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Faculty Perceptions of Remedial Mathematics Programs for Community College

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This is to certify that the doctoral study by

CarolAnn Vassell-Kreitner

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Walden University
2016

Abstract

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by

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MS, Florida Atlantic University, 1998

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Doctoral Study Submitted in Partial Fulfillment

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Abstract

Graduating U.S. high school students who score on college placement tests at an achievement level below the standards for college-level math are typically required to take remedial math coursework when they enter college. However, very few students taking such coursework at community colleges are successful, and the majority drop out or take longer than expected to finish their degree programs. There is a need to improve these outcomes if students are to be well-served by their institutions. Educators at community colleges have tried new remediation approaches to improve student outcomes. Research revealed that these only resulted in minimal improvements. There is limited research on faculty perception of the current state of mathematics remediation. As they are directly involved in educating students, it is important to gauge faculty members' perceptions of approaches to mathematics remediation. The purpose of this study was to investigate community college faculty members' perceptions of two models for mathematics remediation. The theoretical framework is based on cognitive learning theory with a mixed-method study design. Twenty math faculty from a community college were administered a survey and five were interviewed to gauge their perceptions of their current remediation model as well as the Survive, Master, Achieve, Review, and Transfer (SMART) developmental mathematics model. The results had similar mean perceptions for both, but faculty expressed higher perceptions for more elements of the SMART model. Based on study findings, a white paper with suggestions for improving the institution's approach to mathematics remediation was created. By incorporating study recommendations, community college educators may increase remedial program success, in turn increase graduation rates, which may contribute to positive social change.

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Section 1: The Problem

Students who complete high school at an achievement level below the standards for acceptance into four year colleges or universities often turn to community colleges for postsecondary education. Otherwise, they may enroll at community colleges to obtain required skills to qualify for a higher degree beyond the associate degree level (Altbach, Gumport, & Johnstone, 2001). U.S. community colleges are encountering an increase in the number of students needing remediation in mathematical skills for upper-level courses (Calcagno & Long, 2009).

This lack of preparation of mathematical skills for higher level courses shifted the focus of most U. S. community colleges. The new focus transitioned to satisfying societal needs for an improved and better skilled community (McCabe, 2003). According to McCabe (2003), community colleges are often expected to educate “the most deficient students, those who would otherwise be lost to our society – and prepare them for employment and personal advancement” (p. 14). Here, these students have access to opportunities for higher education albeit for employment or a degree beyond a high school diploma.

This necessity for advancement in education and society resulted in a new direction for many students, as they turn to community colleges. These institutions have seen enrollment increases due to more students seeking an affordable education and wanting to prepare for higher studies (McCabe, 2003). This increase in enrollment has magnified other problems, including the underpreparation of high school graduates (Calcagno & Long, 2009). Community colleges now have to deal with not only the influx of students but to find a strategy to successfully educate them. Although this problem may be rooted in the K-12 educational system, it has ultimately become a problem for the community colleges to address. Institutions now have to develop a plan to deal with the dilemma.

According to the cooperating institution's Educational Master Plan (2008), more than 80% of its new students enrolled from 2005 to 2007 were deficient in the skills they need to succeed in mathematics, English, and reading. Freshmen students are required to take college prep or remediation classes if they receive a failing score on the college placement test. Only 5% of the students enrolled in the college preparatory program at the college were successful in the 2-year degree program (Educational Master Plan, 2008). According to the institution, success may be defined as completion of the developmental mathematics program and upper level mathematics courses including but not limited to College Algebra and College Mathematics with grades of A, B, or C and graduation with a 2-year degree or enrollment in a 4-year college or university. I view the low success rate as indicating a possible problem with the institution's mathematics instruction or its remedial program, more broadly.

The development of these remedial programs were to provide a smooth transition between high school and freshman year college (Achieve, 2004). The data collected by Achieve (2004) suggests that they are not meeting that goal. There is interest in remedying this inability to meet this goal, as future student success is dependent on continual evaluation of developmental programs for improvements that will increase the success rates (Gerlaugh, Thompson, Boylan, & Davis, 2007).

Bannier (2009), Bassett and Frost (2010), and others have created several instructional models for remedial students in mathematics; these models include computer-based instruction as well as learning centers and different levels of success. Computer-based programs such as MyMathLab and ALEKS have shown a slight increase rate above 20% (Bassett & Frost, 2010). However, the most successful model with an increased success rate of 45% is the Survive, Master, Achieve, Review, and Transfer (SMART) model, which is a developmental mathematics program established at Jackson State University in Spring 2007 (Bassett & Frost, 2010). Users of this models focus on preparing students based on their educational and career goals instead of remediating high school deficiencies (Bassett & Frost, 2010). With this program, more emphasis is placed on the specific mathematical concepts needed for programs instead of an inclusive list of concepts for a remedial math course.

Another aspect of remedial mathematics program is the question of how well students perform in college level courses. “Despite the extensive use of remedial courses to address academic deficiencies, little is known about the effect on subsequent student performance in college” (Bettinger & Long, 2009, p. 2). More research is needed to gauge this performance. One of the best available resources is drawing from the experience of mathematics faculty who have the most contact with students of remediation. Subsequently, we can promote discussion about ways to improve the effectiveness of mathematics remediation at the local level by surveying mathematics faculty at the cooperative institution regarding the remediation model they currently used as well as the SMART model (Bassett & Frost, 2010), which they were considering using instead.

This chapter provides a definition of the problem, the rationale of the study, definitions of terms, the significance of the study, the research questions, literature review and conceptual and theoretical foundation, definitions of terms, and the implications of the study.

Rationale

The need for college remediation in mathematics is a national problem (Bettinger & Long, 2009). In Ohio, a study completed in 2004 revealed that 45.6% of freshmen students were placed into remedial mathematics courses (Bettinger & Long, 2006). The 110 community colleges in the California Community System have one common goal which is to provide preparation in basic skills including mathematics to underprepared students (Jepson, 2006). Educators in Texas use the Texas Academic Skills Program (TASP) where scores on a standardized statewide test are used to assess precollegiate skills and ultimately place underprepared students into remedial programs.

During the 1990s, researchers studied college remediation to gain insight (Martorrel & McFarlin, 2011). This study consisted of approximately 400,000 4-year and 2-year college students, and compared their total credits earned after freshman year subsequent to remediation. Researchers found that students who struggled in their remedial programs are frequently unsuccessful in higher level mathematics courses, which put them at risk for dropping out of college (Martorrel & McFarlin, 2011). The number of academic credits attempted by students during the first year was lower by 1.5 credits while the total number of credits attempted by students within 6 years decreased by six academic credits. This result of the study indicates that a lack of success in remedial courses hinders students from moving on to future courses and ultimately a reduction in the academic credits attempted. Furthermore, although the results of the study revealed that remedial math students who attempted or passed college-level mathematics experienced improvement in their grade average, the findings were not significant for transfers to other colleges or degree attainment (Martorrel & McFarlin, 2011).

In Florida, researchers also studied the impact of remediation (Calcagno & Long, 2008). Calcagno and Long (2008) presented a statistical test of the discouragement hypothesis, which posits that students become so discouraged when they are required to take remedial classes before college level ones that they ultimately discontinue their pursuit of a college degree. They often see these classes as additional costs and unnecessary. Bettinger and Long (2009) stated that remediation decreases students' persistence while Bahr (2010) suggested that studies providing evidence that basic education remediation works are limited. Meanwhile, others including Clark and Lovic (2008), Wurtz (2015), and Waycaster (2011) presented models that may positively affect the remediation outcomes of students by using a placement tool to serve as good predictors in central mathematics courses.

These placement tools may be effective at the college that I studied, as, according to the institution's Educational Master Plan (2008), more than 80% of new students are deficient in at least one subject area (mathematics, English, and reading). Only 5% of the students enrolled in the college preparatory program offered by the institution graduate from the 2-year degree program. I believe that the 5% graduation rate may indicate that the program is ineffective and that there is a need to investigate how well the institution's college preparation and remedial mathematics program prepares students for college-level courses. My cooperating institution has not been able to find an effective solution to the problem of low completion rates for students of remediation. With my research, I sought to offer some insights and a possible solution.

This study can assist in filling this gap in understanding the low remediation success rates and contribute to the body of knowledge needed to address this problem of ineffective mathematics skill development. I used a mixed method design with two distinct phases of data collection. First, there was a quantitative survey of mathematics faculty on the institution's current model and proposed SMART model. Second, there was a follow up interviews for the qualitative portion with a small group of 5 faculty who teach remedial mathematics course. This second phase of data collection was specifically to gain more detailed views on the current model and proposed SMART model.

Definitions of Terms

For the purposes of this study, the following definitions apply:

College-preparatory/remedial program: "Program inclusive of communication and computational skills necessary to enroll in college credit instruction as well as academic preparedness, diagnostic assessment and placement, development of general and discipline-specific learning strategies, and affective barriers to learning" (Florida Statutes, 2008, Chapter 1004, section 2; NADE, 2009; NADE, 2001).

Community college: A public, 2-year institution offering a broad array of educational programs to meet the needs of a community (Vaughan, 2000).

Developmental education: A field of practice and research within higher education with a theoretical foundation in developmental psychology and learning theory. It includes the cognitive and affective growth of all post-secondary learners at all levels of the learning continuum. Developmental education is sensitive and responsive to individual differences and special needs among learners. Developmental education programs and services commonly address academic preparedness, diagnostic assessment and placement, development of general and discipline-specific learning strategies, and affective barriers to learning (NADE, 2009).

General education requirements (GER): "Thirty-six college-level semester credit hours of general education courses in five subject areas: Communications, Mathematics, Social Science, Humanities, and Natural Sciences" (Florida Community College, 2010/2011, p. 116).

New college students: Students who are enrolled for the first time and have not had prior postsecondary education (NADE, 2009).

Significance of the Study

I strove to contribute to the body of knowledge in the field of mathematics remediation and benefit my study college and its local community and stakeholders.

Contributions to the Body of Knowledge in the Field

Contributions to the body of knowledge in field adds to past studies on developmental education where little is known about the effect of developmental education on subsequent student performance in college (Bettinger, 2005). In 2011, Mesa examined instructors' perceptions of student concerns about their mathematical abilities. However, according to my review of the literature, there are a limited number of literature about faculty perception of students' goal orientations. Mathematics education has even less documentation. One analyst noted, "Research about the effectiveness of remedial education programs has typically been sporadic, underfunded, and inconclusive" (Merisotis & Phipps, 2000, p. 75). However, a large number of research studies revealed in bleak terms the points of failure in the implementation of developmental education (Merisotis & Phipps, 2000). We can better understand the nature of this failure as approximately two out of three community college students who are referred to a remedial mathematics sequence fail to complete it (Achieving the Dream, 2008, 2009; Bailey, 2009; Bailey et al., 2010; Bettinger & Long, 2009; Martorell & McFarlin, 2010). Mathematics, in particular, appears to be an overwhelming obstruction for many community college students (Achieving the Dream, 2006c).

Additional research can only enhance existing knowledge and understanding about this barrier of community college students enrolled in remedial mathematics by providing additional data and interpretation. Studying different models of mathematics remediation may provide educators with more insight about the effects of remediation on higher level mathematics courses. Ultimately, the necessity for a more resilient base for growth to endure future economic storms and enable the U.S. to compete in a global economy is dependent on information that this research study exhibits. As U.S. President Barack Obama stated, "It's time to reform our community colleges so that they provide Americans of all ages *a chance to learn the skills and knowledge* necessary to compete for the jobs of the future" (as cited in National Center for Postsecondary Research, 2010, p. 1).

Contributions at the Local Level

Data from this study may prove useful to faculty and administrators at the college under study in their evaluation of the mathematics preparatory program; they may use the results to find ways to improve its effectiveness, especially for students who need to take higher level courses. Some data exist for students in the U.S. who successfully completed the remedial program in mathematics and enrolled in college math or college algebra courses (Taylor, 2008). However, research on students' completion of higher levels of courses beyond MAC1105 and MGF1106 is minimal. This research collected and evaluated data on faculty perspectives regarding elements of the current mathematical remedial model and examined the existing remediation model in relation to the SMART model (Bassett & Frost, 2010), which is an alternative model for mathematics remediation.

Although the cooperating institution began offering baccalaureate degrees in 2009, it still provides education and preparation for students who wish to transfer to 4-year institutions. Data specific to the institution's college preparatory program should provide administrators with the ideas for enhancement and an insight to future baccalaureate science and engineering programs of study. The rate of transfer and acquisition of higher degrees may be positively affected by success in both remedial and higher level required courses. Enrollment and retention of students may also improve if educators at the study college use more effective remediation approaches. An increase in graduation rates is expected to attract more students and increased success in the remedial mathematics program will allow students to enroll and succeed in higher level mathematics courses.

Previous studies have indicated that about two thirds of community college students placed in developmental mathematics programs, do not complete them (Bailey et al., 2010). Additionally, a regression discontinuity study based on a large data set from Florida showed little support of the usefulness of remedial mathematics (Calcagno, 2007; Calcagno & Long, 2008). These data also revealed that successful completion of a college level mathematics credit course such as College Algebra or higher, was only achieved by considerably less than half of remedial students who excelled in remedial mathematics courses. This was also the case when using data from Ohio and Texas (Bettinger & Long, 2009; Martorell & McFarlin, 2010).

Guiding Research Questions

According to a U.S. Department of Education study (Adelman, 2006), three developmental mathematics courses, Algebra I, Algebra II and Intermediate Algebra, had the greatest withdrawal and failure rates in higher education. Similar to the Calcagno (2007) study, Adelman (2006) also discovered that the failure and withdrawal rates of the most popular general education courses, college algebra and pre-calculus algebra was greater than 50 % on a lot of campuses. This is particularly discouraging since these remedial Algebra courses were established to satisfactorily prepare students to succeed in the college algebra and pre-calculus algebra courses.

Establishing a better understanding of why such failures occur by looking at factors such as teacher influence and confidence in students’ mathematical ability will contribute to an improved knowledge of factors that affect learning success of underprepared college students. Subsequently, this knowledge can be utilized to develop a model for the institution's college preparatory mathematics program to fit the needs of every student of remediation.

This mixed method study evaluated the perceived effectiveness of a college preparatory/remedial program in mathematics at a selected community college by exploring faculty perceptions through a survey and follow up interviews.

1. What elements, if any, of the current mathematics remedial program are helpful in supporting student achievement from the perspective of faculty?

   Ho_1: There are no elements of the current mathematics remedial program that are helpful in supporting student achievement from the perspective of faculty.

   Ha_1: There are significant elements of the current mathematics remedial program that are helpful in supporting student achievement from the perspective of faculty.

2. What elements, if any, of the SMART mathematics model will be helpful in supporting student achievement from the perspective of faculty?

   Ho_2: There are no elements of the SMART mathematics model that will be helpful in supporting student achievement from the perspective of faculty.

   Ha_2: There are significant elements of the SMART mathematics model that will be helpful in supporting student achievement from the perspective of faculty.

Review of the Literature

The underlying frameworks for this research study stems from the definition of developmental education. According to the National Association for Developmental Education (NADE, 2009), developmental education is:

> 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 post-secondary learners, at all levels of the learning continuum. Developmental education programs and services commonly address academic preparation, diagnostic assessment and placement, development of general and discipline-specific learning strategies, and affective barriers to learning. (NADE, 2009, About Dev Ed section, definition, para. 1)

This definition serves as the foundation for the study with cognitive learning theory at its core. Some define learning as “cognitive processes of perception, interpretation, and information processing” (Kanter, 2013, p. 107). A preferred definition is that it is a cognitive process that is influenced by the learner’s prior knowledge, attitudes and beliefs, and physical and mental state (Galbraith, 2004). The cognitivist’s view is that individuals are active participants in their learning they organize information based on mental relations and structures that make prior knowledge essential to what and how individuals learn (Brown, 1994; Heath, 1983).

At the college under study, students are recommended to developmental mathematics courses after taking the CPT exam. However, the choice to enroll and attend is left up to them, with one driving force of satisfying the requirements for enrollment in college algebra or college math in order to graduate. This is the beginning of the role of cognitive learning in the institution’s college preparatory program model. Here, the students need to actively participate in their education by making the first choice to enroll.

Once enrolled, retention is often the next challenge. Some students choose not to continue with the process and drop out. Others who decide to enroll usually do so based on beliefs that a college degree will offer a better life, and prior experience as according to Galbraith's (2005) definition of cognitive learning. Once enrolled, students are faced with three developmental math courses taught in a lecture style and mandatory computerized math lab attendance. They are all expected to learn at the same pace in a program influenced by the four processes attention, retention or memory, behavioral rehearsal, and motivation as dictated by cognitive learning (Hergenhahn & Olson, 2005).

Cognitivism and cognitive learning styles are the cornerstone of successful learning assistance communities/centers at most community colleges that are common resources for students in developmental education and the recently designed SMART Math program at Jackson State Community College (JSCC). These learning centers allow students to be active participants in the learning process which is in line with the cognitivist perspectives. The impact of experience accounts for the finding that the number of college mathematics courses completed is significantly correlated with mathematics learning center visits (Bannier, 2009). One factor in the success of the JSCC program is the accommodation of varying learning styles. Although the program was recently established in 2007, the institution has already noted a 45% increase in the passing rate for students in development mathematics courses (Bassett & Frost, 2010).

This literature review examines the effects of remedial, college preparatory or developmental math on higher level college courses for students whose major plan of study is mathematics, science and engineering. Although there are slight differences in the classical definitions of remedial, college preparatory, and developmental math, these terms are used interchangeably and loosely to indicate a deficiency in the required mathematical skills for success in college level mathematics courses. This study will explore the perceptions of math faculty regarding the effectiveness of their current remediation model and the anticipated effectiveness of a possible alternative model.

Most studies on math remediation tend to focus on the effects and success of the actual completion of the remediation program only, and subsequent success in the courses for which the remedial work prepared the student is not assessed. This study will focus on how the faculty characterize success subsequent to completion of the remedial program. This success entails passing the series of developmental math courses with a grade of C or better. According to Bettinger and Long (2009), there are, “no benchmark to judge the success of higher education’s remediation efforts” (p. 3).

Therefore, the goal of this review is to first explore the background of educational remediation based on the definition of developmental education. Then, past and current trends in effectiveness of programs and models are explored. The goal then ultimately shifts to focus on perceptions of math faculty regarding the effectiveness of their current remediation model and the anticipated effectiveness of the alternative SMART model. The effectiveness of these models affect successful completion of upper level math courses and ultimately graduating with a 4-year degree in a math-type major field (mathematics, statistics, science including biology, chemistry, physics, business, computer science, engineering, and architecture).

Strategy for Searching the Literature

The review of literature presents information from books, articles and studies obtained through an investigation of current educational journals and published works by scholars in the field of education and mathematics. The research keywords that guided the review of literature were: *Remedial mathematics program, college preparatory* *programs in mathematics, developmental math education, recommendations for remediation, developmental program models, successful developmental math programs, faculty perceptions, and history of remediation.* The literature review contributes to the discovery of knowledge and understandings to answer the research questions: What elements, if any, of the current mathematics remedial program are helpful in supporting student achievement from the perspective of faculty? What elements, if any, of the current mathematics remedial program are not helpful in supporting student achievement from the perspective of faculty? What elements, if any, of the SMART mathematics model will be helpful in supporting student achievement from the perspective of faculty? What elements, if any, of the SMART mathematics model will not be helpful in supporting student achievement from the perspective of faculty?

The research databases used to collect the information in the review of literature were retrieved through the Walden Library and Reference Center. The primary sources of information included the Academic Search Premier, ProQuest, and Eric-Educational Resource Information Center, and Dissertations and Thesis. An exhaustive review of the literature between 2004 and 2012 in these databases using the keywords revealed limited research studies on the impact of remedial programs on mathematics courses beyond college algebra and college mathematics.

Organization of the Literature Review

The literature review first discusses the major reasons for remedial programs in mathematics at community colleges and/or the lack of preparation in the high schools or the K through 12 systems. It continues with a brief history of the roots of remediation in general, starting from the nineteenth century to the present time. Subsequently, previous documentation on the effects of enrollment in remedial mathematics on college level courses is explored and presented. The section concludes with suggestions for improvement from documented cases of successful programs that have been utilized in the past and those that are currently being used including the SMART model.

Bridging the Gap from Secondary Education through Reforms

Secondary education received a boost in the form of billions of tax dollars to fund educational reforms and improve practices within the public sector with the passage of the Elementary and Secondary Education Act of 1965 (Roueche & Snow, 1977). The purpose of the funding was to cover the cost of promoting parental involvement, instructional materials, professional development and other educational programs resources. This Act is reauthorized every five years, with the latest reauthorization in 2002 with the No Child Left Behind Act (US Department of Education, 2011).

From the late 1960s into the 1970s, measurable improvements in college preparation at the high school level could not be validated (Roueche & Snow, 1977). However, from 1945 to 1975, enrollments grew exponentially from 2 million to 11 million students in need of remediation (Cohen, 1998; Spann & McCrimmon, 1998). During the 1970s, educators "began to understand that poor academic performance involved far more complex factors than a student's being unable to solve for x in an algebraic equation" (Boylan & Saxon, 1998, p. 7). In 1973, the passage of the Rehabilitation Act introduced another group of students in need of developmental education; this Act prohibited discrimination based on disability in federally funded program which included admissions to institutions of higher education (US Department of Education, 2011). The 1980s were turbulent times with focus on foreign issues, especially the end of the Cold War and the breakup of the Soviet Union (Cohen, 1998). The focus was again shifted toward higher education with the goal of improving the standard of living and the economy. This period even experienced another reauthorization of the Elementary and Secondary Act as the Education Consolidation and Improvement Act of 1981. Later, the Act was again reauthorized to the Improving America's Schools Act of 1994. However, it was found that in 1994, 51% of high school students needed remediation, versus only 14% in 1982 (Cohen, 1998). This indicated that educational reforms were probably ineffective. The outcome was not as expected, and student preparation levels were worse than before the reforms (Altbach et al., 2005; Mercer & Harris, 1993; O'Banion, 1997).

Although improvement efforts were in effect for some time, 30% of students entering college in 1995 were enrolled in remedial courses in reading, writing, or mathematics (Boylan, 2001; Cohen, 1998). Reforms also showed little influence on standardized testing scores which showed no significant change when comparing data from 1987 to 1996 (Boylan, 2001). In response to these scores, Boylan (2001) stated that, "today's high school graduates appear to be neither better prepared nor worse prepared for college… and their need for remedial courses once they arrive in college has been relatively constant" (p. 8).

More recently, NCLB was also intended to improve student performance, and has demonstrated questionable success. This reform required that classrooms nationwide be filled with the best teachers who were knowledgeable, experienced and well qualified. However with this Act, the focus shifted from instruction in the specific subject areas to assessment and performance on standardized tests. This emphasis on raising testing scores affected learning opportunities and decreased valuable instruction time, which really did not increase the value of learning in the schools (Popham, 2004). Opponents were already against increased standardized testing and blamed it for the mediocre performance of the educational system. The lesson from NCLB is that schools need to increase academic standards to better prepare students for higher education and skilled jobs (Toch, 1991).

Two major factors were attributed to the failed reform and lack of preparation at the high school level: excessive mandates and devotion of time to test preparation, and lower socioeconomic schools that lack funding to hire qualified teachers who possess degrees in the subjects being taught (Darling-Hammond, 2004; Haycock, 2001).

It is often discussed that not all students have the required abilities for college-level work (Cronholm, 1999; Marcus, 2000; Trombley, 1998); however, some feel that the level of instruction for high school mathematics is not high enough for students to be prepared for college-level mathematics (Hoyt & Sorenson, 2001). A study by Adelman (2006) suggested that this lack of preparedness from the pre-collegiate level has somehow placed responsibility to remediate on the colleges and universities, so much that they have begun offering classroom and distance learning to high school students as a means of improvement. He further stated that, “the academic intensity of the student’s high school curriculum still counts more than anything else in pre-collegiate history in providing momentum toward completing a bachelor degree” (Adelman, 2006, p. xviii). However, since the high school system seems to have failed in this aspect, institutions of higher learning automatically inherit the problem.

Pre-collegiate Math Preparation

The ineffectiveness of secondary education reform has raised serious questions about the preparation of students to succeed in higher education, and public high schools have been blamed for students' lack of preparedness (Mills, 1998). Results from a remediation study conducted by the Maryland Higher Education Commission indicated that of the students who completed college-preparatory courses in high school, then went on to community college right after, 40% were recommended to developmental mathematics courses (Phipps, 1998). The study also noted one extreme case, at an institution where 73% of the students who completed college-preparatory courses needed math remediation. However, it should be noted that these high percentages of students needing remediation are not typical in all states.

Although postsecondary enrollment has increased over the past 30 years, many students have difficulty with math and have lacked adequate preparation skills for college-level math courses. The importance of mathematical knowledge has become evident in college curriculum and career goals (Stage & Kloosterman, 1995). For students who choose higher education to fulfill their career goals, many discover through standardized tests like the SAT, ACT, or placement tests, that they are under-prepared or lack adequate skills to enroll in college-level courses (Kilian, 2009).

There has been a noticeable trend in high schools and colleges to improve pre-collegiate math skills. In the 1980s, math requirements were made more stringent for high schools, but the number of underprepared students entering college continued to increase (Duncan, 2000). Later, in 1994, as per the National Council of Teachers of Mathematics (2000), all states were forced to adopt challenging core mathematics standards.

In 2000, the government urged schools to increase the required units and rigor of math in high schools. However, increase in units of high school math curriculum does not guarantee that students are learning the information (Duncan, 2000). In 2003, the program for International Student Assessment (PISA), which focuses on the ability of 15 year olds to apply mathematical skills to real-life context, otherwise referred to as mathematics literacy, reported that “U.S. 15-yr-olds performed worse than more than about half of their international peers” (Lemke & Gonzales, 2006, p. 24). These test results indicate that American students are at best average when it comes to math, and below average in some cases.

This led to even more stringent acceptance policies where the best and brightest students were being pursued (Newman et al., 2004). It soon became evident that more stringent acceptance policies did not improve pre-collegiate math skills especially for college-level math and science courses (Hagedorn et al., 1999) since in 2003 it was found that 22% of new college students were enrolled in remedial mathematics (Parsad & Lewis, 2003). Previously, Chen and Carroll (2005) reported that “among the 1992 12th-graders who enrolled in postsecondary education between 1992 and 2000 … 27% had to complete at least one remedial mathematics course” (p. 11).

The inadequate mathematical skills of students entering college cannot be completely blamed on high school curriculum and instructions. All students do not learn at the same pace or at the same time as their counterparts (O’Banion, 1997). Some students are just not good test takers. Although some students do have difficulties with math, many just have low “scores on some form of normative measurement – standardized tests, school grades, and the like” (Astin, 2000, p. 132). There is not too much research on college students who run into difficulties with math (Strawser & Miller, 2001), however it is approximated that 5 to 6% of elementary and secondary students have been found to have significant difficulty with math (Fleisher & Manheimer, 1997). Some other factors that affect math aptitude include: (a) too little practice and long time span between mathematics courses; (b) math anxiety; (c) not attending classes; (d) the idea that math ability or inability is genetic; (e) a bad occurrence with an instructor; (f) being learning disabled or not having good study habits; (g) no motivation or having a "don't care" attitude towards school; or (h) a low confidence or self-worth (Godbey, 1997).

History of Remediation

To understand the issue of remedial programs in mathematics, the history and progress of past remedial programs must be examined. Prior to the nineteenth century, higher education was mostly philosophy based and most of the course offerings focused on mathematics, philosophy, rhetoric and languages like Latin and Greek, and some sciences (Colby, Ehrlich, Beaumont & Stephens, 2003). Simultaneously, colleges had limited enrollment that was exclusively available to white males and the social elite (Colby et al., 2003). The purpose of higher education shifted from knowledge for the sake of knowledge to knowledge that could be used to support the workforce and contribute to new technologies (Altbach et al., 2005; Newnam, Couturier & Scurry, 2004). As a result there was an inflow of curriculum and enrollment and "more students arrived at college with insufficient academic preparation" (Stephens, 2001, p.2). Hence, the first remedial education was established and integrated to institutions across the U.S. with developmental programs and preparatory departments (Casazza, 1999).

The University of Wisconsin was the pioneer with the first formal remedial program offered in 1849. Since then, a few specially designed remedial programs have been offered at the postsecondary level at that institution (Taylor, 2001). Later, the admittance of under-prepared students was increased because of the Morrill Federal Land Grant Act of 1862 and 1890 which resulted in a more diverse population of students (Casazza, 1999; Stephens, 2001). These land acts forced institutions to design and offer agricultural and technical courses to support growing industry (Merisotis & Phipps, 2000). As a result, education became more practically oriented (Kezar, et al, 2005). Institutions began to adopt the German university model that focused on specialization and "by the early 1900's, the focus and structure of higher education had undergone a shift that involved opening opportunities to a much larger and even more diverse audience" (Colby et al., 2003, p. 28).

The establishment of the GI Bill in 1946 also added to the number of students requiring remedial courses when over a million servicemen enrolled, increasing college enrollments to over 2.5 million (Casazza, 1999). Later, the Civil Rights Act of 1964 and Higher Education Act of 1965 resulted in another increase in under-prepared students (Altbach et al., 1999/2005) by opening educational opportunities to more minorities including women, students with special needs, and those with low social and economic training (McCabe & Day, 1998; Prieto, 1997). This led to a dramatic decline in the national test scores thus requiring institutions across the nation to set up formal remedial programs (Duncan, 2000).

In the twenty first century, remedial programs are common at most institutions of higher learning. This is also a major source of income for these institutions. According to

Mills (1998), institutions admit and try to retain under-prepared students because losing enrollment creates financial consequences that can ultimately benefit the institution. Adam (2007) agreed that some institutions face budget cuts when students are not retained. College enrollment benefits the economy and increases the quality of life through greater productivity and tax revenues, lower crime rates because institutions produce civically engaging citizens (Newman et al., 2004; Phipps, 1998). Phipps also stated that remediation will continue to be a central purpose of higher education and a good investment for society, as the alternatives to investing in higher education can extend from no jobs to low-wage jobs, government assistance or imprisonment.

Effects of Remediation on College Level Courses

It is of utmost importance to evaluate the effectiveness of developmental programs to uncover results that may be utilized for program improvements (McCabe, 2003). Successful remedial programs use varying indices to evaluate program success (Roueche & Snow, 1977). Many states have been tracking the outcome of remedial students on subsequent college-level courses and graduation for years (Calcagno & Long, 2008). A Texas study monitored the academic progress and outcome of pre-collegiate students entering a post-secondary institution in the 1990s (Martorell & McFarlin, 2011). The state of Texas established a Texas Academic Skills Program (TASP) to assess college readiness for first time students. The study's sample was comprised of 197,502 4-year and 255,878 2-year college students. A regression discontinuity design was used to measure college success by variables including academic credits attempted based on 30 credit hours per year, attempts and passing of college-level mathematics, transfer to or from other colleges, and degree attainment. The results revealed that the number of academic credits attempted during the first year was lower by 1.5 credits, the total number of credits attempted within the six years decreased by six academic credits, remedial math students who attempted or passed college-level mathematics saw improved grade average, and no significant findings for transfers to other colleges or degree attainment. The cooperating institution also monitored these variables with a similar cohort. One significant outcome of this study was that remediation lowered the probability of completing one year of college by 6% (Martorell & McFarlin, 2011).

In California, 109 open-access community colleges with over 2.5 million students per year (California Community Colleges, 2013) offer a wide variety of programs and goals, and agree on the common mission to provide basic skills preparation (Jepson, 2006). Similar to the local College's methods, California community colleges use a state approved evaluation system to identify students in need of remediation. Enrollments in the recommended college preparatory courses are voluntary for both the local college and California systems. However, successes in these courses are prerequisites to college-level courses. The 4,294 population of this study in California was narrowed to twelve schools based on geographic locations and student demographics with outcomes consistent with the national student population (Jepson, 2006). The majority of the enrollments were in mathematics. Reported data revealed that only two thirds of students recommended for remediation enrolled in the courses. This was an interesting study because it divided the population data into two groups: 17 to 20 year olds and over 21 years. Jepson (2006) used linear probability models to determine the outcomes for these two groups enrolled in remedial courses. The data revealed that although completion of remedial courses increased the probability of both groups returning for a second term and completing a college-level course, the younger group had a lower probability than the older group (15.8 and 10.8 for the younger versus 27.7 and 15.3 for the older).

In Ohio, 65,977 freshman students of 2- and 4-year public colleges and universities were monitored for six years (Bettinger & Long, 2006). This study revealed that across all post-secondary institutions, 36% of the study sample was recommended to remediation with the majority of remediation taking place at community colleges. Of the 23,385 entering freshmen in these community colleges in Ohio, 52% were referred to remedial math or English with 45.6% of them placed in remedial mathematics and only 29.7% placed in English. After four and six years, only 18.3% and 19.3% of math remedial students got past the college-level courses and acquired a 2-year or 4-year degree.

The State of Florida has performed many studies throughout the years. One in particular was the study of freshman degree-seeking students at the 28 Florida Public Community Colleges from 2001 to 2006. This study measured outcomes that included degree attainment, program completion, transfer to 4-year university, and total remedial and non-remedial credits earned (Calcagno & Long, 2008). It was found that remediation had little or no impact on program completion, transfers, and degree attainment. These studies have a common thread of measuring success through completion of the developmental program. The administrators of these statewide remediation efforts (Texas, California, Ohio, and Texas) on institutions of higher education need to study the impact of remediation using a variety of outcomes, mainly the subsequent student performance in college-level courses (Bettinger & Long, 2009; Calcagno & Long, 2008; Bahr, 2013; Martorell & McFarlin, 2011).

Since the goal of remediation is to prepare the student for college level work, the success of a remedial/developmental mathematics program must be evaluated according to how students perform in subsequent college level math courses. For too long success rates, sometimes referred to as course completion rates, have been measured and continue to be measured by grades in remedial courses rather than by the degree to which they fulfill their true purpose, which is to support success in college level coursework (Sheldon & Durdella, 2010). Continual program evaluation has increased awareness of experts of remedial learning to pursue program advancements that will positively affect potential success for students (Gerlaugh, Thompson, Boylan, & Davis, 2007).

As Bettinger and Long (2009) aptly stated, “despite the extensive use of remedial courses to address academic deficiencies, little is known about their effects on subsequent student performance in college” (p.7). However, they did conclude that although it took these students longer to graduate than mainstream students, being successful at remedial mathematics increases graduation probabilities. Adelman (2004) concurred that many students fail to complete developmental courses or even drop out of school but the ones who complete some remedial coursework have a better chance of graduating. Some experts felt that there has been little evidence that remediation improves a student’s chances of graduating due to lack of control for important selection biases (Calcagno & Long, 2008), but Lavin, Alba, and Silberstein (1981) did use controls and discovered that remediation was a positive influence. Thus, the question of the effectiveness of remediation remains without a definitive answer.

A recent study by Calcagno and Long (2008) of nearly 100,000 college students in Florida was developed to examine the effect of remediation on educational outcomes by measuring both short and long-term outcomes including achieving a certificate, two-year degree, or transfer to a 4-year university, and short term outcomes, such as success in college-level courses. One short term measure of success focused on the remedial student's ability to pass college-level courses. It was thought to be the case that after success in the remedial program students would fare better than non-remedial students for courses like College Algebra (MAC1105) and English Composition (ENC 1101) since these are "required for all standard associate degree programs, and so there should be no selection problems in terms of which students elect to take the courses" (p. 16). The results showed that there was no statistical significance of the impacts of math remediation on success in the first college-level mathematics course. Point estimates for students on the margin of the cutoff were negative and ranged from 1.4% to 3 %.

Another study of 24,140 freshman college students enrolled in a Virginia college evaluated success in the first college level math and English courses subsequent to remediation. This study revealed that only 26% of students who entered in summer/fall 2004 completed gatekeeper (remedial) math (Jenkins et al., 2009). However, 73% of students who did enroll in these courses were successful. This result was also confirmed from research by CCRC on colleges involved in the Achieving the Dream Initiative, a national community college reform effort (Bailey, Jeong, & Cho, 2009). In keeping with previous findings, there was no significant difference between remedial and non-remedial students who were successful in a gatekeeper course. These findings among the various Virginia colleges are conflicting and cannot indicate whether remedial education is effective (Jenkins et al., 2009). In fact, among Virginia's community colleges, the proportion of students enrolling in gatekeeper math range from 17 to 50 % with the average math pass rates ranging from 58 to 89 %. This correlation is very weak, showing a difference in success rates among the institutions (Jenkins et al., 2009).

Another similar outcome is the measure of success in higher level math courses beyond college algebra or college math. These are courses for science and engineering majors like pre-calculus and the calculus sequence of courses. One university had to set up a remedial mathematics program after it became evident that students of quantum chemistry were failing because of a lack of basic mathematical skills (Koopman et al, 2008). As Koopman, et al (2008) noted, "proper mathematical skills are important for every science course and mathematics-intensive chemistry courses rely on a sound mathematical pre-knowledge" (p. 1). The institution experienced little or no change in the success rates for quantum chemistry and had to make adjustments in subsequent years for improvement (Koopman et al, 2008).

Faculty Perceptions and Attitudes about Math Remediation

The success of a remedial program in mathematics may also depend on the faculty. A recent study attempted to understand the nature of mathematics instruction at community colleges and opens the door for more investigations on ways in which instruction can promote student success at such institutions (Mesa, 2011). Specifically, Mesa (2011) reported,

> Instructors perceive that their students are more concerned with external judgments regarding their ability and less interested in developing competence, that they engage in self-handicapping behaviors, have a poor sense of their own capacity to do the work, routinely press for reducing challenge in the classroom, and have a low mathematics self-concept. (p. 2)

This perception may subsequently affect methods of instruction. Past research has made a strong case for using non-traditional instructional methods based on new ideas in curriculum like shared learning, which nurtures problem solving and reasoning instead of memorization by repetition (Johnson & Johnson, 1991). According to Mireles (2010), "Developmental mathematics students need to gain both fundamental and problem-solving skills. They need a strong mathematical foundation for obtaining their educational goals because most degree plans require at least one non-remedial mathematics course" (p.10).

On the other hand, supporters of traditional instruction believe that this method is the most effective means of gaining the fundamental skills. But research documents that traditional instructional techniques are used mostly by teachers with mathematics anxiety and that there is a high correlation between such methods and teacher ineffectiveness (Trujillo & Hadfield, 1999).

Instructors' attitudes also affect student success in remedial mathematics courses. Studies have shown the students, "are sensitive to the emphasis teachers place on different types of achievement goals as expressed through instructional practice and the ways in which teachers respond to students' accomplishments or shortcomings" (Friedel, et al., 2010, p. 103). Students can tell when their teachers promote a competitive versus a collaborative classroom, or if the teacher's main emphasis is on individual improvement rather working together and supporting each other, students' adopted beliefs are deeply formed by their teacher behaviors (Church, Elliot, & Gable, 2001; Middleton, Kaplan, & Midgley, 2004; Patrick, Anderman, Ryan, Edelin, & Midgley, 2001; Urdan & Schoenfelder, 2006). Studies have also shown that when teachers are perceived as placing most emphasis on performance, their students' feeling of self-worth declines, along with their behavior towards mastering content. In addition it has been shown that when students perceive teachers emphasize mastery their perceptions of self-worth increase which subsequently results in an increase of students' mastery goal orientation (Friedel, et al., 2010).

It is important to note that the literature, however, does not provide many inquiries regarding instructors' perceptions of their students' goal orientations, a gap that this study will attempt to address. A widespread idea in the literature on school development in mathematics is that teachers are usually uninformed of the resources—reasoning, intimate, and social or traditional—that students bring to class (Cohen, Raudenbush, & Ball, 2003). Faculty who are perceptive of the resources their students convey, can prepare instruction that are more effective and that engage all students with genuine learning (Civil, 1996, 1998; Fennema, Franke, Carpenter, & Carey, 1993; Khisty, 1995).

Successful Program Models/Designs

Several solutions and models of successful remedial programs have been established and utilized over the years. Computer-based instruction models, used also in distance learning, are a major part of higher education remediation models (Zaveralla, & Ignash, 2009). These models have a great influence on retention which is one of the factors of a successful remedial program. Research on the effects of computer-based instruction using 123 colleges and universities has shown some positive effects (Taylor, 2008). Some of these include: (a) faster knowledge acquisition, (b) slightly higher grades on posttests, and (c) improved attitudes toward learning (Kinney, Stottlemyer, Hatfield,

& Robertson, 2004; Kulik & Kulik, 1986, Taylor, 2008). Another benefit was the sense of community with the same instructor and same class meeting time (Kinney & Robertson, 2003). One particular computer algebra system, ALEKS, was found to improve mathematical achievement with mean scores changing from 16.56 to 20.56, an increase that was statistically significant, with a Cohen's *d* of about 0.611 (Taylor, 2008).

Another solution has been the establishment of learning support like individual tutoring in mathematics and statistics which has been successful to the point where the number of students choosing mathematics degree programs has increased (MacGillivary, 2009). Even more common are math learning centers or learning assistance centers. According to Bannier (2009), "research has long suggested favorable connections between peer tutoring and academic success in a variety of disciplines, including college mathematics (p. 1). Many studies have confirmed positive associations between consistent peer tutoring, retention, test scores, and grades in mathematics (Gribbons & Dixon, 2001; Heintz, 1975; Reitz & McCuen, 1993; Sprinthall & Scott, 1989; Xu, Hartman, & Uribe, 2001). A comprehensive mixed methods study by Thomas and Higbee (2000) examined certain correlations and discovered:

> Regardless of gender, race, or learning environment, two factors were consistently associated with achievement: attendance and academic autonomy, which reflects students' interest in learning for learning's sake. What makes these findings so important is that so many other variables were examined, yet it was attendance and students' attitude toward being involved in the learning process were [*sic*] the two that emerged as significant to student success. (p. 229).

Even the National Science Foundation has established a peer-guided learning system known as Workshop Chemistry (Lyle & Robinson, 2003). A major factor in the success of this system seems to be retention and class attendance.

This was also confirmed by Schwartz (2006) who asserted that class attendance is critical but not exclusive to achieving success in mathematics. One drawback to these learning centers is the stigma that such centers only serves developmental students and most students do not want to be openly identified or associated with that group (Bannier, 2009). Another qualitative case study in 15 community colleges across the country found that learning assistance centers and specialized skills labs are an important means of increasing students' academic preparedness for postsecondary study (Perin, 2004). In support of that the NESCC reported that students who paid more than six visits to the learning center had a GPA of a point or more higher than those who paid fewer visits, and NEUCC reported an increase in retention in college English courses when students received learning assistance.

However, Perin (2004) noted that "despite the strong presence of learning centers in community colleges, there is little research into the ways in which they aid in the enhancement of the academic skills of either developmental education or college-credit students" (p. 561). Drawbacks include the risk that tutors provide too much help, and this can raise the question of the originality of the student's work. This can also indicate a need for professional development to help tutors appropriately assist students with learning disabilities, special needs, or even teach students in higher level courses (Perin, 2004).

A highly effective program is the SMART (Survive, Master, Achieve, Review, and Transfer) developmental mathematics program established at Jackson State University in Spring 2007 (Bassett & Frost, 2010). Instead of remediating high school deficiencies, SMART math focuses on preparing students according to their educational and career goals. It consists of 12 modules where faculty determines the prerequisite modules needed for success in each college-level general education course. Outcomes are measured by pre and posttests. If a student demonstrates 80% competency on the module pretest, they advance to the next module. After the pilots were completed, it was noted that students in SMART learned significantly more than traditional programs, and the mean posttest scores increased by 15 points. Pass rates in redesigned sections during the pilots were as follows: Spring 2008, 54% of the 356 students; Fall 2008, 57% of the 711 students; and Spring 2009, 59% of 670 students. Then, in Fall 2009, 60% of the 1324 students passed. This shows a steady increase in the success rate for students in the program and a direct proportion to the number of students enrolled. The percent of students passing development mathematics courses has increased by 45%. Whereas traditional courses saw 74% remain in the course to the end while the redesigned courses had 72% retention. In Pilot II, with only redesign sections offered, 75% remained in the course to the end. With full implementation in Pilot III, 83% were retained. Retention in the SMART program improved overall by 12%. This is important because retention is one of the factors that affect success of a mathematics remediation program.

Another benefit of SMART Math was the reduction in the school's total cost per student by more than 20%. This was done by increasing class size from 24 to 30, which reduced full-time faculty from 78% to 58%, and using tutors at a cheaper rate. In addition, both retention and enrollment in college level courses increased.

Implications

The findings of this faculty survey will be presented to the administrators and stakeholders of the institution in the form of a white paper. This format displays the background, need, benefits of the program evaluation, and suggests possible solutions. Subsequently, there may be open dialogue, decisions and steps can be formulated to enhance the remedial/ college preparatory program. A solid remedial program in mathematics may become the foundation for success in a future four year degree program in science and engineering at the institution.

Summary

This study consists of four sections which include (I) Introduction, Definition and Rationale of the Problem (II) Methodology, (III) Description and Goals of the Project, and, (IV) Reflections and Conclusions. The following section will provide an in-depth review of the methodology that will be used to evaluate the effects of the college preparatory/remedial courses on college-level courses, transfer and graduation, and current models of remedial programs.

Section 2: The Methodology

This section contains information on my research methodology and a justification for the case study method that I used. Also included are discussions on the study population and sample, survey instruments, data collection and analysis methods, and protection of participants.

Mixed Method Design and Approach

Although mixed-method research can be more time-consuming, educational researchers are increasingly recognizing the value of collecting both quantitative and qualitative data (Lodico, Spaulding & Voegtle, 2010). Using both approaches may provide researchers with the best understanding of a research problem especially when it requires contributions of both qualitative and quantitative data to be appropriately investigated (Creswell, 2009). We can know so much more when studies incorporate both methods. Researchers using quantitative approaches administer surveys and conduct experiments to describe the relationships between variables and respond to research questions and hypotheses (Creswell, 2009). Following the quantitative method with a qualitative approach provide further insights and understanding of participants perception of the problem (Merriam, 2009). These are the reasons why I chose a mixed-method design for this study.

It is clear from the institution's educational plan (2008) that a problem exists. The quantitative data include a general idea and an overview of the participants' perception of the persistent problem at the institution. Qualitative data include the meaning and understanding of participants' perception of the problem. Ultimately, utilizing both methods resulted in an outcome that helped achieve the practical goals of this study which was to compare faculty perceptions of two remediation program models (Glesne, 2011).

In this study, I used two-phase sequential transformative strategy for mixed-methods where qualitative data builds on quantitative data. Faculty at the institution under study were first asked to review a PowerPoint presentation and summary of the SMART program model (Basset & Frost, 2010). This was followed by a request to complete a survey about their perceptions of the remedial mathematics model that they currently used as well as the SMART model. During the second phase (qualitative component), I conducted interviews with a group of five developmental math faculty who participated in the quantitative survey and asked them a series of six open ended questions to provide additional insight into their perceptions from the quantitative phase. No other form of data was collected.

Setting and Sample

The cooperating institution is an accredited multicampus institution in South Florida. The total student population in 2009 was 64,651, mostly consisting of students aging from 19-24 years and a total of 5,257 degrees and certificates awarded. All incoming students are required to take the CPT test to determine whether remedial courses are necessary. The college preparatory or remedial program in mathematics consists of three sequential courses (MAT 0012, MAT 0024, and MAT 1033). The study sample consisted of faculty who taught mostly remedial college algebra and/or college mathematics courses at my cooperating institution for the school year ending in 2015.

Participants were randomly surveyed online in May 2015 to explore their perceptions of student learning outcomes as they relate to the current model and the SMART model.

The institution that I studied is one of the 28 community colleges in the Florida Community College System. The System offers adult education, vocational training, and courses for students interested in completing the first two years of 4-year degree programs (Florida Department of Education, 2010). In 2010 Florida College Report (Florida Department of Education, 2010) we learned that in 2008-2009 there were 867,208 students enrolled in the system with 76,445 degrees awarded. These degrees consisted of 40,384 associate in arts, 12,055 associate in science, 21,223 vocational and college credit certificates, 1,741 EPI, and 1,042 bachelors degree program (Florida Department of Education, 2010).

In the past, the goal of the System was to enhance the lives of residents and citizens by offering lower cost tuition for lower-level courses towards an associate in arts degree, prepare students for vocational careers or for upper-level courses and transfer opportunities to universities through remediation. Presently, many of these institutions, including the one that I studied, have begun offering 4-year degrees (Florida Statutes, 2009). Therefore, remediation is now needed for students to complete a 4-year degree without having to transfer to another institution.

This community college is a multi-campus institution that offers a variety of associates in science degrees, an associate in arts degree for transfer to 4-year institutions, and a small amount of baccalaureate degrees. It was established in 1960 and is the fourth largest institution in the Florida Community College system (Florida Department of Education, 2010). The total enrollment increased from 58,979 in 2006-2007 to 64,651 in

2009-2010 with 5,257 total degrees and certificates awarded in the 2009-2010 academic year (Florida Department of Education, 2010).

I surveyed 100 math faculty who taught remedial, college algebra and college math courses at the college during the 2014-2015 academic year. I obtained the math faculty list from the college catalog on the school's website and verified it through contact with the math department at each campus. Information on the SMART model (Basset & Frost, 2010) was supplied to all potential respondents in the form of a PowerPoint from Jackson State Community College prior to accessing the surveys. (See Appendix B for a summary of the SMART program.) I emailed the PowerPoint and surveys to participants, who were prompted to review the slides before recording responses to the survey questions. The surveys for the quantitative portion were sent to all math faculty who teach remedial math courses and/or college-level courses from all four campuses of the institution. The qualitative portion of the study included a small subsample of a 5 participants, consisting mostly of faculty who teach remedial mathematics courses at the central location.

Data Collection Strategy

Instrumentation

The format for this mixed-method study is a quantitative approach as the primary method, followed by a qualitative component to add greater depth to the quantitative results. Although mixed-method research can be more time-consuming, educational researchers are increasingly recognizing the value of collecting both quantitative and qualitative data (Lodico et al., 2010). Utilizing both approaches may provide the best understanding of the research problem (Creswell, 2009). The quantitative approach included surveys to describe the relationships between variables and respond to research questions and hypotheses (see Creswell, 2009). The qualitative portion provides meaning and understanding of the participant's perception of the problem (Merriam, 2009). Faculty was asked to view the PowerPoint presentation of the SMART model then complete the survey designed to gather data on their perception about the current and SMART model.

I first performed a pilot test of the survey instrument to assess validity and reliability prior to administration of the survey to the participants. The design included a Likert 5-point scale where 5 = strongly agree, 4 = agree, 3 = neither agree nor disagree, 2 = disagree, and 1 = strongly disagree. Here, I was able to see which types of outcomes are most important to faculty. Data will focus on perception of instruction of the remedial courses MAT001, MAT002, MAT1033.

The survey was web-based, and consisted of a Likert scale ranging from 1 through 5 where 1 represented a "strongly disagree" response and 5 represented a "strongly agree" response, with some additional questions for demographic purposes. This was the same as the pilot study with the final version of the survey being subjected to the results of the pilot. The maximum possible score was be 75 (a total of 15 questions) that relates to a most positive response, and minimum possible score was 15 (all 15 questions) that relates to a least negative response. Statistical analysis of the data is displayed in tables in this section. The raw data will be available only by request from the researcher, with identifying information removed. The SMART Model PowerPoint and summary can be viewed in Appendix B, and the survey may be viewed in Appendix C.

Pilot Testing

Since the research instruments for both quantitative and qualitative phases of the study were newly developed, a pilot study was performed prior to launching the main study. A pilot study is a smaller version of the main study and may also be referred to as a feasibility study (Polit et al, 2001). In addition, it may be used to improve internal validity and reliability of the questionnaires (Peat et al, 2002).

Prior to performing the data collection step of the study, the questionnaires were administered to a small group of volunteers in the exact same way as was done in the main study. The participants of the pilot study consisted of a group of 5 selected from faculty who teach remedial and college algebra, and college math courses. The survey was administered via e-mail with details of the study and its purpose. Similar to the main study, the pilot study participants were allowed two weeks to respond. After one week, a reminder for participation was sent via e-mail again. The responses were assessed to ensure adequate range of information and support of the research questions.

The participants were allowed to make suggestions for improvements. However, no changes were needed. The survey completion time was recorded and determined to be reasonable. The questions did not need to be revised and no ambiguous or difficult questions were discovered or needed to be discarded. In addition, each question was assessed for adequate range of responses, and that these responses can be interpreted in terms of the information that is required. Any question not answered as expected would have been be revised, but none were found to be problematic.

The pilot test resulted in mean perceptions of 3.59 and 3.48, standard deviations of 0.962 and 0.960 for the Current model and SMART model respectively. The Cronbach alphas were also calculated and found to be 0.909 for the Current model and 0.898 for the SMART model, indicating high reliability for both.

Protection of Participants

To ensure protection of the study participants, the first step was to obtain approval from the Walden Institutional Review Board (IRB) and the cooperating institution, specifically the Office of the Provost. The main component of the study was the survey of faculty from the cooperating institution. Since the informed consent requests and surveys were administered electronically via email, the individual identity of faculty will not be disclosed, with the only knowledge being email addresses for submittal of the surveys only.

Approval and formal documentation were obtained from the cooperating institution's IRB and Office of the Provost where the study was conducted, approval from Walden University, and signed consent forms were used to protect the rights of the participants. The study was introduced using a cover letter and a consent form to ensure confidentiality of the online surveys. The consent form included title nature, purpose, procedures, participant rights and confidentiality of the project (Appendix D). The participants were informed of their right to refuse to participate or cease participation at any time during the study. Only the researcher has access to the information from the raw data from the faculty surveys and interviews. The data is stored at home on a password protected computer file which will be destroyed after five years.

My role as the researcher included data collection from faculty surveys and interviews, and data analysis. I am a current part-time instructor at one of the campus of the institution under study. Contact with faculty was limited to the consent letters and surveys of that portion of the study. The research looked at the effects of college preparatory/remedial mathematics courses on student success and my role was to obtain empirical evidence to support this study.

Data Collection and Analysis

The quantitative survey results were analyzed using descriptive and inferential statistics and qualitative interviews reviewed using coding and themes to determine if there exists a general consensus of faculty perceptions of each model. The surveys and information of the SMART program was emailed to math faculty. The Statistical Package for the Social Science (SPSS) was used to provide the descriptive statistics for the quantitative surveys. For the purpose of this research project, the dependent variables, faculty perceptions of elements of the current remedial model that supports student success and faculty perceptions of elements of the SMART model that support student success was measured on a 5-point Likert scale. The independent variables were elements of the current remedial model and elements of the SMART remedial model. The main research question that drove this study was intended to determine the elements of the current model and proposed SMART model that support student success in both the remedial mathematics courses and college level courses. Specifically, the data collected were used to address the research questions:

1. What elements, if any, of the current mathematics remedial program are helpful in supporting student achievement from the perspective of faculty?

   Ho_1: There are no elements of the current mathematics remedial program that are helpful in supporting student achievement from the perspective of faculty.

Ha_1: There are significant elements of the current mathematics remedial program that are helpful in supporting student achievement from the perspective of faculty.

2. What elements, if any, of the current mathematics remedial program are not helpful in supporting student achievement from the perspective of faculty?

   Ho_2: There are no elements of the current mathematics remedial program that are not helpful in supporting student achievement from the perspective of faculty.

   Ha_2: There are significant elements of the current mathematics remedial program that are not helpful in supporting student achievement from the perspective of faculty.

3. What elements, if any, of the SMART mathematics model will be helpful in supporting student achievement from the perspective of faculty?

   Ho_3: There are no elements of the SMART mathematics model that will be helpful in supporting student achievement from the perspective of faculty.

   Ha_3: There are significant elements of the SMART mathematics model that will be helpful in supporting student achievement from the perspective of faculty.

4. What elements, if any, of the SMART mathematics model will not be helpful in supporting student achievement from the perspective of faculty?

   Ho_4: There are no elements of the SMART mathematics model that will not be helpful in supporting student achievement from the perspective of faculty.

   Ha_4: There are significant elements of the SMART mathematics model that will not be helpful in supporting student achievement from the perspective of faculty.

The sample was comprised of math faculty who teach remedial and college-level mathematics courses. The descriptive statistics was performed using the Statistical Package for the Social Science (SPSS).

As previously mentioned, the targeted population for faculty perception analysis was the math faculty at the participating institution. Since this was a sample of faculty who teach remedial and college algebra, and college math courses, the list was obtained from the college catalog at the school's website and verified through contact with the math department at each campus. The survey was administered via e-mail with details of the study and its purpose. The participants were allowed two weeks to respond. After one week, a reminder for participation was sent via e-mail again.

The quantitative data were tabulated and analyzed using SPSS to display the descriptive statistics of the quantitative survey results. The summary of the statistical results was used to test the hypotheses previously listed in this section. The sample for the qualitative data was randomly selected from the participants who responded to the quantitative surveys. There were two steps to the qualitative interviews. First, there was an initial telephone contact to introduce the researcher and intent of the study. This was used as an icebreaker and to gain the trust of each faculty member. Second, individual interviews were scheduled where each faculty was asked the same six open-ended questions listed in Appendix C. Responses were compared to the quantitative responses and scrutinized for similarities.

For the quantitative portion of the study, the predictor or independent variables were elements of the current model (CRRMDL), elements of the SMART model (SMTMDL), and the dependent variables were faculty perceptions of elements that support student achievement using the current model (FTYPCPc), faculty perceptions of elements that will not support student achievement using the current model (non-FTYPCPc), faculty perceptions of elements that support student achievement using the SMART model (FTYPCPs), and faculty perceptions of elements that will not support student achievement using the SMART model (non-FTYPCPs). These variables were used to address the research questions and accompanying hypotheses. Table 1 outlines the variables and statistical tests that were be used.

Table 1

Statistical Variables

Independent variables	Dependent variables	Research hypotheses	Statistical procedures
	FTYPCPc	H_0: CRRMDL = FTYPCPc	Descriptive, student t test
CRRMDL	FTYPCPc	H_0: CRRMDL ≠ FTYPCPc	Descriptive, student t test
	non-FTYPCPc	H_0: CRRMDL = non-	Descriptive, student t test
	non-FTYPCPc	H_0: CRRMDL ≠ non-	Descriptive, student t test
	FTYPCPs	H_0: SMTMDL = FTYPCPs	Descriptive, student t test
SMTMDL	FTYPCPs	H_0: SMTMDL ≠ FTYPCPs	Descriptive, student t test
	non-FTYPCPs	H_0: SMTMDL = non-	Descriptive, student t test
	non-FTYPCPs	H_0: SMTMDL ≠ non-	Descriptive, student t test

Scores from each element of the questionnaire were totaled for each participant (see Table 2). This indicated a level of faculty perception, where a low total indicated an unfavorable perception of the model and a high total indicated a favorable perception of the model. Each faculty had two total scores; one for the current model and one for the

SMART model. These scores were tabulated and input into the SPSS program. The descriptive statistics include range, mean, variance and standard deviation for each model. Histograms were also included to provide visuals of the shape and spread of each data set.

The summary statistics from the descriptive data results were used for the parametric testing portion of the study. This phase of the data analysis utilized an independent t-test by the SPSS program, with a significance level of .05. This measured the variance between the faculty perception scores of the two models to answer the research hypotheses and reveal if there was a significant difference between the mean scores. A *t* distribution table was used to determine if the t statistic exceeded the critical region, thus rejecting the null hypotheses, and indicating significant differences in the perceptions of the current and SMART models.

Descriptive Statistics

The Statistical Package for the Social Science (SPSS) was used to provide the descriptive statistics for the quantitative surveys. A total of 100 surveys were sent out with a 20% return rate. The sample, n = 20 was obtained from mathematics faculty who were asked the same 15 questions for the current remedial model and the SMART model. The responses were measured on a 5-point Likert scale: 1 – *strongly disagree*, 2 – *disagree*, 3 – *neither agree/disagree*, 4 – *agree*, 5 – *strongly agree*. The mean responses for the current and SMART model were 3.41 and 3.45, respectively. Table 2 shows the breakdown of the responses for each question on the survey.

Table 2

Results of the Quantitative Survey

Survey Questions (CRRMDL/SMTMDL)	Current Model Mean Response (FTYPCPc)	Current Model Standard Deviation	SMART Model Mean Response (FTYPCPs)	SMART Model Standard Deviation
Q1 - Provides accurate student placement	3	1.12	3.4	0.75
Q2 - Includes courses that support all basic algebra concepts	4.2	0.41	2.2	0.83
Q3 - Course formats support student growth, mathematically	3.85	0.67	2.9	1.07
Q4 - Allows students to grasp concepts easily and quickly	3.45	0.94	3.8	0.7
Q5 - Format should focus solely on concepts needed for the next course	2.6	1.1	4.2	0.89
Q6 - Model success is affected by instructor's teaching style	4.5	0.61	1.85	0.49
Q7 - Supports student learning outcomes	4.1	0.31	4	0.56
Q8 - Model is effective in supporting Student success in remediation	2.8	1.2	4	0.56
Q9 - Class size/facilities supports learning	2.5	1.05	3.25	0.64
Q10 - Encourages appropriate faculty development	3.3	0.8	3	0.86
Q11 - Supports use of technology in classroom instruction	4.25	0.44	3.95	0.6
Q12 - Improve student participation in and attitudes toward school	2.3	0.73	4.1	0.31
Q13 - Support career awareness and exposure among students	2.4	0.75	3	0.92
Q14 - Teach critical thinking and problem-solving skills	4.1	0.31	4	0.32
Q15 - Supports student achievement in core academic courses	3.85	0.75	4.05	0.22

Current model

The total scores for each participant for the current model were calculated with possible total scores ranging from 5 to 75. Using SPSS, the mean score was 51.2 and standard deviation was 5.99. More information of the descriptive statistics for the current model is presented in Table 3.

Table 3

Descriptive Statistics of Current Model

Descriptives

			Statistic	Std. Error
CRRMDLTOT	Mean		51.20	1.339
	95% Confidence Interval for Mean	Lower Bound	48.40	
		Upper Bound	54.00	
	5% Trimmed Mean		50.44	
	Median		50.00	
	Variance		35.853	
	Std. Deviation		5.988	
	Minimum		44	
	Maximum		72	
	Range		28	
	Interquartile Range		4	
	Skewness		2.274	.512
	Kurtosis		7.449	.992

Additionally, Figure 1 presents a histogram plot with normal curve which shows the data to be fairly normally distributed with one outlier

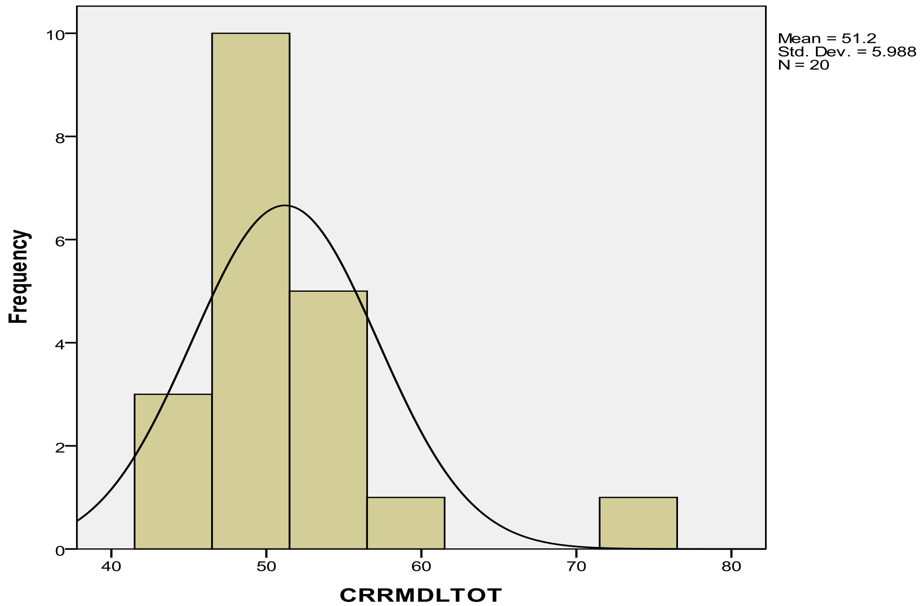

Figure 1. Histogram of faculty perception scores for current model.

SMART model.

Similarly, the total scores for each participant for the SMART model were calculated with possible total scores ranging from 5 to 75. Using SPSS, the mean score was 51.7 and standard deviation was 5.41. More information of the descriptive statistics for the current model is presented in Table 4.

Table 4

Descriptive Statistics of SMART Model

Descriptives

			Statistic	Std. Error
SMTMDLTOT	Mean		51.70	1.210
	95% Confidence Interval for Mean	Lower Bound	49.17	
		Upper Bound	54.23	
	5% Trimmed Mean		51.50	
	Median		51.50	
	Variance		29.274	
	Std. Deviation		5.411	
	Minimum		40	
	Maximum		67	
	Range		27	
	Interquartile Range		4	
	Skewness		1.049	.512
	Kurtosis		3.694	.992

Additionally, Figure 2 presents a histogram plot with normal curve which shows the data to be normally distributed with no outliers.

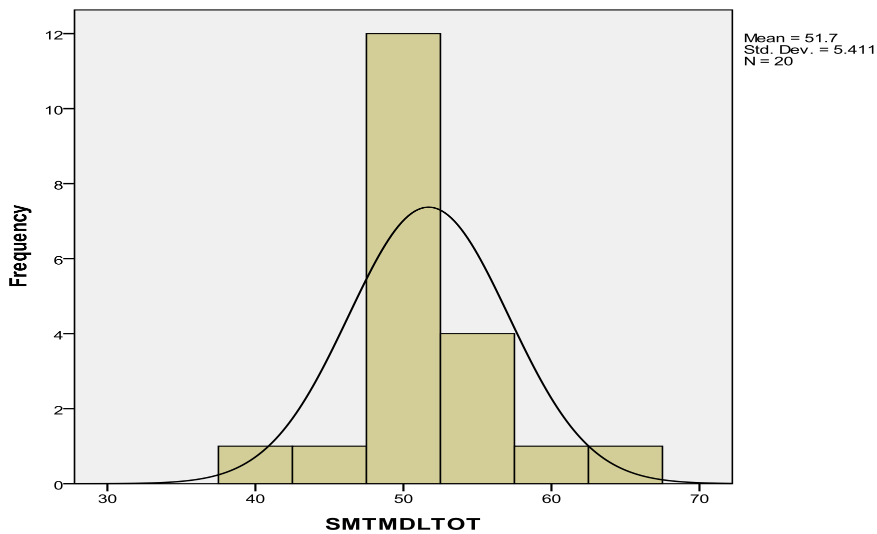

Figure 2. Histogram of faculty perception scores for SMART model

Hypothesis Testing

Research Questions

1. What elements, if any, of the current mathematics remedial program are helpful in supporting student achievement from the perspective of faculty?

   Ho_1: There are no elements of the current mathematics remedial program that are helpful in supporting student achievement from the perspective of faculty.

   Ha_1: There are significant elements of the current mathematics remedial program that are helpful in supporting student achievement from the perspective of faculty.

Faculty responses to the quantitative survey questions for the current model showed high scores listed in Table 5.

Table 5

Element of Current Model with Highest Mean Scores

Elements (CRRMDL)	Current Model Mean Response (FTYPCPc)	Current Model Standard Deviation
Q2 - Includes courses that support all basic algebra concepts	4.2	0.41
Q6 - Model success is affected by instructor's teaching style	4.5	0.61
Q7 - Supports student learning outcomes	4.1	0.31
Q11 - Supports use of technology in classroom instruction	4.25	0.44

The results listed above indicate that faculty perceives these elements of the current model to be effective.

2. What elements, if any, of the current mathematics remedial program are not helpful in supporting student achievement from the perspective of faculty?

   Ho_2: There are no elements of the current mathematics remedial program that are not helpful in supporting student achievement from the perspective of faculty.

   Ha_2: There are significant elements of the current mathematics remedial program that are not helpful in supporting student achievement from the perspective of faculty.

Faculty responses to the quantitative survey questions for the current model showed low scores listed in Table 6.

Table 6

Element of Current Model with Lowest Mean Scores

Elements (CRRMDL)	Current Model Mean Response (FTYPCPc)	Current Model Standard Deviation
Q5 - Format should focus solely on concepts needed for the next course	2.6	1.1
Q8 - Model is effective in supporting student success in remediation	2.8	1.2
Q9 - Class size/facilities supports learning	2.5	1.05
Q12 - Improve student participation in and attitudes toward school	2.3	0.73
Q13 - Support career awareness and exposure among students	2.4	0.75

The results listed above indicate that faculty perceives these elements of the current model to be ineffective.

3. What elements, if any, of the SMART mathematics model will be helpful in supporting student achievement from the perspective of faculty?

   Ho_3: There are no elements of the SMART mathematics model that will be helpful in supporting student achievement from the perspective of faculty.

   Ha_3: There are significant elements of the SMART mathematics model that will be helpful in supporting student achievement from the perspective of faculty.

Faculty responses to the quantitative survey questions for the SMART model showed high scores listed in Table 7

Table 7

Element of SMART Model with Highest Mean Scores

Elements (SMTMDL)	SMART Model Mean Response (FTYPCPs)	Standard Deviation
Q5 - Format should focus solely on concepts needed for the next course	4.2	0.89
Q7 - Supports student learning outcomes	4.0	0.56
Q8 - Model is effective in supporting Student success in remediation	4.0	0.56
Q12 - Improve student participation in and attitudes toward school	4.1	0.31
Q14 - Teach critical thinking and problem-solving skills	4.0	0.32
Q15 - Supports student achievement in core academic courses	4.05	0.22

The results listed above indicate that faculty perceives these elements of the current model to be effective.

4. What elements, if any, of the SMART mathematics model will not be helpful in supporting student achievement from the perspective of faculty?

   Ho_4: There are no elements of the SMART mathematics model that will not be helpful in supporting student achievement from the perspective of faculty.

   Ha_4: There are significant elements of the SMART mathematics model that will not be helpful in supporting student achievement from the perspective of faculty.

Faculty responses to the quantitative survey questions for the SMART model showed low scores listed in Table 8.

Table 8

Element of SMART Model with Lowest Mean Scores

Elements (SMTMDL)	SMART Model Mean Response (FTYPCPs)	SMART Model Standard Deviation
Q2 - Includes courses that support all basic algebra concepts	2.2	0.83
Q6 - Model success is affected by instructor's teaching style	1.85	0.49

The results listed above indicate that faculty perceives these elements of the current model to be ineffective.

The main research question of comparing faculty perceptions of the current model versus the SMART was also analyzed using SPSS. Is there a mean difference between faculty perception of the current model and SMART model? Although the sample was small, $n = 20$, the data was normally distributed which satisfied the criteria for hypothesis testing using the student t distribution. Tables 9, 10 and 11 display the summary statistics, correlation and results of the *t* test, respectively.

Null Hypothesis H_0: mean CRRMDL = mean SMTMDL

Alternative Hypothesis H_A: mean CRRMDL $\neq$ SMTMDL

Paired Samples *t* test

Table 9

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	CRRMDLTOT	51.20	20	5.988	1.339
	SMTMDLTOT	51.70	20	5.411	1.210

The comparison of sample statistics for current and SMART model shows means having very similar values with the SMART model have a slightly higher score. The standard deviation and standard error of the SMART model are lower, indicating smaller deviations from the mean value.

The paired sample correlations listed in Table 10 shows a moderate correlation of .541 between the two models.

Table 10

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	CRRMDLTOT & SMTMDLTOT	20	.541	.014

The critical value for correlation coefficient at n = 20 is 0.444. Since the sample correlation of .541 is greater than the critical correlation value of .444, there is significant linear correlation.

Table 11 lists a calculated t test statistic value of -.408. The critical t value at a 95% confidence level or α = 0.05 and degree of freedom (n-1 = 19), was found to be ±2.093. Since the test statistic does not fall within the critical t value and the p-value of .688 is greater than the α value of 0.05, there is insufficient evidence to reject the null hypothesis that the two means are not significantly different.

Table 11

Paired Samples Test

Paired Samples Test									
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	P- value Sig. (2-tailed)
Pair 1	CRRMDLTOT - SMTMDLTOT	-.500	5.482	1.226	-3.066	2.066	-.408	19	.688

Table 12 lists a calculated t test statistic value of -4.77. The critical t value at a 95% confidence level or α = 0.05 and degree of freedom (n-1 = 19), was found to be ±2.093. Since the test statistic falls within the critical t value and the p-value of .0001 is lower than the α-value of 0.05, there is sufficient evidence to reject the null hypothesis that the two means are not significantly different.

Table 12

Paired t test Results: Model is Effective in Supporting Student Success in Remediation

Paired Samples Test									
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean Difference đ	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	P- value Sig. (2-tailed)
Pair 1-Q5	CRRMDLTOT - SMTMDLTOT	- 1.6	1.501	0.336	-2.302	-0.898	-4.77	19	.0001

Table 13 lists a calculated t test statistic value of -4.33. The critical t value at a 95% confidence level or α = 0.05 and degree of freedom (n-1 = 19), was found to be +2.093. Since the test statistic falls within the critical t value and the p-value of .0004 is lower than the α-value of 0.05, there is sufficient evidence to reject the null hypothesis that the two means are not significantly different.

Table 13

Paired t test Results: Improving Student Participation in and Attitudes Towards School

Paired Samples Test									
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean Difference đ	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	P- value Sig. (2-tailed)
Pair 1-Q8	CRRMDLTOT - SMTMDLTOT	- 1.2	1.240	0.277	-1.780	-0.620	-4.33	19	.0004

Table 14 lists a calculated t test statistic value of -4.68. The critical t value at a 95% confidence level or α = 0.05 and degree of freedom (n-1 = 19), was found to be ±2.093. Since the test statistic falls within the critical t value and the p-value of .0002 is lower than the α-value of 0.05, there is sufficient evidence to reject the null hypothesis that the two means are not significantly different.

Table 14

Paired t test Results: Format Should Focus Solely on Concepts Needed for the Next Course

Paired Samples Test									
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean Difference đ	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	P- value Sig. (2-tailed)
Pair 1-Q9	CRRMDLTOT - SMTMDLTOT	- 0.75	0.716	0.160	-1.085	-0.415	-4.68	19	.0002

Table 15 lists a calculated t test statistic value of -15.4. The critical t value at a 95% confidence level or α = 0.05 and degree of freedom (n-1 = 19), was found to be ±2.093. Since the test statistic falls within the critical t value and the p-value < .0001 is lower than the α-value of 0.05, there is sufficient evidence to reject the null hypothesis that the two means are not significantly different.

Table 15

Paired t test Results: Class Size/Facility Supports Learning

Paired Samples Test									
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean Difference đ	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	P- value Sig. (2-tailed)
Pair 1-Q12	CRRMDLTOT - SMTMDLTOT	- 1.8	0.523	0.117	-2.045	-1.555	-15.4	19	<.0001

Qualitative Results

The qualitative data were transcribed and analyzed using coding and themes by the researcher. For qualitative purposes, the researcher was the principal instrument for data collection and analysis, where analysis really occurs at the same time as data collection (Merriam, 1988). In order to have the highest quality data, four principles are often used: (a) investigate all the facts; (b) cover all main alternative interpretations; (c) be sure to address all key points; and (d) include the researcher's own comprehension and expertise in the analysis (Yin, 2003). Therefore, the researcher may utilize thick, rich descriptions in data analysis, first starting with categories or themes, then breaking them down into theory (Merriam, 1988; Yin, 1994, 2003). The categories or themes for possible answers to the research questions were formulated once all the data from the surveys and transcribed interviews were compiled.

Participants of the quantitative portion of the study were asked to contact the researcher if they wanted to be interviewed. Two participants responded and an additional three were contacted by the researcher, for a total of five participants. They will be referred to as P1 through P5. The consent forms were emailed, signed and scanned or faxed back to the email address and fax number provided. All were interviewed by telephone. The responses were not recorded but notes were taken instead.

The participants were asked the following set of open-ended questions:

Qualitative Interview Questions – Current model

1. What do you like about the current model?
2. What don't you like about the current model?
3. Do you think improvement is needed? If yes, why? If no, why not?
4. What aspects, if any, of the current model do you think are effective? Why?
5. What aspects, if any, of the current model do you think are not effective? Why?
6. How do you think the current model supports student learning outcomes?

Qualitative Interview Questions – SMART model

1. What do you like about the SMART model?
2. What don't you like about the SMART model?
3. Do you think improvement is needed? If yes, why? If no, why not?
4. What aspects, if any, of the SMART model do you think are effective? Why?
5. What aspects, if any, of the SMART model do you think are not effective? Why?
6. How do you think the SMART model supports student learning outcomes?

Participant P1 and P3 taught only remedial mathematics courses whereas participant P2, P4 and P5 taught College Algebra and higher courses. All seemed to agree that the current model needs some improvement, and did not like the fact that the SMART model did not include all materials in the course outcome. Other similarities include the effectiveness of the SMART model for the elements of improving student participation and attitudes towards school, supporting student achievement in core academic courses, and supporting student learning outcomes. This corroborates the results of the quantitative study where these three elements also received high average scores of 4.0 or higher signifying that most agree or strongly agree. In the words of P2, "I guess students are happy when they see that they can progress through their program and not get stuck in some remedial course."

However, there were some distinct differences which may indicate biases that stem from the courses that these faculty members teach. P1 claims a greater than 50% success rate in the remedial courses being taught by this faculty member, therefore thinks the program is somewhat effective and only needs some minor tweaking. Similarly, P3 mentioned having success using the ALEKS program. On the other hand, P2, P4, and P5 shared similar thoughts that a whole new approach is needed but not necessarily the SMART program. The main dissent was the omission of mathematical concepts, as the feel that nothing should be left out. However, all three was willing to look past that aspect, recognizing that community colleges are not necessarily needed to build scholars but instead for students seeking immediate gainful employment and technical professions. All five participants seemed to like the increased student retention results for the SMART model. Table 12 displays an overview of the themes that emerged from the qualitative analysis.

Table 16

Themes from Open-ended Questions and Interviews

Category	Emerging Themes
	Current
Favorable elements	Includes all mathematical concepts
Unfavorable elements	Low student retention, low success rates
Effective Elements	
Ineffective Elements	ALEKS time-consuming, student frustration
Supports learning outcomes	Course format, ALEKS program
	SMART
Favorable elements	Student retention, high success rates
Unfavorable elements	Omission of mathematical concepts
Effective elements	Faster pace, career oriented
Ineffective elements	
Supports learning outcomes	Course format, concepts for next math course

Theme 1 regarding the current model of instruction: Includes all mathematical concepts.

All five instructors mentioned that they like the fact that the current model does not omit any of the mathematical concepts for each remedial course. P2 and P3 felt that students would be cheated out of valuable knowledge all mathematical concepts were not included in the courses. P5 discussed that omitting any concept in a mathematical remedial course may be perceived as lowering the educational standards.

Theme 2 regarding the current model of instruction: Low retention and success rates.

This is a general theme of the institution that has sparked research on ways of improvement. The ALEKS program is the most current one being used and two research participants mentioned that they are involved. Participant, P1 stated,

> I think the ALEKS program is too time-consuming. Students are continually sent back to review a previous concept if they miss a question on the assessment portion. Subsequently, they end up getting frustrated and either drop the course or failing.

It did not matter if the course was using ALEKS, MathLabs, or traditional methods, the common phrase was, “students don’t show up for class”, which seems to be one of the reasons that they fail the course. The ALEKS program allowed them to work at home, but as P4 explained, “they are not disciplined enough to complete assignments at home” which is another reason that they fail the course.

Theme 3 regarding the current model of instruction: Time consuming and students get frustrated.

This theme is directly related to the previous theme. In fact, it seems to be the two reasons that participants perceive to be the cause of low student retention and low success rates. The assignments in the ALEKS program seem require a lot of time to complete. Students are quizzed at intervals to assess the level of knowledge gained per section and concept. If any question is incorrectly answered, they are sent back to the beginning for more practice of the specific concept and quizzed again. Students complain that hit is not only time consuming, but extremely frustrating.

Theme 4 regarding the current model of instruction: Course format supports learning outcomes.

All participants did agree that the current model supports the learning outcomes listed in the course outlines of each remedial course. They mentioned that it might not be effective in some cases, but the format is designed to support all learning outcomes. These learning outcomes were established many years ago. Although the course outlines are periodically updated, some learning outcomes may be outdated or no longer necessary.

Theme 1 regarding the SMART model of instruction: High retention and success rates.

All five instructors were in agreement that the higher retention and success rates of the SMART model favorable. In the words of P1, “it would be great if we could achieve rates similar to those.” They attributed this to the faster pace and career oriented format that allowed students to see the light at the end of the mathematical tunnel. This seems to be another emergent theme directly related to this high retention and success rats theme.

Theme 2 regarding the SMART model of instruction: Omission of some mathematical concepts.

This was the only unfavorable theme for the SMART model. As mathematics instructors, they all felt that students were being cheated of some knowledge and the standards were being lowered. The researcher probed each participant to contemplate the fact that some of the omitted concepts were not necessary for future courses. Both P1 and P4 admitted that they saw the logic in the omission, but P2, P3, and P4, were adamant that omitting any concept was not acceptable.

Theme 3 regarding the SMART model of instruction: Course format supports learning outcomes.

Surprisingly, all participants agreed that the SMART model does also support the learning outcomes. However, they perceived this support to be in a limited capacity. P4 stated,

> The purpose of our institution is prepare students for good jobs, so I'm okay with allowing them to move through the courses while supporting the learning outcomes set forth by the institution.

They all seemed to feel that it was more important for students to be able to achieve their goals and graduate than to get stuck and frustrated in some remedial course.

Integration Process

Utilizing mixed-method analysis was beneficial to the study by helping to strengthen the outcome. Combining the quantitative and qualitative data was done sequentially, with the quantitative data analysis followed by the qualitative data analysis to support the study's research question. Subsequently, comparing the themes that developed within the interviews to the survey responses and collecting the qualitative data after the analysis of the quantitative data helped to refine quantitative data (Lodico et al., 2009). Guided by the research questions of the study, the researcher combined both quantitative and qualitative results.

As previously mentioned, the qualitative data were compared to the quantitative results to observe emergent themes among the participants. The descriptive statistical data from the quantitative results were analyzed first for similarities and patterns. These patterns were then cross-checked against the qualitative data for triangulation of the emergent themes. According to Creswell (2003), connecting the data "involves taking text data . . . segmenting sentences into categories, and labeling those categories with a term, often a term based in the actual language of the participant" (p. 192). This process was employed throughout the qualitative analysis and specifically followed the basic qualitative research technique.

Merriam (2009) stated that "basic qualitative studies can be found throughout the disciplines and in applied fields of practice. They are probably the most common form of qualitative research found in education" (p. 23). The first step was to identify certain characteristics of the data such as recurring patterns or themes. These patterns were then interpreted by the researcher based on the participant's responses. The ultimate goal was to use these interpretations construct meaning of these common themes that emerge from the participants.

The derivation of meaning from the qualitative data resulted from the systematic analysis of each data set using inductive and constant comparative methods. This may or may result in a grounded theory. The data collection for grounded theory may include method such as individual or group interviews, informal conversations, observations or focus groups (Dick, 2005). The process began with review of the interview transcripts and observational notes, and looked for information relevant to the research questions. Codes were then assigned to sections of the data. Coding can be the awareness of phrases or words in interviews that may highlight an important issue to the research with the codes being short descriptor phrases (Allan, 2003). These codes were then used to construct categories by constantly reviewing and matching up comments that seem to relate. Separate lists were generated and later merged into a master list. This was where the recurring similarities and patterns were expected to emerge. Subsequently, themes or categories were evident and sorted. The data was reviewed several more times to reinforce and revise the emergent themes. Subsequently, these categories or themes may lead to the emergence of a theory (Allan, 2003). After constant comparison of the themes, there was no evidence of an emerging theory.

Both qualitative and quantitative data were compared side by side for evidence of similarities or common themes. The grounded theory that will possibly emerge inductively from the qualitative data may be validated or at a minimum supported by the results of the surveys and descriptive statistics in the quantitative portion of the study. Ultimately, this mixed method discovered the participants' main concern about the current model and if these concerns may be resolved by the SMART model. The quantitative results indicated only one low perception for the research question, which was the omission of some algebra concepts. This was the main theme that emerged from the qualitative results.

Assumptions, Limitations, Scope and Delimitations

Assumptions

It was assumed that faculty who respond to the surveys will have enough understanding of the SMART model to offer informed views. Other assumptions included faculty survey responses were honest and completed to the best of their abilities. In addition, it is assumed that the researcher's data collection techniques were sound, and the data was valid and reliable.

Limitations

According to Creswell (2003), the limitations of a study are those defining features of methodology or design that set factors on the relevance or understanding of the study (Creswell, 2003). This study examined whether there existed a statistically significant difference between enrollment and success in a remedial mathematics program and success in higher level mathematics courses, based on faculty perception on the current model and proposed SMART model, therefore one main weakness was the interpretation of correlation to imply causation. Correlation indicates a relationship between two or more variables but cannot be used to show a cause-effect relationship between the same variables (Gravetter & Wallnau, 2008). Other credible alternative interpretation should be investigated before making inferences about causation. The results of the t tests with a correlation of .541 indicate significant linear correlation. However, more research needs to be done to investigate causation.

Scope and Delimitations

The study was limited to a specific institution in a limited geographical area in South Florida. The researcher was a staff member at the institution for approximately eight years with the institution being chosen for the availability of the data. Other delimitations of this study included the omitting of students' perceptions and attitudes towards the college preparatory/remedial program, some courses, and instructors since these factors may affect student success.

Conclusion

This section discussed the research design and methodology for this mixed research study. The purpose of this study was to compare the perceptions of faculty on the current remedial mathematics program to the SMART program. The study population for the quantitative portion was a sample of 20 faculty who currently teach remedial, college algebra and college math courses for the 2014-2015 school year. The qualitative portion consisted of five participants from the 20 sample faculty. The data were sorted into two sets, the quantitative data set and the qualitative data set. Both sets of data were studied to evaluate faculty perceptions on the current and SMART models to determine the elements that support student success in remedial and college-level mathematics courses. A pre-developed and pilot tested survey was utilized and participants were protected by omission of names of students, faculty, and the institution.

The quantitative survey on both the current model and SMART model revealed that, in general, faculty perception was in the middle with mean responses for the current and SMART model were 3.41 and 3.45, respectively. This falls between neither agree/disagree and agree range and shows similar perceptions for both models.

For the current model, faculty seemed in favor of the elements that include courses that support all algebra concepts, model success is affected by instructor teaching style, model supports student learning outcomes, and model supports use of technology in classroom instruction. They did not think that the model should focus solely on concepts needed for the next course, model is effective in supporting student success in remediation, class size/facilities support learning, and model improves student participation and attitudes towards school or support career awareness or exposure.

For the SMART model, faculty seemed to like more elements; model should focus solely on concepts needed for the next course, model is effective in supporting student success in remediation, supports student learning outcomes, teach critical thinking and problem solving skills, support achievement in core academic courses, and model improves student participation and attitudes towards school and support career awareness or exposure. There were only two elements that they were not in favor, which were, models including courses that support all basic algebra concepts and model success affected by instructor teaching style. This makes sense, since the SMART model does not have instructors. Students are allowed to work on their own, work at their own pace and may seek help from facilitators.

The *t* test results indicated that there was no significant difference between overall perceptions of the current model and SMART model. The average total scores for the current program and SMART program were 51.20 and 51.70, respectively. Although this was extremely close, the SMART program had a slight edge over the current one. However, individual t tests results provided evidence of greater perception towards some previously mentioned elements of the SMART model; model should focus solely on concepts needed for the next course, model is effective in supporting student success in remediation, class size/facilities support learning outcomes, and model improves student participation and attitudes towards school and support career awareness or exposure.

There were five participants for the qualitative portion of the study. Some responses to the questions supported the quantitative and t test results, in general, that the current model needed some improvement, and the SMART model supported improving student participation and attitudes towards school, effective in supporting student success in remediation, and class size supports student learning outcomes. The main differences were that one participant perceived there is success in some courses and only minor changes were needed, whereas the other participant perceived that a major overhaul is needed.

Section 3: The Project

There is an ongoing struggle of U. S. institutions of higher education to prepare new students for success in college-level mathematics courses. Community colleges continue to encounter an increased number of students needing remediation in mathematical skills for upper level courses (Calcagno & Long, 2008). Many students require remediation in order to complete their programs and graduate (Calcagno & Long, 2008). The purpose of this study is to explore the perceptions of math faculty regarding the effectiveness of their current remediation model and the anticipated effectiveness of a possible alternative model.

This section presents my proposed project in the form of a white paper that may be presented to stakeholders. Based on t-test results (see Tables 12, 13, 14, and 15), I suggest a possible trial implementation of the SMART model (Bassett & Frost, 2010) and, afterwards, a comparison of the results to the current model. (See Appendix A for the full presentation of white paper.) This section includes my description and goals and rationale for the project, review of the literature, implementation, project evaluation, and implications.

Description and Goals

The results of this study provide significant insights that may benefit math educators. Given this, I have developed a white paper where I outline key recommendations to administrators for improving the outcomes of the remedial mathematics program. The goal of this white paper is to provide educators recommendations for curriculum improvement that are grounded in data from my research. The results of the study revealed that faculty perceive need for a change to the current remedial program, especially in the four following elements; model should focus solely on concepts needed for the next course, model is effective in supporting student success in remediation, class size/facilities support learning outcomes, and model improves student participation and attitudes towards school and support career awareness or exposure. Therefore, curriculum improvement needs to include steps to revamp the current program by constructing a replacement program based on the elements of the SMART program.

Rationale

The creation of a white paper is an appropriate decision, I believe, based on data and results of the study. From the results of the study I found that faculty had higher perception scores of more elements of the SMART model than the institution's current model. This led to some recommendations that I chose to present in a white paper. The recommendations contained within the white paper have the potential to improve practice at the local site by administration adopting elements of the SMART model that may ultimately increase student retention, success in remediation and increase career program completion rates.

Legislatures are concerned with increasing the rates of program completion for U.S. colleges. Regulation from the State of Florida's Department of Education indicates administrators' desire for a greater number of students to not only succeed in remedial courses but also to complete their programs (Florida Department of Education, 2015). The goal of this regulation is to increase graduation and program completion rates in community colleges (Florida Department of Education, 2015). Institutions are offered incentives and grants to improve these success rates and also for improved completion or graduation rates. Therefore, community colleges continue to face greater need for successful remedial mathematics programs. The SMART program (Bassett & Frost, 2010) places greater emphasis on mathematical concepts that support program completion (Florida Department of Education, 2015). Accordingly, in my white paper, I suggest which elements of the SMART program I think my study institution should adopt to achieve this legislative requirement and other goals (see Appendix A).

Review of the Literature

In order to support my findings and provide background for the basis of my white paper, I performed a thorough literature review.

Strategy for Searching the Literature

The review of literature includes information from peer-reviewed articles from databases in the field of education and mathematics. The databases include Academic Search Premier, ProQuest, Eric-Educational Resource Information Center, and Dissertations and Theses. The research keywords included the following: *white paper*, *mathematical instruction, computer algebra programs, classroom design, independent studies, alternative learning, student perceptions of mathematical learning*, and *grant and incentives for program completion*. I narrowed the search by peer-reviewed and dates within five years and was able to review all article listed in the results.

White Paper as an Effective Tool

The project is a white paper in which I outline the steps for curriculum improvement of the remedial algebra courses. White papers continue to serve as a basis for effective marketing of content (Neuwirth, 2014). Their compact time frame makes them a preferred vehicle to deliver important information (Malone, 2012). Recipients can easily obtain the idea without having to read a multitude of pages. In a 2011 survey of IT professionals, 72% of respondents stated that they found white papers useful to extremely useful in their decision making process (Malone, 2012). In my opinion, this white paper project is based on statistically sound data and well-researched findings. These are views on issues that are highly relevant to the college's remedial mathematics program and aims to educate and provoke innovative thinking. It is my hope that these new ideas will be well-received and put into practice.

Student Retention and Remedial Program Completion

The white paper focuses on several elements of the SMART program. One major element in favor of the SMART program is the ability of students to work independently and at their own pace (Bassett & Frost, 2010). Also, this proposed program combines three remedial algebra courses into one course, thus reducing the number of credits and courses students of remediation need to complete. This program has shown an increase in remedial success and program completion rates. A major concern of the institution with the current program is that students drop out of school completely or change program of study.

One noticeable trend is students changing programs from science, technology, engineering or mathematics (STEM) to programs that are not scientific in nature or ones that require less mathematics. The Bureau of Labor Statistics (2014) stated that by 2018 there will be in excess of 3 million jobs created in STEM disciplines, and the Department of Commerce (2012) estimates that STEM occupations will grow at almost twice the rate of non-STEM occupations. Ortiz and Sriraman (2015) explored faculty insights into why students leave STEM fields of study. They found that one main reason is low success rates in mathematical remedial programs (Ortiz & Sriraman, 2015). They conducted two focus groups, and the first comment from faculty in the focus groups was on the inability of students to get past basic mathematics. In addition, students get caught up in too many required remedial courses and feel trapped and frustrated (Ortiz & Sriraman, 2015).

In another study, Woodard and Burkett (2015) commented that reducing the number of remedial math credits from five to three resulted in no significant difference in passing rates and recommended changing the number of required remedial credits from five to three. This reduction in remedial credits allowed students lower cost, shorter time to complete courses with less burn out, therefore increase in retention and completion rates of remedial program. Similarly, the SMART program reduces the algebra courses from three to one and allows students to work at their own pace, thus able to complete the program in a timely manner (Bassett & Frost, 2010).

In 2010, the Carnegie Foundation, along with four other organizations, developed a program called the Quantitative Literacy Pathway. The Quantitative Literacy Pathway is a one semester course which replaces elementary and intermediate algebra and is followed by the completion of a college level math course (Crawford & Jervis, 2011). Middle Tennessee State University also redesigned some mathematical courses to include flexible delivery options, greater uses of technology, and a reduction in the number of required courses (Lucas & McCormick, 2007). This redesign helped to push students though freshman and general education courses, while supplying resources and support for a successful first year experience (Lucas & McCormick, 2007). Graduation and retention rates increases when student do well in their first year in college (Kelly, 2006).

Alternative Learning using Computerized Algebra Program

The white paper also focuses on another favorable element of the SMART program which is the non-traditional format of learning with complete use of technology. Although the current program utilizes technology, the format is still similar to a traditional program where students have to take scheduled chapter tests and final exams. Faculty participants revealed an unfavorable perception of the ALEKS program currently being used where students demonstrate high frustration. Students seem to be more motivated when they are in control of their own learning (Tanyeli & Kuter, 2013). The SMART program uses technology and self-paced learning which puts students in control of their own learning. Because educators are worried about low pass rates in developmental mathematics courses they are seeking out non-traditional methods that have been used for many years in college classrooms (Spadlin & Ackerman, 2010). Computers provides new ways of teaching by creating an active learning ambience (Spadlin & Ackerman, 2010). Computers allow students to become active participants in their learning by allowing them to work whenever and wherever they want to, and receive immediate and accurate feedback (Brown, 2003; Cotton, 1991; Hannafin & Foshay, 2008; Kinney & Robertson, 2003).

Grants and Initiatives for Career Program Completion

The white paper also discusses additional funding that the college may acquire through grants and initiatives. There is tremendous focus on major program completion for students of community colleges. The emphasis has shifted from remedial program completion to college program completion, regardless of the program being a certificate or degree program. According to Crawford and Jervis (2011), “Sixty percent of students seeking a two year degree at a proprietary college graduate, compared with twenty two percent of students at public community colleges" (p. 30). Research has found that some factors that impede student success include lack of basic educational skills, especially mathematics, overwhelming remedial programs and ill defined programs (Crawford & Jervis, 2011). Results of this research have led to some initiatives like the Carnegie Foundation (2010) and others that are funding a $14 million mathematics initiative in community colleges. This study on improving student success in community colleges revealed that, "developmental mathematics courses are often roadblocks to success" (Crawford & Jervis, 2011, p. 30). Carnegie Foundation President, Anthony S, Byrk commented, "rather than a gateway to a college education and a better life, mathematics has become an unyielding gatekeeper" (p. 30). This is one aspect that the SMART program aims to alleviate and is discussed in detail in Appendix A.

Other current initiatives include the AMATYC's partnership with Monterrey Institute for Technology and Education (MITE). MITE, with a $5 million grant from Bill and Melinda Gates, will combine the four courses required in most remedial math sequences. Using pre-assessments and multiple learning approaches, MITE hopes to create coursework that can be customized to each individual student's needs (Bonham and Boylan, 2012). The Department of Education (2015) is also offering grants to institutions that increase their rate of completion for degree and certificate programs.

Project Description

Resources, Supports, and Barriers

The white paper details two main resources. First is the easy access to facilities to set up and implement the SMART program. These rooms are already being utilized for the similar but unsuccessful program that uses the complicated ALEKS software.

Second, is the availability of the MathLab computer software that was previously being used and therefore already installed on most computer in the classroom.

Instructors and teacher assistants will provide most of the support for the project. They are already familiar with the MathLab software and will be able to guide students through each module of the course. Training will be available for any new instructor or teaching assistant.

The greatest potential barrier is the initial and continued management of program. There needs to be constant monitoring and tracking of student performance, completion, and retention for subsequent reports to administrators and management. The white paper outlines reporting these factors on a monthly basis and this could be time consuming. One method of alleviating this barrier is to have a committee with shared tracking and data collecting responsibilities among instructors.

Implementation

Implementation of the project includes several steps. First, the white paper has already been developed; this paper will be presented to the appropriate authorities who are in a position to directly influence the implementation of the SMART program. These include, but are not limited to, Dean of Academic Affairs and Campus President of the campus. The white paper outlines in detail the proposed construction of a remedial program similar to the SMART program. This covers all aspects of the program, including classroom setup with computers programmed with the MyMathLab algebra software, pre and post exams, and modules. Following release of the white paper, administrators of the institution may be contacted for a possible presentation and recommendations. Table 13 outlines the project implementation timeline.

Table 13

Time Table for Project Implementation

Date(s)	Activities
January 7-15	Contact campus administration
January 21-28	Presentation of White Paper
February 1- August 15	SMART program set-up (if approved)
August 21-December 5	Implement SMART program
December 6-15	Evaluate SMART program

Details of program set-up, implementation and evaluation are outlined in the white paper in Appendix A.

Roles and Responsibilities

The researcher has the first responsibility to present the white paper to administrators of the institution. If the project is approved for implementation, faculty will be recruited for a committee with possibly a chair of the committee. The role of the committee chair is to meet with the committee regularly to obtain tracking information for the monthly reports.

The project is highly dependent on technology which indicates a need for adequate technology support from the IT department. Computers will need to be maintained in good working conditions and students will need access to assistance for computer and software related issues.

Project Evaluation

The purpose of a project evaluation is to determine whether a particular program should be prolonged, modified, or shut down (Lodico et al., 2006). The most effective evaluation of this project will be how well the presentation is received by college administration. Subsequently, they may see the proposal as a favorable alternative to the current program and initiate a trial run. Both models may be performed concurrently for comparison. This may be necessary, since the overall goal of the project is to improve student success in remedial mathematics courses and ultimately increase program completions. Program assessment is discussed in detail in the implementation section of the white paper.

The actual evaluation of the project is based on evaluating the progress of the newly formatted SMART courses. The plan consists of both formative and summative evaluations. Formative evaluations are performed to determine if changes need to be made during implementation. This involves discussions with instructors pioneering the courses for two 6 week periods after the start of the semester. Adjustments to the courses may be made after each period. Summative evaluations will be performed for each course at the end of the semester. This consists of analysis of enrollment, results of post tests, and completion rates. An optional student survey may be conducted and included in this summative evaluation.

Implications Including Social Change

The findings of this study demonstrated faculty perception of a need for change to the remedial mathematics program. This resulted in the development of a whitepaper which may be presented to college administrator and stakeholders.

The goal of this whitepaper is to provide recommendations to improve the current remedial mathematics program. Demonstrating increased success in one course using SMART methods may lead to updating other mathematics courses, therefore increased success in general.

Local Community

Throughout the community, residents are depending on the local college to educate students and encourage them through the process of achieving success in their chosen career field and programs. Since the remedial program in mathematics has become a major road block for many of these students, the project in the form of a white paper proposes changes that will help to alleviate elements of the road block. The success of this project will enable students to experience success in both the remedial program and career programs. This will have a positive effect on the community by producing educated, well-rounded, career-oriented citizens.

Far-Reaching

On a larger scale, the success of the project may provide an example for other institutions in the area and the state. It has been documented that college remediation in mathematics is a national problem (Bettinger & Long, 2005). This means that there is a global need for a solution. Ultimately, this project may provide much needed information and a possible solution to the problem on a national level.

Conclusion

As previously mentioned, the goal of this study and project was to find ways to improve the remedial mathematics program through faculty perceptions of the current model and the SMART model. Both quantitative and qualitative study results revealed that faculty was in favor of a change to the current model and was open to trying the SMART model. This project study resulted in the construction of a white paper which suggested steps to implement certain changes to the current model but continue to offer both the old and revised courses to compare the results. Ultimately, all interested parties will be able to evaluate the results for improvements or see if there is a need for alternative solution to the problem.

Section 4: Reflections and Conclusions

Community colleges continue to be a very important part of educating young, diverse population of students in the United States. There is an increase in enrollment at these institutions (Calcagno & Long, 2009) and a decline in success of student in remedial mathematics programs (Calcagno & Long, 2009). Remediation is critical to the educational goal of underprepared students so they can be successfully prepared for college level mathematics courses. The project included a presentation which proposed that my study institution implement an alternative program for remedial mathematics in order to improve student success. This section is a review of the project, its strengths and limitations, development and evaluation, impact on social change, and implication for future research.

Project Strengths and Limitations

One of the major strengths of the project is the proposed development of a course using the SMART method and administering the course simultaneously with the current course. This format allowed for direct comparison of both courses to evaluate the difference in the results of each course. Administering both courses concurrently we may see if there is a direct correlation. If the results of the revised course demonstrate increased effectiveness, the strategies may be applied to other remedial courses.

The project was also strengthened by the fact that it is based on a mixed method study. This design included a holistic view of faculty perspectives to ensure that the recommendations are based on sound data from experts dealing with an unsuccessful developmental mathematics program. Quantitative data results further supported by qualitative data results helped to make a stronger project.

If, as a result of this study, stakeholders become invested in change then the recommendations can be easily implemented. This ease of implementation can occur because most of the resources are already available. Additionally, they may see a reduction in cost because of staffing with lower credentials.

One limitation of the study was concluding that correlation implies causation. The results of this study did not attempt to discuss causes of the failure of the remedial program. Instead, I intended to show whether there exists a statistically significant difference between enrollment and success in a remedial mathematics program and success in higher level mathematics courses, based on faculty perception on the current proposed SMART (Bassett & Frost, 2010) models. There was a correlation of 0.541 which indicated a significant linear relationship between the two models. Correlation indicates a relationship between two or more variables but cannot be used to show a cause-effect relationship between the same variables (Gravetter & Wallnau, 2008). Other credible alternative interpretations should be investigated before making inferences about causation.

Recommendations for Alternative Approaches

This project had a sample size of 20 faculty members for the quantitative portion and five for the qualitative portion. Normally, a sample size of 20 would be considered small (Triola, 2014), however, since data were normally distributed, parametric evaluation was used for evaluation. In addition, there could be some bias towards remedial courses, which could be further evaluated by including demographics of faculty that responded to the surveys and which courses they teach. In addition, I am a mathematics instructor at the college and this may have impacted the outcome as well, especially for the results of the interviews. Implications from my opinions, which I tried to keep concealed, may be a factor in my evaluation of the responses. Using a mixed-method approach may have increased the strength of validity through triangulation of data.

Scholarship, Project Development, and Leadership and Change

This project will provide administration and stakeholders with information about remedial models that may improve effectiveness of the remedial program and increase student success. Implementing a revised course based on the SMART model (Bassett & Frost, 2010) and subsequently comparing the results to the current course will offer tangible evidence of the elements that needs to be changed. Administration may decide to adopt the revised course, discontinue, or expand it to additional courses. At a minimum, they will have documented data for future decisions.

Self Analysis of Scholarship

I found this study, especially the literature review, to be extremely time consuming. I spent many hours reading, analyzing, rereading, and gathering information from peer-reviewed articles and books. I had many late night and early mornings trying to balance work and family, as time management became an important concept to completing this study. Being a mathematics person posed a challenge to my writing skills resulting in numerous revisions and frustrations. Also, there had to be a major improvement in interpersonal and interviewing skills. Many times, a quantitative only study seemed more appealing since it is much less work. However, the project is stronger with more analysis from the addition of a qualitative phase.

Self-Analysis of Project Development

As a practitioner, I gained knowledge of remedial programs and strategies on more effective instruction of underprepared students. My fear of instructing students of remediation and refusal of teaching remedial mathematics courses dissipated greatly from the experience and knowledge gained from this research project. Although I am clearer that the true problem with remediation exists at the high school level, results of my and other studies indicate some evidence of hope at the community college level. Additional research and education on this subject continues as a result of this project.

Self-Analysis of Leadership and Change

This project has helped me realize that although I am just an instructor, I can promote positive change within the college. It has also made me aware of leadership potential that may be used during project implementation and adds to the enhancement of the process and project success. Discussions and findings during the qualitative portion of the study had suggestions that may positively impact social change.

Reflection on the Importance of the Work

After reviewing the literature, I gained considerable knowledge of the problem of remediation and possible solutions. This increased knowledge has increased my skills as a scholar and practitioner and added to my value to the institution. This project may lead to social change within the community and especially the institution. An increase in success rates in remedial mathematics courses, retention, and ultimately graduation as a result of this project may improve the community because of the increase in professional careers.

Implications, Applications, and Directions for Future Research

After reviewing the results of this study, I have crafted some recommendations for further research. Improvement in general is an ongoing task, and "the task of developmental education is especially difficult, and unrelenting attention to improvement is essential" (McCabe, 2003, p. 39). Other researchers may take this study one step further by including the teaching discipline of each participant to check for bias in responses. Also, the research could be initiated from the side of the high school graduates and their college readiness level. In 2015, a change in Florida educational legislation allows students who recently graduated from an accredited high school to bypass remedial mathematics courses and enroll directly in intermediate algebra courses (Florida Department of Education, 2015). Further research, data collection and analysis may help to assess this change.

Conclusion

Educators at U.S. community colleges continue to struggle with an increase in the enrollment of underprepared students and the task of successfully preparing them for college-level courses. Research studies, including this one, add to the body of knowledge needed to address this problem by providing data on this problem. It is the duty of all stakeholders including educational legislatures, administrators, instructors, parents and students to take responsibility to ensure academic success for all students.

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Appendix A: The Project

Mathematics Education: A Proposal for Remedial Curriculum Improvement

by

CarolAnn Vassell-Kreitner

Submitted to the

Dean, Academic Affairs

Campus President

Table of Contents

Introduction

The problem of remediation in mathematics has the focus of administrators of community colleges for many years. Although several models or programs of remediation have been developed, the situation has not improved, but instead, has worsened. It is evident that this problem is deeply rooted in the K - 12 educational system, however, it has become the nemesis of the colleges where solutions are not only expected but mandated by governmental officials and stakeholders.

This white paper proposes and outlines a program based on the SMART program, but developed specifically to cater to the needs of the students enrolled at WHC campus. The SMART (Survive, Master, Achieve, Review, and Transfer) model is a developmental mathematics program established at Jackson State University in Spring 2007, that focuses on preparing students according to their educational and career goals, instead of remediating high school deficiencies (Bassett & Frost, 2010). This program has documented success over most other programs.

Background

According to the institution's Educational Master Plan (2008), more than 80% of the institution's new students are deficient in skills to succeed in mathematics, English, and reading, and only 5% of the students enrolled in the college preparatory program at the college are successful in the two-year degree program (Educational Master Plan, 2008). Success may be defined as completion of the developmental mathematics program and upper level mathematics courses including but not limited to College Algebra and

College Mathematics with grades of A, B, or C, and graduation with a 2-year degree or enrollment in a 4-year college or university. This 5% success rate indicates a problem with the remedial program. These programs were developed to bridge the gap between high school and freshman year college (Achieve, 2004) and the data suggests that they are not meeting that goal. There is interest in remedying this, as future student success is dependent on continual evaluation of developmental programs for improvements (Gerlaugh, Thompson, Boylan, & Davis, 2007).

Another more obvious problem is student retention. With the current system, students tend to get frustrated and disappear from the course. Some of them withdraw from the remedial course and ultimately drop out of school entirely. The college has been experiencing a steady decline in enrollment in the past few years.

Research revealed several models ranging from computer-based to learning centers with different levels of success for remedial students in mathematics. Computer-based programs such as MyMathLab and ALEKS and have documented increased success slightly above 20% (Bassett & Frost, 2010). However, the most successful model with documented increased success rate of 45% is the SMART model. In addition, the research study preceding this project revealed that faculty perceives a need for improvement to the remedial program and projected high perceptions of most elements of the SMART program. These elements include, but are not limited to student retention, increased success and completion rates, faster pace, and career oriented.

A literature review also revealed that student retention and remedial program completion rates increase when students are required to complete less courses and fewer credits for remediation, are in control of their own learning, and can work at their own pace. Faculty revealed an unfavorable perception of the ALEKS program currently being used which students demonstrate high frustration. Students seem to be more motivated when they are in control of their own learning (Tanyeli & Kuter, 2013). The SMART program uses technology and self-paced learning which puts students in control of their own learning.

The literature also revealed a shift in the focus of expectations of remedial programs. The emphasis is now being placed on career program completions instead of just the remedial program completion. Entities such as the Department of Education (2015), Carnegie Foundation (2010), and the AMATYC's partnership with Monterrey Institute for Technology and Education (MITE) are offering grants and initiatives to institutions with increased rates of program completions and graduations. Implementation of a remedial program based on the SMART program will positively affect retention, remedial program completion, and ultimately certificate, degree, transfer, or other types of program completion.

Solution

Implementation

Implementation begins with a revamping of the three remedial mathematics courses and rolling them into one course. This means, MAT 0012, MAT 0024, and MAT 1033, will become one course with 12 modules. Modules 1-4 will cover concepts of the MAT 0012, Modules 5-8 will cover concepts of the MAT 0024, and Modules 9-12 will cover concepts of the MAT 1033. The total credits may be a combination of credits from each course, which results in a maximum of 9 credits but would typically be lowered to 6 credits. Students will be required to complete the appropriate modules that pertain to their program of study. For this institution, there are 17 certificate programs that require MAT 0012 or modules 1 through 4, 55 programs that require the additional MAT 0024 or modules 5 through 8, and 63 degree programs that require all 12 modules, up to MAT 1033. Depending on their program of study, students may choose to complete each block of modules per semester or all 12 modules in one semester. The modules are set up as follows:

MODULE 1: INTEGERS
Topics include exponential notation and order of operations, integers and the number line, addition, subtraction, multiplication and division of integers, order of operations, introduction to algebraic expressions, like terms, and solving one-step equations.
MODULE 2: FRACTIONS
Topics include fraction notation, multiplication, division, addition, and subtraction of fractions and mixed numerals and solving equations with applications.
MODULE 3: DECIMALS
Topics include decimal notation, addition, subtraction, multiplication and division of decimals, solving equations, American and metric units of measure, weight and mass, capacity, time and temperature, ratio and proportion, percent notation, graphs.
MODULE 4: REAL NUMBERS
Topics include introduction to algebra, the real numbers, addition, subtraction, multiplication and division of real numbers, properties of real numbers, and order of operations.
MODULE 5: LINEAR EQUATIONS AND INEQUALITIES
Topics include solving linear equations by the addition and multiplication principle, formulas, solving inequalities, ratio/proportion with applications.
MODULE 6 LINEAR EQUATIONS AND INEQUALITIES IN TWO VARIABLES
Topics include graphs of linear equations in two variables, intercepts, slope, equations of lines (one point with slope) and graphing using slope and y-intercept.
MODULE 7: POLYNOMIALS
Topics include integers as exponents, scientific notation, and introduction to polynomials, addition, subtraction and multiplication of polynomials, special products, operations with polynomials in several variables, division of polynomials by monomials.
MODULE 8: FACTORING
Topics include factoring trinomials, trinomial squares and difference of squares, general strategies for factoring, solving quadratic equations by factoring.
MODULE 9: RATIONAL EXPRESSIONS
Topics include multiplying, dividing, adding, and subtracting rational expressions, simplifying rational expressions, solving rational equations, applications.
MODULE 10: SYSTEMS OF EQUATIONS AND INEQUALITIES

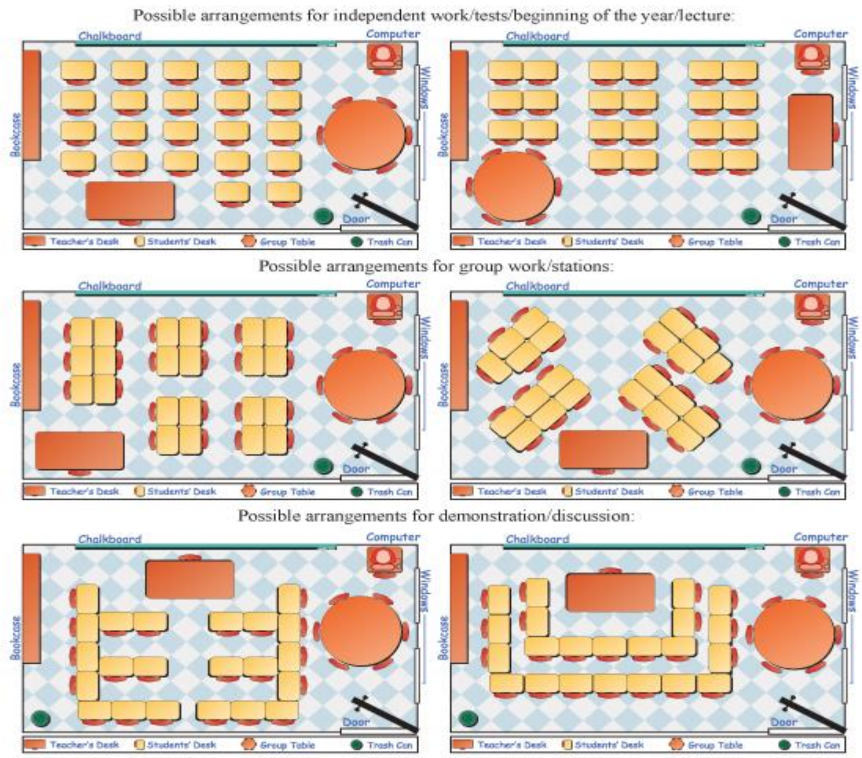
Topics include parallel and perpendicular lines, equations of lines using point-slope, graphing inequalities in two variables, solving systems of equations in two variables using graphing, substitution and elimination methods, applications, and graphing systems of inequalities in two variables.
MODULE 11: RADICALS AND COMPLEX NUMBERS
Topics include radical expressions, multiplying and simplifying radical expressions, quotients involving radical expressions (only 1 term denominators), addition and subtraction, radical equations, applications with right triangles, the distance and midpoint formulas and complex numbers.
MODULE 12: QUADRATIC EQUATIONS AND FUNCTIONS

The program will utilize technology and there will be designated classrooms for computer access. Computers will be programmed for MathLabs instead of ALEKS, which is the less frustrating of the two programs. Students are allowed to work anywhere there is computer access, at home or a library. However, students must demonstrate mastery of the concepts. There will be proctored pre-tests and post-tests after each set of modules which must be completed in the computer classroom on campus.

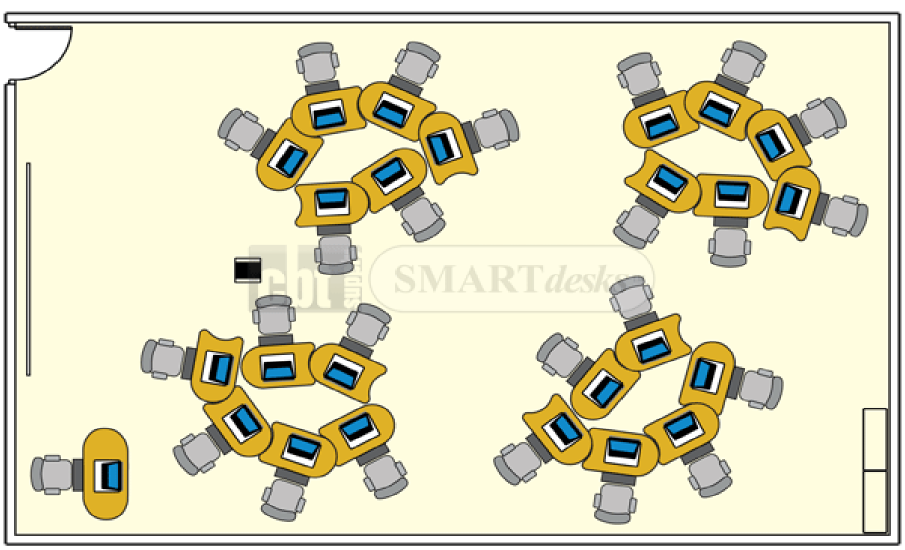
Students who enroll in the course may choose to complete only Modules 1-4, or Modules 1- 4 and Modules 5-8, or Modules 1-12. This would depend entirely on their career program, or goals that they hope to achieve, and may be completed in one, two, or three semesters. The advantage is the ability to have more time to focus on less concepts in a semester and be able to set smaller, more attainable goals.

Initial and Operating Cost

The cost to implement and run the model is almost negligible. There are already computer rooms set up and used for students enrolled in remedial algebra courses that use the ALEKS program. The rooms are currently set up with computer desks in straight rows but may be reorganized in a less intimidating and comfortable format as shown below.



Or, possible arrangement for group work.



Pi™ Cluster Set-up. These odd-shaped groups give each person a creative space without the confrontational body language characteristic of rectangular arrangements. Smaller and larger groups are also possible. These organic shapes often have no "power position," which is conducive to equalizing the communication flow among the team members. Informal arrangements have the flexibility of including members on the fly. Imagine the flexible possibilities using laptops with WiFi.

Having taught this course, it is confirmed that these computers are also equipped with the MathLabs program. These rooms may be utilized with students accessing the MathLabs program instead of the ALEKS program. Since the institution also uses MathLabs for some courses, there will be no additional cost. In fact, the only cost will be to the students who enroll in the course and need to purchase an access code. Note that this is not an additional cost for the students because they would need to purchase an access code for the ALEKS program instead. If courses based on this model are set up as extra courses, then there may be additional cost to staff them. The minimum recommended staff for a course is one mathematics professor/instructor and one teacher assistant with similar qualifications as staff from the learning resource center. This cost may be averted if some of the old courses are transformed from ALEKS model to SMART model.

Program Evaluation

The program will be evaluated in three ways; enrollment, post-tests, and rate of completion. Students enrolled in this program will first be subjected to a pre-test to assess prior knowledge of basic algebra concepts. There will be three post-tests at the end of each module set. This will be monitored, documented and reported at the end of each month. Enrollment will also be monitored and reported to administration on a monthly basis. The computer algebra program automatically tracks assignment completion, scores, and time. This information can be easily transformed to a report, and submitted to administration at the end of each month. At the end of the semester, all the acquired information, including number of student completions will be compiled into one report and submitted to administration.

Program Timeline

Implementation of the proposed program is targeted for the 2016 Fall semester. Program set up should begin in January 2016. The projected dates are as follows:

Timeline for Implementation (completion target for 2016 Fall Semester)

Duration/Time	Activities
February 1, 2016 – February 28, 2016	Select room location (suggest using pre-existing computer room) Select room format Secure desks/chairs (if pre-existing room not used)
March 1, 2016 – April 30, 2016	Set up/ arrange room according to selected format Install MyMathLab program (if not already installed)
May 1, 2016 – May 31, 2016	Develop course outline and assign course numbers (suggest offering one or two sessions initially) Assign faculty and teacher assistants (similar to current program with a minimum of one assistant) List/advertise course for enrollment
June 1, 2016 – August 31, 2016	Monitor course enrollment
September 1, 2016 – December 1, 2016	Track courses for continued enrollment, module completion rates, pre- and post-test rates on a monthly basis.

December 15, 2016	Assess program

Learning Enhancement

The result of the research survey has already revealed that faculty has a positive perception of the SMART program. Implementation is projected to increase faculty perception based on proposed format. Both faculty and students will be satisfied with the flexibility of the program, especially the abolishment of a rigid testing schedule. Students learning will be enhanced with the more user friendly computer algebra program as well as lower stress from a rigid schedule.

Conclusion

This white paper discusses the problem of remedial mathematics and proposes one solution. The research study associated with this paper revealed the dismal outlook for remedial mathematics and the perceptions of faculty indicating the need for a change. Faculty perception also was favorable for most elements of the SMART model for mathematics remediation. It is suggested that this institution adopt a model based on the SMART model. This revised model promises to increase success in mathematics remediation, subsequently increasing completion and graduation rates. The cost associated with this revised model is negligible and the college will be able to acquire additional money from grants and initiatives from foundations, state and federal government.

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Appendix B: Summary of SMART Model

The SMART (Survive, Master, Achieve, Review, and Transfer) developmental mathematics program established at Jackson State University. SMART math focuses on preparing students according to their educational and career goals. It consists of 12 modules where faculty determines the prerequisite modules needed for success in each college-level general education course. Outcomes are measured by pre and posttests. If a student demonstrates 80% competency on the module pretest, they advance to the next module. The following list shows the SMART Math key features.

- 12 Modules replaced three traditional Developmental Math courses
- Student requirements based on educational and career goals
- Accommodation of Learning Styles
- On-demand Individual Assistance
- Immediate Feedback on Tests and Homework
  – motivating students to continue until they get it right!
- Opportunity to Progress More Quickly (or slowly)
- Students know material before moving ahead – MASTERY!
- More Frequent Opportunities for Success
  – Students have the attitude “I can do this!”
- Students begin new semester with the next required module

Jackson State Community College

SMART Math Center

Survive **M**aster **A**chieve **R**eview **T**ransfer

SMART Math Key Features

- 12 Modules replaced three traditional Developmental Math courses
- Student requirements based on educational and career goals
- Accommodation of Learning Styles
- On-demand Individual Assistance
- Immediate Feedback on Tests and Homework
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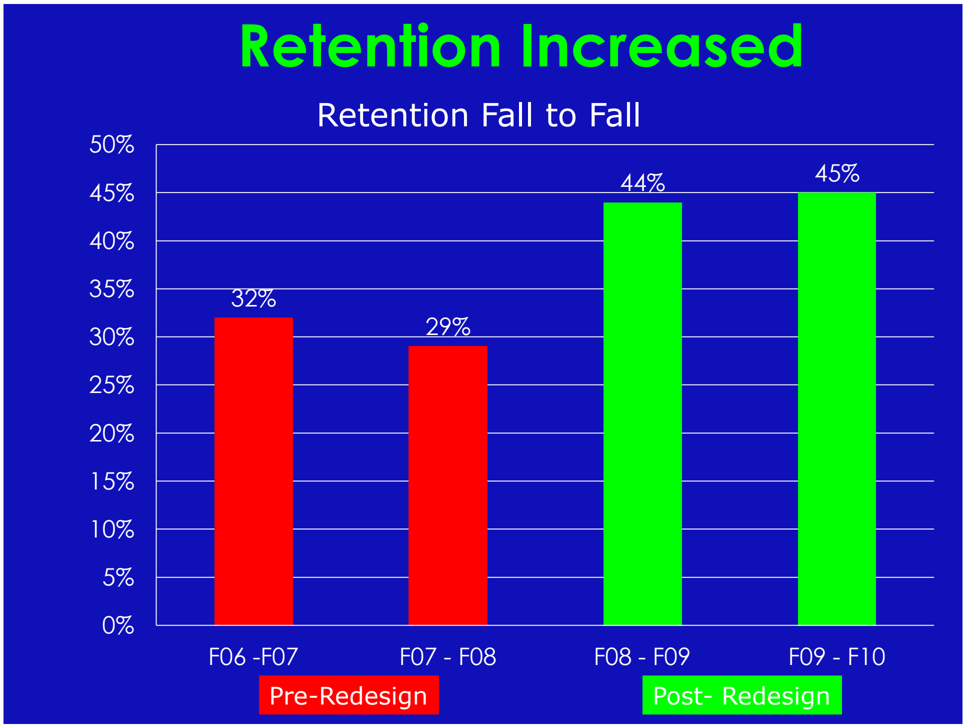
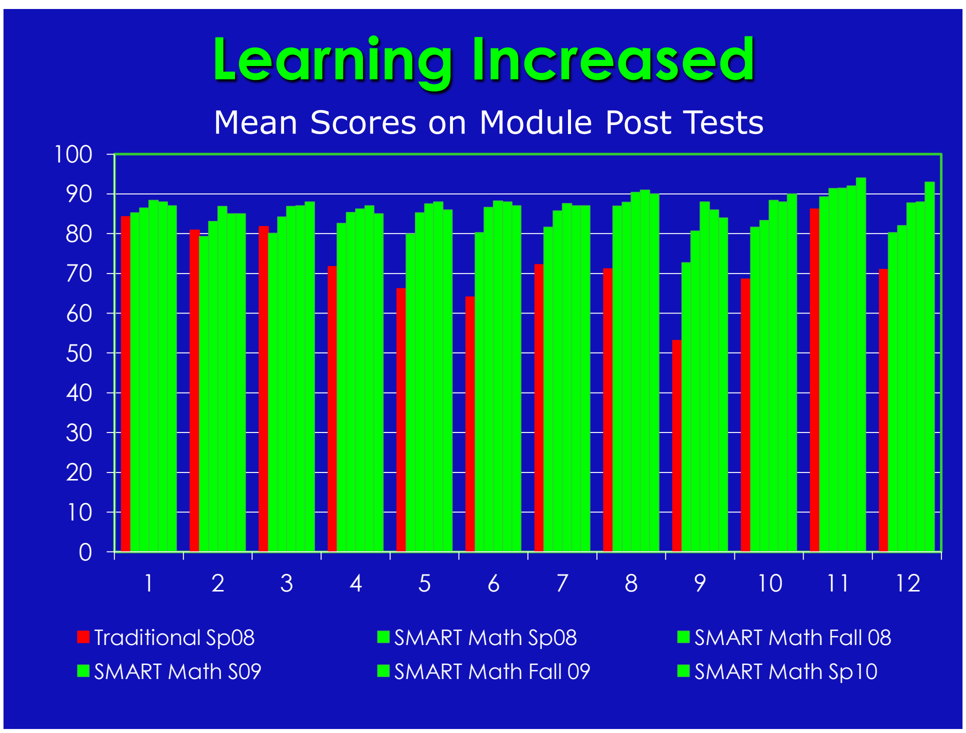
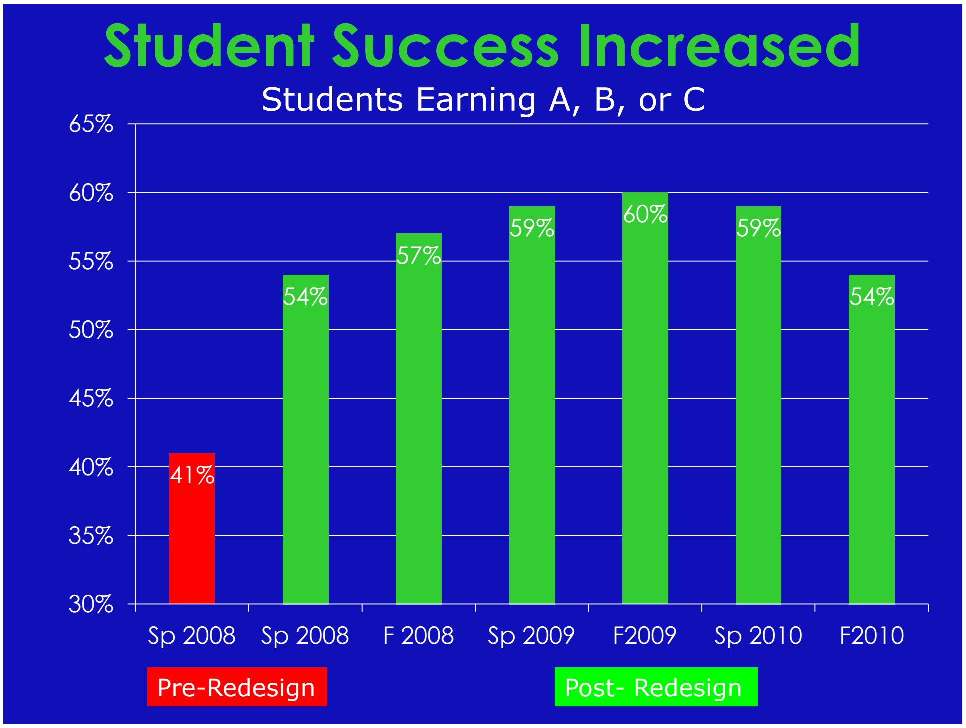
  – Students have the attitude "I can do this!"
- Students begin new semester with the next required module


Retention Increased
Retention Fall to Fall
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
32%
29%
44%
45%
F06 -F07
F07 - F08
F08 - F09
F09 - F10
Pre-Redesign
Post- Redesign


Learning Increased
Mean Scores on Module Post Tests
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
Traditional Sp08
SMART Math Sp08
SMART Math Fall 08
SMART Math S09
SMART Math Fall 09
SMART Math Sp10



College Level Success Increased

Students making A, B, or C in College Level Math Courses

SMART Math	74%
No SMART Math	68%

Students making A, B, C, or D in College Level Math Courses

SMART Math	85%
No SMART Math	75%

Cost Savings for Jackson State

- Reduced cost per student by over 30%
- Improved retention of students by over 46%
- Increased completion rates of developmental math program by 75%

Appendix C: Faculty Survey Questions

Thinking about the current developmental mathematics program model, please circle response to each question.

	Strongly Disagree	Disagree	Neither disagree/agree	Agree	Strongly Agree
Provides accurate student placement	1	2	3	4	5
Includes courses that support all basic algebra concepts	1	2	3	4	5
Course formats support student growth, mathematically	1	2	3	4	5
Allows students to grasp concepts easily and quickly.	1	2	3	4	5
Format should focus solely on concepts needed for the next course	1	2	3	4	5
Model success is affected by instructor's teaching style	1	2	3	4	5
Supports student learning outcomes	1	2	3	4	5
Model is effective in supporting Student success in remediation	1	2	3	4	5
Class size/facilities supports learning	1	2	3	4	5
Encourages appropriate faculty development.	1	2	3	4	5
Supports use of technology in classroom instruction	1	2	3	4	5
Improve student participation in and attitudes toward school	1	2	3	4	5
Support career awareness and exposure among students	1	2	3	4	5
Teach critical thinking and problem-solving skills	1	2	3	4	5

Supports student achievement in core academic courses	1	2	3	4	5

Thinking about the SMART developmental mathematics program model, please circle response to each question.

	Strongly Disagree	Disagree	Neither disagree/agree	Agree	Strongly Agree
Provides accurate student placement	1	2	3	4	5
Includes courses that support all basic algebra concepts	1	2	3	4	5
Course formats support student growth, mathematically	1	2	3	4	5
Allows students to grasp concepts easily and quickly.	1	2	3	4	5
Format should focus solely on concepts needed for the next course	1	2	3	4	5
Model success is affected by instructor's teaching style	1	2	3	4	5
Supports student learning outcomes	1	2	3	4	5
Model is effective in supporting Student success in remediation	1	2	3	4	5
Class size/facilities supports learning	1	2	3	4	5
Encourages appropriate faculty development.	1	2	3	4	5
Supports use of technology in classroom instruction	1	2	3	4	5
Improve student participation in and attitudes toward school	1	2	3	4	5
Support career awareness and exposure among students	1	2	3	4	5

Teach critical thinking and problem-solving skills	1	2	3	4	5
Supports student achievement in core academic courses	1	2	3	4	5

Qualitative Interview Questions – Current model

7. What do you like about the current model?
8. What don't you like about the current model?
9. Do you think improvement is needed? If yes, why? If no, why not?
10. What aspects, if any, of the current model do you think are effective? Why?
11. What aspects, if any, of the current model do you think are not effective? Why?
12. How do you think the current model supports student learning outcomes?

Qualitative Interview Questions – SMART model

7. What do you like about the SMART model?
8. What don't you like about the SMART model?
9. Do you think improvement is needed? If yes, why? If no, why not?
10. What aspects, if any, of the SMART model do you think are effective? Why?
11. What aspects, if any, of the SMART model do you think are not effective? Why?
12. How do you think the SMART model supports student learning outcomes?

Appendix D: Introduction to the Study and Informed Consent - Quantitative

Project Title: A Comparison of Faculty Perceptions of a Remedial Mathematics Program at a Local Community College to the SMART Model for Mathematics Remediation

Researcher: CarolAnn Vassell-Kreitner (Doctoral Research, Riley College of Education, Walden University)

Purpose: You are invited to participate in a research study being conducted at Walden University comparing your perceptions on the current remedial mathematics model and the SMART model. No personal information will be requested from you. This data can help define specific factors that might help to improve the remedial mathematics program.

Procedures: If you decide to participate, you will be asked to view a power-point presentation on the SMART model and then complete a 30 question (15 questions on each model) survey that rates your level of agreement on several factors of both models (the current model being utilized at Broward College and the SMART model). Completion of this survey will take approximately 15 – 20 minutes. Information obtained will be kept secured at all times and for up to five years upon completion of this study and then destroyed.

Risks of Participation: There are no known risks associated with this study which are greater than those encountered in daily life. There may be possible emotional discomfort when answering questions on your personal thoughts and feelings about the current remedial mathematical program.

Benefits: Your participation will help the college obtain information that may be used to improve the effectiveness of the remedial mathematics program. Researchers will also gain information on faculty perceptions on remediation mathematics models, and society can benefit from your voice on the factors that may be improved.

Confidentiality: Any information obtained in connection with this study will be kept strictly confidential. The data will be stored on my personal computer which will be locked at all times and can only be accessed by me. Participants' identities will not be disclosed on any surveys or documented results. Research records will be stored securely where only the researcher will have access. Participant's rights and protection will always be observed and monitored by the researcher's faculty advisor and Director of the Research Center at Walden University for safeguarding such rights and wellbeing.

Compensation: There will be no compensation for participation in this study.

Contacts: If you have any questions, please do not hesitate to contact the researcher at [redacted], or the researcher's faculty advisor, Dr. Jennifer McLean at [redacted] . If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Director of the Research Center at Walden University. Her phone number is [redacted]. Walden University's approval number for this study is **#11-17-14-0141369** and it expires on **November 16, 2015.**

Participating Rights: Participation is totally voluntary. If you decide to participate, you are free to discontinue participation at any time without any penalties, reprisal, or consequences of any kind.

Statement of Consent:

I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By choosing to continue and access the survey, I understand that I am agreeing to the terms described above.

Please print a copy of this document for your records.

You may continue and gain access to the survey by clicking on the link below, or copy the URL into your browser.

https://surveyplanet.com/54fd152423629f5053724a4a

Appendix E: Introduction to the Study and Informed Consent - Qualitative

Project Title: A Comparison of Faculty Perceptions of a Remedial Mathematics Program at a Local Community College to the SMART Model for Mathematics Remediation

Researcher: CarolAnn Vassell-Kreitner (Doctoral Research, Riley College of Education, Walden University)

Purpose: You are invited to participate in a research study being conducted at Walden University comparing your perceptions on the current remedial mathematics model and the SMART model. No personal information will be requested from you. This data can help define specific factors that might help to improve the remedial mathematics program.

Procedures: If you decide to participate, you will be asked to perform a 15 – 20 minute interview, to find out your thoughts on each remediation mathematics model. These interviews will be conducted in privacy, at a convenient place and time for you and may even be conducted by telephone. Note that the interview may be audio recorded. Information obtained will be kept secured at all times and for up to five years upon completion of this study and then destroyed.

Risks of Participation: There are no known risks associated with this study which are greater than those encountered in daily life. There may be possible emotional discomfort when answering questions on your personal thoughts and feelings about the current remedial mathematical program.

Benefits: Your participation will help the college obtain information that may be used to improve the effectiveness of the remedial mathematics program. Researchers will also gain information on faculty perceptions on remediation mathematics models, and society can benefit from your voice on the factors that may be improved.

Confidentiality: Any information obtained in connection with this study will be kept strictly confidential. The data will be stored on my personal computer which will be locked at all times and can only be accessed by me. Participants' identities will not be disclosed on any surveys or documented results. Research records including audio recordings, will be stored securely where only the researcher will have access. Participant's rights and protection will always be observed and monitored by the researcher's faculty advisor and Director of the Research Center at Walden University for safeguarding such rights and wellbeing.

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Contacts: If you have any questions, please do not hesitate to contact the researcher at [redacted], or the researcher's faculty advisor, Dr. Jennifer McLean at [redacted] . If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Director of the Research Center at Walden University. Her phone number is [redacted]. Walden University's approval number for this study is **#11-17-14-0141369** and it expires on **November 16, 2015.**

Participating Rights: Participation is totally voluntary. If you decide to participate, you are free to discontinue participation at any time without any penalties, reprisal, or consequences of any kind.

Statement of Consent:

I have read the above information and I feel I understand the study well enough to make a decision about my involvement.

I have read and fully understand the consent form. I sign it freely and voluntarily. I have received a copy of this form.

____________________________ _______________

Signature of Participant Date

I certify that I have personally explained this document before requesting that the participant sign it.

____________________________ ________________

Signature of Researcher Date

Appendix F: IRB Approval Letter (Broward College)

BROWARD COLLEGE
www.broward.edu

Institutional Review Board
Willis Holcombe Center
Phone: (954) 201-7820/Fax: (954) 201-7322

WILLIS HOLCOMBE CENTER
111 East Las Olas Blvd.
Fort Lauderdale, FL 33301

INSTITUTE FOR ECONOMIC DEVELOPMENT
111 East Las Olas Blvd.
Fort Lauderdale, FL 33301

A. HUGH ADAMS CENTRAL CAMPUS
3501 S.W. Davie Road
Davie, FL 33314

NORTH CAMPUS
1000 Coconut Creek Blvd.
Coconut Creek, FL 33066

JUDSON A. SAMUELS SOUTH CAMPUS
7200 Hollywood/Pines Blvd.
Pembroke Pines, FL 33024

PINES CENTER
16957 Sheridan St.
Pembroke Pines, FL 33331

WESTON CENTER
4205 Bonaventure Blvd.
Weston, FL 33332

MIRAMAR AUTOMOTIVE/MARINE CENTER
7451 Riviera Blvd.
Miramar, FL 33023

MIRAMAR TOWN CENTER
2050 Civic Center Place
Miramar, FL 33025

TIGERTAIL LAKE CENTER
580 Gulfstream Way
Dania Beach, FL 33004

February 26, 2015

Carol-Ann Vassell (Kreitner)
Adjunct Mathematics Instructor
Broward College-Willis Holcombe Center

Re: IRB Protocol #020215-01 "A Comparison of Faculty Perceptions of a Remedial Mathematics Program at a Local Community College to the SMART Model for Mathematics Remediation"

Dear Ms. Vassell,

I have reviewed the revisions to your research protocol entitled "A Comparison of Faculty Perceptions of a Remedial Mathematics Program at a Local Community College to the SMART Model for Mathematics Remediation" along with another member of the IRB, under an expedited review. On behalf of the IRB, your research protocol has been approved. You may now begin work on this project and start data collection. Your IRB approval is valid for one year and will expire on February 25, 2016.

Please note that if any changes are made to your protocol during the course of the approval period, you must submit an Amendment Form and your revised protocol to the IRB. A Research Closure Form must be submitted to the IRB upon study completion. If adverse events occur during the course of the approval period, you must report these events immediately to the IRB using the Adverse Event Report Form, which can be found at: http://www.broward.edu/community/irb/Documents/BC-IRB-Adverse-Event-Report-Form.pdf.

Please note that the consent form for the qualitative portion of your project has been stamped by the IRB and is attached. A copy of the stamped consent form should be provided to participants for their records.

Sincerely,

Dr. Joyce Walsh-Portillo
IRB Chairperson

www.broward.edu
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Appendix G: Permission from Jackson State Community College

RE: SMART Math Request

Coppings, Richard <rcoppings@jscc.edu>

Tue 7/19/2016 12:49 PM
To:Carol-ann Vassell <cvassell@broward.edu>;

Carol:

I hope you receive this promptly.
You have my permission to use the TBR power point presentation regarding the remedial/developmental math redesign carried out at JSCC.
Only stipulation is that you give proper credit citation when use it which I suspect you would do anyhow.

I listened to your voicemail three times but you said your phone number so fast I never could get it.

Thursday – You can do it!

Richard Coppings
Dean, Math & Science
Jackson State Community College