruska & Grasha, 1982, p. 82). Hruska & Grasha (1982) refer to the reliability data on the instrument and report that the “test-retest reliability coefficients, with a seven day interval between testings, range from .76 for the dependent scale to .83 for the independent scale ($N = 269$) (p. 82).

The GRSLSS is comprised of six different learning style scales: competitive, collaborative, avoidant, participant, dependent, and independent. A description of each learning style is found in Table 2.

Table 2

Description of the Six Learning Styles

Learning Style	Characteristics
Competitive	Students who learn material in order to perform better than others in the class. Believe they must compete with other students in a course for the rewards that are offered. Like to be the center of attention and to receive recognition for the accomplishments in class.
Collaborative	Typical of students who feel they can learn by sharing ideas and talents. They cooperate with teacher and like to work in groups and teams.
Avoidant	Not enthusiastic about learning content and attending class. Do not participate with students and teachers in the classroom. They are uninterested and overwhelmed by what goes on in class.
Participant	Good citizens in class. Enjoy going to class and take part in as much of the course activities as possible. Typically eager to do as much of the required and optional course requirements as they can.
Dependent	Show little intellectual curiosity and who learn only what is required. View teacher and peers as sources of structure and support and look to authority figures for specific guidelines on what to do.
Independent	Students who like to think for themselves and are confident in their learning abilities. Prefer to learn the content that they feel is important and would prefer to work alone on course projects than with other students.

Note. The descriptions are from *Teaching with style: A practical guide to enhancing learning by understanding teaching and learning styles* (p. 169), by A.F. Grasha, 1996, Pittsburgh: Alliance Publishers. Copyright 1996 by Alliance Publishers. Adapted with permission.

According to Grasha (1996), these scales represent a blend of characteristics that are found within each student. Grasha continues by stating that ideally, there would be a “comfortable balance among the six styles. More often, however, certain qualities are more pronounced than others” (1996, p. 170). The responses from the GRSLSS were used to identify the strengths of the six learning styles of each student in the study. For this study, student learning style was classified by the dominant style as indicated by the

six sub-scales. The data from this survey was used to answer Research Question 1: Is there a relationship between students' learning styles and their completion or withdrawal from a remedial math course (MAT 0024) by a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning)?

Student Choice of Delivery Format Survey

The survey to determine reasons why students selected a particular instructional delivery format was designed from a combination of two sources. The first source originates from a study conducted by Roblyer (1999) that examines whether choice is important in distance learning by studying student motivation for selecting either an internet-based course or a face-to-face course for students enrolled at both high school and community college levels. Roblyer's survey was designed to capture perceptions about course delivery systems. The Fall 2007 course schedule included a description of the delivery format for the computer-based Basic Algebra courses (See Appendix E).

Roblyer (1999) established construct validity for the Likert scale used in the survey by first reviewing the literature for existing measures. Second, she developed a list of four constructs to be measured. The constructs used to develop the 13 items in the survey are as follows:

1. Logistical factors: Distance and driving time to course site, access to parking, and access to computer resources.
2. Control factors: Choosing when to accomplish learning activities and flexibility in time students needed to complete them.
3. Personal interaction factors: The need for personal interaction with instructors and other students.
4. Technology perspectives: Attitudes about and prior experiences with technology and DL. (p. 6).

Third, a committee that was comprised of K-12 teachers and higher education instructors in the region as well as the instructors involved in the study reviewed the constructs.

Fourth, after adjustments were completed, those involved in the study designed items to measure the constructs. Finally, the final draft was reviewed by the committee and additional changes were suggested and subsequently completed. The survey is included as Appendix B.

The second source for the student choice of delivery format survey comes from a questionnaire developed by a full-time instructor who currently teaches Basic Algebra (MAT 0024) through distance learning. The questions were previously administered to students during the 2004/2005 and 2005/2006 academic years. The collection of information occurred during mandatory orientation sessions held at the beginning of each term and was collected using a survey designed by the instructor (Appendix C). The researcher compared the reasons students chose to enroll in a distance learning course to the items found in Roblyer's survey. There were several comments from students related to logistical and control factors that were not included in the Roblyer survey. As a result, Roblyer's original survey was modified to incorporate these additional items (see Appendix D for the modified survey).

The modification of Roblyer's survey was limited to the addition of four questions, taken from data collected in the last two years, which fit into the previously identified constructs found in the factor analysis of the survey items. The two years of recent data collected from the population being studied, and the limited modification of the original survey preclude the need for a pilot to establish validity and reliability.

The researcher repeated the factor analysis to verify the four original Roblyer constructs including verification of the four additional items that the researcher included in the modified survey. According to Tabachnick & Fidell (2001), there are several ways to determine the number of factors that are selected to allow for accurate estimate of variance. One process is to examine the eigenvalues that are produced from the factor analysis. Eigenvalues represent variance and hence, only eigenvalues greater than one are important from a variance standpoint. Another method to determine the number of factors is to examine the scree plot. A scree plot is a graph where eigenvalues are plotted against the number of factors. When examining the scree plot “you look for the point where a line drawn through the points changes slope” (p. 621). After examining the eigenvalues and the scree plot, it was determined that there are only two factors to consider to allow for an accurate estimate of variance.

Once the number of factors to be considered was identified, the number of variables that load onto each factor needed to be determined. “As a rule of thumb, only variables with loadings of .32 and above are interpreted” (Tabachnick & Fidell, 2001, p. 625). The researcher identified the variables that load onto each factor and then calculated the Cronbach Coefficient for each of the two factors. Cronbach’s alpha is a measure of reliability of the factor or internal consistency of the solution. A high Cronbach’s alpha (.70 or better) “means that the observed variables account for substantial variance in the factor scores” (p. 625). The Cronbach alpha for the first factor was .75 and .57 for the second factor. The final step was to search for a concept that unified these variables. The researcher characterized the first factor as those variables that were related to student’s personal reasons for selecting a particular delivery style.

The second factor was characterized as student’s perceived learning needs that prompted the selection of a particular delivery format. Table 3 presents the items used to compose each of the two factors and Cronbach’s alpha values for each factor.

Table 3

<i>Variable Names and Operational Definitions</i>		
Variable	Survey Item Description	Operational Definition
Personal Factors	Composite of a) attitudes & feelings about DL systems b) control over learning environment c) comfort with technology d) access to computer e) control over pace f) whether course lends to delivery method g) ability to access campus due to caring for others h) prior experience with DL i) fits my schedule. Cronbach’s $\alpha = .75$	Range 1-5 (High number represent greater consideration when selecting delivery format)
Perceived Learning Needs	Composite of a) need for face-to face vs online access to my instructor b) need for face-to-face vs online access with my classmates c) physical limitations or learning disabilities. Cronbach’s $\alpha = .57$	Range 1-5 (High number represents greater consideration when selecting delivery format)

The data from the student choice of delivery format survey was used to answer Research Question 2: Is there a relationship between students’ reasons for choosing a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning) and their completion or withdrawal from a remedial math course (MAT 0024)?

Demographic data and CPT scores for each student involved in the study was gathered from the database of the participating college. The demographic data that was

gathered included age, gender, ethnicity, and marital status. The CPT scores collected from the database were utilized to answer Research Question 3: Is there a relationship between students' College Placement Test (CPT) mathematics score and their completion or withdrawal from a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning) of a remedial math course (MAT 0024)?

Data Collection

The two surveys were administered during the second week of the Fall 2007 semester. These surveys were administered in paper format for all sections involved in the study. The paper surveys for the distance learning students were administered during the mandatory orientation session held at one of the campuses. The participants' surveys were identified by the use of their student identification number. The demographic data and CPT scores were collected from the database during the semester.

At the end of the semester, withdrawal and completion data for each of the sections was collected. The withdrawal data was presented in two different ways based on two cut-off dates within the semester. The first group represented those students who withdrew by the sixth week of the semester. The second group represented those students who withdrew by the date identified by the college as the last date to withdraw without a grade. Under the descriptive data in Chapter 4, a breakdown of the withdrawal status by the two groups for each delivery format is detailed. For those students who formally withdrew from the course at the registrar's office, a reason for withdrawal was to be captured on a withdrawal form and noted in the database. For those students who withdrew online, the reason for withdrawal was to be completed by the student. This process was not followed for each participant in the study and the researcher attempted to

contact by phone, mail, and email those students whose reasons for withdrawal were not noted. For those students who did not formally withdraw, the researcher attempted to contact each individual by email, phone, and mail to determine a reason for non-completion of the course. The withdrawal data was analyzed and an attempt made to link the data back to the students' reasons for choosing a delivery format and learning style. Students who withdrew from all courses for which they had registered were dropped from the study. Students who withdraw from the entire institution do so for reasons that are different (e.g. illness, employment issues, military duty, etc.) than those who withdraw from a Basic Algebra course. Students who withdrew from the institution for uncontrollable circumstances were not the focus of this study.

Completion data was analyzed according to three categories of students. The first group represented students who have successfully completed the course. The second group represented students who have completed the course with a passing grade, but did not meet the requisite score of at least a 70% on the Florida State exit exam. The third group represented those students who complete the course by attendance only, but did not receive a passing grade and were not eligible to sit for the final exam.

Data Analysis

Descriptive and bivariate statistics were examined for all variables. Measures of central tendency were calculated as descriptive data for the continuous variables including age, CPT score, and student choice. Frequencies were used for the categorical variables including learning style, gender, ethnicity, and marital status. Correlations were run to examine the bivariate relationship between the independent variables, namely, learning style, student choice, CPT score, gender, age, ethnicity, and marital status, and

the dependent variable of completion status. Each of the research questions were addressed by logistic regression.

Logistical regression was chosen for its predictive ability. “Logistic regression allows one to predict a discrete outcome such as group membership from a set of variables that may be continuous, discrete, dichotomous, or a mix” (Tabachnick & Fidell, 2001, p. 517). In addition, “logistic regression has no assumptions about the distributions of the predictor variables; in logistic regression, the predictors do not have to be normally distributed, linearly related, or of equal variance within each group” (p. 517). “Logistic regression applies maximum likelihood estimation after transforming the dependent into a logit variable (the natural log of the odds of the dependent occurring or not). In this way, logistic regression estimates the probability of a certain event occurring” (Garson, 2006, ¶3). In other words “the linear regression equation is the natural log (\log_e) of the probability of being in one group divided the probability of being in the other group” (Tabachnick & Fidell, 2001, p. 518). Logistic regression can be used to predict a dichotomous dependent variable based on either continuous or categorical independent variables. The dependent variable in this study is completion status (0 = no complete, 1 = complete), which is a dichotomous variable. In addition, logistic regression can “determine the percent of variance in the dependent variable explained by the independents; to rank the relative importance of independents; to assess interaction effects; and to understand the impact of covariate control variables” (Garson, 2006, ¶2).

Research Question 1 was addressed by logistic regression. The dependent variable is completion status. The primary independent variable is learning style. The control variables included gender, age, ethnicity, and marital status.

Research Question 2 was addressed by logistic regression. The dependent variable is completion status and the primary independent variable is student reasons for choosing a delivery format. The control variables included gender, age, ethnicity, and marital status.

Research Question 3 was addressed using logistic regression. The primary independent variable is student CPT score, and the dependent variable is the completion status from the particular course. The control variables will include gender, age, ethnicity, and marital status.

Summary

The high withdrawal rate within computer-based instruction in general, and within distance learning in particular, has been documented in the literature, yet there are few studies that focus on why the dropout rate in these types of classes is unusually high. This study is designed to add to the literature by examining the withdrawal and completion rates between instructional delivery formats to determine if student learning style and/or student reasons for choosing a delivery format and/or CPT scores have an effect on the dropout rate in a remedial mathematics course.

This chapter also described the study population and sample, including a complete description of the instrumentation that was in data collection. A general overview of the statistical methods was also presented.

Chapter Four

Results

The purpose of this study was to examine the differences in students' withdrawal and completion rates in classes delivered via different instructional formats (distance learning, hybrid, or traditional) to determine if student learning style and/or student reasons for choosing an instructional format have an effect on the dropout rate in a remedial mathematics course.

This chapter is divided into four sections: the results of all descriptive data of the research group, bivariate data of all variables, the results of the multivariate data as they pertain to each of the three research questions, and a summary of all the results.

Descriptive Data

The research group consisted of students enrolled in nine sections of Basic Algebra (MAT 0024) delivered in three different instructional delivery formats. The nine sections were divided as follows: (a) students enrolled in three sections delivered in a traditional lecture-based format, (b) students enrolled in three sections delivered in a hybrid format, (c) students enrolled in three sections delivered in a distance learning format. Of the 218 students enrolled in the nine sections of the course, 199 (91.28%) participated in the study. Four of the 199 responses were not included because of incomplete surveys, and three responses were not included due to the age of the participants (under the age of 18). Of those students who participated, 192 usable

responses were obtained (96.48%). The usable responses included 36% from the lecture-based sections ($N=69$), 35% from the hybrid sections ($N=67$), and 29% from the distance learning sections ($N=56$).

The tables in this section present the raw data that describe the research group. The descriptive variables presented include gender, age, ethnicity, marital status, CPT scores, learning style, student reasons for selecting an instructional delivery format, and completion status. The bivariate correlations of the descriptive data are detailed in a subsequent section presented in Table 15 and Table 16.

Table 4 presents gender data of the research group as a whole and by instructional delivery method including the college census data as of Fall 2006.

Table 4

Gender of Research Group as a Whole and by Instructional Delivery Format including College Fall 2006 Census

Gender	Research Group Overall $N=192$		Lecture Format $n = 69$		Hybrid Format $n = 67$		Distance Format $n = 56$		College Census Fall 2006 $N = 24,499$	
	n	%	n	%	n	%	n	%	n	%
Female	137	71%	51	74%	43	64%	43	77%	13,961	57%
Male	55	29%	18	26%	24	36%	13	23%	10,524	43%
Not Reported									14	
Total	192	100%	69	100%	67	100%	56	100%	24,499	100%

A chi-square goodness of fit test ($\alpha = .05$) revealed a significant difference in the gender of the research group as compared to the college as whole ($\chi^2 (1, N = 192) = .0001$). Thus, the gender of the research group is not representative of the college population. The data in Table 4 suggest that the difference is driven by the 71% of

females in the research group as compared to the 57% of females in the college population.

In order to determine if there is a significant difference between gender and instructional delivery format, the researcher conducted a chi-square test of independence. The chi-square test of independence ($\alpha = .05$) found no significant difference in the proportions between gender and type of instructional delivery format ($\chi^2 (2, N = 192) = .2571$).

The other student demographic data that was collected as part of the study included age, ethnicity, and marital status. The data related to age of the research group as a whole and by instructional delivery format including data from the college Fall 2006 census is presented in Table 5.

Table 5

Age of Research Group as a Whole and by Instructional Delivery Format including the College Fall 2006 Census

Age	Research Group Overall N=192		Lecture Format n = 69		Hybrid Format n = 67		Distance Format n = 56		College Census Fall 2006 N = 24,499	
	n	%	n	%	n	%	n	%	n	%
< 25	120	63%	45	65%	48	72%	27	48%	14,551	60%
≥25	72	37%	24	35%	19	28%	29	52%	9,775	40%
Not Reported									173	
Total	192	100%	69	100%	67	100%	56	100%	24,499	100%

A chi-square goodness of fit test ($\alpha = .05$) showed no significant difference in the age of the participants of the research group as compared to the college population as a

whole ($\chi^2 (1, N = 192) = .0822$). Thus, the age of the participants in the research group is representative of the college population.

A chi-square test of independence was employed to determine if there was a significant difference between age of participants and type of instructional delivery format. The results of the independence test showed a significant difference ($\alpha = .05$) in the proportions between age and type of instructional delivery format ($\chi^2 (2, N = 192) .0072$). Thus, there is an association between age and type of instructional delivery format. As the data in Table 5 suggest, it appears that the difference is driven by the percentages within the lecture and hybrid formats. Within the lecture format, the percentage of students under the age of 25 is higher (65%) than the percentage of students that are 25 years of age and older (35%). Within the hybrid format, the percentage of students under 25 years of age (72%) is higher than the percentage of student 25 years of age and older (28%). In addition, the results from test of independence showed no difference in the proportions between age and distance learning format.

The data related to ethnicity of the research group as a whole and by instructional delivery format and including the college Fall 2006 census are presented in Table 6. A chi-square goodness of fit test ($\alpha = .05$) showed a significant difference in ethnicity of the research group as compared to the college population ($\chi^2 (4, N = 192) .0001$). Thus, the ethnicity of the research group is not representative of the college as a whole. From the data in Table 6, this difference may be accounted for by the higher percentage of African Americans in the research group (34%) as compared to the college as a whole (19.1%). In

addition, the percentage of White students in the research group (35%) is lower as compared to the college as a whole (54.6%).

In order to determine if ethnicity is associated with type of instructional delivery method, a chi-square independence test was conducted. The results of the independence test ($\alpha = .05$) revealed a significant difference between ethnicity and type of instructional delivery format ($\chi^2 (8, N = 192) .0033$). However, the results included a warning that 40% of the cells had expected counts less than five; therefore, caution was exercised when interpreting the results. However, according to the results depicted in Table 6, it appears that the lecture and hybrid formats had the highest percentage of African Americans (44% and 40% respectively) and the distance learning course had the highest percentage of White students (57%).

Table 6

Ethnicity of Research Group as a Whole and by Instructional Delivery Format Including the College Fall 2006 Census

Ethnicity	Research Group Overall N=192		Lecture Format n = 69		Hybrid Format n = 67		Distance Format n = 56		College Census Fall 2006 N = 24,499	
	n	%	n	%	n	%	n	%	n	%
African American	66	34%	30	44%	27	40%	9	16%	4,645	19.1%
American Indian/Alaskan	1	1%	0	0%	0	0%	1	2%	100	.4%
Asian/Pacific Islander	4	2%	2	3%	1	2%	1	2%	1,024	4.2%
Hispanic	53	28%	17	25%	23	34%	13	23%	5,272	21.7%
White	68	35%	20	29%	16	24%	32	57%	13,283	54.6%
Not Reported									175	
Total	192	100%	69	100%	67	100%	56	100	24,499	100

The data regarding marital status is found in Table 7. Fall 2006 census data for the college was not included in Table 7 because the college does not collect marital status information as part of their demographic data.

Table 7

Marital Status of Research Group as a Whole and by Instructional Delivery Format

Marital Status	Research Group N=192		Lecture Format n = 69		Hybrid Format n = 67		Distance Format n = 56	
	n	%	n	%	n	%	n	%
Single	146	76%	55	80%	56	84%	35	63%
Married	34	18%	9	13%	6	9%	19	34%
Divorced	6	3%	2	3%	3	4%	1	2%
Separated	6	3%	3	4%	2	3%	1	2%
Total	192	100%	69	100%	67	100%	56	100%

A chi-square independence test was run to determine if there is a significant difference between marital status and type of instructional delivery format. The results of the independence test ($\alpha = .05$) indicated a significant difference between marital status and type of instructional delivery format $\chi^2 (2, N = 192) .0007$. Thus, there is an association between marital status and type of instructional delivery method. According to the data presented in Table 7, this association appears to be driven by the large percentages of students in the study who are single and who are enrolled in each of the instructional delivery formats.

Table 8 presents the CPT scores for the students participating in the study. All students entering the college are enrolled into mathematics courses based on either their

CPT score or SAT/ACT score. Each student begins the test with an Elementary Algebra test. If a student scores a 51 or higher, the student is enrolled in Basic Algebra (MAT 0024). If a student scores less than a 51, the student must take the Arithmetic test. If a student scores an 80 or higher on the Arithmetic test, the student is enrolled in Basic Algebra (MAT 0024). If the student scores below an 80, the student is enrolled in Pre-Algebra (MAT 0012). Based on this information, the students who scored 51 or higher on the Elementary Algebra test were coded for statistical purposes as a high CPT score. The students who scored a 50.9 or less, were coded as a low CPT score. The CPT scores of the students participating in the study ranged from a low score of 20 to a high score of 71. Of the 192 students participating in the study, 16 students had no CPT score recorded.

Table 8

CPT Scores of Research Group as a Whole and by Instructional Delivery Format

CPT Score	Research Group Overall N=192		Lecture Format n = 69		Hybrid Format n = 67		Distance Format n = 56	
	n	%	n	%	n	%	n	%
Low	101	61%	37	59%	31	52%	33	62%
High	75	39%	26	41%	29	48%	20	38%
Not Reported	16		6		7		3	
Total	192	100%	69	100%	67	100%	56	100%

The results of a chi-square test of independence ($\alpha = .05$) revealed that there is no statistically significant difference between CPT score and type of instructional delivery format ($\chi^2 (2, N = 192) .6635$). Thus, it appears that there is no association between CPT score and instructional delivery format.

The Grasha-Riechmann Student Learning Style Scale (GRSLSS) was the instrument used to assess the learning styles of the students in the research group. The instrument is used to group students into one of the six learning styles (Independent, Avoidant, Collaborative, Dependent, Competitive, and Participant). Each student in the group earned a score in each of the six categories. Each category has a range associated with it, so that each student would earn a score that was low, medium, or high in each category (Appendix A). Each student was assigned a dominant learning style based on his or her highest score. If a student earned the same score in two or more learning styles, a percentage was calculated for each of the learning styles. The range of scores for each learning style were not identical, therefore a unique percentage could be calculated to determine the dominant learning style. The learning style that had the highest percentage was selected as the dominant learning style.

In Table 9, descriptive data are presented related to the dominant learning styles of the research group as a whole and the dominant learning styles associated with each of the three instructional delivery methods.

Table 9

Learning Styles of Research Group as a Whole and by Instructional Delivery Format

Learning Style	Research Group Overall N=192		Lecture Format n = 69		Hybrid Format n = 67		Distance Format n = 56	
	n	%	n	%	n	%	n	%
Independent	22	11.46%	5	7.25%	9	13.43%	8	14.29%
Avoidant	14	7.29%	3	4.35%	6	8.96%	5	8.93%
Collaborative	78	40.63%	32	46.38%	28	41.79%	18	32.14%
Dependent	17	8.85%	12	17.39%	3	4.48%	2	3.57%
Competitive	15	7.81%	1	1.45%	7	10.45%	7	12.50%
Participant	46	23.96%	16	23.19%	14	20.90%	16	28.57%
Total	192	100%	69	100%	67	100%	56	100%

A chi-square test of independence ($\alpha = .05$) showed that there is a significant difference between learning style and instructional delivery format ($\chi^2 (10, N = 192) = 10.0296$) despite the warning that 22% of the cells had expected counts less than five. While the interpretation of the results must be considered with caution, there is evidence of an association between learning style and instructional delivery format. According to the data in Table 9, the dominant learning style of almost half the students involved in the study (41%) was found to be collaborative. Furthermore, the collaborative learning style was found to be the dominant learning style regardless of instructional delivery format with the highest percentage (46%) in the traditional format. The participant learning style was the second most prevalent learning style regardless of instructional delivery format representing about one quarter of the dominant learning style of students participating in

the study. The avoidant learning style was the least represented learning style among students participating in the study.

The instrument used to determine student reasons for selecting an instructional delivery format asked students to rank their responses to 17 questions using a Likert scale rating from low (1) to high (5). The results of the data collected from this survey are found in Table 10.

Table 10

Students Reasons for Enrolling in a Particular Instructional Delivery Format (N = 192)

	Lecture Format <i>n</i> = 69		Hybrid Format <i>n</i> = 67		Distance Learning Format <i>n</i> = 56	
Personal Factors	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Low	36	52%	19	28%	8	14%
Med	26	38%	39	58%	22	39%
High	7	10%	9	13%	26	46%
Total	69	100%	67	100%	56	100%
Perceived Learning Needs						
Low	22	32%	34	51%	42	75%
Med	31	45%	29	43%	12	21%
High	16	23%	4	6%	2	4%
Total	69	100%	67	100%	56	100%

Statistical significance could not be tested because the numbers in some of the cells of Table 10 were too small. As a result, no inferential statistics were examined

between student reasons for choosing a particular format and type in instructional delivery format.

Measures of central tendency for all continuous variables were also calculated for the research group as a whole and by instructional delivery format. Table 11 presents the mean and standard deviation for these variables.

Table 11

Mean and Standard Deviation for all Continuous Variables by Instructional Delivery Format (N = 192)

Variables	Research Group		Lecture-Based		Hybrid		Distance Learning	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	25.95	8.99	26.00	10.47	24.06	7.51	27.64	8.38
CPT Score	44.97	15.61	43.29	15.80	46.15	16.09	45.60	14.94
Personal Factors	3.31	0.77	2.96	0.69	3.28	0.73	3.77	0.71
Learning Needs	2.72	1.06	3.20	1.01	2.73	0.95	2.13	0.96

According to the 2006 census of the college, the mean age of students enrolled for credit in the fall semester was 25.4 years of age. According to the data in Table 11, the mean age of the research group (25.95) is in line with the college census. The distance learning sections had a slightly higher average age (27.64) and the hybrid course had a somewhat lower average age (24.06). The large standard deviations of the ages are indicative of the wide range of ages (18-55 years of age) of participants who were involved in the study.

The mean CPT score for the research group as a whole was 44.97. The mean CPT scores for the three instructional formats were similar to the research group. The large

standard deviations of the CPT scores for all groups is indicative of the wide range of CPT scores (20-71) earned by the participants who were involved in the study.

The mean personal factor score was highest (3.77) for the distance learning group and lowest (2.96) for the lecture-based group. Conversely, perceived learning needs score was highest (3.20) for the lecture-based group and lowest (2.13) for the distance learning group. These mean scores are consistent with the data presented in Table 10.

Descriptive Data Related to Completion Status

The following two tables address the descriptive data that relates to the completion status of the research group by instructional delivery format. Table 12 includes the percentage of students who either completed or withdrew from their respective courses. For this study, completion refers to a) those students who successfully passed the course and received a grade, b) students who passed the course with at least a 70% average, but did not pass the state exit exam, and c) those students who completed the course by attendance only. Withdrawal refers to those students who either formally withdrew or disappeared by the withdrawal date set by the college (10 weeks from the beginning of the semester).

Table 12

Completion Status by Instructional Delivery Format (N = 192)

Completion Status	Lecture Format <i>n</i> = 69		Hybrid Format <i>n</i> = 67		Distance Learning Format <i>n</i> = 56	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Completed	55	80%	39	58%	34	61%
Withdrew	14	20%	28	42%	22	39%
Total	69	100%	67	100%	56	100%

A chi-square test of independence ($\alpha = .05$) showed a significant difference between completion status and instructional delivery format ($\chi^2(2, N = 192) = .0155$). Thus, completion status is associated with instructional delivery format. From the data presented in Table 12, it appears that this difference may be attributed to the difference in percent of students who completed the course (80%) as compared to those who withdrew from the course (20%) within the lecture based format. It may also be noted from the data in Table 12 that the percentage of students who withdrew from either the hybrid or distance learning course is approximately twice the percentage of students who withdrew from the lecture format.

Table 13 defines further the percentages cited in Table 12 by including a breakdown of completion status into five categories. Successful completion encompasses those students who passed the course with at least a 70% and passed the State Exit exam with a minimum score of 70%. Completion refers to those students who passed the course with at least a 70%, but did not pass the State Exit exam. Completion by attendance includes those students who did not pass the course, but continued to participate in class until the end of the semester. Early withdrawal encompasses those students who either formally withdrew or disappeared within the first six weeks of the semester. Withdrawal refers to those students who formally withdrew or disappeared by the withdrawal date set by the college (10 weeks from the beginning of the semester).

Table 13

Completion Status Defined as Successful Completion, Completion, Completion by Attendance, Early Withdrawal, and Withdrawal by Instructional Delivery Format

Completion Status	Lecture Format <i>n</i> = 69		Hybrid Format <i>n</i> = 67		Distance Learning Format <i>n</i> = 56	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Completion						
Successful Completion	35	51%	27	40%	20	36%
Completion	2	2%	2	3%	1	2%
Completion by Attendance	18	26%	10	15%	13	23%
Non-Completion						
Early Withdrawal	6	9%	14	21%	13	23%
Withdrawal	8	12%	14	21%	9	16%
Total	69	100%	67	100%	56	100%

Because the majority of the cells in Table 13 were too small, no inferential statistics were examined. Thus, only a narrative description of the raw data in Table 13 is presented. The lecture-based format had the highest percentage of students who successfully completed the course as well as the highest percentage of students who were retained until the end of the semester although they did not pass the course. The lecture-based course had the lowest percentage of students who withdrew from the course. The hybrid course represented the largest percentage of students who withdrew without consideration of the withdrawal date. According to the data in Table 13, the largest percentage of students in the distance learning format withdrew during the first six weeks of the course.

Concomitant to examining the completion and withdrawal of participants enrolled in the course, the researcher collected data regarding the reasons for student withdrawal from the course. The researcher attempted to contact all students who withdrew from the course by email, mail, and phone. A total of 64 students withdrew from all sections of the course irrespective of delivery method, which represents 33% of the participants. Of the 64 students who withdrew, there were 30 responses representing a 47% return rate. Table 14 presents a breakdown of the reasons students chose to withdraw from the course by delivery method.

Table 14

Student Reasons for Withdrawal by Instructional Delivery Method (N=30)

Reasons	Lecture-Based Format <i>n</i> = 10		Hybrid Format <i>n</i> = 10		Distance Learning Format <i>n</i> = 10	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Learning math online/computer-based presented challenges that I did not expect	0	0%	5	50%	6	60%
My job/family/medical reasons	1	10%	3	30%	3	30%
Technical Issues	0	0%	0	0%	1	10%
Low Test Grades	5	50%	0	0%	0	0%
Transportation Issues	0	0%	0	0%	0	0%
Military Duties	0	0%	1	10%	0	0%
Instructor	4	40%	1	10%	0	0%
Total	10	100%	10	100%	10	100%

The researcher had difficulty contacting students who had withdrawn from the course. The student contact information in the college database was in many cases either

incorrect or not current. The researcher emailed students using the college email system requesting a response. Those who responded did so by email, text message, or by phone. The students were asked to respond by choosing one of the selections listed in Table 14 that best represented their reason for withdrawal. There was also a section for students to add additional comments.

As with Table 13, because the majority of the cells in Table 14 were too small, no inferential statistics were examined. Therefore, only a narrative of the raw data from Table 14 is discussed. According to the data in Table 14, students who withdrew from the computer-based formats (hybrid and distance learning) did so due to challenges that they did not expect to encounter with this instructional format. The students either responded with a number, or if they commented, they did not present specific reasons why this format presented unexpected challenges, apart from two students who cited lack of support in addition to unexpected challenges. One student who withdrew from a distance learning section wrote, “[t]his proved to be much harder than I thought . . .” and another student wrote “[l]earning math online was a problem . . . it was a mistake signing (sic) up for an online math class”. Interestingly, two of the six distance learning students who reported that learning online was not what they expected also reported that there was no support for additional help. One student wrote “I was assessed (sic) with many challenges, such as help and resources to get the needed help. There was no support on campus.” Another student wrote, “I could not get the support/help I needed!”

Students who withdrew from the computer-based formats also cited work or family responsibilities as the reason for withdrawing from the course. In contrast to the inability of students to ascertain specific reasons for the challenges presented with

computer-based learning, most of the students who withdrew for job or family responsibilities were very specific about why they withdrew. One student who withdrew from a distance learning course stated, “My brother passed away ... without any life insurance and I was the contact person. I had to take off and fell too far behind.” Another student who withdrew from a hybrid section wrote “[m]y father has been very sick. He had to leave his job because he was too sick to work. The bills had to be paid ... I had to focus on trying to get more money so we could pay the bills.” Interestingly, this student also commented that when he returned to school he would like to “take my math class with a professor and not a computer mediated class.”

The students who withdrew from the lecture-based sections were the only group who selected their instructor as the reason for their withdrawal from the course as well as low-test grades. Of the four who responded that the instructor was their reason for withdrawal, only one student commented in addition to choosing a numbered selection. The student wrote, “I did not think that I could learn from his style of teaching”. Low test scores were also indicated as a reason for student withdrawal from the lecture-based sections, although none provided additional comments about what factors may have contributed to their low test scores.

Bivariate Relationships

For ease in reading, the bivariate relationships have been divided into two tables. Table 15 presents the bivariate relationship of completion status with delivery method and learning styles and Table 16 presents the bivariate relationship of completion status with student reasons and demographic variables.

Table 15

Bivariate Relationship of Completion Status with Instructional Delivery Methods and Learning Style (N = 192)

Variables	CS	DL	H	L	A	CP	I	D	P	CO
ComStat (CS)	1.00									
Distance (DL)	-0.08	1.00								
Hybrid (H)	-0.13	-0.47	1.00							
Lecture (L)	0.21	-0.48	-0.55	1.00						
Avoidant (A)	-0.14	0.04	0.05	-0.08	1.00					
Compete (CP)	-0.08	0.11	0.07	-0.18	-0.08	1.00				
Independ (I)	0.01	0.06	0.05	-0.10	-0.10	-0.10	1.00			
Dependent (D)	0.06	-0.12	-0.11	0.23	-0.09	-0.09	-0.11	1.00		
Participant (P)	0.14	0.07	-0.05	-0.85	-0.16	-0.16	-0.20	-0.17	1.00	
Collab (CO)	-0.04	-0.11	0.02	0.09	-0.23	-0.24	-0.30	-0.26	-0.46	1.00

*Note: Bold indicates statistical significance at $p < .05$

The statistically significant correlations presented in Table 15 range from weak to medium positive and negative correlations. Of the correlations that are statistically significant, three correlations are of relative importance as they relate to the data collected in this study. The lecture-based format is positively correlated (.21) with completion status, which agrees with the earlier findings that completion status is associated with instructional delivery format. The dependent learning style is positively correlated with the lecture-based format (.23) while the competitive learning style is negatively correlated with the lecture-based format (-.18). These correlations are not surprising based on the earlier associations found between learning style and instructional

delivery format. The remainder of the correlations that are statistically significant are negatively correlated and of little relevance in the interpretation of results. As noted earlier, although the collaborative and participant learning styles were the dominant learning style regardless of instructional delivery format, neither of these two learning styles nor the other four are correlated to completion status.

Apart from the variable age, which has a medium positive correlation with marital state, the statistically significant correlations presented in Table 16 are weak positive and negative correlations. None of the independent variables presented in Table 16 are correlated with completion status.

Table 16

Bivariate Relationship between Completion Status and Student Choice, CPT Score, Marital Status, Gender, Age, and Ethnicity (N = 192)

Variables	CS	LN	PF	CPT	MS	G	Age	E
Completion Stat (CS)	1.00							
Learning Needs (LN)	-0.19	1.00						
Personal Factors (PF)	0.03	0.08	1.00					
CPT Score (CPT)	0.02	0.04	-0.09	1.00				
Marital Status (MS)	-0.02	-0.18	0.20	-0.09	1.00			
Gender	-0.09	0.04	-0.18	0.15	-0.14	1.00		
Age	0.07	0.01	0.28	-0.27	0.40	-0.21	1.00	
Ethnicity (E)	0.04	-0.12	0.10	-0.08	0.17	0.04	0.03	1.00

*Note Bold indicates statistical significance at $p < .05$

Multivariate Data Analysis

The next section will provide an analysis of the data associated with each of the three research questions that guided this study.

Research Question 1

Is there a relationship between students' learning styles and their completion or withdrawal from a remedial math course (MAT 0024) by a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning)? Logistic regression was employed to answer this question. The researcher began by running a logistic regression model that included delivery method, learning style and interactions between delivery method and learning style while controlling for age, gender, ethnicity, and marital status. There were seven main effects and 10 interaction effects. The model returned no significant results and included a warning that a maximum likelihood estimate may not exist. This warning can occur when a quasi-complete separation of data points is detected indicating convergence issues. Upon further investigation, the researcher discovered that a small sample size may cause convergence issues. According to Tabachnick & Fidell (2001), a quasi or complete separation of data points or groups "is likely to be the result of too small a sample" (p. 522) or "when there are too many variables relative to the few cases in one outcome . . . [if] this occurs, increase the number of cases or eliminate one or more predictors" (p. 522). Based upon this advice, the researcher ran the model again using only the main effects as predictors which included delivery method and learning style (pseudo- $R^2 = .0933$). The results of the main effects model are presented in Table 18.

In an effort to confirm that there was no significant relationship between learning style and completion status before controlling for delivery format, the researcher analyzed the results of crosstabulation of the independent variables associated with the learning style by the dependent variable of completion status. The results of the crosstabulation appear in Table 17.

Table 17

Crosstabulation of Learning Style by Completion Status before Controlling for Delivery Format (N = 192)

Style	Non-Complete		Complete		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Avoidant	8	4.17%	6	3.13%	14	7.29%
Collaborative	28	14.58%	50	26.04%	78	40.63%
Competitive	7	3.65%	8	4.17%	15	7.81%
Dependent	4	2.08%	13	6.77%	17	8.85%
Independent	7	3.65%	15	7.81%	22	11.46%
Participant	10	5.21%	36	18.75%	46	23.96%
Total	64	33.33	128	66.67	192	100%

*Note: $\chi^2 = 0.1287$

The results confirmed no statistical significance between the variables ($\chi^2 (5, N = 192) = 0.1287$).

Table 18 shows that when controlling for learning style, age, ethnicity, marital status, and gender, the hybrid and distance learning formats were statistically significant in predicting withdrawal from the course. Specifically, students enrolled in the hybrid and

distance learning course had greater odds of withdrawal compared to students enrolled in the lecture-based course (OR = 2.5 and OR = 2.8, respectively).

The Wald chi-square statistic is a measure that evaluates the contribution of an individual predictor to a model. The Wald chi-square statistic is calculated as the square of the estimate of the coefficient (β) divided by the standard error (SE) whose units are log odd units which are not as intuitive a statistic as the Odds Ratio statistic. The most meaningful part of the table apart from the Odds Ratio is the 95% Confidence Interval, which indicates the reliability of the ratio.

Table 18

Statistically Significant Main Effect Variables as Predictors of Completion Status (N=192)

Predictor	Completion Status	β	SE (β)	Wald χ^2	Odds Ratio	95% CI (Odds Ratio)	
						Lower	Upper
Hybrid	Non-Complete	0.93	0.41	5.12	2.54	1.13	5.69
Distance	Non-Complete	1.04	0.45	5.21	2.83	1.16	6.89
Avoidant	Non-Complete	0.77	0.63	1.49	2.16	0.63	7.44
Competitive	Non-Complete	0.27	0.60	0.19	1.30	0.40	4.26
Dependent	Non-Complete	-0.30	0.64	0.22	0.74	0.21	2.62
Independent	Non-Complete	-0.38	0.54	0.50	0.68	0.24	1.97
Participant	Non-Complete	-0.77	0.45	2.90	0.46	0.19	1.12
Ethnicity	Non-Complete	-0.47	0.38	1.58	0.62	0.30	1.30
Gender	Non-Complete	0.27	0.36	0.56	1.31	0.65	2.66
Marital Status	Non-Complete	0.46	0.48	0.91	1.59	0.62	4.07
Age	Non-Complete	-0.37	0.38	0.94	0.70	0.33	1.46

*Note: Bold Items Indicate Statistical Significance

* pseudo- $R^2 = .0933$

So, to answer Research Question 1, the results indicated that learning style does not impact the completion status of students enrolled in the course when controlling for delivery format.

Research Question 2

Is there a relationship between students' reasons for choosing a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning) and their completion or withdrawal from a remedial math course (MAT 0024)? Logistic regression

was the statistical model used to answer research question 2. The model included the predictors associated with student reasons for enrolling in a particular delivery format namely, delivery method, personal factors, learning needs, age, ethnicity, gender, marital status including interactions between student reasons and delivery method (pseudo- $R^2 = .1148$). The output of the model contained no statistically significant results. Following the normal procedure when a logistic model includes interactions that are not significant, a second main effects only model was run eliminating the interactions. The results of the second model are presented in Table 19.

Controlling for delivery method, age, ethnicity, marital status, and gender the personal factors and learning needs were statistically significant in predicting withdrawal from the course. Specifically, students who enrolled in a course based upon personal factors had greater odds of completing the course. Students who enrolled in a course based on their perceived learning needs had greater odds of withdrawing from the course (OR = .59 and OR = 1.8 respectively). Controlling for delivery method, age, ethnicity, marital status, and gender, the results for Research Question 2 indicate that student reasons for enrolling in a course appears to impact the completion or withdrawal in the course. In addition, as with the previous model, the students enrolled in the hybrid and distance learning courses had greater odds of withdrawal compared to students enrolled in the lecture-based course (OR = 4.6 and OR = 8.2, respectively) after controlling for personal factors, learning needs, age, ethnicity, and gender.

Table 19

*Statistically Significant Student Reason Effects as Predictors of Completion Status
(N=192)*

Predictor	Completion Status	β	SE (β)	Wald χ^2	Odds Ratio	95% CI (Odds Ratio)	
						Lower	Upper
Hybrid	Non-Complete	1.52	0.45	11.54	4.55	1.90	10.92
Distance	Non-Complete	2.10	0.57	13.66	8.15	2.68	24.80
Personal Factors	Non-Complete	-0.53	0.26	4.12	0.59	0.35	0.98
Learning Needs	Non-Complete	0.58	0.20	9.51	1.79	1.24	2.60
Ethnicity	Non-Complete	-0.36	0.37	0.97	0.70	0.34	1.43
Marital Status	Non-Complete	0.62	0.49	1.61	1.86	0.71	4.87
Age	Non-Complete	-0.41	0.39	1.11	0.66	0.31	1.42
Gender	Non-Complete	0.22	0.37	0.36	1.25	0.61	2.57

*Note: Bold Items Indicate Statistical Significance

* pseudo- $R^2 = .1148$

Research Question 3

Is there a relationship between students' College Placement Test (CPT) mathematics score and their completion or withdrawal from a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning) of a remedial math course (MAT 0024)? The researcher employed logistic regression to answer research question 3. The researcher began by running a logistic regression model that included delivery method, CPT scores, interactions between delivery method and CPT scores while controlling for age, gender, ethnicity, and marital status. The model returned no significant results. As with research question one, following the normal procedure when a logistic model includes interactions that are not significant, a second model main effects

model was run eliminating the interactions. The results of the model are presented in Table 21.

In an effort to confirm that there was no significant relationship between CPT score and completion status, the researcher analyzed the results of crosstabulation of the independent variable CPT score by the dependent variable of completion status. The results of the crosstabulation appear in Table 20.

Table 20

Crosstabulation of CPT Score by Completion Status (N = 192)

CPT Score	Non-Complete		Complete		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Low	40	20.83%	77	40.10%	117	60.94%
High	24	12.50%	51	26.56%	75	39.06%
Total	64	33.33%	128	66.67%	192	100%

* $\chi^2 = 0.7537$

The results confirmed no statistical significance between the variables ($\chi^2(1, N=192) = 0.7537$).

As with the previous models, Table 21 reveals that when controlling for CPT score, age, ethnicity, marital status, and gender, the hybrid and distance learning formats were statistically significant in predicting withdrawal from the course. Specifically, students in the hybrid and distance learning formats had greater odds of withdrawing from their courses as compared to students enrolled in a lecture-based format (OR = 2.7 and OR = 2.9 respectively).

Table 21

Statistically Significant CPT Effects as Predictors of Completion Status (N = 192)

Predictor	Completion Status	β	SE (β)	Wald χ ²	Odds Ratio	95% CI (Odds Ratio)	
						Lower	Upper
Hybrid	Non-Complete	1.00	0.39	6.43	2.71	1.25	5.87
Distance	Non-Complete	1.07	0.43	6.12	2.92	1.25	6.84
CPT Score	Non-Complete	-0.29	0.34	0.77	0.74	0.38	1.45
Ethnicity	Non-Complete	-0.37	0.36	1.08	0.69	0.34	1.39
Marital Status	Non-Complete	0.34	0.47	0.58	1.41	0.57	3.49
Age	Non-Complete	-0.47	0.38	1.50	0.63	0.30	1.32
Gender	Non-Complete	0.41	0.36	1.35	1.51	0.75	3.03

*Note: Bold Items Indicate Statistical Significance

*pseudo-R² = .0644

The results for Research Question 3 indicate that CPT score has no effect upon completion status while controlling for delivery method.

Summary

This section summarizes the procedures, data, and data analysis from this study that was conducted to determine if relationships existed between learning styles, student reasons for selecting a particular delivery format, and CPT scores relative to their completion or withdrawal in a particular delivery format, i.e. distance learning, hybrid, or a lecture-based course.

The participants in this study were community college students enrolled in nine sections of a remedial mathematics course titled Beginning Algebra (MAT 0024). The study was conducted during the fall semester of the 2007 academic year. Three of the

nine sections were taught in a lecture-based format, three were taught in a hybrid format, and three were taught in a distance learning format. All participants were administered the Grasha-Riechmann Student Learning Styles Scales survey, as well as a survey to determine student reasons for enrolling in their chosen delivery format. Usable responses were obtained from 192 of the 199 students who participated in the study resulting in a 96.5% return rate. The CPT scores, gender, and ethnicity data were gathered from the database of the participating college. Marital status data were gathered as part of the student choice survey.

Learning styles and their relationship to completion status within the three instructional delivery formats were examined. It was determined that those students who were enrolled in a hybrid or distance learning course had greater odds of withdrawing as compared to students enrolled in a lecture-based course. It was also determined that learning style did not impact the completion or withdrawal of students regardless of the delivery format.

Student reasons for enrolling in a particular delivery method and the relationship to completion or withdrawal within the three instructional delivery formats was also examined. It was determined that those students who enrolled in the course based upon personal factors had greater odds of completing the course without distinction to a particular instructional delivery method. Those students who enrolled in the course because of their perceived learning needs had greater odds of withdrawing from the course without distinction to a particular instructional delivery method.

CPT scores and their relationship to completion or withdrawal within the three learning styles was examined. Based on the data, there is no relationship between students' CPT scores and their withdrawal or completion in a particular delivery format.

A discussion of the results, implications, conclusions, and recommendations is presented in Chapter Five.

Chapter Five

Summary, Conclusions, Implications, and Recommendations

The purpose of this study was to examine the differences in students' withdrawal and completion rates in classes delivered via different instructional formats (distance learning, hybrid, or traditional) to determine if student learning style and/or student reasons for choosing an instructional format have an effect on the dropout rate in a remedial mathematics course.

Much of the current research on the effectiveness of computer-based instruction has found that computer-based instruction is as good as lecture-based instruction (Lesh & Rampp, 2000; Perez & Foshay, 2000; Tucker, 2001). These studies focused mainly in areas that examined student outcomes, student attitudes and overall student satisfaction (Phipps & Merisotis, 1999). Despite the wealth of studies that purport that students enrolled in computer-based instruction perform equally well as compared to their lecture-based counterparts, there is a high dropout rate associated with computer-based instruction including distance learning. Of particular interest in this study was the relationship between student learning styles, reasons for choosing a particular instructional delivery format, and subsequent completion or withdrawal from said delivery style.

The site for this study was a large, urban, multi-campus college located in west central Florida. The participants were community college students enrolled in a remedial

mathematics course (Basic Algebra MAT 0024) which was taught using three different instructional delivery formats.

This chapter contains a summary of the results of the study, the conclusions drawn from the data analysis presented in Chapter Four, the implications for practice, and recommendations for colleges based on the findings from this study as well as recommendations for further research.

Summary of the Findings

This section summarizes the results of the demographics of the research group including learning styles, completion status as well as a summary of the results from each of the research questions.

Demographics

Demographic information including gender, age, ethnicity, and marital status of the research group as a whole and by instructional delivery method including the college census information from Fall 2006 were collected and tabulated as part of this study. The gender of the research group was significantly different from the gender of the college population. Specifically, the proportion of females in the research group as a whole was higher (71%) than the college population (57%). These findings are consistent with the literature reporting that higher percentages of females are enrolled in remedial/developmental courses (Saxon & Boylan, 1999, Young, 2002). This finding is also in line with the majority of the literature that reports a higher number of females enroll in distance learning courses/program. In addition, the fact that there are a larger percentage of females enrolled in the college also supports the reason for the higher percentage of female participants. There was no significant difference between gender

and instructional delivery method. Thus, a relatively equal number of females enrolled in each of the instructional delivery methods and a relatively equal number of males enrolled in each of the instructional delivery methods.

Students under 25 years of age were the predominant members in the research group as a whole (63%) which was consistent with the percentage enrolled in the college (60%). The results also indicated an association between age and instructional delivery format. This age group composed the highest percentage enrolled in the hybrid (72%) and the lecture-based format (65%) as opposed to only 48% of students under 25 enrolled in the distance learning format. These data support the literature that states that the majority of students enrolled in distance learning courses/programs are older than the traditional-aged student (Diaz & Cartnal, 1999).

The data also show that African Americans, Hispanic, and other minority groups represented 65% of the research group while the combined percentage of minorities was 45.4 % for the college as a whole. The higher percentage of minorities tallied in the research group is not consistent with the reports found in the literature. As noted earlier in the literature review, Baltzer (1997) found that only one-third of developmental college students were from a minority group. Saxon & Boylan (1999) reviewed 18 studies in an effort to compile a list of characteristics found in community college students who enroll in remedial courses. In addition to being female and under the age of 25, the researchers reported that the majority were White.

White students had greater representation (57%) in the distance learning format and Hispanic, African American, and other minorities were underrepresented. These data are consistent with what has been reported in other research studies. Berg (2001) cites an

example from a study conducted by Diaz (2000) “that reported a smaller proportion of ethnic minorities in the distance learning sections of the study compared to the numbers found in the traditional classes and the all-campus averages” (p. 122).

The majority of students were single in the research group as well as in each of the instructional delivery formats; however, both the lecture-based and hybrid formats contained a higher number of single students (80% and 84% respectively) than the distance learning format (63%). These results agree with the majority of the literature that reports that most community college students who are enrolled in remedial coursework are single (Saxon & Boylan, 1999). However, the number of single students enrolled in the distance learning format was higher than what has been reported in the literature. Phipps and Merisotis (1999) describe the typical distance learner as both female and married. However, the data from this study do support the findings of Rezebek (1999) and Wallace (1996) whose research “suggested that the demographics of the distance learner was changing” (as cited in Berg, 2001, p. 122).

Learning Styles

The collaborative and participant learning styles were the predominate learning styles among students in the research group as a whole and in the three instructional delivery formats. This distribution is indicative of the learning styles among college students found in a national sample. Grasha (1996) analyzed the distribution of learning styles of pre-med students in another study and found the distribution shape to be “in line with the national norms. The students displayed relatively higher scores on the independent, collaborative, dependent, and participant styles and relatively lower scores on the avoidant and competitive styles” (p. 174).

Completion Status

The students enrolled in the hybrid or distance learning formats had a higher withdrawal rate (42% and 39% respectively) than those students enrolled in the lecture-based format (20%). The data concluded that the withdrawal rate from the hybrid and distance learning formats is double the rate of the lecture-based format. These data support the literature indicating that computer-based courses/programs experience a higher dropout rate as compared to traditional lecture-based courses/programs (Carr, 2000; Diaz, 2002; Kaplan 2004; Phipps & Merisotis, 1999; Parker, 1999; Searcy and Others, 1993).

A total of 64 students withdrew from all sections of the course. An attempt was made to contact these students to ascertain the students' reasons for withdrawing from the course. Although the response rate was low, 55% of those responding from the computer-based sections stated that the course presented challenges they did not expect. This finding suggests that students' may have the perception that computer-based instruction may be less challenging than a traditional lecture-based course. For example, students' may perceive that the course material delivered via computer is more comprehensible than when the material is delivered in a classroom setting. Students may have the perception that computer-based instruction is less time consuming than a traditional course. Because the students responding did not provide specific reasons as to why the computer-based course presented challenges they did not expect, more research is needed in this area of student reasons for withdrawal.

Of the students who selected job, family, or medical reasons for withdrawal, all but one student were from the computer-based sections. Students who have outside

responsibilities may enroll in computer-based instruction with the perception that it will allow them more time to attend to their other responsibilities than if they enrolled in a traditional lecture-based course. It would be beneficial to conduct focus groups with students who have withdrawn from a computer-based course to gain a better understanding of their perceptions of computer-based instruction as well as their reasons for withdrawal from the course in order to gain a deeper understanding of retention in general and in particular, computer-based instruction.

Research Questions

The study examined three research questions to determine if student learning style, student reasons for selecting a delivery format, and/or CPT scores had an effect on the completion or withdrawal from their chosen format. A summary of the findings are presented in the next section.

Research Question 1

Is there a relationship between students' learning styles and their completion or withdrawal from a remedial math course (MAT 0024) by a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning)?

Logistic regression was used to analyze the data in an effort to predict the odds of withdrawal from the course based on students' learning style and their enrollment in a particular instructional delivery format. Controlling for learning style, age, ethnicity, marital status, and gender, the statistical model indicated that the hybrid and distance learning formats were statistically significant in predicting withdrawal from the course. Specifically, students enrolled in hybrid or distance learning formats had greater odds of withdrawing from the course compared to students enrolled in the lecture-based format

(OR = 2.5, and OR = 2.8). These results are consistent with other research findings that show a higher dropout rate for students using computer-based instruction as compared to those students taking courses/programs delivered in a traditional lecture-based format (Carr, 2000; Diaz, 2002; Kaplan 2004; Phipps & Merisotis, 1999; Parker, 1999; Searcy and Others, 1993).

Based on the research hypothesis stated previously, the researcher expected to find a statistically significant difference between students' learning style and their completion or withdrawal from their chosen instructional delivery format in a remedial math course. Based on the sample size of this study and controlling for delivery format, the results indicated that learning style does not appear to impact the completion or withdrawal of students enrolled in the course. As suggested earlier, a larger sample size may be required before the researcher can reject the null hypothesis. Another possible explanation for the contradiction of the research hypothesis may be attributed to the nature of the learning styles. Hruska & Grasha (1982) state that every student will have some combination of each of the six styles and that no one person will prefer one style exclusively. Although the researcher was able to identify a dominant learning style for each of the participants, the interaction of the other five learning styles that each person possesses may have played a confounding role in the study.

Research Question 2

Is there a relationship between students' reasons for choosing a particular instructional delivery format (i.e. lecture-based, hybrid, or distance learning) and their completion or withdrawal from a remedial math course (MAT 0024)?

Logistic regression was used to analyze the data in an effort to predict the odds of withdrawal from the course based on students' reasons for selecting a particular delivery format. Controlling for delivery method, age, ethnicity, marital status, and gender, the personal factors and learning needs were statistically significant in predicting withdrawal from the course. Specifically, students who enrolled in a course based on personal factors had greater odds of completing the course. Students who enrolled in the course based on their perceived learning needs had greater odds of withdrawing from the course (OR = .59 and OR = 1.8 respectively).

The results of this analysis suggest that while controlling for delivery method, age, ethnicity, marital status, and gender, students who enrolled in the course because it met their personal needs are more likely to persist in the course. In contrast, those students who enrolled in a course based upon their perceived need for face-to-face instruction versus online access to either instructor or their peers were more likely to withdraw from the course.

Based on the research hypothesis stated previously, the researcher expected to find a statistically significant difference between students' reasons for choosing a particular instructional delivery format and their completion or withdrawal from a remedial math course. The results support the researcher's hypothesis and show a statistically significant difference in the prediction of withdrawal in the course based on students' reasons for selecting a particular delivery format.

Research Question 3

Is there a relationship between students' College Placement Test (CPT) mathematics score and their completion or withdrawal from a particular instructional

delivery format (i.e. lecture-based, hybrid, or distance learning) of a remedial math course (MAT 0024)? Logistic regression was used to analyze the data in an effort to predict the odds of withdrawal from the course based on students' CPT score and their enrollment in a particular instructional delivery format. A main effects model and the results suggested that while controlling for CPT score, age, ethnicity, marital status, and gender, the hybrid and distance learning formats were statistically significant in predicting withdrawal from the course. Specifically, students who enrolled in either the hybrid or distance learning formats had greater odds of withdrawing from the course as compared to students enrolled in a lecture-based format. The results indicated that CPT scores appear to have no relationship with completion status of the course while controlling for delivery method.

Based on the research hypothesis stated previously, the researcher expected to find a statistically significant difference between students' CPT mathematics score and their completion or withdrawal from a particular instructional delivery format of a remedial mathematics course. The results indicated that while controlling for delivery format, CPT score appears to have no relationship upon the completion or withdrawal from the course. As noted earlier, there was a statistically significant negative correlation between age and CPT score. The issue of how much time has elapsed since a student's interaction with math may explain this association. The average age of the community college student in this study is 25.9 years old. It has been several years since most students have taken a mathematics course, which may negatively affect their CPT score. However, once the student enrolls in the course, the concepts and ideas are refreshed, and the student continues on to successfully complete the course. Conversely, a student may

take the CPT the semester following high school and perform well on the CPT. However, many semesters may pass before he or she takes the required mathematics course and may struggle to relearn the concepts and ideas negatively affecting ability to complete the course.

Conclusions

The findings from this study support the conclusion that while controlling for learning style, age, ethnicity, gender, and marital status, the students who enrolled in either the hybrid or distance learning formats of a remedial mathematics course (MAT 0024) were more likely to withdraw from the course as compared to those students who were enrolled in a lecture-based format (OR = 2.5 and OR = 2.8 respectively).

The positive correlation between the variable of lecture-based sections and completion status as noted in Table 15 also supports the observation of administrators and educators involved in computer-based education who state, “course-completion rates are often 10 to 20 percentage points higher in traditional courses than in distance offerings” (Carr, 2000, p. 2). The positive correlation found between the lecture-based delivery method and completion status coupled with the results from the logistic regression model support the conclusion that students who enrolled in a computer-based section of the course were more likely to withdraw than those who enrolled in a lecture-based section of the same course. This conclusion supports the current literature that identified a high attrition rate within computer-based education (Bendickson, 2004; Carr, 2000; Kaplan, 2004; Kozeracki, 1999; Parker, 1995; Phipps & Merisotis, 1999; Roblyer, 1999; Terrell, 2005).

From the results of this study, it can also be concluded that while controlling for delivery method, age, ethnicity, gender, and marital status, students who enrolled in the course based on personal factors and/or direct experiences with computer-based instruction and technology were more likely to complete the course as opposed to those students who enrolled because of their perceived need for face-to-face versus online interaction between the instructors and/or their peers (OR = .59 and OR = 1.8 respectively).

The data from the logistic regression supports the conclusion that student reasons for enrolling in a particular delivery format does impact retention in that course. Of the few studies that have examined student choice, the findings do support the current literature that state there is some support to continue to offer students a choice between delivery formats in courses and programs (Roblyer, 1999; Berg, 2001). In her 1999 study, Roblyer suggests that further research be conducted to determine if students who have dropped out of the course differ in some systematic way from course completers. The conclusion from this study based upon the data from the logistic regression adds to the limited knowledge base regarding student choice of one particular delivery format over another and its impact on retention.

It can also be concluded from this study that the results indicated that CPT scores appear to have no relationship with completion status of the course while controlling for delivery method, age, ethnicity, gender, and marital status.

Implications

This study has shown that the withdrawal rate in computer-based sections of the mathematics course is approximately double the rate as compared to the lecture-based

sections. This result supports other research that has shown that computer-based instruction may not be as effective as lecture-based instruction in the area of retention at two-year community colleges (Bendickson, 2004; Kaplan, 2004, Searcy & Others, 1993). The data collected from those students who withdrew from the computer-based course suggested that the instructional delivery method presented challenges that they did not expect. The fact that students did not expect or anticipate particular challenges implies that educators and institutions may not be effectively communicating to students what to expect when enrolling in a computer-based course or program.

One of the challenges that students reported experiencing in their computer-based sections was the lack of available tutorial services. Although students were informed during their mandatory orientation session that tutoring is available, the instructor who taught the distance learning courses reported that students rarely utilized the posted office hours, even when encouraged to make appointments for times outside the posted office hours. The instructor also stated that the distance learning students came on campus to access the computers in the lab but did not seek tutoring. The fact that distance learning students come to campus to access computers but do not access tutoring may imply that although help is available and accessible, their perception is that they do not need help beyond the course materials they access as part of their course. The implication is that students may not understand the importance of combining tutoring with their computer-based instructional materials.

The effectiveness of tutoring alone and in combination with computer-based instruction and its effect on retention is supported in the literature. Kaplan (2004) found that students who received tutoring alone in a lecture-based remedial mathematics course

had higher retention rates than those who received only computer-based instruction as a supplement to their lecture-based course. The study further showed that those students who received both tutoring and computer-based instruction had significantly higher retention rates than those who received computer-based instruction alone. The importance of receiving tutoring for those students enrolled in computer-based instruction should be communicated early and often throughout the semester.

The literature recognizes that there is no one medium that will meet the expectations and needs of every student. Distance learning theorists suggest that information conveyed in a well-designed computer-based course or program is one that “delivers information in various forms, suited to various learning styles, and gives the greatest range of alternative communication modes” (Moore, 1989, p. 9). Garrison and Shale (1990) expanded the notion of quality within distance education by arguing that an increase in two-way communication is the most important component in the education process. The implication is that a well-designed computer-based course or program is the result of expertise in the areas of academics, course/curriculum design, as well as expertise in the production of media materials. Moore (1989) writes that “no academic can be both expert and authoritative in his or her field of academic study and simultaneously expert in communicating ... through the various media that make up a full distance education system” (p. 9). This implies that in order to have an effective distance education program, an institution should have a dedicated department to meet the special needs and challenges associated with computer-based instruction and teaching at a distance. The department would then be responsible for communicating information to students who wish to enroll in computer-based instruction as well as provide the

necessary expertise to address the unique problems and/or unanticipated events that may arise with computer-based courses and programs.

This study also concluded that those students who enrolled in a particular instructional format based on their perceived need for online versus face-to-face interaction had greater odds of withdrawing from the course. It was also concluded that students who enrolled in a particular format based on personal factors had greater odds of completing the course (OR = 1.8 and OR = .59, respectively). This notion of perception of computer-based instruction upon the part of students, particularly when associated with computer-based instruction has been documented in the literature. Lesh & Ramp (1990) reported that students who were enrolled in computer-assisted instruction initially perceived that this form of instruction would be less time-consuming when in fact, students ultimately spent much more time on this course than they had anticipated. This perception of computer-based instruction may be implied from analyzing students' reasons for withdrawal from the course. Although the total number of students' response was low, 55% (11/20) of the students who withdrew from the computer-based sections did so because this mode of instruction presented challenges that they did not anticipate. Interestingly, students did not specifically state why the computer-based course presented particular challenges but stated generally that the course was not what they had anticipated. For example, a student wrote, "[t]his proved to be much harder than I thought . . ." and another student wrote "[l]earning math online was a problem . . . it was a mistake signing (sic) up for an online math class".

These data may imply that students have a preconceived idea about learning math from computer-based formats that contradicts the reality of what is required to complete a

computer-based course. On the other hand, those students who enrolled based on personal factors including previous experience with computer-based instruction and/or technology either positive or negative, had greater odds of completing the course. This result implies that there is a need for choice in instructional format to meet students' needs. The importance of providing choice in instructional format is supported in the literature. Roblyer (1999) found evidence that choice in instructional delivery format is important at the high school and community college level.

Recommendations for Practice

The results of this study confirm the majority of related research, which concludes that students enrolled in computer-based instruction including distance learning have a higher dropout rate as compared to students enrolled in a traditional lecture-based course. The college in this study is approximately 9% below other state community colleges in retention. This is a concern for the faculty and administrators because state funding is based in part on the individual college retention rates. Another financial implication is the number of dollars spent on recruitment of students into the college. The students who are recruited into courses and programs are expected to complete their program. Students who drop out represent a financial loss to the college. One campus also has a policy of not overriding class size caps once a course is filled. A high dropout rate represents a lost opportunity for other students who wished to enroll but found the class initially full.

In an effort to improve the retention rate within computer-based courses and programs including distance learning, an increase in two-way communication between the institution and the student is recommended. As suggested in the literature, an increase in two-way communication is one of the most important elements to improve the

educational process in distance learning (Garrison, 1993; Garrison and Shale, 1990). The next section details several recommendations for practice to improve two-way communication between institutions and their students.

The first recommendation is to develop and maintain a process to collect accurate withdrawal information from students. One barrier that the researcher encountered to gaining a better understanding of student withdrawal was inconsistent procedures at the administrative level of the college. If a student withdraws from a course at the registrar's office, the staff member is to record a reason for withdrawal in the colleges' internal database. This process is not followed consistently. Even more erratic, if a student withdraws from a course online, there is no required field for the student to supply a reason for withdrawal. In order to maintain accurate and current records of student withdrawal from courses and programs, it is recommended that in-person withdrawal information be collected consistently and accurately. It is also recommended that if a student withdraws from a course online, a required field on the online withdrawal form be present so that the student can accurately explain the reason for withdrawal. This procedure should ensure that the student cannot move forward with the process of withdrawal from the course until this required field is completed. This process will allow for accurate collection of reasons for student withdrawal from a course. This recommendation will increase two-way communication because accurate information from students will help guide educators and administrators in their response to students' issues and problems

This study also concluded that those students who enrolled in a particular instructional delivery format based on their perceived learning needs had greater odds of

withdrawing from the course. In addition, the study revealed that 55% of those students who withdrew from their computer-based sections did so due to unexpected challenges. Furthermore, although additional tutoring is available for all students, most did not access this additional help. As discussed earlier, these results imply that students may lack an understanding of what is expected in a computer-based course/program, and/or the institution is not effectively communicating to students what is required to be successful in a computer-based course/program. In an effort to increase two-way communication, it is recommended that institutions have a separate distance-education department to aid in the design, development, implementation, and administration of computer-based courses/programs. In order to communicate best practices in computer-based courses and programs effectively, the institution should have access to specialists in the area of computer-based instruction and teaching at a distance (Moore, 1989). The distance-education department would provide a single location for students to seek out applicable courses and programs, receive information regarding best practices in distance education, as well as a place for receiving information regarding tutoring and other support services. It is recommended that the institution, through its distance education department, provide training in learning at a distance to educators wishing to develop/teach computer-based courses/programs, as well as existing advisors and counselors. It is also recommended that a link to a webpage for distance education be posted on the institutions' website. This webpage should provide all the necessary information to help students gain a solid understanding of the requisite technology skills, time requirements, and importance of support services that are necessary in order to be successful so that the student can make an informed decision when enrolling in a computer-based course/program.

The recommendations listed above represent a financial impact to the institution. While most institutions who are offering computer-based instruction have already invested in the technology including the media used to convey the content of these courses and programs, more investment is needed to maintain the functionality of the program including upgrades to hardware and software. The institution must carefully weigh the costs of implementing the recommendations and maintaining the functionality of their computer-based programs with the degree of success their programs are currently experiencing. Therefore, until such recommendations are implemented and/or the viability of the institutions computer-based courses and programs are examined, it is recommended that the number of sections of hybrid and distance learning courses that are offered each semester at the college be reduced from its current offerings. This practice may help the overall retention rate while still maintaining a choice in instructional delivery formats to meet students' needs.

Recommendations for Further Research

Much more research is needed to gain an understanding of why the dropout rate is higher in computer-based instruction as compared to traditional lecture-based instruction. Although this study found no statistical evidence that learning style impacts students' completion or withdrawal from a particular instructional delivery format, the sample size may not have been sufficient to support the statistical model employed. It is recommended that this study be replicated with a larger sample size, perhaps over several semesters in lieu of a single semester.

This study agrees with much of the literature regarding the high withdrawal rate from courses utilizing computer-based instruction (Bendickson, 2004; Kaplan, 2004;

Searcy and Others, 1993; Weems, 2002). The researcher concluded that for those students who enrolled in a course taught in computer-based format, they had greater odds of withdrawing from the course as compared to those who enrolled in a lecture-based format. Although learning style or CPT scores did not appear to impact the withdrawal from the course, there is still much to be gained in continuing to research the reasons for the higher withdrawal rate from computer-based instruction especially since the sample size in this study was small.

A specific area for which it was difficult to collect information but may prove beneficial to researchers is in the area of student reasons for withdrawal from computer-based courses. The impetus for students' withdrawing from a particular instructional delivery format may help guide educators who are interested in the area of retention.

Further research is recommended in the area of computer-based instruction and access to tutorial services and/or utilization of instructor office hours and its impact on success and retention.

It is also recommended that further research be conducted to track the subsequent enrollment status of those students who withdrew from a computer-based course to ascertain whether they re-enroll the next semester in the same instructional delivery format, a different instructional delivery format, or dropout of college completely.

It is also recommended that this study be expanded to include other remedial courses such as reading and writing to ascertain if the dropout rates are higher for those courses offered in a computer-based format. It is possible that the subject matter itself may be a contributing factor to the high dropout rate.

Summary

Learning styles and their relationship to completion status within the three instructional delivery formats were examined. It was determined that those students who were enrolled in a hybrid or distance learning course had greater odds of withdrawing as compared to students enrolled in a lecture-based course. It was also determined that learning style did not impact the completion or withdrawal of students regardless of the delivery format.

Student reasons for enrolling in a particular delivery method and the relationship to completion or withdrawal within the three instructional delivery formats was also examined. It was determined that those students who enrolled in the course based upon personal factors had greater odds of completing the course without distinction to a particular instructional delivery method. Those students who enrolled in the course because of their perceived learning needs had greater odds of withdrawing from the course without distinction to a particular instructional delivery method.

CPT scores and their relationship to completion or withdrawal within the three learning styles were examined. Based on the data, there is no relationship between students' CPT scores and their withdrawal or completion in a particular delivery format.

The implications as a result of the data suggest that more research be conducted in the area of students' perception of computer-based instruction. Recommendations for practice include limiting the number of computer-based sections until more research has been conducted to reduce the negative effects of low retention rates while still providing an alternative to meet students' needs. Additionally, a more consistent process of tracking student reasons for withdrawal from a course is recommended. This information should

be accurately and consistently collected in an effort to gain an understanding of why students withdraw from particular courses.

This study should be replicated with a larger sample size and/or over a longer period of time before it can be concluded that student learning styles do not impact the withdrawal rate of students in the course. This study should be expanded to include other remedial courses such as reading and writing to ascertain if these student withdrawal trends transfer to other subject areas.

The high dropout rate within computer-based instruction implies that computer-based instruction is not a panacea for teaching and/or learning in a remedial mathematics course. Computer-based instruction can be a viable educational alternative for some students. This study has shown that some students can be successful and complete a remedial mathematics course delivered in a computer-based format. However, this study also found that the withdrawal rate is double for those students enrolled in a computer-based format as compared to those students enrolled in a traditional lecture-based format. Although the response rate was low (47%), the results of this study also found that of those students who withdrew from the computer-based sections, more than half did so because the course presented challenges they did not expect. This implies that students may not fully understand what it means to learn mathematics in a computer-based format.

A successful computer-based program is the result of the combined efforts of many experts from various fields including education, distance education, technology, media production, and content area specialists. Faculty members alone will be hard-pressed to design, implement, and administer a computer-based course/program to meet the special needs of the distance learner. Therefore, before institutions spend additional

time and money increasing their distance learning offerings or developing new computer-based programs for remedial mathematics, institutions need to examine their distance learning infrastructure to ensure that it is meeting the needs of their distance learning students, or if the infrastructure does not currently exist, focus on developing one that will support a quality distance education program.

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Appendices

Appendix A:

Grasha-Riechmann Student Learning Style Scales

**Grasha-Riechmann
Student Learning Style Scales**General Class Form

The following questionnaire has been designed to help you clarify your attitudes and feelings toward the courses you have taken thus far in college. There are no right or wrong answers to each question. However, as you answer each question, form your answers with regard to your general attitudes and feelings towards all of your courses.

Respond to the items listed below by using the following rating scale. Follow the instructions of the person administering this questionnaire and put your answers either on a separate sheet of paper or on a computer scored answer sheet that is provided.

- Use a rating of 1 if you *strongly disagree* with the statement.
 - Use a rating of 2 if you *moderately disagree* with the statement.
 - Use a rating of 3 if you are *undecided*.
 - Use a rating of 4 if you *moderately agree* with the statement.
 - Use a rating of 5 if you *strongly agree* with the statement.
-

01. I prefer to work by myself on assignments in my courses.
02. I often daydream during class.
03. Working with other students on class activities is something I enjoy doing.
04. I like it whenever teachers clearly state what is required and expected.
05. To do well, it is necessary to compete with other students for the teacher's attention.
06. I do whatever is asked of me to learn the content in my classes.
07. My ideas about the content often are as good as those in the textbook.
08. Classroom activities are usually boring.
09. I enjoy discussing my ideas about course content with other students.
10. I rely on my teachers to tell me what is important for me to learn.
11. It is necessary to compete with other students to get a good grade.
12. Class sessions typically are worth attending.
13. I study what is important to me and not always what the instructor says is important.
14. I very seldom am excited about material covered in a course.
15. I enjoy hearing what other students think about issues raised in class.
16. I only do what I am absolutely required to do in my courses.
17. In class, I must compete with other students to get my ideas across.
18. I get more out of going to class than staying at home.
19. I learn a lot of the content in my classes on my own.
20. I don't want to attend most of my classes.
21. Students should be encouraged to share more of their ideas with each other.
22. I complete assignments exactly the way my teachers tell me to do them.
23. Students have to be aggressive to do well in courses.
24. It is my responsibility to get as much as I can out of a course.
25. I feel very confident about my ability to learn on my own.
26. Paying attention during class sessions is difficult for me to do.

• Please continue questionnaire on the next page.

**Grasha-Riechmann
Student Learning Style Scales**
General Class Form

Page 2

Rating Scale

- Use a rating of 1 if you *strongly disagree* with the statement.
 Use a rating of 2 if you *moderately disagree* with the statement.
 Use a rating of 3 if you are *undecided*.
 Use a rating of 4 if you *moderately agree* with the statement.
 Use a rating of 5 if you *strongly agree* with the statement.

27. I like to study for tests with other students.
 28. I do not like making choices about what to study or how to do assignments.
 29. I like to solve problems or answer questions before anybody else can.
 30. Classroom activities are interesting.
 31. I like to develop my own ideas about course content.
 32. I have given up trying to learn anything from going to class.
 33. Class sessions make me feel like part of a team where people help each other learn.
 34. Students should be more closely supervised by teachers on course projects.
 35. To get ahead in class, it is necessary to step on the toes of other students.
 36. I try to participate as much as I can in all aspects of a course.
 37. I have my own ideas about how classes should be run.
 38. I study just hard enough to get by.
 39. An important part of taking courses is learning to get along with other people.
 40. My notes contain almost everything the teacher said in class.
 41. Being one of the best students in my classes is very important to me.
 42. I do all course assignments well whether or not I think they are interesting.
 43. If I like a topic, I try to find out more about it on my own.
 44. I typically cram for exams.
 45. Learning the material was a cooperative effort between students and teachers.
 46. I prefer class sessions that are highly organized.
 47. To stand out in my classes, I complete assignments better than other students.
 48. I typically complete course assignments before their deadlines.
 49. I like classes where I can work at my own pace.
 50. I would prefer that teachers ignore me in class.
 51. I am willing to help other students out when they do not understand something.
 52. Students should be told exactly what material is to be covered on exams.
 53. I like to know how well other students are doing on exams and course assignments.
 54. I complete required assignments as well as those that are optional.
 55. When I don't understand something, I first try to figure it out for myself.
 56. During class sessions, I tend to socialize with people sitting next to me.
 57. I enjoy participating in small group activities during class.
 58. I like it when teachers are well organized for a session.
 59. I want my teachers to give me more recognition for the good work I do.
 60. In my classes, I often sit toward the front of the room.

**Grasha-Riechmann
Student Learning Style Scales**
Scoring Key General and Specific Class Forms

1.] Copy your responses from the sheet of paper with your ratings on it to the space provided below for each item.

Learning Style Test Items

01. ___	02. ___	03. ___	04. ___	05. ___	06. ___
07. ___	08. ___	09. ___	10. ___	11. ___	12. ___
13. ___	14. ___	15. ___	16. ___	17. ___	18. ___
19. ___	20. ___	21. ___	22. ___	23. ___	24. ___
25. ___	26. ___	27. ___	28. ___	29. ___	30. ___
31. ___	32. ___	33. ___	34. ___	35. ___	36. ___
37. ___	38. ___	39. ___	40. ___	41. ___	42. ___
43. ___	44. ___	45. ___	46. ___	47. ___	48. ___
49. ___	50. ___	51. ___	52. ___	53. ___	54. ___
55. ___	56. ___	57. ___	58. ___	59. ___	60. ___

2.] Sum your ratings for each column and place them in the spaces below.

3.] Divide your total score for each column by 10 and place your answer in the spaces below.

Independent Avoidant Collaborative Dependent Competitive Participant

4.] The names of each learning style associated with each column are shown above.

5.] Check whether your score represents a relatively Low, Moderate, or High score based on the norms for each learning style scale shown below.

	Low	Moderate	High
Independent	[1.0-2.7]	[2.8-3.8]	[3.9-5.0]
Avoidant	[1.0-1.8]	[1.9-3.1]	[3.2-5.0]
Collaborative	[1.0-2.7]	[2.8-3.4]	[3.5-5.0]
Dependent	[1.0-2.9]	[3.0-4.0]	[4.1-5.0]
Competitive	[1.0-1.7]	[1.8-2.8]	[2.9-5.0]
Participant	[1.0-3.0]	[3.1-4.1]	[4.2-5.0]

From: Laurie Richlin [mailto:Laurie.Richlin@cgu.edu]
Sent: Wednesday, March 19, 2008 7:59 AM
To: Carol Zavarella
Subject: RE: Getting permission to use the Grasha-Riechmann Student Learnings Style Scales (GRSLSS)

yes you may

Laurie Richlin, PhD
Director
Preparing Future Faculty &
Faculty Learning Communities Programs
1263 N. Dartmouth Avenue
Claremont, CA 91711
909.607.8978
laurie.richlin@cgu.edu
<http://www.cgu.edu/pff>

-----Original Message-----

From: Carol Zavarella [mailto:czavarella@verizon.net]
Sent: Wed 3/19/2008 4:12 AM
To: alliance@iats.com
Subject: FW: Getting permission to use the Grasha-Riechmann Student Learnings Style Scales (GRSLSS)

Hello Dr. Richlin,

May I reprint the six learning style descriptions found on page 169 of the publication titled Teaching with Style: A practical guide to enhancing learning by understanding teaching and learning styles?

Thank you,

Carol Zavarella

From: Laurie Richlin [mailto:Laurie.Richlin@cgu.edu]
Sent: Monday, April 02, 2007 12:32 AM
To: Carol Zavarella
Subject: RE: Getting permission to use the Grasha-Riechmann Student Learnings Style Scales (GRSLSS)

Hi.

We are happy to grant permission to use the inventories at no cost when we receive a copy of the reserach proposal and with the assurance we will be sent the research results. A self-scoring version of the Inventories is at <http://www.iats.com>. Let me know if you have any questiohs and send me your proposal if you wish to proceed.

Laurie

Laurie Richlin, PhD
Director
Preparing Future Faculty &
Faculty Learning Communities Programs
1263 N. Dartmouth Avenue
Claremont, CA 91711
909.607.8978
laurie.richlin@cgu.edu
<http://www.cgu.edu/pff>

President, International Alliance of Teacher Scholars

-----Original Message-----

From: Carol Zavarella [mailto:czavarella@tampabay.rr.com]
Sent: Sun 4/1/2007 4:56 PM
To: alliance@iats.com
Subject: Fw: Getting permission to use the Grasha-Riechmann Student Learnings Style Scales (GRSLSS)

Hello Dr. Richlin,

I am a graduate student at the University of South Florida as well as a mathematics instructor at Hillsborough Community College in Tampa, Florida. I am writing to you to ask permission to use the Grasha-Riechmann Student Learning Style Scales as part of my dissertation research. I understand that your company now owns the copyright. Please let me know if you will grant permission to use the GRSLSS as well as any other conditions that I will need to abide by. I look forward to your response.

Sincerely,
Carol Zavarella
PhD Candidate
The University of South Florida

----- Original Message -----

From: Frank, Ilene
To: czavarella@tampabay.rr.com
Sent: Sunday, April 01, 2007 5:50 PM
Subject: FW: Getting permission to use the Grasha-Riechmann Student Learnings Style Scales (GRSLSS)

Here's some info from Dr. Diaz! This sounds like the real deal! -- Ilene Frank, ifrank@lib.usf.edu

From: David Diaz [<mailto:davidpdiaz@earthlink.net>]
Sent: Sun 4/1/2007 12:01 PM
To: Frank, Ilene
Subject: Re: Getting permission to use the Grasha-Riechmann Student Learnings Style Scales (GRSLSS)

Hello Ilene,

The International Alliance of Teacher Scholars, Inc. owns the copyright to the Grasha Teaching Style Inventory (they published Grasha's book Teaching With Style and received copyrights when Dr. Grasha died two years ago).

You can contact Dr. Laurie Richlin: President, IATS: alliance@iats.com

I am attaching a hard copy of the instrument in PDF format.

Please let me know if I can be of further service.

Best,

Dr. Diaz
--
David P. Diaz, Ed.D.
Professor: Physical Education and Athletics
Cuesta Community College
E-mail: davidpdiaz@earthlink.net
Phone: 805-546-3100, ext. 2702
Web Site: <http://academic.cuesta.edu/phyped/diaz/>

Appendix B:

A Survey of Perceptions About Course Delivery Systems

**A Survey of Perceptions About Course Delivery Systems
(M. D. Roblyer, © 2002)**

Place each of the following on a form with a Likert scale of 1=low to 5=high.

Factors Related to Choice of Delivery System – How important were each of the following factors in your choice of this delivery system? Circle the number that represents the degree of importance that each factor has for you.

When I choose a delivery system for a course, I consider:

1. Distance and/ or driving time to /from a building where a traditional course is offered
2. Parking or other factors related to access to the facility
3. Degree of control I would like over the learning environment (e.g., choosing when I do activities)
4. Degree of control I would like over the pace of learning activities (e.g., how quickly I go through activities)
5. My attitudes and feelings about distance learning delivery systems (positive or negative)
6. The instructor who teaches the course/ section
7. My need for face-to-face vs. online access to the instructor
8. My need for face-to face vs. online interaction with my classmates
9. How comfortable I feel doing technology-based activities
10. My prior experience with distance-learning courses
11. The access I have to computer resources/facilities required to do course activities
12. Whether or not this type of course lends itself to this delivery system
13. My physical limitations or learning disabilities
14. Other - Please specify: _____

-----Original Message-----

From: M. D. Roblyer [<mailto:margaret-roblyer@utc.edu>]
Sent: Monday, December 11, 2006 10:49 AM
To: Zavarella, Carol
Subject: RE: Student Motivation for Taking Internet-Based Courses

Sorry about that, Carol. It is attached now.

Peggy

This correspondence should be considered a public record and subject to public inspection pursuant to the Tennessee Public Records Act.

M. D. (Peggy) Roblyer, Ph. D.
Professor, Graduate Studies Division
University of Tennessee-Chattanooga
College of Health, Education, and Professional Studies
615 McCallie Avenue
310 Pfeiffer Hall
Chattanooga, Tennessee 37403
margaret-roblyer@utc.edu
(423) 425-5567
<http://www.prenhall.com/roblyer>

-----Original Message-----

From: Zavarella, Carol [<mailto:czavarella@hccfl.edu>]
Sent: Monday, December 11, 2006 10:43 AM
To: M. D. Roblyer
Subject: RE: Student Motivation for Taking Internet-Based Courses

Hi Dr. Roblyer,

Thank you so very much for responding to my request. I really appreciate you sharing your items. However, I did not see an attachment to your email.

Is

it possible to resend with another attachment? I would appreciate it very much and thanks again for taking the time to answer my email.

Sincerely,

Carol Zavarella

-----Original Message-----

From: M. D. Roblyer [<mailto:margaret-roblyer@utc.edu>]
Sent: Monday, December 11, 2006 10:39 AM
To: Zavarella, Carol
Subject: RE: Student Motivation for Taking Internet-Based Courses

TO: Carol Zaverella

Thanks for your interest in my 1999 study. Attached is a copy of the items I used. No validation data are available for this, so you might just want to use this as basis for creating your own instrument.

Good luck with your study!

Peggy Roblyer

This correspondence should be considered a public record and subject to public inspection pursuant to the Tennessee Public Records Act.

M. D. (Peggy) Roblyer, Ph. D.
Professor, Graduate Studies Division
University of Tennessee-Chattanooga
College of Health, Education, and Professional Studies
615 McCallie Avenue
310 Pfeiffer Hall
Chattanooga, Tennessee 37403
margaret-roblyer@utc.edu
(423) 425-5567
<http://www.prenhall.com/roblyer>

-----Original Message-----

From: Zavarella, Carol [<mailto:czavarella@hccfl.edu>]
Sent: Saturday, December 02, 2006 10:59 PM
To: mroblyer@polaris.umuc.edu
Subject: FW: Student Motivation for Taking Internet-Based Courses

From: Zavarella, Carol
Sent: Sat 12/2/2006 10:48 PM
To: mroblyer@westga.edu
Subject: Student Motivation for Taking Internet-Based Courses

Hello Dr. Roblyer,

I read with great interest your article regarding choice in Distance Learning which was published in the Journal of Research on Computing in Education (Fall 1999). I am the Program Manager for the Mathematics department at Hillsborough Community College in Tampa, Florida as well as a doctoral student at the University of South Florida. I am working on my dissertation and part of it entails measuring student motivation for enrolling in a computer-based class versus a traditional lecture-based class. During my research, I came across your article and the description of the instrument that you developed to measure this as well as certain demographics.

I am writing to ask your permission to use your instrument, and provided that you agree, how I might access the instrument, and the cost to use it.

I would also be interested in the validity data as well.

I would be most grateful for your assistance, and I hope to hear from you soon.

Sincerely,

Carol Zavarella
Program Manager, Mathematics
Hillsborough Community College, Ybor City Campus
813-259-6078

Appendix C:

Distance Learning Student Information Sheet

STUDENT INFORMATION SHEET

DISTANCE LEARNING
ACADEMIC SYSTEMS

MAT 0024
DR. LIANA F. FOX

COLLEGE PREP ALGEBRA
FALL 2006 MEETING TIME _____

LAST NAME

FIRST NAME

DIAGNOSTIC SCORE

Min Score = 7

SOCIAL SECURITY NUMBER

HCC STUDENT NUMBER (omit first zero)

EMAIL ADDRESS

STREET ADDRESS

CITY, STATE ZIP

PHONE: HOME
(AREA CODE)-(NUMBER)

OPTIONAL PHONE: WORK or CELL

ARE YOU REPEATING THIS COURSE? YES or NO

CHECK ONE:

- I PLACED INTO THIS CLASS WITH THE REQUIRED MINIMUM CPT SCORE OF 52.
 I PASSED THE PRE-REQ MAT 0024 WITH A GRADE OF "C" OR BETTER.

WHICH TUTORING CENTER ARE YOU MORE LIKELY TO USE FOR THIS COURSE? CIRCLE ONE.
 YBOR BRANDON DALE MABRY PLANT CITY SMARTHINKING.COM

THREE (3) CHAPTER TESTS ARE GIVEN ON CAMPUS IN THE YBOR TEST CENTER. Each test is available for only three days. Which day are you most likely to use? (You must arrive AT LEAST 1½ hours before closing).

- SATURDAYS FROM 9 AM TO 1 PM (ARRIVING BY 11:30 AM)
 MONDAYS FROM 8 AM TO 7PM (ARRIVING BY 5:30 PM)
 TUESDAYS FROM 8 AM TO 7PM (ARRIVING BY 5:30 PM)

WHICH IS YOUR "HOME" HCC CAMPUS?

IF YOU WORK, HOW MANY HOURS PER WEEK DO YOU WORK?

WHAT IS YOUR MAJOR?

IS THIS YOUR FIRST DISTANCE LEARNING CLASS? YES or NO

FOR HOW MANY TOTAL HOURS ARE YOU ENROLLED THIS SEMESTER?

RANK (1st-2nd-3rd) YOUR TOP THREE REASONS FOR TAKING THIS COURSE THROUGH DISTANCE LEARNING.

- A. This was the only section left that was open.
 B. I have difficulty coming to campus because of work schedule.
 C. I have difficulty coming to campus because of transportation.
 D. I have difficulty coming to campus because of caring for others – children, parents, spouse, others
 E. I wanted privacy.
 F. I wanted flexibility.
 G. I didn't realize this was taught completely online but I'm still willing to try it.
 H. Other reason _____

YOUR COMPUTER: OPERATING SYSTEM? INTERNET SERVICE PROVIDER? DIAL-UP OR DSL?

From: Fox, Liana
Sent: Monday, December 04, 2006 10:42 AM
To: Zavarella, Carol
Subject: RE: Electronic Copy of Distance Learning Demographic Survey

here you go

From: Zavarella, Carol
Sent: Mon 12/4/2006 10:35 AM
To: Fox, Liana
Subject: Electronic Copy of Distance Learning Demographic Survey

Hi Liana,

Thank you so much for offering to send me the electronic copy of the student's survey for your Distance Learning course. If you could send it to me today, I can attach it to my concept paper that I will be turning in tomorrow.

See you on Wednesday.

Carol

*Carol Zavarella
Program Manager, Mathematics
Hillsborough Community College
Ybor City Campus
813-259-6078*

Appendix D:

Modified Survey of Perceptions About Course Delivery Systems

Student ID #

Marital Status

A Survey of Perceptions About Course Delivery Systems					
Instructions: Please rate how important each of the following factors were in your choice of this delivery system by placing a check mark in the appropriate box.					
When I choose a delivery system for a course, I consider:					
Distance and/or driving time to/from a building where a traditional course is offered	Low	Low/Med	Med	Med/High	High
Parking or other factors related to access to the facility	Low	Low/Med	Med	Med/High	High
Degree of control I would like over the learning environment (e.g. choosing when I do activities)	Low	Low/Med	Med	Med/High	High
Degree of control I would like over the pace of learning activities (e.g. how quickly I go through activities)	Low	Low/Med	Med	Med/High	High
My attitudes and feelings about distance learning delivery systems (positive or negative)	Low	Low/Med	Med	Med/High	High
The instructor who teaches the course/section	Low	Low/Med	Med	Med/High	High
My need for face-to-face vs. online access to the instructor	Low	Low/Med	Med	Med/High	High
My need for face-to-face vs. online interaction with my classmates	Low	Low/Med	Med	Med/High	High
How comfortable I feel doing technology-based activities	Low	Low/Med	Med	Med/High	High
My prior experience with distance-learning courses	Low	Low/Med	Med	Med/High	High
The access I have to computer resources/facilities required to do course activities	Low	Low/Med	Med	Med/High	High
Whether or not this type of course lends itself to this delivery system	Low	Low/Med	Med	Med/High	High
My physical limitations or learning disabilities	Low	Low/Med	Med	Med/High	High
Whether the course fits into my class/work schedule	Low	Low/Med	Med	Med/High	High
Ability to access campus due to caring for others (children, parents, spouse, others)	Low	Low/Med	Med	Med/High	High
I chose this delivery format because it was the only section that was open	Low	Low/Med	Med	Med/High	High
I was not aware of the delivery format of this course	Low	Low/Med	Med	Med/High	High

Appendix E:

Course Description of Delivery Formats for Basic Algebra (MAT 0024)

COURSE#	COURSE TITLE	SECTION #	DAYS	TIME	BLDG.	ROOM	INSTRUCTOR	CREDIT HOURS
JOU 1949	Co-Op Journalism	67168					Nienberg, Valerie	3.00
	<i>Instructor permission required. E-mail: vnienberg@uccf.edu</i>							
MATHEMATICS-CALCULUS AND PRECALCULUS								
MAC 1105	College Algebra							3.00
	64638	TTH		08:00AM-09:15AM	YBOR	216	Zavarella, Carol	
△	64672	S		08:00AM-10:00AM	YBOR	303D	Fox, Liana	
	<i>Distance Learning Web Course. This course is taught completely on the web following a mandatory orientation on 8/7/07. Upon registration students must contact the instructor: lfox@uccf.edu. Course requirements available at Dr. Fox's website: www.uccf.edu/academic/department/math</i>							
	64639	MW		09:30AM-10:45AM	YBOR	217	Cureton, Patrick	
	64673	TTH		09:30AM-10:45AM	YBOR	216	Zavarella, Carol	
△	64676	S		10:00AM-12:00PM	YBOR	303D	Fox, Liana	
	<i>Distance Learning Web Course. This course is taught completely on the web following a mandatory orientation on 8/7/07. Upon registration students must contact the instructor: lfox@uccf.edu. Course requirements available at Dr. Fox's website: www.uccf.edu/academic/department/math</i>							
	64680	MW		11:00AM-12:15PM	YBOR	217	Cureton, Patrick	
	64692	MW		02:00PM-03:15PM	YBOR	212	STAFF	
	64640	MW		05:30PM-06:45PM	YBOR	212	Cureton, Patrick	
MAC 1147	Pre-Calculus Algebra/Trigonometry							5.00
	67218	TTH		11:00AM-01:45PM	YBOR	213	Wing, Philip	
MAC 2233	Calculus for Business & Social Sciences							3.00
	64723	MW		11:00AM-12:15PM	YBOR	216	Wing, Philip	
	64715	TTH		03:00PM-04:15PM	YBOR	213	Wing, Philip	
	64714	T		05:30PM-08:15PM	YBOR	213	Wing, Philip	
	64726	MW		05:30PM-06:45PM	YBOR	216	Wing, Philip	
MAC 2311	Calculus & Analytic Geometry I							5.00
	64733	TTH		02:00PM-04:10PM	YBOR	217	Cureton, Patrick	
MAC 2313	Calculus & Analytical Geometry III							5.00
	64739	MW		03:00PM-05:15PM	YBOR	216	Wing, Philip	
MANAGEMENT								
MAN 1021	Principles of Management							3.00
	64743	MW		09:30AM-10:45AM	YPST	214	Amin, Katen	
MARKETING								
MAR 1011	Principles of Marketing							3.00
	64756	TTH		11:00AM-12:15PM	YPST	214	Amin, Katen	
	64755	T		05:30PM-08:15PM	YPST	216	Amin, Katen	
MATHEMATICS								
MAT 0012	Pre-Algebra							4.00
	64791	MTWTH		08:00AM-08:50AM	YBOR	305	STAFF	
	64792	MTWTH		11:00AM-11:50AM	YBOR	305	STAFF	
	64793	MTWTH		12:30PM-01:20PM	YBOR	305	STAFF	
	64796	TTH		02:00PM-03:40PM	YBOR	305	STAFF	
△	64794	MW		05:15PM-06:55PM	YBOR	303D	STAFF	
	<i>Computer assisted instruction. Academic Systems</i>							
	64795	TTH		05:15PM-06:55PM	YBOR	305	STAFF	
MAT 0024	Beginning Algebra							4.00
	64841	MTWTH		08:00AM-08:50AM	YBOR	304	STAFF	
△	64844	TTH		09:30AM-11:10AM	YBOR	303D	STAFF	
	<i>Computer assisted instruction. Academic Systems</i>							
	64846	MTWTH		09:30AM-10:20AM	YBOR	305	STAFF	
△	64847	F		10:00AM-12:00PM	YBOR	303D	Fox, Liana	
	<i>Distance Learning Web Course. This course is taught completely on the web following a mandatory orientation on 8/7/07. Upon registration students must contact the instructor: lfox@uccf.edu. Course requirements available at Dr. Fox's website: www.uccf.edu/academic/department/math</i>							
△	64848	F		01:00PM-03:00PM	YBOR	303D	Fox, Liana	
	<i>Distance Learning Web Course. This course is taught completely on the web following a mandatory orientation on 8/7/07. Upon registration students must contact the instructor: lfox@uccf.edu. Course requirements available at Dr. Fox's website: www.uccf.edu/academic/department/math</i>							

102 HCC CREDIT COURSE SCHEDULE/FALL TERM 2007

COURSE#	COURSE TITLE	SECTION #	DAYS	TIME	BLDG.	ROOM	INSTRUCTOR	CREDIT HOURS	
64842		MW		02:00PM-03:40PM	YBOR	305	STAFF		
Δ ⁰ 64849		F		03:00PM-05:00PM	YBOR	303D	Fox, Liana		
<p><i>Prerequisite: Writing YBOR class 100 or above or 1.5 credit hours of transfer credit with a minimum grade of C- or a minimum of 60 credits. This prerequisite is waived for students who have completed the prerequisite. See the official college website for more information.</i></p>									
64843		MW		05:15PM-06:55PM	YBOR	305	STAFF		
Δ 64845		TTH		05:15PM-06:55PM	YBOR	303D	STAFF		
<p><i>Prerequisite: Writing YBOR class 100 or above or 1.5 credit hours of transfer credit with a minimum grade of C- or a minimum of 60 credits. This prerequisite is waived for students who have completed the prerequisite. See the official college website for more information.</i></p>									
MAT 1033	Intermediate Algebra								3.00
64863		MW		08:00AM-09:15AM	YBOR	218	STAFF		
Δ 64867		TTH		08:00AM-09:15AM	YBOR	303D	STAFF		
<p><i>Prerequisite: Algebra YBOR class 100 or above or 1.5 credit hours of transfer credit with a minimum grade of C- or a minimum of 60 credits. This prerequisite is waived for students who have completed the prerequisite. See the official college website for more information.</i></p>									
64864		TTH		09:30AM-10:45AM	YBOR	217	STAFF		
64865		MW		09:30AM-10:45AM	YBOR	216	STAFF		
64868		MW		11:00AM-12:15PM	YBOR	213	STAFF		
64906		TTH		12:30PM-01:45PM	YBOR	217	STAFF		
64924		MW		12:30PM-01:45PM	YBOR	216	STAFF		
Δ ⁰ 64914		S		01:00PM-03:00PM	YBOR	303D	Fox, Liana		
<p><i>Prerequisite: Writing YBOR class 100 or above or 1.5 credit hours of transfer credit with a minimum grade of C- or a minimum of 60 credits. This prerequisite is waived for students who have completed the prerequisite. See the official college website for more information.</i></p>									
Δ ⁰ 64918		S		03:00PM-05:00PM	YBOR	303D	Fox, Liana		
<p><i>Prerequisite: Writing YBOR class 100 or above or 1.5 credit hours of transfer credit with a minimum grade of C- or a minimum of 60 credits. This prerequisite is waived for students who have completed the prerequisite. See the official college website for more information.</i></p>									
64934		MW		04:00PM-05:15PM	YBOR	213	Zavarella, Carol		
64866		TTH		05:30PM-06:45PM	YBOR	216	STAFF		
64923		MW		05:30PM-06:45PM	YBOR	213	Zavarella, Carol		
MICROBIOLOGY									
MCB 1000	Microbiology & Human Disease								3.00
64938		MW		08:00AM-09:15AM	YBOR	214	Ketcham, Beverly		
MCB 1000L	Microbiology Laboratory								1.00
64952		M		11:00AM-01:30PM	YBOR	205	Ketcham, Beverly		
MATHEMATICS-GENERAL AND FINITE									
MGF 1106	Mathematics for Liberal Arts I								3.00
64975		TTH		09:30AM-10:45AM	YLRC	305	Cureton, Patrick		
64995		TTH		12:30PM-01:45PM	YBOR	214	Cureton, Patrick		
64976		MW		02:00PM-03:15PM	YBOR	217	Cureton, Patrick		
64977		MW		05:30PM-06:45PM	YLRC	305	STAFF		
MGF 1107	Mathematics for Liberal Arts II								3.00
65002		MW		08:00AM-09:15AM	YBOR	216	STAFF		
65001		TTH		11:00AM-12:15PM	YBOR	212	STAFF		
MASS MEDIA COMMUNICATION									
MMC 2000	Introduction to Mass Communications								3.00
65015		MW		02:00PM-03:15PM	YFAC	228	Nienberg, Valerie		
65016		TTH		02:00PM-03:15PM	YFAC	226	Nienberg, Valerie		
67169		M		05:30PM-08:15PM	YPAB	309	Nienberg, Valerie		
MMC 2100	Writing for Mass Communication								3.00
65019		MW		04:00PM-05:15PM	YFAC	228	Nienberg, Valerie		
65021		TTH		04:00PM-05:15PM	YFAC	226	Nienberg, Valerie		
MUSIC LITERATURE									
MUL 1010	Introduction to Music								3.00
65029		TTH		09:30AM-10:45AM	YPAB	107	Hanks, Kenneth		
MUSIC: COMMERCIAL									
MUM 1623	Electronic Music: Introduction to MIDI								3.00
65042		TTH		08:30AM-09:45AM	YPAB	103	Winslow, Robert		
MUSIC ENSEMBLES									
MUN 1120	Concert Band I								1.00
65043		T		07:00PM-09:00PM	YPAB	132	STAFF		
MUN 1310	Chorus								1.00
65044		TTH		12:15PM-01:30PM	YPAB	132	STAFF		

About the Author

Carol Zavarella was born and raised in Buffalo, New York. She lived there until 1986 when she moved to Tampa, Florida. She graduated from the University of Tampa in 1994 with a Bachelor's degree in Mathematics. In 2001, she began graduate studies at the University of South Florida and earned a Master's degree in Teaching Junior College, Mathematics. Ms. Zavarella is currently a full-time faculty member and Program Manager for the mathematics department at the Ybor Campus of Hillsborough Community College. She has two grown children, Andrea and Philip, and lives with her husband, Glenn in the Channelside District in Tampa, Florida.