DEVELOPMENTAL MATHEMATICS EDUCATION: A STUDY OF REMEDIAL MATHEMATICS PROGRAMS IN ALABAMA COMMUNITY COLLEGES

by

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A DISSERTATION

Submitted in partial fulfillment of the requirements for the
degree of Doctor of Education in the Department of
Educational Leadership, Policy, and Technology Studies
in the Graduate School of
The University of Alabama

TUSCALOOSA, ALABAMA

2013

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ABSTRACT

With open door admission policies, lower tuition rates, and convenient locations, community colleges are enrolling more and more academically unprepared students who are placing into developmental mathematics courses. Many of these community colleges need to assess their developmental education programs, instructors, courses, and students to determine if they are providing an effective developmental experience for students. The purpose of this study is to determine if students at selected Alabama community colleges are involved in remedial mathematics activities that are documented in the literature as best practices.

Using student surveys, student focus groups, and faculty interviews from students and instructors currently involved in developmental mathematics courses, data were collected from three selected Alabama community colleges. Data analysis for the study incorporated qualitative and quantitative methodologies which were used to establish common themes in developmental math courses with an emphasis on best teaching and learning practices. The results of the study provided strong feedback and opinions on the topic of developmental mathematics education by students and faculty. By addressing the findings in this study with a renovation and/or revitalization of identified student services, updated placement testing procedures, and faculty professional development on the specific needs of developmental mathematics students, community colleges may find that numerous facets of their developmental education programs will incorporate and model documented best teaching and learning practices. The findings also led to suggestions for future research.

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ACKNOWLEDGMENTS

I would like to thank my family and friends for serving as my cheerleading squad. They provided encouragement, reassurance, and inspiration in times of doubt (and sometimes desperation). I am definitely blessed to have these individuals in my life.

I am forever grateful to my committee members: James McLean, Karri Holley, Kathy Buckelew, David Hardy, and Claire Mjor. Dr. McLean has been such a fantastic chairperson, quickly responding with assistance and support even after officially retiring from The University of Alabama. Dr. Holley graciously agreed to serve as my co-chair at the last minute, and for this I will be ever grateful. Dr. Buckelew, a dear friend, has diligently reviewed my math documents offering suggestions and advice, despite that she has no true interest in the subject. A fellow Phi Theta Kappa advisor, Dr. Hardy, has been such an inspirational instructor full of knowledge in regards to the community college, offering many words of wisdom throughout my years in the program. Last but definitely not least, Dr. Major agreed to serve on my committee at the last moment without ever formally meeting me. She has provided invaluable comments relating to my study of which I am very appreciative.

I would like to thank the developmental mathematics faculty members and students at all three community colleges for their valuable time and hospitality. It was a joy getting to meet you all.

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INTRODUCTION

Introduction

During the fall 2011 term, the United States had 18 million undergraduate students with 11 million attending postsecondary institutions full-time and the other 7 million part-time. Among the full-time students, 26% attended a public two-year institution (NCES, 2012b). In the state of Alabama in the fall semester 2011, more than 93,000 students were enrolled in two-year colleges, which consist of 22 comprehensive community colleges, four technical colleges, and one upper division university (ACCS, 2012). These institutions and other extensive workforce development initiatives operating within the state of Alabama are collectively known as the Alabama Community College System (ACCS). The mission of the ACCS is to provide accessible and quality educational opportunities, promote economic growth, and enhance the quality of life for the people of Alabama (Alabama Community College System, 2012). The ACCS serves approximately 300,000 people annually in various capacities. Of those 300,000 people, roughly 125,000 are enrolled in credit courses.

Americans depend on higher education to provide opportunities that other facets of society cannot (Massey, 2003). Despite this dependence, citizens frequently believe that college faculty members are more focused on priorities other than providing students with a quality education, such as university research or furthering their own education. On the contrary, community college faculty members and administrators are attentive to developing students who are ready to enter the workforce and serve as responsible community members while providing a

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high-quality education (Banta, Black, Kahn, & Jackson, 2004). Faculty members at the community college level devote 90% of their job responsibility to teaching with a very small focus, if any in many cases, on research (NCES, 2008).

Almost 80% of jobs in our knowledge-based economy require education beyond high school (McCabe, 2000). Many adults are in need of gaining the knowledge and skills necessary for employment but are simply not prepared to enter college-level course, not to mention that they often view postsecondary education as a ladder that can be used to climb their way out of looming negative social conditions (Wang, 2009). This seems definitely to be the necessary situation for many Alabamians who have suffered job displacement in the recent years of economic distress in the United States. In addition, those individuals who have earned a bachelor's degree have higher median earnings than those with no postsecondary education (NCES, 2008). The ACCS (2012) reported that Alabama's continued achievement in economic development is largely dependent on a well-educated and highly skilled workforce that is in direct correlation to higher wages for Alabama workers.

A large and disproportionate number of adults entering postsecondary education are under-prepared for a myriad of reasons, including persistent poverty and changes in demographics (McCabe, 2000). These adults enroll in courses and certificate programs with their unique set of needs and with their own distinctive expectations. Many of these students are underprepared for college not only in academic skills, but also in organizational and critical thinking skills that are imperative for success in college and in the workforce (Boylan & Saxon, 2002; Petrides & Nodine, 2005). For these adults, community college developmental education is the bridge to continued education, constructive employment opportunities, and full participation in society (McCabe, 2000).

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Throughout the literature cited in this document, the terms developmental and remedial education are used interchangeably. Developmental educators often have the daunting task of teaching topics to students they should have learned while in high school. In some cases, students could not grasp the concepts when they were initially introduced to them, while in other cases their high school instructors may not have been teaching the state specified curriculum (Galbraith & Jones, 2006). In either situation, developmental educators have a monumental role in aiding and supporting those students to find success and progress to other mathematics courses without stopping or dropping out (Bettinger & Long, 2005).

The National Center for Educational Statistics (NCES) provides annual reports on the educational achievement of students in the United States at all instructive levels. NCES reported that in 1989 about 74% of higher education institutions offered developmental courses, but developmental courses were provided at 78% of institutions in 1995 (U.S. Department of Education, 2005). In addition, NCES found that one or two developmental courses were being offered in the areas of reading, writing, and mathematics, with students generally spending one year or less enrolled in the developmental courses (NCES, 2003). Boylan, Bonham, and Bliss (1992) have claimed that over 90% of community colleges provide developmental courses. Community colleges were developed based on open-access admission policies; therefore, developmental education has become an integral part of the community college academic programs (Kolajo, 2004; Bettinger & Long, 2005). NCES also stated that "29% of community college students (compared with 19% of students at public four-year institutions) reported having taken some remedial coursework in their first year . . . mathematics was the most common remedial course reported" (NCES, 2008, p. 11). These details support the lack of mathematical preparedness that is prevalent among numerous high school students in the United States, not to

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mention many of those community college students returning to school having never taken advanced mathematics courses.

According to the U.S. Bureau of Labor Statistics (2012), 68.3% of the 2011 high school graduates were enrolled in an institution of higher education in October 2011. The report also states that this enrollment rate was lower than the 70.1%, which was the record high in October 2009. Although a large number of U.S. high school graduates did become college attendees, many of them never saw their sophomore year. The average national first-to-second year retention rate in fall 2011 for two-year institutions was 55.4% and 73.3% for four-year (ACT, 2011).

Marcotte (2010) expressed that community colleges have long been a place where typically academically underprepared and economically disadvantaged students take classes and approximately 30% attain a degree. Students may enroll in community colleges with no expectation of graduation; they are merely taking courses to enhance their current skill set or learn new job-related technology. Because these students are often not on the track toward a degree, they may be lacking in some academic fields, especially mathematics. A lack of readiness for college level mathematics courses has become a serious issue faced by community colleges (Squires, Faulkner, & Hite, 2009).

The implementation of developmental mathematics courses at the institutional level has become the solution for student inequities in mathematics education. These developmental courses are aiding in student understanding by teaching basic mathematical concepts. Statistics from NCES (2012a) confirmed 42.2% of first-time postsecondary students took a remedial math course. Based on the same student population, 55.6% enrolled in Algebra II in high school; 40.1% in Trigonometry/Algebra II; 31.1% in Precalculus; and 13.5% in Calculus.

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Many students, despite their age, will freely admit that they are simply "not good" in mathematics (Wieschenberg, 1994). Schneider and Yin (2011) reported in an American Institutes for Research (AIR) publication that most certificate and degree programs at the community college level require at least one for-credit math course. Based on their need to complete required courses, mathematics cannot be completely avoided.

Approximately one-third of community college students are not prepared for the placement test in mathematics and subsequently fail, placing them into one or more remedial courses (Schneider & Yin, 2011). This lack of academic preparation prolongs the time it takes for students to reach certificate/degree completion and generates additional costs. Additionally, two-thirds of the students placing into remedial math courses drop out of community college without completing their degree (Schneider & Yin, 2011). Laughbaum (2001) stated the following:

> Many two-year college students in the United States and elsewhere, who are taking pre-college (developmental) courses are studying material they covered previously in high school or other college courses and did not learn. Or they may have 'learned' it before and did not retain it due to a lack of understanding. (p. 384)

This study focused on the effectiveness of developmental mathematics programs in three community colleges in the Alabama Community College System.

Purpose of the Study

In order for the Alabama Community College System to raise the educational attainment levels among its developmental students enrolled in one or more remedial courses, the skill level of these students will need to be boosted to college standards (Bailey & Cho, 2010). A new way of thinking – a collective vision for developmental education – must be implemented system wide. At the present time, developmental programs exist at the 26 statewide campuses but little or nothing is being done to assess their effectiveness (ACCS, 2012). Each community college

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campus is currently responsible for developing and achieving certain learning outcomes for its students to obtain success in college credit courses (Roueche & Roueche, 2001b). Two goals must occur simultaneously for the developmental programs to be deemed effective (Escobedo, 2007).

First, more developmental students need to be retained through their first year of college. Approximately 40% of community college students who do not place in developmental courses obtain a certificate/degree within eight years of first enrolling. This rate falls to less than 25% when students do require developmental courses (Bailey & Cho, 2010). Retention of these students is difficult at best because failure rates among underserved students in developmental courses are alarming. Second, because these courses are prerequisites for later classes, developmental students must not only complete them but also must effectively master the skills and knowledge provided by the courses.

A linkage or partnership between administration, faculty, and staff is only as strong as their shared beliefs about the importance of their work together (Galbraith & Jones, 2006). A collective vision and hard work determine the success of a long and continuing collaborative process with the ultimate goal of student success in developmental education. Hence, the purpose of this study is to determine if students at selected Alabama community colleges are involved in remedial mathematics activities that are documented in the literature as best practices.

Background and Rationale for the Study

A number of compelling reasons exist for assessing the effectiveness of developmental mathematics programs. A student's preparation for life begins very early in the educational system. According to the *Principles and Standards for School Mathematics,* the primary

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developmental years in elementary and high school bring most young people to a level of sound decision-making in choosing their life's road (NCTM, 2000). However, many young adults leaving the high school setting are ill prepared for the academic road ahead (Galovich, 2007). Developmental education in community colleges seeks to fill the void created in the preparatory process.

In 1947, a national thrust for developmental education was set in motion by the Truman Commission Report, which recommended developmental education become part of the community college mission (President's Commission on Higher Education, 1947). Since this date, community colleges have been struggling to offer the best education possible for an ever-increasing number of under-prepared students. The efforts by community colleges in the state of Alabama have been successful in helping thousands of students graduate and/or transfer to four year institutions (ACCS, 2012). However, the ACCS is now at a turning point in the developmental education process due to inadequate retention and pass rates. The system must prepare to meet the challenges head on to comply with and aid in meeting President Obama's initiative to graduate five million more community college students by 2020 (Bailey & Cho, 2010).

The institutional and organizational structures of higher education are changing to emphasize academic accountability, competency outcomes, outsourcing, content standardizing, and adaptation to learner-consumer demands (Howell, Williams, & Lindsay, 2003). Technological changes are contributing to the obsolescence of certain job skills. The changes in technology, along with other factors such as changes in the way companies do business, have turned the world of student preparation upside down (Wang, 2009). All of these factors indicate that a proactive approach to student preparation is necessary.

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According to the Alabama Department of Industrial Relations (2012), of the 22 occupational groups under the Standard Occupational Classification system, computer and mathematical science occupations are expected to provide the greatest opportunities for employment. Of the 40 fastest growing occupations in Alabama, 19 are health-related and 9 are computer-related occupations. Additionally, two more of the 40 fastest growing occupations in Alabama are production occupations utilized by automobile assembly plants. These skilled occupations can be learned at the community college level through a certificate or degree granting program and all require at least one mathematics course.

Community colleges must develop programs that meet the challenges of today to prepare students for their futures. The learning environment for developmental education must become relevant, competitive, accessible, and accountable (Bettinger & Long, 2005). To be successful in the future, community colleges must address the needs of business and industry by preparing an ever-changing workforce, provide impactful and relevant instruction, and allow students to become responsible for their own learning (O'Banion & Wilson, 2011; Barr & Tagg, 1995). This paradigm shift focuses on measurable learning outcomes, active learning strategies to engage students, and alternative assessments.

The current and future success of developmental programs depends directly on how well students are prepared to meet the demands of the 21st century literacy requirements, which includes strong academic skills, thinking, reasoning, teamwork skills, and proficiency in using technology. The learning college model proposed by O'Banion (1997) suggests six basic principles to guide community colleges in meeting these demands:

1. Creates substantive change in individual learners;

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2. Engages learners as full partners in the learning process, requiring them to assume primary responsibility for their own choices;
3. Creates and offers as many options for learning as possible;
4. Assists learners to form and participate in collaborative learning activities;
5. Defines the roles of learning facilitators by the needs of the learners; and
6. Succeeds when its learning facilitators can document improved and expanded learning for students.

Developmental students are ill prepared for the shift, and developmental programs should strive to fill the void created in the preparatory process (Squires et al., 2009).

In recent years, a number of problems have been identified relating to developmental studies. Among these problems are the increased need for developmental education, the increased length of time required to attain goals, and adjunct (part-time) faculty serving as primary instructors for developmental education. Certainly, developmental education has become an integral part of the community college mission (Carnevale & Desrochers, 2001; Levin, 2001; McCabe, 2000). The challenges faced by developmental programs are not surprising with community college's open-door admission policy and commitment to serving the widest range of students in their local communities. Obviously, the problem lies in offering the best education to the vast number of under-prepared students in an efficient and successful way.

According to McCabe (2000), nearly one-third of students in the United States are academically under-prepared when enrolling in higher education courses. Many of these students have no other option than to enroll in community college remedial courses. Furthermore, over half of the students entering community colleges are not prepared to begin college. A National Center for Educational Statistics report, *Remedial Education at Degree-*

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Granting Postsecondary Institutions (2003) indicated that 98% of community colleges offered remediation in reading, writing, and mathematics, with 42% of first-year students enrolled in at least one pre-collegiate course.

Community colleges admit "hundreds of thousands of under-prepared students each year, and the number of these students seeking higher education will increase in the coming decades" (Young, 2002, p. 3). Therefore, the needs and wants required for student success must be addressed. The difficulty lies in the fact that many developmental students vary in preparation, motivation, and self-esteem, which are three factors that influence student retention (Umoh & Eddy, 1994).

In fall 2000, public two-year colleges enrolled more of their entering freshmen in remedial courses than at their four-year counterparts, and they reported longer average time periods that students spent in remediation than other types of institutions (NCES, 2003). For example, 42% of freshmen at public two-year colleges and 12 to 24% of freshmen at other types of institutions enrolled in at least one remedial reading, writing, and/or mathematics course. Moreover, between 1995 and 2000, the proportion of institutions that reported an average of one year of remediation for students increased from 28 to 35%. Clearly, community colleges are facing an ever-increasing number of developmental students needing better services in a shorter amount of time.

With the open-door admissions policies, community colleges attract a wide variety of culturally and racially diverse students (League for Innovation in the Community College, 2012). "These groups have traditionally been underrepresented in American higher education, and every effort should be made to help them complete college programs" (p. 19). Within this same

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diverse group, many of these learners are first-generation college students who sometimes need up to five levels of remediation to be deemed as college-ready (Bailey & Cho, 2010).

Another key area of concern for community colleges is the vast number of adjunct faculty used for instruction in developmental courses. Adjunct faculty members are in great demand at many public community and technical colleges. Wallin (2004) reported that almost two-thirds of faculty members at two-year colleges were adjunct, many of whom have other full-time occupations. The American Federation of Teachers (1995) reported that while the total enrollment in U.S. colleges grew by 66% between 1970 and 1995, the number of full-time faculty grew by only 49%. The number of adjunct faculty, however, grew 266% in the same time period. At community colleges, adjunct instructors represent some 63% of the faculty; among four-year institutions in the United States, 43% of college faculties are part-time employees. In many cases, adjuncts make up significantly more than 50% of an institution's professional employees (Mansour & Mupinga, 2007).

Adjuncts are assigned fewer student contact hours; however, their responsibilities to students and to the profession are identical to those of their full-time counterparts (Wallin, 2004). Eagan and Jaeger (2009) have suggested that part-time faculty members are less engaged and not as readily available to students and the institution as full-time faculty members: "Part-timers' lack of availability might be attributed to deficient resources, such as office space, provided to part-time faculty as well as poor incentives for part-time faculty to make them available to students outside of class" (p. 182).

The overwhelming use of adjunct faculty at institutions of higher education has created unique professional development challenges. In general, adjunct faculty members are offered fewer incentives or opportunities for participation in those activities that might enhance their

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teaching skills and strengthen their programs and courses (Eagan & Jaeger, 2009; Waycaster, 2001). Institutions often fail to assume responsibility for providing support and resources that enhance knowledge, skills and networking opportunities for those who do not have full-time contracts (Wallin, 2004).

While adjunct counselors and faculty are often assigned positions that directly support developmental students, background education and experience in the field of developmental education may not be prerequisites for employment in those positions (Wallin, 2004). As a result, many adjunct professionals begin their assignments under-prepared for the work they are asked to perform. Therefore, it is imperative that institutions provide both the opportunity and incentive to support the professional development of their adjunct employees (Laughbaum, 2001).

Finally, many developmental programs are in need of revision (Bailey & Cho, 2010). Low rates of student persistence and achievement have plagued community college developmental programs for years, resulting in a number of academic and personal risk factors (Umoh & Eddy, 1994). The increased use of adjunct faculty, coupled with the growing number of developmental students, has only exacerbated the existing problem in developmental education (Wallin, 2004; Waycaster, 2001; Umoh & Eddy, 1994). The institutions of the ACCS need to assess their developmental education programs, instructors, courses, and students to determine if they are currently providing an effective developmental experience for students, as well as, track student progress after the remedial courses have been completed.

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Research Questions

The purpose of this study was to determine if students at selected Alabama community colleges are involved in remedial mathematics activities that are documented in the literature as best practices. The following research questions guided my study. They included the following:

1. Are best teaching and learning practices for developmental mathematics found in the literature review being implemented at certain community colleges in Alabama;
2. What are the most important identifiable needs for students enrolled in developmental mathematics courses at certain Alabama community colleges;
3. What are the attitudes toward developmental education of students currently enrolled in developmental mathematics courses at specified Alabama community colleges;
4. What are the attitudes toward developmental education of instructors currently teaching developmental mathematics courses at specified Alabama community colleges?

It should be noted that the researcher works as a mathematics instructor teaching credit and developmental courses and has a professional background at one of the studied community colleges. The researcher will make all attempts to prevent bias throughout the study by directly quoting instructors and students with no personal opinion. Additionally, the three community colleges which serve as the basis of this study exhibit similar student populations, impacting the results and conclusions.

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CHAPTER II:

REVIEW OF THE LITERATURE

Introduction

With the continued economic downfall in the United States, it is no surprise that enrollment at two-year colleges is increasing across the country, especially with student eligibility for federal grants and other financial assistance being accessible (Marcotte, 2010). Although record numbers of students are entering into postsecondary programs, many of these individuals will place into developmental courses based on test scores. According to Shelton and Brown (2008), more than 60% of students entering community colleges place into non-credit courses. These non-credit bearing, remedial courses are primarily offered in the subject areas of mathematics, English, and reading.

Despite the major that a student chooses at any college or university throughout the world, he/she will inevitably be faced with at least one mathematics course. The American Diploma Project (2004) stated that "all students no matter their talents or proclivities, should leave high school prepared for both college and high-tech work" (p. 2). Although this proclamation is incredible in theory, Greene and Winters (2005) reported that one in three students who enter college take remedial mathematics courses as a prerequisite to taking college algebra and/or elementary statistics.

Community colleges are serving as the stepping stone to a college degree for those students who place into remedial courses. Students who progress through remedial and gatekeeper courses, which enroll the largest number of first-time college students and are

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required for most degrees, have a higher probability of obtaining a postsecondary credential (Calcagno, Crosta, Bailey, & Jenkins, 2006). Although developmental mathematics courses are offered at both two and four-year institutions, community colleges offer a higher percent of these courses on average (Maciejewski & Matthews, 2010). Developmental courses are a necessary evil at the community college level, and their best practices should be studied.

Bettinger and Long (2005) have claimed that several states such as Arizona, Florida, Montana, South Carolina, and Virginia now prohibit four-year institutions from administering developmental/remedial programs on their campuses. As stated by Levin (2001), two-year institutions serve as the bridge between academically under-prepared student success and graduation.

> For many students in large or small communities, the community college is the only public educational institution that will accept them for college-level studies given their high school academic performance. Furthermore, of the many types of postsecondary institutions facing students who are unprepared for college-level studies, the community college is the only institution whose legal and social mandate is remedial education. (p. xii)

The community college is faced with a population of students that have not been properly prepared in the areas of reading, writing, or mathematics (Perin, 2004). This lack of academic preparedness extends beyond developmental education into college-credit courses when academic difficulty occurs.

Community College Developmental Programs Defined

Developmental/remedial education has been defined by the National Center for Educational Statistics (1996) as courses for credential-seeking students who are not academically prepared to perform college-level work usually in the areas of writing, reading, and mathematics. Levin and Calcagno (2008) stated that the most common approach to correct the under preparedness is remediation/remedial courses to jumpstart academic and often social success in

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students' early college experiences. Bettinger and Long (2005) have defined remedial education as courses below college-level that include remedial, developmental, non-traditional coursework, and basic skills training (excluding English as a second language courses). In addition, the National Association for Developmental Education (NADE) have indentified remedial/developmental education as "a field of practice and research within higher education with a theoretical foundation in developmental psychology and learning theory. It promotes the cognitive and affective growth of all postsecondary learners, at all levels of the learning continuum" (2008). Moreover, according to Boylan and Bonham (2007),

> Developmental education refers to a broad range of courses and services organized and delivered in an effort to help retain students and ensure the successful completion of their postsecondary education goals. These courses and services are generally delivered according to the principles and theories of adult development and learning, hence the term "developmental" education. (p. 2)

In 2008, Cohen and Brawer acknowledged that developmental courses appeared in the early years of the 20th century for postsecondary institutions. The first junior college was established in Joliet, Illinois, in 1901. The college was developed on the basis of remedial education in order to help students attend an institution of higher education although they were not academically prepared to enroll in the University of Chicago (Cohen & Brawer, 2008). Many community colleges offer a full array of developmental courses that welcome numerous students who would be left behind at a four-year college or university (Melguizo, Hagedorn, & Cypers, 2008).

According to the Alabama Community College System records, Alabama opened its first state-operated two-year college in 1925 (ACCS, 2012). In 1963, the Alabama legislature created a community college system that linked technical and junior colleges. The number of two-year colleges and the student population grew quickly in Alabama, just as in numerous other states.

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Over the years, a dual system of primarily African-American trade schools and primarily white junior and technical colleges were merged to create the single Alabama Community College System (ACCS, 2012). The number of students served by all facets of the community college system in Alabama today is approximately 300,000 (125,000 of which are enrolled in courses for credit). Of these students, a large majority of them are enrolled in developmental courses based on the open door admission policy combined with convenient locations and lower tuition rates (Melguizo, Hagedorn, & Cypers, 2008).

Developmental education programs typically address diagnostic assessment and placement, academic preparedness, specific learning strategies, and affective barriers to learning (Miglietti & Strange, 1998). Due to the fact that over 40% of first-year students at colleges take remedial courses, states are grappling with the question of whether developmental courses should be offered at four-year institutions, two-year institutions, privately by for-profit entities, or not at all (U.S. Department of Education, 2005). State policymakers want to ensure that students pursue postsecondary education and, more importantly, that they are prepared to execute college-level work. The debatable topics are at what type of institution should offer developmental courses and to what level should remedial education occur in general.

Community College Developmental Student Profile

In order to provide the best education possible for developmental students, it is first imperative to take a closer look at just who these students are. Students needing developmental education vary considerably in skill level and needs (Laughbaum, 2001). Some students are under-prepared while others are at at-risk (Young, 2002). Experts suggest that at-risk pertains to students "whose academic, social, and economic conditions guarantee failure if there are no appropriate interventions" (Young, 2002, p. 4). These students may be deficient in learning

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skills and organization and/or a broad range of deficiencies that affect their success in college-level coursework (Armington, 2003a).

Community colleges tend to have a high number of students who represent a diversity of age, socioeconomic backgrounds, academic preparation, race, and ethnicity as compared to four-year colleges and universities (Cohen & Brawer, 2008). The largest growth areas in the population now are the ethnic minority groups. African-American and Hispanic students are already over-represented in remedial programs, and these numbers are expected to have continual growth (Escobedo, 2007; Kane, Beals, Valeau, & Johnson, 2004). Based on most recent details from the Alabama Commission on Higher Education (ACHE) student profiles report, 57,178 of the 84,092 enrolled students were of the white/non-Hispanic ethnicity, while 21,114 were African-American/non-Hispanic and 1,526 were Hispanic (ACHE, 2012).

Regardless, the skill level varies considerably among groups. The differences in subject-specific skill levels can be attributed to numerous factors, including but not limited to, attending a school system that was under-funded, lack of prior teaching, a personal disinterest in subject matter, lack of adequate classroom resources, and simply an insufficient effort on the part of the student (Bailey, 2009; Armington, 2003a). Some students succeed in all areas with the exception of one subject, such as mathematics. These students generally perform well in college coursework that does not require the use of mathematical concepts.

Some students cannot find present value in their postsecondary education, which is apparent in their lack of planning and preparation when in enrolling in college courses (Bettinger & Long, 2005). They simply do not see attending college or college graduation as priorities. Some students are forced to enter a college setting because their parents make the decision for them; therefore, they view college as an obligation instead of a privilege. In studying non-

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cognitive variables and academic achievement, Higbee and Thomas (1999) found that once students realized the foundational instruction and significance of the course, they performed better and were more motivated to earn a passing grade. Moreover, once the underachievers developed an interest in their learning and viewed it as important to their overall success, they were particularly capable of exceeding the expectations of themselves and their educators.

Young (2002) believes the relationship among motivation, poor performance, and low grades is correlational, not causal. However, the sources of student motivation can be linked to affective variables, such as college preparedness, self-confidence, and anxiety, as well as to achievement in mathematics. Frequently, poor motivation is a result of a lack of clearly defined goals; developmental students are often the last to enroll in courses, as well as, the last to set specific academic and personal goals (Kolajo, 2004). This late enrollment could lead to other difficulties such as choice of class time, instructor selection, and type of course delivery. All of these factors have the possibility to increase a student's choice to stop out or even drop out of the institution as a whole.

Many students also have pessimistic attitudes or self-esteem problems that have existed for a considerable time, often resulting from prior scholastic experiences or a specific off-putting event of which they cannot set free (Young, 2002). Low self-esteem has resulted from previous low-test scores, low socioeconomic background, and sometimes race (Waycaster, 2001). Tinto (1996) believes that social and academic experiences influence self-esteem issues for developmental students. Students often avoid developmental courses or take them toward the end of their studies because of the academic stigma that is associated with non-credit courses, especially writing and mathematics (Crews & Aragon, 2004). Students who choose to defer

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enrollment in developmental courses to subsequent academic terms could lead to delayed graduation and prolonged future success.

Tinto (1996) proposed that student persistence, self-esteem, and other attributes result from the experience provided by both the instructor and the institution. Poor self-concepts and unclear goals are vague and speculative dimensions. Educational institutions should concentrate on providing outstanding instructors that can negate negative experiences and concepts that occurred beforehand and have resulted in poor self-esteem problems and defeating attitudes (Banta, Black, Kahn, & Jackson, 2004). Research provided by NADE (2008) shows that faculty attitudes affect student attitudes, thereby affecting academic performance. Furthermore, other important factors that promote positive or negative student image include classroom environment, anxiety, and the remedial stigmatization (Jones, Reichard, & Mokhtari, 2003).

Developmental Mathematics Student Profile

According to Levin and Calcagno (2008), the developmental math student, generally, is defined as one who does not possess the required mathematics skills needed to enter a college-level math course. In a report prepared for the United States Department of Education (2005), *Strengthening Mathematical Skills at the Postsecondary Level: Literature Review and Analysis*, researchers stressed two common themes that discuss the necessary skills for success in college-level mathematics. The first is knowledge of content, and the second is having the required skills and abilities needed to perform functions such as critical thinking, problem solving, and reasoning. Therefore, effective developmental math programs should strive to incorporate these skills and abilities, along with content into instructional models (Wheland, Konet, & Butler, 2003). Students must have a fundamental understanding of mathematical concepts, not simply retain enough memorized information to make passing grades on exams. Additionally, students

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must be taught critical thinking and problem solving skills throughout developmental education courses (Engelbrecht & Harding, 2005).

Due to the diversity of skill deficiencies, Armington (2003a) specified five categories that further define developmental math students. The first category includes students who have the math aptitude, but due to disinterest or lack of motivation have fallen behind. The second category can be defined as those students who have adequate learning skills and motivation but lack the required math skills. The third category includes those students who lack both the learning skills and the math skills but are motivated to pursue college level work. The fourth category is those students who have a verifiable learning disability. The final category is comprised of those students who have deficiencies in math skills, motivation, and a broad range of learning skills. To encourage the success of students from all categories, a developmental math program should develop strategies for addressing learning skills and motivation, as well as math skills (Wheland, Konet, & Butler, 2003).

The students entering developmental math courses with documented learning disabilities are an exceptionally sensitive cohort of learners because of their proven lack of academic ability, self-confidence and/or self-esteem, as well as prior educational experiences (Miller, Narney, & Hintz, 2002). These students need positive educational experiences in order to counteract the challenges they bring with them to college. Moreover, they need to develop a strong sense of belonging to the college (Weisman & Marr, 2002).

Due to the lack of motivation, many of these individuals are not ready for any type of self-directed or dictated instruction (Young, 2002), which many instructors utilize. Additionally, students are not motivated because they fail to see the importance of the developmental course (Levin & Calcagno, 2008; Perin, 2006; Waycaster, 2001). Many of these students sense

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confusion because they received passing grades in high school but later scored low on the college placement test. Therefore, these students fail to see the value of developmental or transitional classes; they feel the coursework is a waste of their time and money (Kolajo, 2004; Bettinger & Long, 2005). In order for these students to be motivated, they must be shown the value of the developmental course.

Although the population of students with documented learning disabilities has grown from approximately 3% in the late 1970s to more than 10% in the 21st century, they still represent a small portion of college students (Mamiseishvili & Koch, 2012). In the 2008-2009 academic year, approximately 350,000 students with disabilities were enrolled in community colleges which can be attributed to "enhanced assistive and instructional technology, expanded disability support service programs, greater self-determination among individuals with disabilities, and increased public awareness regarding the capabilities of individuals with disabilities" (Mamiseishvili & Koch, 2012, p. 321). Within this population of students, there is no specific documentation regarding how many are enrolled in developmental courses, but it can assumed that approximately half of the group based the general community college student population.

In addition, students enrolled in developmental mathematics courses vary greatly in age (Calcagno et al., 2006). These researchers found that age was a factor in remedial mathematics:

> It is likely that older students, having been out of school longer, were more likely to need some remediation (but not a lot) because their basic skills were merely 'rusty' rather than grossly, deficient…For students who passed college algebra, the first college-level math course, the odds ratio for older students was about half as high as the ratio for younger students, although passing algebra was predicted to have a positive impact on graduation probabilities for all students. Thus, passing the first college-level math course could be much more important for younger students. (p. 4)

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Younger and older students respond differently to developmental mathematics courses. Perin (2004) claimed that older students are less negatively affected by enrolling in developmental courses due to the fact that they have been out of school for longer periods of time. They do not find a stigma associated with enrollment in the course.

Despite the opinions of the general public especially in the United States, countless research studies have proven that intrinsic mathematical ability is equal in males and females (Perry, 2004). Students need to acknowledge their academic background and formulate a plan that will allow them to succeed in college-level courses. Moreover, they also need to familiarize themselves with the resources available at their institutions.

Mathematics Anxiety

Anxiety experienced by students in collegiate mathematics courses is an extremely common phenomenon (Perry, 2004). This anxiety ranges from moderate test anxiety to extreme anxiety including physiological symptoms such as headaches and nausea. In his book titled *How to Teach Mathematics,* Krantz (1999) proclaimed the following:

> Math anxiety is an inability by an otherwise intelligent person to cope with quantification, and more generally, mathematics. Frequently the outward symptoms of math anxiety are physiological rather than psychological. When confronted with a math problem, the sufferer has sweaty palms, is nauseous, has heart palpitations, and experiences paralysis of thought. (p. 16)

Anxiety, especially in the subject area of mathematics, is experienced by many college students (Farrell, 2006; Perry, 2004).

Math anxiety is often developed at an early age during the elementary school years (Farrell, 2006; Perry, 2004). The condition is usually recognized after a student has a single insensitive mathematics teacher or some incident in which they were made to feel incredibly incompetent during a math class. The field of mathematics has humbled numerous students

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throughout history because of its often intangible concepts and difficult to understand, spell, and pronounce terminology (Farrell, 2006). This humility cannot be easily overcome because many students genuinely lack the ability to master the subject.

In a 2004 research study, Perry found math anxiety to be equally prevalent in males and females. On the contrary, Bailey, Jeong, and Cho (2010) found math anxiety to be a more common problem for men, students enrolled as part-time, and those studying a vocational program. Although findings differ among different groups of students and researchers, it is evident that math anxiety plagues students.

In her text, *Overcoming Math Anxiety*, Sheila Tobias (1993) stated that math anxiety at the college level usually occurs due to three reasons: "chalk and talk," "dropped stitches," or "30 seconds or bust" (p. 60). The chalk and talk situation occurs when a college professor teaches in a large lecture hall, where students sit back and passively watch the instructor work out problems. This method makes it difficult for some students to learn new concepts when the instructor is inaccessible by covering material too fast and/or not answering questions during the scheduled class meeting time. The chalk and talk teaching method does not lend itself to developing faculty-student relationships. Many students begin to lose focus and determination using this method, and this loss could enhance their urgency to withdraw from the course.

Another main cause of math anxiety is a dropped stitch. This dropped stitch is a gap in a student's prior math education that holds him or her back from learning more complicated concepts. Dropped stitches are very common in developmental mathematics because most students do not master every concept they were previously taught. The student could miss one mathematical idea, fall behind, and be confused by each new taught idea. Students are often afraid to ask for extra help and catching up with the taught material seems like an

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insurmountable task (Steen, 2007). Without extra assistance, these math students may simply attend class and copy notes, never truly mastering taught concepts.

Tobias (1993) found that another source of math anxiety in college students is 30 seconds or bust. Instructors usually pose a question to the class as a whole; they allow 30 seconds or less for students to answer; then, they work out the problem. Those students who do not grasp the concept in the designated 30 seconds feel as if it were beyond their comprehension. In many ways, our society believes that people either simply get math or they do not, which is not true. Many students who do not excel at mathematics can learn the skill with practice and persistence when they are given an adequate amount of time.

Currently there is no medicine that can be prescribed specifically for math anxiety; students and instructors must develop specialized tactics to aid in the fear of mathematics. Perry (2004) claimed that although there is no simple solution to the mathematical illiteracy faced by numerous college students, there are numerous strategies that can be used to attack the problem. Students and instructors, especially in developmental courses, should have a proactive attitude toward mathematics education. Almost every student has had some positive experience in a math class, and this should be the focus (Farrell, 2006). Students should be encouraged to reflect on positive experiences to the entire class aloud or in writing, especially via journaling. These exercises will help to remind students and their classmates of successful moments and accomplishments, as well as supply a source of inspiration for future math courses (Perry, 2004).

Rounds and Hendel (1980) developed the Mathematics Anxiety Rating Scale (MARS), which is a psychometrically sound assessment instrument of math anxiety. The MARS has reliability and validity, and normative data are also available (Resnick, Viehe, & Segal, 1982). The instrument contains 98 items asking respondents how much anxiety is felt while performing

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specific mathematical tasks. Respondents check off one of five phrases to indicate their anxiety level: (1) not at all, (2) a little, (3) a fair amount, (4) much, or (5) very much. The MARS has been used by some developmental math programs to assess student anxiety.

A study conducted by Resnick et al. (1982) found inconclusive evidence to support that the level of math anxiety is correlational to achievement in mathematics. The study "results tend to confirm that math anxiety measures have not yet demonstrated incremental validity beyond that of prior math preparation and performance as an explanatory variable for predicting future math performance" (p. 45). They also concluded that the actual number of students experiencing concentrated anxiety only related to mathematics is minute. Furthermore, levels of math anxiety cannot be generalized from one cohort group to another, especially at differing institutions.

Best Practices for Success in Developmental Mathematics Programs

Students need to develop adequate skills in developmental mathematics courses in order to find success in college-credit mathematics courses. In research conducted on the academic attainment of community college students taking remedial math, Bahr (2007) stated

> I find that students who remediate successfully experience outcomes that effectively are equivalent to those of students who do not require remediation, indicating that remedial math programs are highly effective at resolving skills deficiencies. However, the majority of remedial math students do not remediate successfully, and the outcomes of these students are not favorable. (p. 421)

Community colleges need to adapt their developmental education programs into successful and beneficial support systems for students.

Many factors have contributed to successful developmental education programs. In order to identify best practices for community college developmental education, several factors must be considered, including 1) centralized remedial services; 2) faculty members who value success and are carefully chosen, connected to the college, and integrated among for-credit instructors; 3)

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development of students that experience positive, meaningful, and valuable math learning; 4) varied teaching and course delivery methods; and 5) student preparation for the placement tests and advising to assist with course selection (Boylan & Saxon, 2002; Perin, 2004; Wheland et al., 2003). Whether or not one approach works better than another depends largely on institutional commitment, faculty and student attitudes toward developmental education, and the environment in which the services are provided.

Structural Organization

The organization of developmental education has a direct impact on the quality of education offered (Perin, 2004). Community college developmental education can be organized in two different ways: mainstreaming or centralization. Mainstreaming (decentralized) involves offering developmental courses in the academic departments, such as mathematics, whose purpose is to offer college level courses applicable to associate's degrees or certificates (Perin, 2002). These courses are numbered in a sequence that begins with noncredit, remedial level instruction, and then continues through advanced associate-level preparation. A large number of faculty members teaching these courses are adjunct faculty members who are generally on campus only during their scheduled class times (Wallin, 2004).

On the other hand, when remedial education is centralized, the remedial courses are offered in a separate department whose sole function is to offer pre-college level courses (Perin, 2004). In this type of organization, developmental mathematics courses are numbered to reflect the separateness of the department. In addition, the centralized developmental departments may offer ancillary support services, such as counseling and tutoring (Boylan & Saxon, 2002). The majority of the instructors are paid from the centralized department's budget although some may have joint appointments with academic departments and teach courses in both. This type of

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organization lends well to a comprehensive system of support available to all developmental students via a learning assistance center (Koski & Levin, 1998).

Learning assistance typically includes computer labs with developmental software programs such as PLATO, MyMathLab, I CAN Learn, and WebAssign. The PLATO (2012) software is a self-paced learning tool where instruction is targeted to each student's needs. MyMathLab (2012) is a modular, self-paced, and completely web accessible learning program developed by Pearson Education. This is an innovative program of text-specific online courses that accompany Pearson textbooks. In addition, the I CAN Learn (2012) education system is a software program works on a one-on-one basis for students. I CAN learn is similar to the PLATO system, but is geared more toward college age mathematics students. Finally, the Enhanced WebAssign (2012) program was designed at North Carolina State University and was adopted by Cengage learning to aid instructors and students in online homework help. This program allows students to complete assignments online and ask questions if needed to an online tutor; additionally, it grades the homework assignment and files it in an electronic gradebook.

It is not clear whether more colleges mainstream or centralize developmental education. Roueche and Roueche (1999) report that a slight majority of community colleges mainstream their developmental student population (58% mainstream mathematics). On the contrary, Grubb and Associates (1999) claim that most remediation tends to be centralized.

Many developmental education programs are centralized where student services and remedial courses are components of one program (Boylan & Saxon, 2002). Of particular importance is a study by Boylan, Bliss, and Bonham (2007) on the relationship between organizational structure and student outcomes. Based on an analysis of academic data on a random sample of 6,000 developmental education students attending 300 community and four-

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year colleges, it was found that students attending institutions with a centralized organization had significantly higher first-term grade point averages, cumulative grade point averages, and retention rates. These students also had grades in mathematics compared with students in colleges where remediation was mainstreamed. In studying The Community College of Denver's centralized structure, Roueche and Roueche (2001b) claimed that this type of organization helps prevent at-risk students from "falling through academic cracks in the system and establishes a highly visible presence for the important role that developmental education plays in improving student success at the college" (p. 115).

In practice, centralized departments may be more likely to provide support services needed by at-risk students and better able to implement an early alert system that identifies and refers at-risk students for counseling or other support services (Perin, 2004). Roueche and Roueche (2001b) have argued that the effectiveness of higher education could be improved by providing support services that rely on multiple intervention strategies. Programs considered exemplary by McCabe and Day (1998) have provided support services including tutoring, academic and career advisement, and workshops in areas such as time management and study skills. By linking community colleges' effectiveness in educating remedial students to the provision of supplementary tutoring, mandatory participation in learning labs, and case management models that permit individualized attention, Roueche and Roueche (2001b) believe student support services should be centralized with developmental education.

These ancillary services may be necessary to increase the persistence and performance of academically low functioning students, many of whom experience not only financial and familial difficulties typical of community college students in general, but may also suffer from low self esteem related to academic difficulties (Perin, 2002). Remedial students often feel displaced in a

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college environment that they may perceive as impersonal. Support services are especially critical for students at the lower remedial levels who test into three or more remedial courses, particularly those students who experience reading difficulties (Boylan & Saxon, 2002; Perin, 2002, 2004).

Faculty Commitment to Success

Quality faculty members are critical to student success. Primarily, exemplary community college developmental education programs must utilize faculty who have demonstrated a commitment to the value of developmental education and to developmental students (Wheland, Konet, & Butler, 2003). Best practice institutions assign faculty to develop courses only after they have been properly oriented to the college's philosophy on teaching developmental education and institutional expectations for student outcomes (Wallin, 2004). These outcomes may include successful completion of courses, progression through the developmental curriculum, and/or the achievement of individual student academic goals (Boylan & Saxon, 2002).

According to Roueche and Roueche (2001a), the Community College of Denver (CCD) makes sure both full-time and adjunct faculty associates are indoctrinated in their Teaching/Learning Center and its staff development opportunities. CCD holds intensive orientation sessions for new faculty members and assigns each new instructor a mentor. The researchers also stated that Instructor Success Courses are required for all adjunct faculty members at some institutions (p. 32).

In the text *Math Attack: How to Reduce Math Anxiety in the Classroom, at Work, and in Everyday Personal Use* (1999), Curtain-Phillips confirmed that today's learners are much different than in past decades. Today's learners are often not satisfied until they comprehend the

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why of mathematics. These learners will continuously question instructors on methodology and technique instead of merely memorizing content and repeating patterns. Community college faculty members must be prepared to answer student inquiries with logic and reason. Educators and students alike must steer away from the belief that there is only one correct way to teach, learn, or solve problems in mathematics (Galovich, 2007).

Faculty in developmental education mathematics departments must be chosen carefully (Galbraith & Jones, 2006; Miles, 2000). Generally speaking, faculty in centralized developmental education departments see the teaching of remedial students as a primary task, while academic discipline instructors may view developmental teaching as a low-status assignment and perhaps a punishment (Perin, 2002, 2004). Instructors hired for developmental courses seem more likely to be able to identify strengths and weaknesses, rather than only deficiencies, in remedial students (Maciejewski & Matthews, 2010).

Due to the close proximity of staff, impromptu referrals may occur and more conversations on best teaching methods may be shared. Instructors who primarily (and in some cases only) teach developmental courses may be more aware of and responsive to the needs of students who are academically challenged. In addition, these instructors may implement special programs to identify those students who need supplementary academic, emotional, and/or personal assistance. Specialized training sessions and professional development opportunities for remedial faculty may be more readily available under one roof. Thus, on the dimension of instructor motivation and experience, centralized departments appear superior to mainstreamed education (Boylan & Bonham, 2007; Boylan, 1999).

One problem, of course, lies in the tendency to place only adjunct faculty members as instructors in developmental courses. This practice presents a number of problems for the

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students, as well as the faculty themselves (Grubb & Associates, 1999). Discipline area instructors may choose to decline developmental teaching assignments. When taught in academic departments, the instruction of remedial courses may be left to adjunct faculty who may or may not also be teaching college-level courses. Levin (2003), a distinguished professor of higher education at North Carolina State University on Raleigh, North Carolina, has claimed that the prevalence of adjunct faculty members is linked not only to the quality of instruction, but also to the culture of the institution. This issue is a major concern with regard to coherence and unity within the faculty.

Schuetz (2002) indicated that part-time faculty members often have little or no ties to the college or university as a whole. Also, they may not even be closely linked to their academic department or to the students that they teach. Part-timers tend to have less teaching experience and teach fewer hours per week. Schuetz's study found that part-timers use less innovative or collaborative teaching methods and interact less with students, peers, and institutions. In a 2002 study by Wacek, professional development of faculty and staff was found to be generally inadequate with almost none for adjunct or part-time staff at any of the institutions studied. Moreover, at most institutions, only part-time faculty taught developmental courses (Armington, 2003c).

Based on reporting of Alabama community colleges to the Integrated Postsecondary Educational Data Systems (IPEDS) in fall 2011, the majority of faulty members were adjunct (NCES, 2012c). The Alabama Community College System reported that throughout the 26 associate degree granting colleges, 34.7% of faculty members were full-time and 65.3% were part-time. Faculty members were deemed part-time when teaching less than 15 semester credit hours in a regular semester.

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By reason of budget constraints, community colleges often find it difficult to find funding that can be specifically dedicated to training faculty (Grant & Keim, 2002). In order to achieve better results, developmental faculty, full-time and adjunct, should be provided with the equipment, the training, and the confidence to integrate technology into their classes. Brown (2000) claims that richer classroom content in these environments leads to increased student enthusiasm and engagement, thus improving student retention and course completion and, ultimately, job placements for developmental students.

By hiring more full-time faculty members to teach developmental courses and/or by providing office hours for adjunct faculty, community colleges can better train all faculty members, while providing students with more direct contact with their instructors (Grant & Keim, 2002). Adjunct faculty can be paid with hourly wages for working in labs and for office hours to conference with students needing more assistance/explanation outside of class. This arrangement provides a two-fold advantage: a cost savings for the college and more adjunct faculty-student contact hours (Dusen, 1997). Clearly, faculty development (such as professional programs and conferences, in-service workshops, and departmental meetings) is important for adjunct faculty, as well as full-time faculty (Wallin & Sweet, 2003).

Faculty Attitudes Toward Developmental Education

In the realm of developmental education, both faculty and students may feel segregated from the rest of the college. According to Grubb and Cox (2005), when remedial instructors are isolated from other faculty, the stigma associated with remedial education is worsened. For centralization of developmental classes to work, efforts must be made to include developmental faculty in college activities. A developmental curriculum committee, consisting of full-time and

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adjunct faculty from the centralized developmental program, would lessen perceived feelings of segregation (Engstrom, 2005).

Regular committee meetings would also permit developmental education instructors to mingle with colleagues who teach college-level courses. These meetings would allow for a smoother alignment between remedial instruction and college-level curriculum (Engstrom, 2005). Specifically, conversations could take place on how the skills and content taught in remedial mathematics courses can be aligned with the skills and content taught in college-level courses. From a cognitive perspective, close alignment if developmental and college-level instruction should promote developmental students' generalization of learning beyond remediation to the college-level classroom (Perin, 2002).

Opponents of centralized developmental education claim that students need the opportunity to interact with their higher achieving peers and to participate more fully in college life (Perin, 2002). Support services for developmental students could include student mentors provided by various clubs. At Broward Community College in Fort Lauderdale, Florida, a team of faculty and staff have assigned *Success Coaches* to groups of students (Gilpatrick, 2007). These coaches provide the extra support students need to successfully mainstream into the college.

Student Attitudes Toward Developmental Education

Galovich (2007) stated that "many people wear their distaste for mathematics almost as a badge of honor … societal attitudes toward mathematics can discourage a student from doing well in math" (p. 274). He has claimed that math is undervalued by a large segment of American society; therefore, causing this population to proclaim negative attitudes toward math because of numerous false beliefs. They include:

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1. You are practically a genius if you are good at math;
2. My parents were not skilled in math, so I will not be either;
3. There are too many formulas and algorithms to memorize; and/or
4. If I cannot solve the math problem in less than one minute, then it is impossible.

Unsuccessful mathematical experiences that occur throughout primary and middle school grades often reinforce negative attitudes toward mathematics, but these beliefs can be reversed.

Across the United States, community colleges offer up to four developmental mathematics courses (Lewis & Farris, 1996). Some students place into the lowest level math course (which are usually non-credit) and are then forced to spend numerous semesters trying to simply enroll in a credit course. Daniel (2000) used this knowledge to review time-shortened courses. The time-shortened courses allow developmental students to often take multiple remedial courses in the same semester using a mini-term course delivery option. Daniel concluded that the student population completing the time-shortened courses had a higher level of motivation and morale than those completing the traditional term courses.

Sheldon and Durdella (2010) found that traditional, semester-long courses may not be the best route for academically low-achieving students. Students enrolled in short-term courses with repeated practice and a rigorous meeting schedule often performed better or at the same level as those enrolled in traditional 16/17-week courses. They also claim that normally half of the students who enroll in developmental courses, especially mathematics, are not successful on their first attempt. Sheldon and Durdella (2010) offered the following data in support of this approach:

> For example, in math, those courses offered in the 6-week compressed format had successful course completion rates of 67% compared to 61% for courses compressed in an 8-week time period and 52% for the regular length 16-week course. Withdrawal rates were 17% for the 6-week course, 21% for the 8-week course, and 26% for the 16-week

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> course… Better students tended to enroll in the compressed courses, even those students with lower cumulative grade point average or probationary status achieved higher success rates in aggregate than their counterparts enrolled in traditional-length courses. (p. 42-43)

Clearly, courses offered in this shortened format might not be an option for all colleges due to budget constraints for supplemental instructor training and/or willingness of faculty members to teach the courses using the modified format.

Practices for Teaching Methods and Course Delivery

The use of technology in mathematics courses, especially in developmental programs, continues to be a source of controversy in college classrooms (Shore, 2002). Numerous mathematics instructors deem that students, especially those placing in developmental courses, should be capable of performing skills with a pencil and paper. They think that technology (mainly calculators) is replacing actual student thought processes (MacDonald, Vasquez, & Caverly, 2002). Technology is widely accepted as long as the students are manually computing solutions and mastering skills needed to progress to successive courses.

MacDonald et al. (2002) have claimed that one component of best practices in teaching developmental education involves whether to incorporate technology into the lesson plans. Although emerging and expanding technologies are seen in most classrooms, labs, and students' point-of-entry service areas, many developmental instructors are hesitant to incorporate technology into the remedial classroom. Roueche, Ely, and Roueche (2001b) have argued that there is no longer a question of whether technology should be in the remedial classroom, but rather how much, and to what ends. Technology is often woven into the college's instructional plan, and computer skills are incorporated into all courses and are considered basic competencies (MacDonald et al., 2002).

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Developmental students should be comfortable using computers to prepare their course assignments, design presentations, and create documents (Miles, 2000). They should also be comfortable conducting research and finding information on college websites, as well as using email and completing assignments online. According to an interview with Bob Hackworth, an innovator in developmental education, the development of technology and readily available online information will only enhance teaching and learning in the area of mathematics for students and faculty (Miles, 2000). The previously mentioned skills should be taught in developmental courses and orientation courses (Galbraith & Jones, 2006).

Most successful colleges use a blended method of teaching developmental courses (Engstrom, 2005; Galbraith & Jones, 2006; Miles, 2000). Lessons are designed to enhance a student's learning and performance. With real-world scenarios and interactive activities, students are engaged in the process of learning. In a report entitled *Increasing Success for Underserved Students: Redesigning Introductory Courses*, Twigg (2005) claimed instructional software and other web-based resources that support student engagement should replace the traditional lecture format. In particular, the software program *MyMathLab* (developed by Addison-Wesley Publishers) was effective in supporting verbal, visual, and discovery-based learning styles and can be accessed anytime at home or in a lab. With this program students receive instant feedback and guided solutions to incorrect answers.

Some community colleges may not be capable of offering a wide variety of web-based options for developmental math courses due to funding in terms of technology (i.e. web platform, student access, technical support, on-campus labs, faculty/student training). Lucas and McCormick (2007) reported that on average states spend more than $25 million annually for developmental education. With the rising cost of education and the increasing demand for

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access at the community college level, states need to work with legislatures and governing bodies for funding directed toward developmental education (p. 37).

In an article declaring the importance of developmental education written by James, Bruch, and Jehangir (2006) the following ideas were stated,

> Developmental education can be thought of as a bridge between students' familiar worlds and the unfamiliar world of college they are trying to navigate… One environment through which instructors can help students build strong, flexible, two-way bridges between home and higher education is a learning community, in which the same group of students is enrolled in two or more courses that are collaboratively designed and intentionally linked by organizing themes. (p. 10)

In an effort to address the learning skills and motivation issues that define the developmental math student, many universities and colleges are developing learning communities. Gabelnick, MacGregor, Matthews, and Smith (1990) defined learning communities as linked courses that enroll a common cohort of students for the purpose of structuring learning experiences to build a sense of community and foster connections between students.

One of the linked courses is appearing more often in a learning community is the first-year seminar; sometimes referred to as the freshman experience or orientation (Henscheid, 2004). Students in a learning community have shown higher academic achievement in their developmental math courses than their peers who did not participate in the community and faculty noted more enthusiasm in class, along with higher class attendance (Irvin, Cotton, Kimbrough, & Shaw, 2000). By linking the first-year seminar with the developmental coursework, institutions create the avenue for addressing content skills, motivation, and self-esteem of developmental students (Rhodes & Carifio, 1999).

Although first-year seminar courses using learning communities may be a productive strategy for developmental students at four-year institutions, very few community colleges have designated first-year seminar courses (Squires et al., 2009). All community colleges in the

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ACCS have some form of student orientation, but none have first-year seminar courses (ACCS, 2012). Squires et al. (2009) have suggested that first-year experience courses and/or learning community courses could be an encouraging alternative to traditional classroom settings for developmental students, especially in the area of mathematics (p. 886).

In the article *Restructuring Developmental Math Courses to Enhance Emotional Intelligence,* Wilkinson (2002) suggested that the five domains of emotional intelligence greatly affect the success of developmental students; therefore, pedagogical changes in the delivery of developmental courses need to address these issues. Wilkinson suggests recognizing the significance of instructors as emotionally intelligent role models; requiring journal writings to promote self-awareness and emotional management; implementing daily partner or group work exercises to build empathy, social competence, and self-motivation; and including effort as a component of a student's final grade to increase self-efficacy, hope, and optimism.

Fisher and Alley (2002) found that the number one reason students gave for their placement in a developmental math course was not being able to perform well on math tests. Thus, they conclude that testing strategies need to be incorporated into these math courses. Developmental students also believe that their success or failure is due to external factors (Kolajo, 2004). They lack an internal locus of control, so instructors must use strategies to emphasize student responsibility and the relationship between what they do and how they succeed.

Math anxiety is also a persistent problem for many developmental math students. Sheila Tobias discussed this issue in her keynote address to the 2001 NADE Conference (Armington, 2003c). She suggested that math anxiety is predominantly caused by environmental factors created by mathematics instructors. These factors include timed tests, absence of discussion,

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humiliation at the board, and instructors' teaching styles that do not consider students' learning styles. From the literature, it is clear that developmental instructors must have access to professional development resources. They should possess qualifications or experience beyond the minimum requirements to teach basic content skills and be well-versed in technological advances within their teaching discipline (Grant & Keim, 2002).

In *Crossroads in Mathematics: Standards for Introductory College Mathematics before Calculus* (Cohen, 1995), the American Mathematical Association for Two-Year Colleges (AMATYC) published standards for introductory college math courses. Standards for Intellectual Development address desired modes of student thinking and represent goals for student outcomes. While some of the topics in the Standards for Content go beyond the curriculum level of developmental math, the Standards for Intellectual Development and the Standards for Pedagogy reaffirm the best practices found in developmental mathematics.

In the report *Strengthening Mathematical Skills at the Postsecondary Level: Literature Review and Analysis*, prepared for the U.S. Department of Education (2005), researchers summarized the best practices found in developmental math as follows:

1. Instructional and pedagogical: adjuncts to traditional instruction; multiple delivery options from which students may choose; computer-assisted instruction; Internet-based; self-paced; distance learning; calculators; computer algebra systems; spreadsheets; laboratories; small group instruction; learning communities; contextual learning; linkages to and examples from the workplace; and career pathways;

2. Curriculum content: nonstandard topics covered in developmental math courses or topics that vary by career path; length of instruction; and types of activities used to reinforce the taught material;

3. Professional development: faculty training and development; full-time versus part-time instructors; and proportion of faculty members that are adjunct;

4. Supporting strategies: counseling, assessment, placement, and exit strategies; and

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5. Learner and institutional characteristics: full-time versus half-time community college student; socioeconomic attributes of learner; workplace versus academic learner; and having private or military employment versus preparing for a new career. (p. 4)

Both the AMATYC Crossroads publication (1995) and the U.S. Department of Education report (2005) stressed the need for technology to be infused into developmental math instruction. However, researchers reported that the studies that address the effectiveness of technology found no significant change in final grades, pass rate, or persistence in higher level math courses between traditional instructor-led versus computer-assisted instruction. They concluded that technology is most applicable as a supplemental tool; technology should not serve as the actual instructor; and that faculty members must be suitably trained in the use of appropriate technology based on state and institutional guidelines (U.S. Department of Education, 2005).

Providing students with multiple options for course delivery is a recommendation from both *Crossroads* and *Strengthening Mathematical Skills* (Cohen, 1995; U.S. Department of Education, 2005). In addition to the traditional lecture format, some of the delivery options being used are self-paced, computer-assisted instruction (sometimes called hybrid), on-line, and mastery learning (El Mansour & Mupinga, 2007; Murphy, 2007). Murphy (2007) found that some students grasp concepts better when taught using an alternate method to the traditional college lecture, such as hybrid learning.

> Hybrid learning is learning that mixes various event-based training activities, including face-to-face, instructor-led classroom training; live (synchronous) or recorded (asynchronous) Internet-based e-learning; and self-paced learning. Hybrid learning represents an alternative to traditional instructor-led training. The most important factor is that individuals can choose which type of learning best suits their personal learning needs. (p. 40)

Self-paced learning involves the instructor evaluating student skills from each chapter with a pre-test and making assignments based on the problems missed (Creery, 2001).

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In self-paced learning, students have access to teaching resources, such as the instructor to answer questions individually, tutors, videos produced for the textbook, and solution manuals, but a traditional lecture on each section of the chapter is not given (Creery, 2001). According to Murphy (2007), the best approach for a self-paced learning model would be when a post-test for each chapter is used to evaluate student progress. If a student does not pass the post-test, the instructor gives a new assignment for the material, and the student works until he or she masters the skills to pass the post-test. Students who complete the course requirements early have the option of beginning work on the next level developmental course. For example, a student who completes basic mathematics could move on to elementary algebra and finish two courses in one semester.

With large percentages of students working and parenting, an online education may be the most feasible or sole learning option (Lorenzetti, 2005). Computer-assisted instruction is a necessity for community college developmental education, and is normally referred to as the combination of traditional lecture and supplemental computer tutorial, drill and practice, or simulation activities (U.S. Department of Education, 2005). The online model provides instruction through the internet but can be supplemented by a textbook and tutoring (Creery, 2001). The student interacts with the instructor through email or bulletin board discussion groups.

Mastery learning uses a traditional lecture format for instruction, but allows the student to retake tests until the content is mastered (McClory, 2003). In the mastery learning model, "the meaning of failure shifts from assessment of ability to feedback about progress. When progress is deficient, students use feedback to continue learning the material, strengthening contingencies between effort and academic success" (Ironsmith & Eppler, 2007, p. 28). Assignments can be

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retaken using pencil and paper or web-based testing. For those students who do not master a certain test, additional instruction can be provided outside of the class through one-on-one tutoring, computer tutorials, or special review sessions given by the instructor.

Another important aspect of teaching developmental education involves assessment and feedback. Twigg (2005) has argued the importance of continuous assessment and feedback. In a landmark study involving 30 institutions redesigning their courses, all 30 used automated assessment and feedback in their new designs. Automating assessment and redesign facilitated repetition and increased both the specificity and the frequency of feedback to the students – pedagogical techniques that research has consistently claimed enhance learning (Engstrom, 2005). This pedagogy involved frequent quizzes online with a trial until progress format.

Teaching at the developmental level differs substantially from teaching at college level. Multiple delivery options for diverse talents and learning styles, computer-assisted instruction, self-paced models with frequent testing and feedback, learning communities emphasizing group work, collaboration between students and faculty and among peer groups of students are suggested by researchers as being among some of the best practices in postsecondary education (Boylan & Saxon, 2002; U.S. Department of Education, 2005; Wilson, 2005). In a study conducted by the National Center for Academic Transformation, Twigg (2005) reported the most prominent techniques for improving learning and in increasing success for underserved students were as follows: online tutorials, continuous assessment and feedback, increased interaction among students, individualized on-demand support, structural supports that ensure student engagement, and peers as learning assistants.

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Assessment and Placement

Retention is an important aspect of success for any developmental student. Therefore, an imperative aspect of the success of developmental programs must include assessment and placement. Young (2002) has suggested that promoting collaboration between high schools and community colleges is an important factor in correct college course placement. A proven misalignment exists between the expectations of college faculty members and the actual skills mastered by students in high school, especially in the areas of math and reading (Shelton & Brown, 2008). This gap continually occurs in spite of the importance placed on attending college and obtaining a degree.

A multi-faceted process can be used in an attempt to increase student retention (Klicka, 1998). Young (2002) has recommended that mandatory assessment and placement should occur at the institutional level. Faculty and the institution as a whole should collaborate and reach out to current students in order to increase retention. Furthermore, Young believes that retention often describes at-risk students as opposed to those not prepared, and educators need to define the difference in the two types of developmental learners.

In the state of Alabama, the ACCS (2012) requires incoming students to have an official ACT exam score or take the COMPASS test in mathematics, reading, and/or English for appropriate placement into college courses. The COMPASS placement test is utilized by all Alabama community colleges as deemed by the state board of education. The only way to bypass placement by ACT or COMPASS score, a student must have instructor approval to enroll in the course.

Some critics argue that requiring mandatory assessment and placement results in self-esteem problems for students by forcing them to take unwanted and expensive classes that do not

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provide college credit or transfer (Byrd & MacDonald, 2005). Proponents maintain that students must be made aware of the importance of this foundational learning (Young, 2002). Ashburn (2007) cited the 2007 Community College Survey of Student Engagement (CCSSE) which stated "more than a third of students said they had not completed any course-placement tests after a month in college, even though most colleges say they require all students to take such tests" (p. A30).

The COMPASS assessment is used by many colleges and universities to determine a student's need for developmental education courses (Armington, 2003b). Sheila Tobias, during her keynote address at the 2001 National Association of Developmental Education Conference, emphasized the need for colleges to give the opportunity for students to prepare for placement exams (Armington, 2003c, p. 2). If students are not given the opportunity and the information to prepare for the placement exam, accuracy of results could be affected, and the goal of proper placement could be undermined. For effective placement, information on testing procedures and review information should be provided for students (Byrd & MacDonald, 2005).

Because of inherent problems with computerized placement, some educators advocate that additional testing needs to be done the first day of class to ensure proper placement (Moon, 2003). Another model that could address the placement issue is to design an accelerated developmental curriculum that would allow a student to complete more than one course in a semester. Adelman (1996) has suggested that tests could be given repeatedly throughout the semester and claims:

> More and more community colleges are currently supplementing their basic skills tests by retesting students in previously identified areas of deficiency on the first day of remedial class instruction so as to target specific needs accurately, reevaluate skill levels, and even move students up to a higher level if they score well enough. (p. 56)

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This early exit practice can reduce student frustration, resulting from sitting through classes with mastered content, while allowing a reduction in class size for those students who need more individualized attention (Ironsmith & Eppler, 2007).

Once effective placement policies are established, it is equally important for developmental students to be properly advised (Ashburn, 2007). It is essential that advisors who work with developmental students be trained in the diverse issues that affect this student group. Even terminology such as "developmental" can create a negative self-image, so advisors must be sensitive and employ effective strategies for encouraging these students (McClory, 2003).

Course selection is another issue for which advisors of developmental students must be trained (Ashburn, 2007). Placing students in college level courses that require the skills these students are deficient in will lead to student failure. Although course selection may be relatively easy within content areas, it is a bit more nebulous across disciplines. For example, should a student who is required to take developmental reading be advised to take a general psychology or history course at the same time? A skilled advisor who had been trained in course selection would be capable of making an educated decision within this scenario (Ashburn, 2007).

The Board of Regents of the University System of Georgia dealt with these advising concerns by establishing a list of allowable courses that students could take while they are completing their developmental coursework (1997). Likewise, Piedmont Virginia Community College required each department to submit the reading, writing, and math requirements of specific regular courses. The college, then, established a Pathways List that identified the minimum competency levels required of students to enroll in each course offered at the college. This list was disseminated to the Advisement Center, as well as to the academic advisors (McCusker, 1999).

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In a 2004 study at The University of Wisconsin, 82.5% of developmental students believed that a remedial English course would help them succeed in future English courses. However, 92.4% of these students indicated developmental courses should count for credit hour (Horner, 2004). Current research suggests that students resent being placed in remedial courses that do not earn credit hours. In fact, Bruce Horner, Director of Composition at The University of Wisconsin, argues that placement into remedial courses is one of the barriers to student success. Being placed into a noncredit course signals to remedial students they do not belong to the college. This discouraging signal slows their progress toward earning a degree by preventing them from taking other courses required by graduates (Byrd & MacDonald, 2005).

To increase the retention and success of developmental students, The University of Wisconsin has introduced a new program focusing on first-year student success. In its recommendation to organize for student success, their newly formed Black and Gold Commission outlined a two-part operational plan that includes a call to design for credit course and a framework for monitoring class completion rates (Horner, 2004).

The Need for Continued Improvement of Mathematics Education

The National Council of Teachers of Mathematics (2000) has outlined the need for mathematics in our ever-changing world:

> New knowledge, tools, and easy of doing and communicating mathematics continue to emerge and evolve. Calculators, too expensive for common use in the early eighties, now are not only commonplace and inexpensive but vastly more powerful. Quantitative information available to limited numbers of people a few years ago is now widely disseminated through popular media outlets. The need to understand and be able to use mathematics in everyday life and in the workplace has never been greater and will continue to increase. (p. 4)

In today's varying global society, those students who understand and can perform mathematical skills at the community college level will have significantly enhanced opportunities. Skills

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taught and learned in even the most fundamental college-level mathematics courses are used in all occupations (NCTM, 2000). Mathematical competence is a necessary instrument in today's society where technology abounds.

The NCTM *Principles and Standards* (2000) outlines six principles for mathematics: 1) equity – high expectations and strong support for all students; 2) curriculum – coherent, focused, and well articulated across all courses; 3) teaching – understanding what students know and need to learn, then challenging achievement; 4) learning – actively building new knowledge from experience and prior knowledge; 5) assessment – furnish useful information to students and educators; and 6) technology – essential for teaching and learning mathematics. These principles depict exact features of high-quality mathematics education at any educational level.

NCTM Principle One: Equity

The equity principle states that mathematics is an obligation for students, and all students are capable of learning at some level:

> All students regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study – and support to learn mathematics. Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students. (NCTM, 2000, p. 12)

In the United States, students are expected to learn to read and write in the English language, but as a society, we believe that only some students are capable of learning mathematics.

According to study results by Bahr (2007), community college level students who were provided with mathematics remediation and successfully completed these courses achieved at an equivalent level as those who did not place into the remedial courses. He further claimed that students taking multiple developmental math courses eventually performed at the same level in for-credit math courses as those students who took none. This fact seems to prove that when the

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playing field is deemed equal, all students would have the opportunity to succeed in college-level mathematics courses whether they initially placed into remedial courses or not.

In addition, the NCTM (2000) declared that students in mathematics courses must have access to technology and other instructional tools that aid in understanding. Instructors must attend professional development seminars for new and innovative teaching strategies and supplemental materials may be needed within these developmental mathematics courses in order to attain equity for students.

NCTM Principle Two: Curriculum

The curriculum taught at the community college level is typically mandated by the state in which they are located. Local instructors should make all attempts to participate in the curriculum selection process at the state level, using the following criteria:

> Mathematics comprises different topical strands, such as algebra and geometry, but the strands are highly interconnected. The interconnections should be displayed prominently in the curriculum and in instructional materials and lessons. A coherent curriculum effectively organizes and integrates important mathematical ideas so that students can see how the ideas build on, or connect with, other ideas, thus enabling them to develop new understandings and skills. (NCTM, 2000, p. 15)

The curriculum must be a fluid model that connects mathematics taught at the high school level with that taught in college, community and four-year. In 2003, the Stanford University Bridge Project investigated the relationship between placement tests at the high school and community college level. A disconnect was found between the two educational levels and a suggestion was made that states examine the connection linking high school standards and postsecondary placement testing (Venezia, Kirst, & Antonio, 2003). If these disconnects could be pinpointed, the transition between secondary and collegiate mathematics courses could be less problematic.

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Students often believe that the study of mathematics as a whole is useless because the only groups of people they view as using it are mathematics instructors and statisticians (Steen, 2007). Math departments, especially those teaching developmental/remedial courses, should emphasize the study and usefulness of mathematics, just as reading and writing are now emphasized across the curriculum.

NCTM Principle Three: Teaching

As stated before in this review of literature, faculty in developmental education must be chosen carefully (Galbraith & Jones, 2006; Miles, 2000). The teaching principle clarifies that mathematics instructors, despite the level of courses taught, need a number of diverse kinds of mathematical knowledge:

> Deep, flexible knowledge about curriculum goals and about the important ideas that are central to their grade level; knowledge about the challenges students are likely to encounter in learning these ideas; knowledge about how the ideas can be represented to teach them effectively; and knowledge about how students' understanding can be assessed. (NCTM, 2000, p. 17)

With an understanding of how students process taught concepts in various courses, instructors can become more effective teachers.

Friedlander and Serban (2004) proclaimed that in order to meet the challenge of accurately assessing community college students in remedial courses, institutions should provide or appropriate monetary resources for professional development opportunities at the subject level. As part of the teaching principle, the NCTM (2000) declared that numerous teaching strategies and methodologies can be used to assist students in productively mastering math concepts. Successful techniques used by one instructor may not deem successful for others, even when teaching the same concepts.

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According to Farrell (2006), mathematicians must in general become improved teachers. Instructors must continually strive to improve their teaching practices especially in the area of developmental mathematics. Instructors teaching developmental math courses may need to use non-standardized grading procedures and unorthodox teaching tactics. Also, interactive classrooms with student-to-student or student-to-computer learning may be utilized with an abundance of instructor supervision and support.

NCTM Principle Four: Learning

Students must be able to absorb and retain mathematical information in order to be an autonomous learner. The learning principle states that students have supplementary learning at a higher level when they can take control of their individual learning experience, particularly in mathematics courses (NCTM, 2000). Mathematics must be a developed by a pyramid approach where a firm foundation is first developed and extra layers are added as understanding occurs (Ironsmith & Eppler, 2007).

A tracking study completed by Berry (2003), affirmed that despite the fact that the majority of incoming community college freshmen had taken Algebra II or higher at the secondary level, these students still did not place into non-remedial courses. The material had been covered based on the demands set forth by the curriculum and high school exit exams, yet students did not fully understand the concepts well enough for mastery to occur:

> Unfortunately, learning mathematics without understanding has been long a common outcome of school mathematics instruction. In fact, learning without understanding has been a persistent problem since at least the 1930s, and it has been the subject of much discussion and research by psychologists and educators over the years (e.g., Brownell, 1947; Skemp, 1976; Hiebert & Carpenter, 1992) . . . In the twenty-first century, all students should be expected to understand and be able to apply mathematics. (NCTM, 2000, p. 20)

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Despite the fact that many students had difficulty learning math in high school, an additional group of students did not learn with enough understanding for retention into college-level courses (Bailey & Cho, 2010).

NCTM Principle Five: Assessment

The assessment principle states that assessment needs to be an incessant process between the instructor and student. Students should be assessed using a variety of methods so instructors can view their performance under varied conditions (NCTM, 2000). Also, faculty members should draw on the assessments to manipulate their teaching styles and guide classroom interactions. Banta et al. (2004) claimed that community college faculty members have realized that previously used assessment tools such as the ACT Collegiate Assessment of Academic Proficiency (CAAP) are of limited value in assessing actual student learning and understanding. They further declare that faculty of community college programs have begun to develop local assessment approaches based on student performance, such as capstone projects, portfolios, and internship experiences.

Open-ended and constructed-response questions, observations, conversations, selected-response items, performance tasks, portfolios and journals can all be utilized in mathematics courses as suitable assessment techniques (Wheland, Konet, & Butler, 2003). Obviously, assembling evidence from a variety of sources would offer a broader view into the actual assessment of a student in developmental education courses. The differing assessment methods could help those developmental students with understanding and course progression, which according to Waycaster (2001) may assist in retention and graduation at the community college level.

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NCTM Principle Six: Technology

The integration of technology within the mathematics classroom can be extremely beneficial (MacDonald, Vasquez, & Caverly, 2002; NCES, 2002; Stumpf, McCrimon, & Davis, 2005). Technology offers instructors a means to adapt their teaching methods for varying student needs:

> Electronic technologies – calculators and computers – are essential tools for teaching, learning, and doing mathematics. They furnish visual images of mathematical ideas, they facilitate organizing and analyzing data, and they compute efficiently and accurately. They can support investigation by students in every area of mathematics, including geometry, statistics, algebra, measurement, and number. When technological tools are available, students can focus on decision making, reflection, reasoning, and problem solving. Students can learn more mathematic more deeply with the appropriate use of technology. (NCTM, 2000, p. 24-25)

Faculty members need to take advantage of web-based training seminars and other resources to familiarize themselves with the ever-changing technological offerings in the area of mathematics.

Conclusion

This literature review has attempted to provide details of best practices for teaching and learning in the area of developmental mathematics at the community college level. It examines community college developmental students with an emphasis on those enrolling in mathematics, mathematics anxiety and its prevalence among developmental math students, best practices for developmental mathematics programs, and the continual need for improvement in developmental mathematics courses in community colleges. The findings in this review indicate that developmental math instructors and students have numerous barriers to overcome to promote progress and success.

In order to thrive, community college developmental education requires college presidents, trustees, chief academic officers, faculty, and staff to play a central role in creating

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the instructional framework conducive to successful developmental education outcomes. In their studies of exemplary practices, both Boylan and Saxon (2002) and Roueche and Roueche (1999) concluded that positive student outcomes were more likely to be achieved when institutional leaders established high standards for success and expected everyone involved in the developmental education effort to strive toward achieving program goals. Opportunities for student success must be created by crafting the instructional framework most beneficial to student outcomes, which must be college-wide.

Specifically, the literature suggests that successful developmental mathematics programs can be attributed to several factors such as structural organization, faculty's commitment to success, faculty and student attitudes, practices for teaching methods and course delivery, and mandatory assessment and accurate placement (Boylan & Saxon, 2002; Perin, 2004; Wheland et al., 2003). Some community college developmental programs are not utilizing this data to assess their instructors, courses, and programs. Students are placing into incorrect courses in which they are bored or often fail; possibly creating a negative college experience in a subject area that is already not preferred. Too, the stress of placing into developmental courses causes a feeling of math anxiety in students at all age levels. Therefore, it is imperative to create a positive learning experience for the academically unprepared in developmental mathematics programs.

Based on the review of literature, best practice for a mathematics developmental education program should include the following critical elements:

1. Centralized remedial services such as counseling, tutoring, advising, and workshops that provide support to this designated population of students (Perin, 2004; Roueche & Roueche, 2001b; Wallin, 2004);

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2. Faculty members who value the success of developmental students and the program, are carefully chosen and prepared to identify student strengths and weaknesses in math, are connected to the college by being on campus as full-time instructors with designated office hours, are integrated among instructors who teach credit courses and may teach developmental courses as well, and are trained in math pedagogy and current technology (Boylan & Saxon, 2002; Galovich, 2007; Maciejewski & Matthews, 2010; Wheland et al., 2003);
3. The development of students that experience positive, meaningful, and valuable math learning (Bettinger & Long, 2005; Kolajo, 2004; Levin & Calcagno, 2008; Perin, 2006);
4. Teaching methods and course delivery options including blended teaching method with traditional lecture and web-based resources; increased student interactions to promote self-efficacy and self-awareness; acknowledgement of math anxiety and ways to combat this dilemma; and multiple options for course delivery such as traditional, self-paced with post test, computer assisted, online and mastery learning (Daniel, 2000; Engstrom, 2005; MacDonald et al., 2002; Sheldon & Durdella, 2010); and
5. Student preparation for the placement test (COMPASS) and advising to assist with course selection across disciplines to promote academic success for students enrolled in developmental courses (Byrd & MacDonald, 2005; Ironsmith & Eppler, 2007; Moon, 2003; Young, 2002).

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CHAPTER III:

METHODOLOGY

Context of the Study

The study was set in the Alabama Community College System (ACCS), which is governed by the Alabama State Board of Education consisting of an appointed chancellor and elected state board members. This comprehensive community college system provides academic and technical degree/certificate programs, workforce development training, and adult education to approximately 300,000 people annually (Alabama Community College System, 2012). Approximately 125,000 of those individuals are enrolled in courses for obtaining college credit.

The ACCS is committed to providing low tuition rates, open enrollment, and statewide locations for the citizens of Alabama and beyond. The system prides itself on five key values: 1) integrity; 2) excellence; 3) accessibility; 4) accountability; and 5) diversity. Additionally, the ACCS instructional faculty consisted of 4,451 adjunct employees and 2,012 full-time employees in fall 2010. These numbers produced a faculty-to-student ratio of 14:1.

According to statistics published by the Alabama Commission on Higher Education, in the fall 2009 semester, 94,599 students were enrolled in two-year public institutions. Of these students, 18,675 or 19.7% were enrolled in a remedial math and/or English course. More than 12,000 of these remedial students were less than 25 years old. In the fall 2010 semester, enrollment increased in Alabama Community Colleges (98,477), and so did the number of students taking remedial math and/or English courses (20,561 or 20.9%) (ACHE, 2012). It

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appears that although additional students are enrolling in the community college, more and more continue to place into developmental courses.

A study of developmental mathematics programs, instructors, and students was conducted. The purpose of this study was to determine if students at selected Alabama community colleges are involved in remedial mathematics activities that are documented in the literature as best practices. Within this study, the researcher used a non-random convenience sampling strategy to study developmental programs at the community college level based on comments provided by faculty members and students who are presently involved in developmental mathematics courses (Larson & Farber, 2009; Merriam, 1998).

Based on the size of the Alabama Community College System and the proximity of the colleges, the researcher studied three community colleges in the ACCS: Large Community College (LCC), Medium State Community College (MCC), and Small Community College (SCC). These colleges were selected for this study based on enrollment statistics (see Table 1), developmental mathematics courses offered, location of the campuses, demographics of students and faculty, and familiarity of instructors who could aid in the logistics of student surveys and focus groups (Marshall & Rossman, 2006). Additionally, these three community colleges serve contiguous service areas and are located in rural locations of the state.

Based on spring 2011for-credit enrollment numbers, LCC served more than 11,000 students; MCC served more than 7,000 students; and SCC served more than 3,000 students (ACCS, 2012). All three of these community colleges offer two remedial mathematics courses: *Elementary Algebra* (MTH 098) and *Basic Mathematics* (MTH 090). Both courses are taught by full-time and adjunct faculty members at all three locations as well.

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The mission of the Alabama Community College System is to provide an excellent source of academic education, adult education, and workforce development training with an open-door enrollment policy (ACCS, 2012). The community colleges that were chosen for analysis strive to accomplish this mission. These three colleges depict numerous characteristics of the Alabama Community College System as shown in the following table.

Table 1

Characteristics of the Community College Sites Studied

Institution	Enrollment	Students Enrolled in Remedial Courses		
		Course	Number of Students	Percentage
Large Community College	12,139	Total	2,411	19.9%
		Math only	1,014	8.4%
		English only	621	5.1%
		Math & English	776	6.4%
Medium Community College	6,374	Total	1,160	18.2%
		Math only	817	12.8%
		English only	109	1.7%
		Math & English	234	3.7%
Small Community College	2,483	Total	493	19.9%
		Math only	279	11.2%
		English only	71	2.9%
		Math & English	143	5.8%
Alabama Community College System (all)	98,477	Total	20,561	20.9%
		Math only	11,398	11.6%
		English only	3,421	3.5%
		Math & English	5,742	5.8%
Sample Average	6,999	Total	1,355	19.3%
		Math only	703	10.8%
		English only	267	3.2%
		Math & English	384	5.3%

Note. Data provided by each institution based on fall 2010 enrollment.

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The review of literature provided affirmation that research has been conducted in the area of mathematics education. On the contrary, little research has been conducted regarding remedial courses in community college mathematics. Should college students be forced to take remedial courses, especially in math, English, and reading? Will the students be able to succeed in college-level courses if they are under-prepared? Also, does the responsibility of remedial/developmental education fall into the community college realm?

The intent of this research was to determine if students at selected Alabama community colleges are involved in remedial mathematics activities that are documented in the literature as best practices. The study established some common themes in developmental math courses with an emphasis on best teaching and learning practices. The study focused not only on the developmental student, but also on college resources and instructors specific to remedial mathematics education.

Framework of the Study

Data was collected to identify the linkage between documented teaching and learning best practices and developmental math programs at three Alabama community colleges. As found in the literature review, the best practices included 1) centralized remedial services; 2) faculty members who value success and are carefully chosen, connected to the college, and integrated among for-credit instructors; 3) development of students that experience positive, meaningful, and valuable math learning; 4) varied teaching and course delivery methods; and 5) student preparation for the placement tests and advising to assist with course selection (Boylan & Saxon, 2002; Perin, 2004; Wheland et al., 2003).

In terms of structural organization, developmental math programs are either centralized or decentralized (Perin, 2004; Wallin, 2004). Faculty members teaching in these programs may

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not have scheduled office hours or work full-time at the institution. Also, centralized programs may have designated technology labs with assistants, accessible tutoring labs, counseling, and other student support services readily available for students enrolled in developmental math courses (Perin, 2004; Roueche & Roueche, 2001b).

Faculty members in developmental programs must be committed to success. These instructors progress through a series of departmental outcomes, such as proper orientation and mentoring, successful completion of courses, and eventually curriculum development. Developmental mathematics educators must be willing to try various strategies and be attentive to current teaching trends (Galovich, 2007).

Student and faculty attitudes are a crucial component to successful developmental programs, especially in mathematics (Grubb & Cox, 2005). Faculty members must provide encouragement to students using positive learning experiences. In addition, students must strive to overcome any math anxiety that might have developed in grade school or previous courses (Sheldon & Durdella, 2010).

In an increasingly technological culture, developmental programs must find a balance between face-to-face instruction and digital course design (Engstrom, 2005). Course delivery and teaching methods must be constantly evaluated and modified based on current student populations. Multiple delivery options can be provided to accommodate a wide variety of learning styles and academic levels (Ironsmith & Eppler, 2007). Also, learning communities, linked courses, and cohort groups have been documented as providing positive support for student success.

Assessment of prior knowledge when enrolling in community colleges is often a formality that some students do not take seriously (Young, 2002). Assessment and placement

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into courses, especially at the developmental level, can help increase retention rates, but can also enhance self-esteem problems in at-risk students (Byrd & MacDonald, 2005). Through proper advising, developmental students can be reassured that while it is often discouraging to place into a non-credit course, it is not a roadblock for transfer or graduation (Ashburn, 2007).

Research Design and Questions

Students currently enrolled in developmental mathematics courses were provided with a survey consisting of closed and open-ended questions. In addition, instructors teaching developmental mathematics courses completed the survey and were interviewed. Student focus groups met and the researcher used guided questions to further discuss the developmental courses and their perceptions on the courses/developmental mathematics. Statistics for developmental course completion and pass rates were calculated for comparison among the three selected institutions and with statewide Alabama community college statistics.

The following research questions served as a guide for the study:

1. Are best teaching and learning practices for developmental mathematics found in the literature review being implemented at certain community colleges in Alabama;
2. What are the most important identifiable needs for students enrolled in developmental mathematics courses at certain Alabama community colleges;
3. What are the attitudes toward developmental education of students currently enrolled in developmental mathematics courses at specified Alabama community colleges; and

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4. What are the attitudes toward developmental education of instructors currently teaching developmental mathematics courses at specified Alabama community colleges?

Data Collection

The study took place during the spring 2013 academic semester. Data were collected by using qualitative and quantitative research. Qualitative methods of interviewing, focus groups, and student surveys were used to identify if documented best practices and methods are being incorporated into remedial mathematics education at the community college level. These research methodologies were incorporated to establish student and faculty attitudes/opinions toward remedial education and its processes at the three specified Alabama community colleges. Padgett (2004) claimed the following regarding data:

> Quantitative data are collected in bits, stored in bytes, and interpreted via statistical analyses where hypotheses are tested by aggregating (and reaggregating) the data. Qualitative knowledge is based not on decontextualized bits of information, but on weaving back and forth between local context and conceptualization. Only humans are sentient beings who can connect the dots. (p. 4)

The quantitative research component consisted of survey items that describe demographic, educational, and attitudinal characteristics of the developmental students.

In order to answer the research questions identified in the study, data were collected (see Table 2) by the researcher in a three-part process consisting of student surveys (see Appendix A), instructor interviews (see Appendix B), and student focus groups (see Appendix C). The researcher obtained permission to conduct the study at each of the three community colleges by contacting the college academic dean and the developmental mathematics department head (see Appendix D). The researcher made initial contact for permission to college personnel via campus e-mail, insuring that precautions were taken to protect the identity of all participants.

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Table 2

Data Collection Methods

Collection Method	Number of Participants	Time Needed
Student Survey	50 – LCC 50 – MCC 50 – SCC	20 Minutes
Student Focus Groups	8 – LCC 9 – MCC 6 – SCC	Up to 75 Minutes
Instructor Interviews	3 – LCC 3 – MCC 3 – SCC	30 – 45 Minutes

Once permission was obtained, the researcher arranged for the study-specific survey instrument to be distributed by the course instructor to developmental mathematics students at each of the three community colleges (LCC, MCC, and SCC), which served as the population. The student survey consisted of structured and unstructured questions with non-biased, unambiguous wording (Leedy & Ormrod, 2010). Characteristics of the population based on best practices determined by the literature review were investigated using student responses (Larson & Farber, 2009).

Students were asked to voluntarily complete the anonymous survey in a time frame of approximately 20 minutes. Leedy and Ormrod (2010) stated that a survey questions should be concise and able to be answered within 20 minutes or the participants might lose interest. The researcher numbered and coded all student surveys with the name of the community college where they were enrolled. Lastly, the probability method of simple random sampling was used

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to select a sample of 50 students from each community college using a random number generator.

According to Larson and Farber (2009), the necessary sample size for the study depends on the size of the population. The determined sample size should be 10% to 20% of the entire population. The researcher purposefully chose a sample size of 50 students from each of the three participating colleges based on the school with least enrollment (SCC). Small Community College enrolled 279 developmental mathematics students in fall 2010. A sample size of 50 students was approximately 18% of the developmental mathematics student population at SCC, 6% at MCC, and 5% at LCC.

Moreover, the study included interviews from at least three instructors presently teaching developmental mathematics courses at each college. The interview questions were developed based on the best practices of successful developmental math programs as recognized in the literature review. The interview was used to expose in-depth information that cannot be gathered from a questionnaire. The interview lasted 30-45 minutes and consisted of open-ended questions for free response (Padgett, 2004).

Names and contact information for these instructors was obtained by the researcher from the college dean. The researcher contacted all instructors via campus e-mail to schedule an interview. Interviews were conducted with the first three respondents from each college. These instructors were interviewed in order to provide the researcher with personal responses regarding teaching practices in developmental courses, professional development offered, the overall developmental program, and students at their specific campus. The interviews were conducted in-person and the interviewees were provided with an interview guide via e-mail by the researcher within 48 hours of agreement to be interviewed.

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All persons being interviewed were asked to sign a form to release access of their thoughts and direct quotations. The interviews were recorded and transcribed to guarantee accuracy, and the researcher took notes and made observations during each interview. Each participant was assigned a code used for anonymity based on their college and the order in which they were interviewed; therefore, instructor names were not recorded or used in transcription.

The interview consisted of well thought-out questions established by the researcher based on the areas of best practice discussed in the literature review. The initial interview questions were used to answer the study research question, followed-up by more direct questions regarding practices at their college. To conclude, the researcher asked each interviewee to provide some further recommendations and final comments about developmental mathematics at the community college level.

Lastly, student focus groups were conducted by the researcher at each of the three community colleges. With assistance from instructors teaching developmental mathematics, 6 to 10 students who completed the student survey were chosen at each institution to interact and provide feedback to the researcher during guided group discussions (Larson & Farber, 2009). The student focus group participants were chosen by the non-probability sampling method of convenience (Farber & Larson, 2009). Convenience sampling allowed the researcher to take student volunteers based on a specific meeting date and time at the college.

Student focus group meeting specifics (i.e. date, time, campus location) were coordinated with assistance from math instructors at each school. These focus groups allowed students to freely comment on the developmental program/classes at their college. These discussions lasted up to 75 minutes (length of one class period) and were recorded and transcribed to establish

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common themes on the subject of developmental mathematics programs (Leedy & Ormrod, 2010).

In an attempt to eliminate any researcher bias, the interview/discussion questions were asked in an established order set by the researcher at each meeting. Throughout the study, the researcher strived to minimize bias based on the subjectivity of qualitative research. The researcher avoided framing questions or anticipating answers. Furthermore, the interview and student focus group recordings were transcribed by a non-partisan transcriber (Merriam, 1998).

Data Analysis

Data collected from student surveys, faculty interviews, and student focus groups were coded and arranged into categories. The categories assisted the researcher to uncover commonalities within the samples. Coding of the data was completed by computer software and the aid of a qualitative lab assistant to assure non-bias and create internal validity within the study (Merriam, 2009). The researcher reviewed the coded data and compared similarities and differences between the software.

The researcher condensed the found data. Emerging themes were established from the research based on the responses of students and faculty members. Finally, the researcher examined and compared the responses of the developmental mathematics students to those of the faculty teaching the courses.

Due to the nature of qualitative research, the researcher utilized a variety of methods to establish trustworthiness and validity for the study (Merriam, 2009). Six strategies were established to provide rigor in qualitative research. Three of the strategies were used throughout the collection and analysis of data in this study: triangulation, auditing, and member checking.

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Triangulation is one of the earliest strategies used in qualitative research. Triangulation is the use of data from two or more sources (Padgett, 2004). A comparison of findings to scholarly, peer-reviewed literature, surveys, transcribed interviews and focus groups, and document review will provide triangulation for the study. Member checking and auditing are more recently developed strategies for providing trustworthiness in qualitative research.

The data collected must be audited to ensure quality control and non-bias opinions from the researcher. Providing an audit trail using careful documentation also allowed data to be free of the researcher's interpretations. An auditor outside of the study is suggested and can increase the reproducibility of the study (Padgett, 2004). Researcher interview notes, detailed lists of study participants, and survey notes assist to detail an audit trail for the study.

Member checking was the third technique utilized to provide study creditability. Member checking allows the researcher to verify data collected with the study respondents (Padgett, 2004). The researcher incorporated member checks into each interview. These member checks allowed the researcher to take data back to the interviewee in order to establish plausible results.

Assumptions and Limitations

The following assumptions served as a basis for this study of developmental mathematics programs: (a) the survey was completed by 50 students at three different community colleges; (b) the student survey, instructor interviews, and student focus groups provided sufficient data to answer the study research questions; and (c) all data were self-reported accurately by the chosen samples. Limitations of the study include the following: (a) the study was restricted to three community colleges in the Alabama Community College System; (b) a limited number of instructors and students was asked to respond to questions; (c) truly random sampling of students

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was impossible and would not ensure that the sample truly represent the population; (d) the study only focused on the area of developmental courses in mathematics; and (e) the results cannot be generalized because the three community colleges serve the same population of students.

Summary

Based on student surveys, instructor interviews, and student focus groups, data will be collected regarding developmental mathematics courses presently offered at three Alabama community colleges. These data may possibly be used to provide guidance and direction for students and instructors in the area of remedial mathematics. In addition, the data obtained could be used to develop insight into the questions that the researcher is attempting to answer contained in this study. After the conduction of research and analysis of data, the findings were further discussed in a future chapter. These findings were discussed by colleagues at each institution to analyze and enhance their developmental mathematics programs.

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CHAPTER IV:

RESULTS OF THE STUDY

The purpose of the study was to determine if students at selected Alabama community colleges (Large Community College, Medium Community College, and Small Community College) are involved in remedial mathematics activities that are documented as best practices. Data were gathered using three collection approaches: student surveys, faculty interviews, and student focus groups. The results of the data collected are presented in this chapter.

Demographic Data

Surveys were administered to 150 students (50 at each of the three colleges). These students were currently enrolled in MTH 098 (Introductory Algebra) or MTH 090 (pre-algebra), which are developmental courses for no college credit. The first 50 students at each college willing to participate were given the survey during their math course, granted that they were at least 19 years old. Although the student survey contained 20 questions, not all students answered all questions.

As shown in Table 3, the majority of students were enrolled in MTH 098. In addition, the majority of surveyed students (63.3%) were female and Caucasian (72%). The average age of the survey respondents was 26.6 years old with ages ranging from 59 to 19. Of the developmental students completing the survey, 48% had taken a mathematics course within the past year or less, whereas it had been more than five years for 33.3% of the respondents. Interestingly, the highest level of mathematics taken in high school was almost equally dispersed

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for the group: Algebra II/Trigonometry/Calculus – 24.7%; Geometry – 25.3%; Algebra I – 24.7%; and General Math – 22%.

Table 3

Demographics of Survey Participants

	LCC		MCC		SCC		All	
	f	%	*f*	%	*f*	%	*f*	%
Course Currently Enrolled								
MTH 098	36	72	25	50	37	74	98	65.3
MTH 090/091	14	28	25	50	13	26	52	34.7
Gender								
Female	30	60	31	62	34	68	95	63.3
Male	20	40	19	38	16	32	55	36.7
Ethnicity								
African American	11	22	3	6	5	10	19	12.7
Asian	0	0	0	0	0	0	0	0
Caucasian	32	64	41	82	35	70	108	72
Hispanic	4	8	2	4	6	12	12	8
Native American	1	2	2	4	2	4	5	3.3
Other	2	4	2	4	2	4	6	4
Highest Level of High School Math								
Alg II/Trigonometry/Calculus	15	30	10	20	12	24	37	24.7
Geometry	11	2	17	34	13	26	41	25.3
Algebra I	11	22	9	18	17	34	37	24.7
General Math	12	24	13	26	8	16	33	22
Length of Time Since Last Math Class								
1 Year or Less	24	48	19	38	29	58	72	48
2 Years	4	8	7	14	8	16	19	12.7
3 – 5 Years	7	14	5	10	3	6	15	10
More Than 5 Years	13	26	17	34	10	20	40	33.3

Focus groups were conducted at each of the three selected community colleges in order to provide information and express student opinions regarding their developmental mathematics experience. Students who had completed the survey were asked to volunteer to take part in a

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group discussion on a specified day and time at their campus. Of the student volunteers wishing to participate in the focus groups, only one of the students who signed up did not return to participate on the specified date. The majority of the participants were female (56.5%) and enrolled in MTH 098 (78.3%). The average age of the focus group members was 26.6 years old, which was interestingly identical to the entire group completing the student surveys (see Table 4).

Table 4

Demographics of Focus Group Participants

	LCC		MCC		SCC		All	
	f	%	*f*	%	*f*	%	*f*	%
Gender								
Female	4	50	4	44.4	5	83.3	13	56.5
Male	4	50	5	55.5	1	16.7	10	43.5
Courses Currently Enrolled								
MTH 098	6	75	6	66.7	6	100	18	78.3
MTH 090/091	2	25	3	33.3	0	0	5	21.7

Interviews were conducted with three instructors that were currently teaching developmental mathematics at each selected community college. Maciejewski and Matthews (2010) have claimed that individuals teaching college mathematics arrive at their position through a variety of ways that are extremely unique; it is rare that two instructors follow the exact same path that lead to teaching college mathematics. The instructors interviewed did have a variety of degrees earned and years taught in K-12 (elementary, middle, or high school) and higher education (see Table 5).

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Table 5

Demographics of Instructor Interview Participants

Institution	Teaching Experience		Degree(s) Earned	Gender
	K-12	CC		
Large Comm. College				
Interview 1	5	3	BS, MA	Female
Interview 2	2	2	BS, MA	Female
Interview 3	7	2	BS	Female
Medium Comm. College				
Interview 1	7.5	9	BS, MA	Male
Interview 2	3	1.5	BS	Female
Interview 3	11	5	BS, MA	Female
Small Comm. College				
Interview 1	42	4	BS, MA, EdS	Male
Interview 2	3	10	BS, MA, EdS, EdD	Female
Interview 3	0	19	BS, MBA	Female

Note. K-12 = Elementary, Middle, and/or High School, CC = Community College

Data Collection Results

Research Question 1

The first research question asked, "Are best teaching and learning practices for developmental mathematics found in the literature review being implemented at certain community colleges in Alabama?" The best teaching and learning practices based on the review of literature (located in Chapter II) include five critical elements: 1) centralized remedial services; 2) faculty members who value success and are carefully chosen, connected to the college, and integrated among for-credit instructors; 3) development of students that experience positive, meaningful, and valuable math learning; 4) varied teaching and course delivery methods; and 5) student preparation for the placement tests and advising to assist with course

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selection. To answer this research question, specific data collected from student surveys and student focus groups precisely related to the five critical elements was analyzed. At least some component of all five stated best practices were being implemented at all three community colleges.

Remedial Services. According to Perin (2004, 2002), the organization of developmental education and services provided to students enrolled in developmental courses have a direct impact on student success. Remedial services such as career counseling, tutoring, academic advising and workshops provide much needed support to students enrolled in developmental mathematics courses. Roueche and Roueche (2001b) have claimed that the quality of these student services can be used to determine the effectiveness of the entire developmental program.

The selected community college developmental programs offer all of these services, but many developmental students do not take advantage of these offerings (see Table 6). Of the survey respondents, 71.3% were aware of academic advising, 38% of career counseling, 81.3% of tutoring, and 29.3% of available workshops. More than 50% of students surveyed stated that although they had knowledge of the remedial services provided by their community college, they did not utilize any of them. One student stated that he "didn't feel like he needed it them at the time." Another student declared the following: "In hindsight, I wish I had taken advantage of the services because I could have used the extra help."

In addition, the focus group participants responded similarly, claiming that they had rarely, if ever used the existing student services (see Table 6). Focus group participants stated that their math instructor had constantly reminded them of the tutoring lab and their class had even visited the lab for an orientation, but only 2 of 8 (25%) focus group participants at that community college had returned for assistance. In all three focus groups, students claimed to

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know where the services were located on campus and were aware of specific hours and events (via campus flyers, student email, online social media announcements, etc.), but did not remain on campus for assistance. One focus group participant stated, "I just don't have time to keep waiting at the tutoring lab when other people are in line ahead of me for help. I usually have to get to work or get studying done for other classes."

Table 6

Summary Statistics of Survey Participants Regarding Remedial Services Offered

	LCC		MCC		SCC		All	
	f	%	*f*	%	*f*	%	*f*	%
Knowledge of Remedial Service Offered								
Academic Advising	31	62	36	72	40	80	107	71.3
Career Counseling	26	52	30	60	1	2	57	38
Tutoring	42	84	43	86	37	74	122	81.3
Workshops	22	44	21	42	1	2	44	29.3
Utilization of Remedial Service Offered								
Academic Advising	12	24	9	18	15	30	36	24
Career Counseling	5	10	4	8	0	0	9	6
Tutoring	6	12	9	18	2	4	17	11.3
Workshops	2	4	2	4	0	0	4	2.7
None	29	58	27	54	33	66	89	59.3

Faculty Members. College instructors who teach developmental courses should have an authentic commitment to serving students (Wheland, Konet, & Butler, 2003). These instructors must be able to identify strengths and weaknesses, rather than only deficiencies, in remedial students (Maciejewski & Matthews, 2010). In the realm of community colleges, students often need additional assistance to achieve academic success; therefore, faculty members must be willing to provide in depth explanations and various methods of teaching, assessing, and problem solving in developmental mathematics courses.

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The survey respondents were asked numerous questions about their developmental mathematics instructor. At all three community colleges, the bulk of survey participants (57.8%) stated that their instructor tried to understand the way of doing math they used and was interested in their math work even if the answer was wrong. Moreover, the respondents declared that their instructor questioned them about their thinking process when they did not fully grasp taught concepts (72.7%) and encouraged them to think about various ways to solve each math problem (74%) (see Table 7).

Students completing the survey (67.3%) claimed that their developmental mathematics instructor did use technology when teaching MTH098/090. As for the use of technology by students in the class, the majority used a web-based math program (all three colleges used MyMathLab by Pearson Education) for homework assignments (70%), which were not necessarily completed during the assigned class meeting time. Furthermore, students stated they were assessed using quizzes and/or tests (75%), but not all (25.6%) were assessed using project-based learning (see Table 7).

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Table 7

Summary Statistics of Survey Participants Regarding Faculty Members

	LCC % (n)			MCC % (n)			SCC % (n)			ALL % (n)		
	VT	ST	NT	VT	ST	NT	VT	ST	NT	VT	ST	NT
My instructor asks me to explain how I got my answers to math problems.	80 (40)	14 (7)	2 (1)	46 (23)	42 (21)	6 (3)	34 (17)	36 (18)	12 (6)	53.3 (80)	30.7 (46)	15 (10)
My instructor tries to understand my way of doing math problems.	82 (41)	10 (5)	2 (1)	70 (35)	20 (10)	(2)	64 (32)	22 (11)	4 (2)	60 (108)	17.3 (26)	2.8 (5)
We have quizzes or tests.	92 (46)	4 (2)	0 (0)	90 (45)	4 (2)	0 (0)	88 (44)	4 (2)	0 (0)	75 (135)	3.3 (6)	0 (0)
We have projects that are graded.	40 (20)	22 (11)	34 (11)	38 (19)	16 (8)	40 (20)	14 (7)	20 (10)	58 (29)	25.6 (46)	16.1 (29)	36.7 (66)
My instructor is interested in my work even if it is wrong.	86 (43)	8 (4)	0 (0)	72 (36)	14 (7)	6 (3)	50 (25)	20 (10)	12 (6)	57.8 (104)	11.7 (21)	7.2 (13)
When I don't understand concepts, my instructor tries to assist by questioning me about my thinking process.	82 (41)	8 (4)	4 (2)	76 (38)	38 (19)	0 (0)	60 (30)	22 (11)	2 (1)	72.7 (109)	22.7 (34)	2 (3)
My instructor asks me to think about various ways to solve each math problem.	78 (39)	16 (8)	0 (0)	80 (40)	12 (6)	2 (1)	64 (32)	18 (9)	0 (0)	74 (111)	15.3 (23)	0.7 (1)
We do web-based math work during class.	60 (30)	20 (10)	16 (8)	50 (25)	10 (5)	36 (18)	72 (36)	10 (5)	6 (3)	60.7 (91)	13.3 (20)	19.3 (29)
We use web-based math programs for homework.	88 (44)	8 (4)	0 (0)	50 (25)	10 (5)	34 (17)	72 (36)	12 (6)	4 (2)	70 (105)	10 (15)	12.6 (19)
My instructor uses technology when teaching.	64 (32)	24 (12)	8 (4)	76 (38)	18 (9)	0 (0)	62 (31)	16 (8)	8 (4)	67.3 (101)	19.3 (29)	5.3 (8)

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Learning Experience. Students who place into remedial courses, especially in the area of mathematics, often prolong registering for those non-credit bearing classes. This postponement could potentially delay graduation or employment (Crews & Aragon, 2004). A positive learning experience in remedial course(s) will aid in assuring that students successfully progress on the for-credit path. In many cases, instructors can assist students in negating past experiences and creating positive new ones; therefore, faculty members play a dynamic role in the developmental learning experience (NADE, 2008).

More than 75% of survey respondents at all three community colleges claimed to have a positive experience in their current developmental mathematics course (see Table 8). Students made numerous statements regarding their MTH 098/090 learning experience, such as "The class gave me a good foundation for college algebra – I feel prepared." and "My fellow students and the instructor made the class enjoyable and easier to learn." For the most part, students commented that they "learned a lot" and "had a great instructor."

One female survey participant responded, "When I started I thought I couldn't do anything harder than 2 + 2, but as the class went on I understood much more. I even feel pretty confident that I will able to pass college algebra." A couple of students (both male) stated the developmental math course was "much better than expected because I thought I was bad at math – I learned if you work hard, you can learn and progress" and "stressful at first because it had been 30 years since I had a math class, but the instructor showed us step-by-step methods that helped to jog my memory – I am definitely going to pass!" These student quotes echoed the findings of Farrell (2006), which suggested students in mathematics courses can overcome past experiences with proper instruction and attitude.

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Although the majority of students surveyed had a positive experience in their developmental mathematics course, 1.3% responded they had a negative experience, 12% responded with neutral, and 8.7% provided no response to the question (see Table 8). "I hate math" and "I am never going to have a passion for math" were two quotes provided by the respondents claiming their course was a negative experience. In addition, one of neutral respondents stated, "I did what I needed to pass the class – nothing more, nothing less."

Table 8

Demographics of Survey Participants According to Overall Experience

	LCC		MCC		SCC		All	
	f	%	*f*	%	*f*	%	*f*	%
Positive	41	84	39	78	37	74	117	78
Negative	0	0	2	4	0	0	2	1.3
Neutral	5	10	6	12	7	14	18	12
No Response	4	8	3	6	6	12	13	8.7

Course Delivery Options. As mentioned in the review of literature, traditional, semester-long courses might not be the optimal course delivery technique for developmental students (Sheldon & Durdella, 2010). A study by Daniel (2000) found that shortened courses with repeated drill and practice of taught concepts increase retention and pass/success rates while opening up the option for students to take multiple developmental courses in one semester. Furthermore, shortened courses tend to boost the academic morale of students who placed into often more than one non-credit course.

All of the students surveyed were enrolled in traditional lecture courses, but some had an online homework component. All three of the community colleges offer traditional lecture courses, hybrid or computer-assisted courses, and solely online courses. Although it is false

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information, data collected from the respondents of the student survey indicated that self-paced with post-test assessments and mastery learning were course delivery options on their campus (see Table 9).

Most of the students (more than 60%) completing the survey had taken a math course in the traditional, 16/17 week-long version. Fewer than 20% of the participants stated that they had taken an online math course (see Table 9). Participants were also asked to list any pros and/or cons of the course delivery methods offered on their campus.

Students listed numerous positive aspects of having a traditional class that meets on a weekly or bi-weekly basis. The most frequently noted positive aspects of traditional courses were as follows:

- Instructors are readily available for face to face interactions to check for understanding;
- Taught concepts are easier to comprehend when viewing and hearing the step by step process;
- Students are held more accountable knowing that the instructor expects them to attend class and participate; and
- Interactions between classmates and class discussions are helpful when trying to understand difficult math topics.

Students also listed a few negative aspects of traditional courses. One student declared, "It is just hard to get up, get ready, and drive to campus when you have worked a late shift and gas prices are so high." Another student found the entire experience to be a con, stating: "It is math!"

Likewise, survey respondents stated positive and negative features of hybrid and/or online developmental mathematics courses. Positives were that lectures are always available

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online, assignments can be completed at any hour of the day or night, and there are no other students around to cause disruptions. On the contrary, keeping themselves on a regimented time schedule and not having an interactive instructor are negatives provided by survey respondents.

Table 9

Demographics of Survey Participants According to Course Delivery Options

	LCC		MCC		SCC		All	
	f	%	*f*	%	*f*	%	*f*	%
Positive	41	84	39	78	37	74	117	78
Hybrid/Computer Assisted	28	56	29	58	1	2	58	38.6
Mastery Learning	2	4	7	14	0	0	9	6
Online	34	68	42	84	47	94	123	82
Self-Paced with Post-Test	9	18	6	12	0	0	15	10
Traditional Lecture	44	88	49	98	49	98	142	94.7

COMPASS Placement Test. Placement testing via the COMPASS exam, in the areas of English, reading, and mathematics, is required by all community colleges in Alabama as mandated by the Alabama Commission on Higher Education (ACHE, 2012). Students may bypass the COMPASS placement test by using an appropriate score from the ACT exam. Placement testing has been a debated topic in colleges for many years (Armington, 2003b). Proponents claim that students need a process to be formally placed into college courses in order to build foundational academic concepts (Young, 2002). Opponents of placement testing claim that results may lead to unnecessary expenses and lower self-esteem for students who are already in danger of dropping or stopping out of college (Byrd & MacDonald, 2005).

When asked about taking the COMPASS Placement Test for mathematics courses, 149 of 150 students who took the survey responded (see Table 10). The vast majority (77.3%) of

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respondents had knowledge of the placement test, yet less than half of the respondents (49.3%) were able to adequately prepare before taking the test. One student stated, "After I found out I had to take it (COMPASS placement test), I had only one weekend to cram. I studied for three straight days, but I am not sure that it helped."

Numerous comments regarding the COMPASS placement test in mathematics were noted, some positive and others negative. "A necessary evil", "tricky", "not a proper assessment", "helpful", "difficult", "effective", and "confusing" were a few of the test descriptors provided by students. "I needed more preparation and awareness before I sat down to take the COMPASS test – but a calculator and formula sheet would have helped" was a comment provided by one female. Like the aforementioned student, most respondents who provided comments in reference to the placement test admitted their lack of preparation: "Awkward and uncomfortable with the material it tested"; "It had been so long since I had math that I hardly remembered any of it"; "Confusing – I've never been good at taking tests"; "Hadn't seen most of the problems before and I didn't know to bring a calculator"; and "Ready to get it over with, so I just picked answers and landed in remedial math." Students participating in the survey were open to admit that they lacked preparation and study skills for the placement test given at each community college.

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Table 10

Summary Statistics of Survey Participants According to COMPASS Placement Test

	LCC		MCC		SCC		All	
	f	%	*f*	%	*f*	%	*f*	%
Knowledge of COMPASS Placement Test for Math								
Yes	37	74	36	72	43	86	116	77.3
No	12	24	14	28	7	14	33	22
Able to Adequately Prepare for COMPASS Placement Test								
Yes	24	48	19	38	31	62	74	49.3
No	25	50	31	62	19	38	75	50

The student survey also asked if participants felt like they were placed into the correct math course based upon their COMPASS placement test score. The most common response was yes at all three community colleges (see Table 11). Of those who felt they were placed into the appropriate mathematics course, a couple of students stated that the COMPASS placement test was an "adequate measure for college placement" and "placed me into the correct class because I've never been 'good' at math." In contrast, other students listed negative comments about their placemen. Students commented, "Not a proper tool to decide what class you should be placed into," "The COMPASS test was a horrible and inaccurate measure of my ability," and "I needed a better explanation of the test results and class options – I was still lost after I got my score back." Despite assorted survey opinions concerning the COMPASS placement test, students acknowledge that the test is mandatory for course enrollment in mathematics.

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Table 11

Summary Statistics of Survey Participants According to Course Placement

	LCC % (n)			MCC % (n)			SCC % (n)			ALL % (n)		
	VT	ST	NT	VT	ST	NT	VT	ST	NT	VT	ST	NT
I believe that I placed into the correct math course.	72 (36)	20 (10)	2 (1)	62 (31)	22 (11)	10 (5)	64 (32)	18 (9)	0 (0)	66 (99)	20 (30)	4 (6)

Research Question 2

The second research question asked, "What are the most important identifiable needs for students enrolled in developmental mathematics courses at certain Alabama community colleges?" Focus group and instructor interview responses were used to address the second research question. Given that more than half of incoming college students are referred to at least one developmental course, it is imperative that the needs of this student population be assessed (Bailey & Cho, 2010). Instructors and students at the three community colleges identified four main needs for developmental mathematics students: 1) need to have a positive experience in mathematics course(s); 2) need for additional/revised college services to assist students weak in mathematics; 3) need for an updated/revised placement testing process; and 4) need for students to understand the importance of developmental mathematics courses in their academic progression. At some level, these needs were currently being addressed at each community college, yet students and instructors expressed that improvements and/or revisions could be made for greater student success.

Need for Positive Mathematics Experiences. According to research provided by Banta et al. (2004), countless students believe they will not be successful in current and/or future math courses they need in college because they lost confidence in their ability after negative experiences occurred in previously taken math courses, especially in elementary and middle

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school years. When asked to discuss their earliest recollections of learning math and to identify them as positive or negative, focus group participants had mainly negative memories. The subsequent responses were provided by students with negative past math experiences: "I am quite uncomfortable in any math course because in third grade I couldn't remember my multiplication tables and it has spun out of control from then – that was most definitely a negative experience"; "I was pretty good at math in elementary school, but algebra in middle school was tough – it was negative because I had to go to summer school. To me, summer is for fishing, not for math"; "I failed the math portion of the graduation exam twice, but eventually passed with a lot of tutoring – that was a negative and embarrassing experience"; and "For me math has always been hard. I learned the most basic concepts early on in grammar school, but I always thought my math teachers were scary."

One student shared a negative incident that occurred in her high school geometry course. Her experience began as follows:

> Although I did not really deem myself as a mathematical genius, I thought I was okay in math. I struggled through middle school math classes, but I really thought that it was probably just not my best subject – because I really do enjoy English classes and reading way more than math. I made it through algebra I in ninth grade making low B's and C's and even passed my high school graduation exam in math on the first try. Well that all changed when I entered my tenth grade geometry class. I was used to teachers, especially math teachers, going to the whiteboard and working problems – they would usually write a few problems up there for the class to try to understand and talk through the step by step process. The class would then ask questions if we needed to and work together to complete a normal amount of homework problems. My geometry teacher did not do that at all. She sat at her desk and pointed with a yardstick at some problems that she had written on the board earlier that day. She never even got out of her desk.

The focus group participant went on to explain her geometry teacher's methodologies for teaching and assessment.

> She would really just read the numbers and letters and words to us (like we couldn't read). There was no explanation and no time for the class to ask her questions. Then, she would assign every problem in the section that the textbook had for homework.

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> Sometimes there would be 100 problems, and in geometry that was time consuming. The problems had pictures that had to be drawn too. At night after I got home from volleyball or softball practice or games, I would work on the problems for sometimes two or three hours and still not get finished. I had no idea if I was working them correctly and really no idea if the answer was correct (and more times than not it was wrong). When we got back to class the next day, she would collect the papers and mark them right or wrong. I made horrible grades on the homework and the tests, but somehow I passed the class with a C for the semester.

Her final thoughts regarding the high school geometry course were negative as well. She stated:

> Maybe she just felt sorry for me or maybe everyone failed and she had to pass some. I have never been so glad to get out of a class. I dropped from advanced to standard diploma after my tenth grade year. Math was easier, but I didn't learn anything new. I will let you take a guess if the experience was positive or negative – yep, you guessed it, negative with a capital N.

The focus group participant who provided the previous quote did state that she has had a positive experience in her current MTH 098 course at her community college.

On the contrary, a few of the focus group participants did have fond recollections of learning math. A couple of the students (from different community colleges) indicated that their teachers in elementary and middle school tried to make learning math fun by playing games and using manipulatives. They recalled that their experience on those "fun math days" was positive which was largely in part due to the effort by their teacher. One focus group student had the following to say:

> I have been out of high school for fifteen years, but I can still remember it. In fourth grade I started to find math class getting harder. I thought I understood what was going on at school when the teacher was teaching, but when I got home to do homework or had to take a test I would go blank. I would get a panic feeling like I hadn't ever seen the problems before. My mom had a conference with my teacher and she suggested that I get a tutor. I ended up getting a tutor who was a kindergarten teacher at another local school. She helped me so much. She would explain the problems and it just seemed to click. I went from making D's in fourth grade math (sad I know) to A's and B's. I was finally able to catch on when the whole class learned something. I had the same tutor until I got to middle school. My parents probably spent a fortune hiring her, but she was a lifesaver for me. I did better in middle school. I think that the teachers were better or maybe I was

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> just getting better at catching on. My kindergarten teacher tutor made my fourth grade and fifth grade experiences positive ones. I am really grateful for her. I think I will take time to thank her.

These comments summarized the findings of Sheldon and Durdella (2010) who claimed students must strive to overcome mathematics anxiety that may have been developed in early school years.

All nine of the instructors interviewed stated they attempt to create positive learning experiences for their developmental students. An instructor who has taught mathematics in high school for 11 years and in the community college for five years stated:

> I try to build confidence by allowing students opportunities to be successful during class time using independent and group work. I stress to my students that the more hard work they put into the class, the more successful they will be in my class and in future classes.

Another participant responded in a similar way: "Lecture/repeat/demonstrate is my motto. I constantly repeat what I've previously taught and ask questions to check understanding. This helps create a positive class environment." Finally, a third instructor lamented, "Most developmental students come in with a bad and negative attitude, but I try to pump them and the entire course up (for slang) as a positive stepping stone for success here at Medium Community College."

Need for Additional/Revised College Services. Students completing surveys and participating in focus groups were asked to provide feedback that would identify and explain improvements that could be made to current practices in their developmental math courses and at the college level. In the focus groups at all three community colleges, it was noted that each college offered quality services, but often were not accommodating to student work/home/family schedules. Students completing surveys offered similar opinions:

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I think that MTH 098 should be kept as a 3 credit hour class, but maybe it could be scheduled for a longer time period. If you are bad at math, you probably need more time to ask questions, do homework with a teacher there, and more time on tests. I know some instructors offer to stay after class, but that doesn't really help when you have another class starting in 15 minutes that you have to get to and get prepared for.

I work full time, sometimes more than 40 hours per week, and it is hard to get over to the tutoring lab during the hours of operation. I have been a few times, but I had to take time off work to go. You would think that if they offer MTH 098 at night and online that the tutoring lab where you can get free help would be open at night. Even one night would be better than none.

It would be good if there was some way to interact with other students in MTH 090 at our college, even if we don't have the same instructor. Those students might be able to let me know about services that might help pass the class. If nothing else, we could just offer each other support. Maybe we should start a Facebook page for MTH090 and MTH 098, or Twitter.

Maybe they could offer a study skills workshop, or maybe they do. I don't think that I actually learned how to study and how much time to put into studying when I was in high school. I actually did very little studying back then and really haven't since then either.

MTH 098 and MTH 090 instructors should be required to video their classes andpost them online after class. They could post notes and other helpful items as well. I am a student who very rarely misses class, but if would be fantastic to get to watch the entire class that I missed. I could also use the videos to review things that I did not quite learn the first time she went over it. I am going to ask my instructor to start videoing his class.

The tutoring lab should be open at night or on Sunday afternoon. That is when I study most.

It is so hard to get to campus early or stay late to take advantage of the academic advising and counseling services they offer. It is especially hard when my kids are not in school. They should think about offering Skype sessions or some way to communicate in real-time online so students could use the services from home. I know you can call, but sometimes if they are busy they don't answer and it takes days for someone to call you back.

Colleges should do a better job of letting students know what services they offer. Once I found out that there was a free tutoring lab, it was too late.

My internet service is not so great at home, so I come to campus to use the lab because I just live five miles away. The computer lab is open at night, but it doesn't do any good if there is no one there to help explain the math.

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Need for Updated/Revised Placement Testing Process. Proper placement into college courses is essential. Students who are incorrectly placed into courses, especially remedial courses, can enhance negative self-esteem issues (Byrd & MacDonald, 2005). Schneider and Yin (2011) claimed that roughly one-third of college entrants are unprepared for the placements tests they take; therefore, these students perform poorly and place into non-credit courses. Additional tuition costs and more time at community college are two of the possible unconstructive effects of students who are academically underprepared or unprepared for the COMPASS placement test.

The COMPASS placement test generated numerous comments from study participants. Students declared they had trouble understanding the problems and they were dreadfully unprepared. One focus group participant said, "With no review, no heads up that I was supposed to bring a calculator, and no idea that I was even going to take a test on the day I came to register for classes, unprepared is an understatement." Another student offered, "I graduated and made pretty good grades in school, but now I'm placed into remedial math – it's like I'm going backward." A third student observed, "You just wonder why they don't offer a refresher course or seminar for a test that is so important to scheduling your classes, especially the first semester that you are enrolled." In contrast to negative opinions regarding their math placement, one student proclaimed, "I'm glad I placed into MTH 098. I feel like I would have held up the students and instructor in MTH 100 class by asking too many 'dumb questions' that they all already knew the answer to."

Need to Understand the Importance of Developmental Mathematics Courses. According to Ashburn (2007), quality counseling and advising can aid students in understanding that placement into non-credit courses is not a road block for their education, it is an access road.

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College personnel can support developmental students and instructors by emphasizing the value of successfully completing remedial courses (McClory, 2003). They can also reiterate that community colleges are not offering developmental courses in order to make students take more classes for the college's financial gain; these courses aid in bridging the gap to college-level courses.

A small number of students participating in the focus groups proclaimed that community colleges should offer remedial courses to students with no charge. If that was not an option, then at least they could offer numerous mini-courses in a semester and have students pay one flat fee. In regard to the importance of developmental mathematics courses, focus group participants declared, "I feel like I am just throwing money away by having to take remedial courses, but I suppose I wouldn't pass if I didn't them;" "MTH 098 has been helpful and it only took me one extra semester;" and "I needed to take developmental math and English for sure. They saved me from repeating other courses in future semesters."

Research Question 3

The third research question asked, "What are the attitudes toward developmental education of students currently enrolled in developmental mathematics courses at specified Alabama community colleges?" Often students are not shy to proclaim their dislike for mathematics (Galovich, 2007). Because of the large number of students taking developmental courses in community colleges, no stigma is attached to those taking courses for no college credit. Students simply view this process as a hurdle to jump on the path to a degree or employment (Murphy, 2007). In contrast, some students develop a sense of remedial stigmatization, which can affect their scholastic performance (Jones et al., 2003).

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Focus group students were asked to define what *developmental mathematics* meant to them. Additionally, they were asked if there was a positive or negative status associated with placement into developmental math courses and if the placement had hindered them in other academic subjects. The following responses were given as definitions of developmental mathematics: "Lower than college-credit math courses. It's a good starting point to help us (the students who can't remember how to work the problems) succeed in college"; "Classes that I have to take because I did not learn and remember enough from high school to pass college algebra and that COMPASS test"; "A class that gives you the basic building blocks to move forward in higher level math classes – kind of like a review of high school math, but shorter"; and "Math classes that students take when they need extra help in the subject."

Of the 23 focus group participants, none of them stated that there was a negative status associated with placing into MTH 098/090. A student enrolled in MTH 098 provided the following statement:

> If I hadn't been told to take MTH 090, then MTH 098, I probably would have flunked out of algebra. There was no way that I could have passed without some remediation. I am aware that math is not my strongest subject, but I am willing to work at it. Who really cares and who even knows if you are required to take an '0' math class. The only students who know are also in the class.

The focus groups participants were in unanimous agreement that placing into developmental course(s) has not hindered their enrollment into other academic classes. One student declared, "I plan to finish out this developmental math course and take MTH 100 and maybe even MTH 112 before I take physics, but I would think that would be logical because there's a lot of math in the class." A second student said, "I think that not taking developmental courses would hinder me more because I would end up taking classes over and over to try to pass. I know college algebra is going to be hard, but this class (MTH 098) has prepared me." Finally, a third focus group

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student stated, "My instructor told us on the first day of MTH 098 that this class was of great use and we needed it to 'tighten up our academic muscles.' I believed him that day and still do. This class is helpful, not a hindrance."

Research Question 4

The fourth research question asked, "What are the attitudes toward developmental education of instructors currently teaching developmental mathematics courses at specified Alabama community colleges?" Faculty attitudes toward developmental education are just as important, if not more, than those of their students (Grubb & Cox, 2005). In fostering positive faculty attitudes toward developmental education, faculty members who teach remedial courses do not need to feel segregated from the rest of campus. They need to feel a sense of belonging with their associated academic department (Engstrom, 2005; Gilpatrick, 2007; Perin, 2002).

During the instructor interviews, current developmental faculty members were asked to describe their typical weekly schedule, including hours on campus and information about their office and departmental meetings. Interviewees were also asked to discuss their methodology for teaching developmental math courses. Lastly, the nine instructors were asked to express their opinions regarding developmental education at the community college level.

Seven of the nine interviewees work Monday through Friday with varying hours, but most 7:45 am until 3:30 pm. One instructor works Monday through Thursday, while another instructor is part-time time, working 19 hours per week. Although one developmental math instructor works only part-time at his college, all nine (100%) have offices located on campus. Five of the nine instructors (55.6%) have regular departmental meetings with other developmental mathematics instructors. One interviewee stated, "We have meetings when necessary. All teachers teach some developmental math courses. We teach from the same

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lesson plans and try to use the same methods of presenting the material." Some instructors stated that they do not necessarily have meetings with the math department; instead, they have meetings with other developmental instructors, including those who teach reading and English. In addition, 6 of 9 instructors who were interviewed are members of the math department at their college. A female instructor declared, "We have a math department meeting at the beginning of each semester. This is when the mathematics department chairperson gathers all full-time and adjunct math instructors for planning, assessment, updates, and announcements."

When asked to describe any difference(s) in their teaching style/methods in developmental courses versus credit courses, the interviewee responses varied. The following responses were noted about the teaching similarity between developmental and for-credit courses:

> I lecture to developmental classes in the same manner that I lecture to other classes. There is not a lot of difference in my teaching approach to developmental students versus students in credit courses.
>
> I don't teach them very differently. I just feel like students who take developmental courses need a lot more encouragement and motivation. I do a lot of cheerleading in those classes.
>
> I would teach any class I taught the same way. The only variant that I can think of would be the pace at which I would go.

Other instructors stated that they did not teach developmental mathematics courses in the same manner as for-credit courses. Some of their responses are as follows:

> Scheduling is different in some of our developmental math courses. We have a lecture/lab split in those courses. The for-credit math courses are traditional unless students take a class completely online. The homework is web-based an completed via MML (MyMathLab) outside of class – preferably at our math lab on campus.
>
> I offer a lot of time for one on one teaching with MyMathLab. Depending on the student, I try to do what is best for each of them. Our classes are smaller, giving me that opportunity.

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> Slower pace, more review time. I stress the more work they put into the class, the more successful they will be in the class.

Overall, the developmental mathematics instructors that were interviewed stressed the importance of providing much needed encouragement and support for their MTH 098/090 students. In conjunction, they made attempts to progress through the taught material at a slightly slower pace in hopes that students will grasp hard-to-learn concepts and retain the material.

Faculty interviewees provided their opinion(s) on the topic of developmental courses at community colleges. They were also asked to express their thoughts about the fact that some four-year institutions are no longer offering non-credit/remedial math courses. Of the nine instructors who were interviewed, only two (22.2%) stated that they understand why colleges are eliminating developmental programs due to many factors such as cost to the institution, facility restraints, etc. One of the two instructors who understood the elimination made the following statement:

> In a way, I agree with it. College is not for everybody. I think we gear our thoughts more to a way public education is approached. These days everyone thinks they should be entitled to a college education. In my opinion, students who want to go to college should go above and beyond in high school to insure they are prepared for college level classes. If remediation is needed, it should be handled with tutors, etc. before applying to college.

When asked his opinion on developmental education at the community college level, the same instructor stated, "I feel it is a shame that so many of our incoming freshmen are so poorly prepared for college level math and English. However, my personal opinion is that everybody is not cut out for college." Some of the other interviewees expressed that community college developmental programs are needed because many students are not ready to take on a university or simply college-level courses. One instructor believed that developmental courses are necessary, but "Do not like the idea of throwing students in a computer lab and having them

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work at their own pace." All interviewees agreed that developmental mathematics students need as much instruction, encouragement, and interaction as possible.

Summary

Overall, the students and instructors at the three selected Alabama community colleges provided strong feedback and opinions on the topic of developmental mathematics education. By critically studying the responses of these community college developmental math education stakeholders, the Alabama Community College System will be better informed on how to assess current developmental mathematics programs and will have the capability to provide feedback to colleges about the status of their developmental math programs. Despite the fact that developmental instructors are diligently working to provide positive learning experiences in the area of mathematics in hopes to counteract negative past experiences, a closer look at the demographic characteristics of these students may be needed to further address this topic.

Moreover, tracking the mathematical progression of the surveyed students at their community college may clarify why some students continue to have negative experiences and opinions about mathematics while other students have developed positive ones. By addressing the findings in this study with a renovation and/or revitalization of identified student services, updated placement testing procedures, and faculty professional development on the specific needs of developmental mathematics students, community colleges may find that numerous facets of their developmental education programs (i.e. student achievement, attitudinal changes toward remedial education, faculty satisfaction) will incorporate and model documented best teaching and learning practices.

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CHAPTER V:

CONCLUSION AND RECOMMENDATIONS

Numerous students are not only underprepared academically, but they also lack essential critical thinking, study, and organizational skills upon entering college (Boylan & Saxon, 2002; McCabe, 2000; Petrides & Nodine, 2005). Knowing that students who enroll in community college courses are regularly placing into one or more developmental (non-credit) mathematics course, the state of Alabama must be aware of documented best teaching and learning practices in developmental education. As documented in the literature review contained in Chapter II, five essential elements were deemed necessary for successful developmental mathematics programs: 1) centralized remedial services; 2) faculty members who value success of developmental students and the program; 3) development of students that experience positive, meaningful, and valuable math learning; 4) an assortment of teaching methods and course delivery options; and 5) student preparation for the placement test (COMPASS) and advising. The purpose of the study was is to determine if students at selected Alabama community colleges are involved in remedial mathematics activities that are documented in the literature as best practices.

Discussion and Summary of the Study

Community college developmental education programs assist students in bridging educational gaps between previously taught, not-learned concepts in high school and those needed for college-level courses in the areas of English, reading, and mathematics, (Galovich, 2007; NCTM, 2000). It is pertinent for community colleges throughout the United States, not just the 22 located in Alabama, to assess their current developmental education platforms in

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order to promote a positive learning environment for developmental education that is relevant, competitive, accessible, and accountable (Bettinger & Long, 2005). Also, the results of this assessment could be used to assist current and future students while promoting President Obama's initiative to graduate five million more community college students by 2020 (Bailey & Cho, 2010). This assessment should include the five key elements discussed in Chapter II.

Results of a study conducted by Boylan et al. (2007) articulate a direct relationship between the organizational structure of developmental education and student outcomes. Centralized developmental education departments produced students with significantly higher first semester grade point averages than those decentralized departments. Within this study, solely one of nine instructors interviewed belonged to the developmental education department; the eight others were mathematics department instructors. Moreover, math department instructors did not regularly meet with members of the developmental education courses for planning and discussions. Community colleges might consider joint faculty meetings with academic and developmental departments on a regular basis to ensure collaboration and course alignment among all instructors teaching developmental mathematics

In regard to remedial services provided for developmental mathematics students, all three community colleges offer career counseling, tutoring, academic advising, and workshops. Although the results of the study verify these offerings to students on campus, these services were not readily utilized by the surveyed students. Wheland et al. (2003) claimed colleges must strive to motivate developmental students in all facets. According to one of the interviewed instructors, "These students need to be motivated to attend class, complete assignments, and sometimes even stay awake. No wonder they are not using the services our college provides. The services are great, but they just don't take advantage of them." If this is the case, student

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services offered may not affect the quality of developmental math programs at the community college level, no matter how extensive and supportive they are.

The data collected from this research did indicate students speculated they would utilize the offered services more often if they made some revisions. These revisions were mostly in relation to the hours of operation and convenience/inconvenience to students. Developmental students reported the tutoring lab for mathematics was not accessible at night or on weekends. Additionally, due to work schedules and family obligations, it is difficult to devote time to attending workshops, receiving career counseling or academic advising, and/or going to the tutoring lab for assistance. Student focus group members also discussed frustrations at the tutoring lab based on the first come, first serve policy that is presently in place at all three community colleges. Not only Ironsmith and Eppler (2007) but also Boylan and Saxon (2002) provided information that confirmed student services for developmental students need to be located in a central location with flexible hours to accommodate student schedules, a recommendation that is consistent with findings from this study.

The number of students who have not been properly prepped for college will only increase in future decades (Young, 2002). With this knowledge, instructors teaching developmental mathematics are a vital component of remedial programs. Assorted instructional styles and diverse assessment methods should be implemented by these instructors to aid in the retention of taught material which will increase student potential to progress to credit courses (Boylan & Saxon, 2002; Galovich, 2007; Maciejewski & Matthews, 2010; Wallin, 2004).

Supporting findings of Boylan and Bonham (2007), who argued instructors teaching developmental courses need to use assorted and ever-changing methods for teaching, surveyed students claimed their current math instructor tried to instill concepts by questioning student

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thinking processes when they did not understand. These developmental mathematics instructors incorporated various problem-solving techniques into the course. Moreover, in conjunction with findings by MacDonald et al. (2002), they embraced several types of technology when teaching the course, including scientific calculators, iPad, Sympodium, MyMathLab and the Blackboard platform.

Other instructor characteristics reported in the study present issues of concern. First, only 53.3% of surveyed students confirmed being asked for mathematical explanations to coursework. Because it is known that developmental students deem asking for help as a daunting idea, instructors must take the initiative to question students to increase retention and understanding (Steen, 2007). Second, 57.8% stated that their incorrect work was of importance to their instructor. This finding contradicts previous research by Perry (2004) who suggested that instructors should value student work and note inaccuracies to prevent identical mistakes on future assignments. Third, students who participated in the survey (75%) described their main assessment tool in the course to be pen and paper exams. Merely 25.6% of students stated they complete project-based learning that is graded. The lack of multiple assessment techniques is inconsistent with research provided by O'Banion and Wilson (2011) and Twigg (2005) stating alternate learning outcomes for developmental students should be measured using alternatives to standard pencil and paper exams.

According to conversations by student focus groups, many of the participants had experienced a negative mathematical experience in their past. In findings by Sheldon and Durdella (2010), students who have these negative incidences can develop a new appreciation for the subject if their current experience is positive. Surprisingly, 78% of the students surveyed deemed their experience positive in their current developmental math course, while only 1.3%

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declared it negative. Quality instructors, accountability, and class interactions were some of the stated characteristics that aided in making their experience favorable.

Findings from this study revealed developmental students desire a favorable experience in their MTH 098/090 course, which is consistent with prior research (Banta et al., 2004; Crews & Aragon, 2004; Jones et al., 2003; Waycaster, 2001; Young, 2002). Conducted research by the National Association for Developmental Education (NADE) stated that positive attitudes of faculty members can contribute to creating a positive classroom environment for developmental mathematics students (2008). Student attitudes can actually be modified by instructor attitudes, in turn creating a desirable mathematics experience that could possibly negate past occurrences that were not favorable.

Although research by Daniel (2000) established that time-shortened courses with repeated practice are the most advantageous approach for course delivery, none of the selected community colleges offer this type of developmental mathematics at the present time. One instructor interviewed disclosed, "Our developmental math program is hoping to start offering self-paced courses with lots of practice and mastery learning. We have been selected as an Achieving the Dream School, and one of our objectives is developmental education reform."

All survey respondents were enrolled in a traditional lecture format at the time of the survey that conflicts with research (Sheldon & Durdella, 2010). In addition, fewer than 20% of surveyed students stated they had previously been enrolled in an online developmental mathematics course. Students made numerous positive comments pertaining to traditional lecture and hybrid courses at their community college. One explanation for the positivity toward course delivery methods that have not been deemed as ideal by the researcher may be that

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students are not aware of any other option(s); they are forced to enroll in one of the developmental mathematics course offerings at their college.

Having knowledge of the need to take COMPASS placement test and making an appropriate score to place into college-level credit courses did not necessarily affect student academic preparation for the exam. Provided 77.3% of surveyed students had knowledge of the placement test, only 49.3% of the identical population believed they were able to adequately prepare prior to the assessment. Research findings by Armington (2003b, 2003c) claimed unprepared students taking placement tests for courses may not denote strong academic tendencies. Although the results of this study indicate student knowledge of and academic unpreparedness for the COMPASS placement test, survey participants commented they did place into the correct course based on their mathematical ability.

Furthermore, Byrd and MacDonald (2005) found that placement test review materials need to be distributed to students to promote accurate course placement. Students and instructors from the three community colleges stated that no formal review for the COMPASS test is currently in place. An argument could be made that students enrolled in community colleges may perform better on mandatory placement tests when provided some form of review. This review could be delivered using a variety of methods and in all areas tested (i.e., English, reading, and mathematics). Also, a second argument could be made that the number of community college students enrolling in developmental courses may decline based on the provided review helping to improve placement scores.

Developmental mathematics students declared a lack of understanding as to why the MTH 098/090 courses were relevant. Students sometimes lack motivation to succeed in these courses, finding them not valuable, expensive, and time consuming (Bettinger & Long, 2005;

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Kolajo, 2004; Levin & Calcagno, 2008; Perin, 2006; Waycaster, 2001). Research conducted by Ashburn (2007) supported this finding and stated quality counseling and academic advising can benefit students by helping them understand the importance of developmental courses.

When participating focus group members at the three colleges were asked to define developmental mathematics education, responses aligned with the definition stated in the study. Developmental education was defined by the National Center for Educational Statistics as courses for credential-seeking students who are not academically prepared to perform college-level work usually in the areas of writing, reading, and mathematics (NCES, 1996). Participants declared developmental mathematics courses to be building blocks aiding progression into college-level classes.

Community colleges offer more developmental courses than four-year colleges; therefore, instructors teaching these courses have to be chosen carefully (Galbraith & Jones, 2006; Maciejewski & Matthews, 2010; Miles, 2000). Instructors need to deem developmental education as necessary in order to remediate unprepared students and provide support for student persistence. According to findings in this study, 77.8% of instructors stated remedial courses are needed at their college. Two of the nine interviewed instructors felt that remediation should be an individual task and that perhaps college courses might not be suitable for everyone.

For researchers, the results of this study provide evidence that documented best teaching and learning practices in community college developmental mathematics programs are being utilized to some extent. Developmental mathematics faculty members and students found their experience in MTH 098/090 to be favorable and rewarding. However, if remedial services, placement testing, and course delivery options are modified to better fit student needs, developmental mathematics programs will attain further advancement.

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Recommendations for Practice

Recommendation One

This study echoed previous research indicating that developmental students need supplementary motivation and support by instructors (Banta et al., 2004; Farrell, 2006; Galovich, 2007; Maciejewski & Matthews, 2010). Most of the faculty interviewees claimed to provide some extra level of motivation in taught remedial courses, yet none stressed the importance of developmental courses for academic success. Therefore, instructors could incorporate in-class guest lecturers to provide stories about their educational path and the role developmental courses played in this path.

Recommendation Two

If community colleges are going to provide a tutoring lab free of charge to developmental students, then the hours of operation should be conducive to student schedules. These labs hire qualified tutors capable of assisting students with mathematics and English courses, especially developmental courses. Primarily at the three studied institutions, tutors are accessible only during daytime hours and do not take appointments for work sessions either. Students desiring to use the service must be at the lab between the hours of 8:00 am and 3:30 pm at these three institutions, sometimes being required to wait until a tutor is available in their subject area. Hours of operation in the lab could include a night schedule and even weekend schedule at peak study times during the semester at these community colleges (Bahr, 2007; Boylan et al., 2007; Wallin, 2004). Also, developmental instructors could devote some of their weekly office schedule to lab, posting hours when they would be available.

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Recommendation Three

Surveyed students and focus group participants alike offered some technologically savvy ideas regarding student services. Based on provided comments, students could use an internet based interaction service (such as Skype) to take advantage of career counseling and academic advising. Developemtnal services are generally expensive for institutions, yet these services would be of no additional cost to the community college or the student (James et al., 2006; Maciejewski & Matthews, 2010). These services could deliver one on one interaction without the necessity of being on campus.

Recommendation Four

Because placement testing is necessary for placement into college courses, the requirement for placement testing needs to be extremely visible for students entering community college courses (ACCS, 2012; Shelton & Brown, 2008). A simple pop-up on the college website geared toward placement testing locations and dates would be an effective way of dispersing this information. Additionally, links to online review websites and information about on-campus review sessions for the COMPASS placement test could be provided on the main college homepage during peak registration dates.

Recommendation Five

Community colleges may address the additional semesters that are often added by offering time-shortened courses for developmental students. These courses could conceivably afford students with an opportunity to complete multiple developmental courses in one semester. As stated in the review of literature, these courses could promote student morale and potentially boost motivation (Schneider & Yin, 2011; Sheldon & Durdella, 2010).

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Recommendation Six

Alabama community college developmental mathematics faculty members – whether full-time or part-time – need to participate in subject-specific professional development. Workshops and conferences should be made available to instructors. These professional opportunities could introduce faculty members to innovative ideas in such areas as collaborative learning and assessment (Wallin & Sweet, 2003). In addition, these seminars could present current research in educational theory and philosophy and provide faculty with rationales for implementing alternate teaching strategies.

Recommendation Seven

Focus group participants declared that their instructors actually only graded answers for right/wrong; whether correct or incorrect, their work was not graded. Faculty members teaching developmental mathematics should make attempts to question students when possible. Instructors should require students to provide explanations and show step-by-step calculations on assigned problems (MacDonald et al., 2002).

Recommendations for Future Research

Recommendation One

Future studies could replicate this study on a state level using all 22 Alabama community colleges (ACCS, 2012). By replicating this study on a larger scale, a more representative sample could provide additional information as to how community college developmental mathematics programs compare throughout the ACCS. This study could also be expanded to a national level to include urban, suburban, and rural community colleges.

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Recommendation Two

For the most part, college instructors interviewed in this study currently taught and were advocates for developmental education, especially in mathematics. Research findings indicated that instructors were in favor of community colleges continuing to offer remedial courses to aid academically unprepared students for college credit courses. A study that further examined the attitudes of all community college faculty members, not just those directly involved, toward developmental education could provide an interesting avenue of research.

Recommendation Three

In researching literature on community colleges, the researcher found multiple delivery options for developmental mathematics courses. Past studies have declared that instructors should incorporate a variety of teaching methods, but did not address delivery options. A state or national survey based study on the course delivery methods used by community colleges for developmental mathematics could generate valuable data for departmental course planning.

Recommendation Four

Based upon data derived from this study, the majority of students were still enrolled in traditional, semester-long developmental mathematics courses. A search of literature suggested a shorter format, indicating the 16/17 week-long courses are not the best route for academically low-achieving students (Sheldon & Durdella, 2010). It would be interesting to conduct a broader study comparing traditional lecture to time-shortened developmental math courses.

Recommendation Five

Future qualitative studies should investigate methods in which developmental mathematics students can be motivated. Students who have successfully progressed through the developmental mathematics sequence at community colleges could offer valuable insights.

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These findings could be highly beneficial to instructors who often struggle with providing adequate student motivation in developmental courses.

Recommendation Six

Due to the large number of white, female respondents in this study, a future research could analyze the responses of the respondents by gender and/or race. These findings could provide insights into the actual needs and attitudes of this sub-population in order to better serve them in future courses.

Recommendation Seven

Future qualitative research could be conducted to further analyze the data collected from the community college developmental mathematics instructors. These participants were asked numerous questions that were not directly addressed in the findings of this study.

Conclusion

Approximately one-fourth of all students entering post-secondary education are enrolling in community colleges (NCES, 2012b). Many of these students are often unprepared to enter college level courses, forcing them to enroll in remedial courses that could possibly prolong their time at the community college, delay graduation, and/or decrease overall academic morale. Community colleges are at a crossroads regarding developmental education. These programs must be capable of identifying and addressing student needs. In order to enhance student potential and encourage progress, these programs must provide quality education guided by best practices in teaching and learning stated in literature.

Developmental students from three selected community colleges who participated in focus groups and completed surveys stated their overall experience in MTH098/090 had been positive largely due to their instructor. These participants also noted some modifications or

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enhancements which could be made to current student services (i.e., placement testing, career counseling, academic advising, and tutoring services) offered at each community college; therefore, efforts should be made to enrich these student services in order to better serve the developmental student population. In addition, instructors interviewed at each community college were passionate about teaching developmental mathematics and strongly dedicated to their students. These educators approached teaching in diverse ways, yet strived to provide a positive learning environment. In order to better serve the developmental program at their college, these instructors could possibly communicate with other developmental math teachers (across campus or via professional development) for additional strategies in course delivery, assessment, and questioning methodologies. Assessing best practices in teaching and learning will not rid community colleges of the need to provide developmental education, but it is an important step in combating some of the inequities that exist from college to college.

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Appendix A
Survey of Developmental Math Students

Please respond to the following:

1.) Math course in which I am currently enrolled: □ MTH 098 □ MTH 090

2.) Gender: □ Female □ Male

3.) Age: _____ years

4.) Race/Ethnicity: □ African American □ Asian □ Caucasian
□ Hispanic □ Native American □ Other

5.) Highest level of math taken in high school:
□ Algebra II/Trigonometry/Calculus □ Geometry
□ Algebra I □ General Math

6.) Length of time since last math class:
□ 1 yr or less □ 2 yr □ 3-5 yr □ more than 5 yr

7.) Had knowledge of the COMPASS Placement test for math:
□ Yes □ No

8.) Able to adequately prepare for the COMPASS test before taking the exam:
□ Yes □ No

9.) Please provide any thoughts regarding the COMPASS Placement test.

10.) On the first day of MTH 098/090, you felt:

11.) Describe in which ways you learn and understand math best. Is your current community college instructor using these methods?

12.) Check the following way(s) that math courses can be taken at your college:
□ Hybrid and/or Computer-Assisted □ Online □ Traditional Lecture

□ Self-Paced with Post-Test Assessment
(teach-yourself method of learning that is initiated and directed by the learner)

□ Mastery Learning
(reaching a level of predetermined mastery on concepts before being allowed progress to next unit)

13.) Based on question 12, in which of these course delivery methods have you taken MTH classes? What are the pros and cons?

14.) Developmental math students at your college are offered (check all that apply):
□ Academic Advising (assistance with course selection) □ Career Counseling

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□ Tutoring (specifically for MTH 098/090)
□ Workshops (study skills, learning styles, etc.)

15.) Based on question 14, have you utilized any of these services? If so, which one(s)?

16.) In your current MTH 098/090 course, by what methods are you assessed (graded) and how do you receive feedback?

17.) Is class interaction and/or group work used in your math class to aid in teaching and learning? If so, please describe.

18.) Overall, my experience in MTH 098/090 thus far has been:
□ Positive □ Negative □ Neutral

19.) Please explain your answer for question 18 (your MTH 098/090 experience thus far).

20.) Please answer the following questions regarding your current developmental math course by checking the box for your response that is most correct.

	Very true	Somewhat true	Not at all true
I enjoy my MTH 098/090 course.			
I believe I placed into the correct math course.			
My instructor asks me to explain how I got my answers to math problems.			
My instructor tries to understand my way of doing math problems.			
We have quizzes or tests.			
We have projects that are graded.			
My instructor is interested in my work even if it is wrong.			
When I don't understand concepts, my instructor tries to assist by questioning me about my thinking process.			
My instructor asks me to think about various ways to solve each math problem.			
We do web-based math work during class.			
We use web-based math programs for homework.			
My instructor uses technology when teaching.			

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Appendix B
Developmental Mathematics Instructor Interview Questions

1.) How did you become a college math instructor?
   a.) Describe your educational background.
   b.) How long have you worked here and what classes are you currently teaching?
   c.) Were you previously employed in K-12 education?
   d.) If so, what grades/courses did you teach and for how long?

2.) Describe your typical weekly schedule at your community college.
   a.) Do you have an office on campus? If so, describe its location.
   b.) Do the developmental math instructors at your college have regular departmental meetings?
   c.) If so, are these meetings held with members of the math department?

3.) What kind of preparation do you have for teaching at the community college level?
   a.) Do you participate in any math-related professional development?
   b.) If so, what have you learned that you are currently practicing?
   c.) Did any of these professional development opportunities specifically relate to teaching developmental math courses? If so, which ones?

4.) How did you come to teach developmental mathematics courses as you do?
   a.) Is there something specific after which your teaching is modeled?
   b.) Were you mentored at your current institution by a seasoned instructor?
   c.) Describe your methods for teaching developmental math students/courses.

5.) What are your opinions on developmental courses at the community college level?
   a.) Describe the structure of the developmental math department at your college – is it centralized or simply use mainstreaming?
   b.) Describe any difference(s) in your teaching style/methods in developmental courses versus credit courses.
   c.) Some four-year institutions are no longer offering non-credit/remedial math courses, how do you feel about this?
   d.) Students often disagree with their COMPASS placement scores. What is your opinion of the placement exam?

6.) What methods and/or techniques do you use to create positive learning experiences for developmental math students?
   a.) Do you promote interaction between classmates? Please describe.
   b.) Describe assessment(s) that you currently use in MTH 098/090.
   c.) Overall, do students leave your courses satisfied with their experience? Are they prepared for the next math course and how do you know?

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Appendix C
Developmental Mathematics Student Focus Group Questions

1.) Describe your attitudes toward math in the past.
   a.) Are you attitudes different now that you are a college student?
   b.) Discuss why math is needed for your future.

2.) What are your earliest recollections of learning math?
   a.) Were these positive or negative incidences?
   b.) Can you identify specific difficulties that you experienced?
   c.) How did you learn to cope with these difficulties?

3.) Discuss your placement into developmental math in college.
   a.) Was this placement expected or a surprise?
   b.) Was it a good placement? Why or why not?

4.) What does the terminology "developmental mathematics" mean to you?
   a.) Is there a positive or negative status associated with placing into one of these courses?
   b.) Has placing into developmental course(s) hindered your enrollment in other academic subjects?
   c.) If so, please describe.

5.) What teaching and learning strategies have helped you to become a better math student?
   a.) Are these strategies being used in your current math course?
   b.) What could be done to improve current practices in your math course?

6.) Many services are available for developmental students. If these services are available on tour campus, have you taken advantage of any of these?
   a.) If so, which ones and were they beneficial?
   b.) If not, why?

7.) Describe "math anxiety."
   a.) Do you believe that this is applicable to you?
   b.) If so, how?
   c.) If not, do you think that other students face this hindrance?

8.) Is there anything else you would like to express concerning your community college developmental math experience?

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Appendix D
Community College Request for Participation

Developmental Mathematics Education: A Study of Remedial Mathematics Programs in Alabama Community Colleges

Stacey Moore-Sivley, Researcher
Dr. James McLean, Advisor

Consent Email Letter

Dear Administrator:

As part of the requirements for the completion of my doctorate degree at the University of Alabama, I am conducting a research study to examine if best practices as stated in literature are being used in community college developmental mathematics programs. In order to accomplish this research, I need your assistance.

The study requires instructor interviews, completion of student surveys, and student focus groups. It would be valuable to my study if you would recommend developmental math instructors within your college that I may contact and ask for an interview and class participation. These instructors should be currently teaching MTH 098 – Elementary Algebra and/or MTH 090 – Basic Mathematics.

Data from interviews and focus groups will be transcribed by the researcher and the tape will be destroyed. I may use direct quotations from these interviews for my research, however, no names or distinguishing characteristics will appear with a quote from any individual without obtaining prior permission from the instructor or student. Student surveys will be anonymous and will attempt to gauge student attitudes and teaching/learning methods in their current developmental math course. There are no foreseeable risks, nor any distinct benefits to the participants of this study.

The results of the interviews, focus groups, and surveys will be reported in the form of a doctoral dissertation at the University of Alabama in Tuscaloosa. Research such as this is important and needed to help make decisions regarding successful teaching and learning methodologies in developmental math programs/courses. The benefits to education are that the results will be added to the information bank for further study.

Instructors and students will be asked to read and sign a consent form giving permission for the interview and focus group to be recorded. For any questions about this research, contact me at stacey.moore@wallacestate.edu or 256.708.7400. I look forward to hearing from you and to the participation of instructors and students at your college.

Sincerely,
Stacey Moore-Sivley
The University of Alabama

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