

SELF-EFFICACY AND REMEDIATION
OF HIGHER EDUCATION
MATHEMATICS STUDENTS

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DEDICATION

To my Dad,

who, with his strong hands, has always encouraged me to do my best and is my hero.

To my Mom,

for always being there to give guidance and loving support.

To my family,

for just being the best!

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CHAPTER I

DESIGN OF THE STUDY

After high school, thousands of graduates each year seek a college or other advanced education to acquire a job, for many, the job of their dreams. Research has shown that “more than 60 percent of all high school graduates now go on to some form of postsecondary education” (Altbach, Gumport, & Johnstone, 2001, p. 39) as the need for more highly skilled workers and a college education has increased over the last several decades (Dilworth & Imig, 1995; Hoyt & Sorenson, 2001).

Early colleges were for an elite few, but college student numbers are raising (Parsad & Lewis, 2003) as well as the amount of information needed to succeed today. Students must not only know more, but learn how to deal with the global society amidst vast technological changes. In our information-based society, jobs today demand workers trained beyond high school, require the mastery of certain kinds of information, and are essential to success where higher education brings greater earnings over time (Altbach et al., 2001; Hunt, Tierney, & Carruthers, 2006; Newman, Couturier, & Scurry, 2004). In other words, a person’s economic status is his/her educational level (Learning Matters, Inc., 2005) and “for most Americans, some level of education and training beyond high school is the only path to a traditional middle-class standard of living” (Callan & Finney,

2002, p. 29). According to Redovich (2003), one does not need a college degree or even to complete a degree program to enter the middle class, but then relates that the degree is highly desirable in most cases as the increased level of one's education can mean higher earnings and greater career opportunities.

The paradox is that a wide array of students, including many from racial, ethnic, and socioeconomic backgrounds, are not academically ready to successfully complete college-level courses, those courses that earn credit towards one's program leading to a degree, as they were not prepared at the high school level for a college education (Bettinger & Long, 2007; Bottoms & Carpenter, 2003; Boylan, 1999a; Callan, 2006; McCabe & Day, 1998). During the last decade, more than 60 percent of high school graduates attended college, but only around 43 percent followed a college preparatory curriculum, which meant completing more rigorous classes in high school that are supposed to prepare a student for college (Breneman & Haarlow, 1998). Consequently, pre-collegiate preparation has become increasingly prevalent as more high school graduates are taking upper-level math and science courses (Callan, 2006) to meet their graduation requirements.

But the high school mathematics graduation requirements vary from state to state, some states do not have any, and nationally, no requirements have been established (Duranczyk & Higbee, 2006). The quandary that has transpired is that high school students who are completing a college-prep curriculum are only half as likely to be under-prepared and need remedial courses in college (Hoyt & Sorenson, 1999) which leads some to believe that following a specified curriculum or taking more math classes does not ensure readiness or preparation for a college education (Duncan, 2000).

Under-prepared students are first-time college students, who do not meet the academic requirements needed for a job or required of their proposed postsecondary institution, or who assess below a specific level on placement tests; those students require remediation through developmental education or remedial courses to successfully earn a degree. Developmental and remedial programs are sometimes mistakenly interchanged, but have distinctly different meanings. It is important to differentiate between remedial, courses in reading, writing, and mathematics for college students lacking those skills necessary to perform college-level work at the level required by the institution, and developmental education, which involves a comprehensive approach to helping all individuals improve their learning skills (Illich, Hagan, & McCallister, 2004). Remedial courses were created to remove a student's deficiencies in basic skills, those that may have been previously taught but were not learned adequately or forgotten such that they need to be repeated (Miglietti & Strange, 1998). But developmental programs and their courses are designed to build a student's competencies in basic skills that have not been previously taught (in high school); one's ability is not faulted, but one's preparation is (McCabe, 2003; Weissman, Silk, & Bulakowski, 1997; Wiens, 1998).

The National Association for Developmental Education (NADE) provides a more detailed description of the scope of this special area.

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 postsecondary 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. Developmental education includes, but is not limited to: all forms of learning assistance, such as tutoring, mentoring, and supplemental instruction; personal, academic, and career counseling; academic advisement and coursework. (NADE online, 2007)

Most often, developmental or remedial courses are non-credit and therefore not considered college-level because they are not offered for institutional credit. Non-traditional students generally need developmental or remedial math courses as Algebra I and II were not taken in high school by many of these older students who are now returning to college to better themselves (Miglietti & Strange, 1998). If one or both algebra classes were taken in high school or through a General Education Development (GED) program by some non-traditional students, the time lapsed since taking them has usually been too long for many to remember the material. But both remedial and developmental courses can instill better basic skills and develop skills of writing, speaking, critical thinking, and good study habits.

Math remediation means preparing students for college-level courses by their learning basic concepts and acquiring math skills that should have already been attained at the high school level. Even though credit may not be earned, the knowledge gained is an aid for math-dependent disciplines and a good investment for society as the economic consequences could be staggering if remediation were not available.

Statement of the Problem

Thousands of students enter college each year underprepared. The lack of needed skills often necessitates remediation to successfully earn a college degree (Bettinger & Long, 2007; Weissman, Silk, & Bulakowski, 1997). And, research has shown that despite remedial or developmental academic interventions designed to provide the preparation they need, these same students are less likely to finish their degree (Parsad & Lewis, 2003; Wirt et al., 2004). In sum, the less prepared they are, the more likely they are to drop out (Jerald & Haycock, 2002).

Pajares (1995) would explain the anomaly of a lack of student success, despite remediation, on low student self-efficacy. If individuals feel like a failure, self conscious or humiliated because of placement in remedial coursework, dropping out may become their best solution. Perceptions of self-efficacy may very negatively impact remediation strategies.

Theoretical/Conceptual Framework

Students who finish a remedial program and then take college-level courses have been faulted, according to O'Banion (1997), for the academic rigor being dragged down and receiving college diplomas despite lacking knowledge that was once customary with the completion of a degree program. Also, since higher education institutions desire greater prestige, the focus is on gaining top students, those which are easier to educate, which makes the under-prepared students undesirable (Newman et al., 2004; Phipps, 1998). This is an issue that can, for those students that require any remediation, make them feel rejected or like a failure or an outcast. A students' self-efficacy can also be changed; their confidence in themselves might be altered.

Self-efficacy theory has been used in research to predict student achievement in mathematics (Pajares & Kranzler, 1995; Stevens, Olivarez, Lan, & Tallent-Runnels, 2004). “Because perceived self-efficacy fosters engagement in learning activities that promote the development of educational competencies, such beliefs affect level of achievement as well as motivation” (Zimmerman, 1997, p. 208). Through this research, self-efficacy might explain the anomaly of success for some and not others – in other words, do those who gain confidence through remediation succeed and those who feel less confidence fail or drop out?

Self-Efficacy Theory

Self-efficacy can play a role in students’ academic success in college and especially, for students in remedial programs. Bandura (1994) expressed that

Perceived self-efficacy is defined as people’s beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people feel, think, motivate themselves, and behave.... A strong sense of self-efficacy enhances human accomplishment... and people with high assurance in their capabilities approach difficult tasks as challenges to be mastered rather than as threats to be avoided... set themselves challenging goals and maintain strong commitment to them... heighten and sustain their efforts in the face of failure.... In contrast, people who doubt their capabilities shy away from difficult tasks which they view as personal threats. They have low aspirations and weak commitment to the goals they choose to pursue. When faced with difficult tasks, they dwell on their personal deficiencies, on the obstacles they will encounter, and all kinds of adverse

outcomes rather than concentrate on how to perform successfully. They slacken their efforts and give up quickly in the face of difficulties. They are slow to recover their sense of efficacy following failure or setbacks. Because they view insufficient performance as deficient aptitude it does not require much failure for them to lose faith in their capabilities. (p. 71)

Remedial math students who think they are unable to do math, who doubt their capabilities, will not have the commitment to succeed. These students are the ones who will give up more quickly than others and most likely drop out.

Students who do not feel capable of being successful in a remedial math program are doomed to fail and must be persuaded or motivated to turn those thoughts around; to create a positive attitude of being successful. There are several ways to build or gain self-efficacy. According to Bandura (1994),

Efficacy can be developed by [multiple] sources of influence. The most effective way of creating a strong sense of efficacy is through mastery of experiences.

Successes build a robust belief in one's personal efficacy. Failures undermine it, especially if failures occur before a sense of efficacy is firmly established... A resilient sense of efficacy requires experience in overcoming obstacles through perseverant effort... A second way of creating and strengthening self-beliefs of efficacy is through... seeing people similar to oneself succeed... Social persuasion is a third way of strengthening people's beliefs that they have what it takes to succeed. People who are persuaded verbally that they possess the capabilities to master given activities are likely to mobilize greater effort and sustain it than if they harbor self-doubts and dwell on personal deficiencies when

problems arise.... It is more difficult to instill high beliefs of personal efficacy by social persuasion alone than to undermine it. Unrealistic boosts in efficacy are quickly disconfirmed by disappointing results of one's efforts. But people who have been persuaded that they lack capabilities tend to avoid challenging activities that cultivate potentialities and give up quickly in the face of difficulties. (pp. 72-73)

Remedial math students, who are told, convincingly, by teachers or peers that they are capable of doing math may strive harder to succeed. On the other hand, students who are told they cannot do math or will not succeed, most likely will lose what little confidence they may have had and drop out.

Therefore, self-efficacy can explain the anomaly of success for some and not others because those who do gain confidence through remediation and a stronger sense of accomplishment will succeed (Bandura, 1994; Pajares, 1995). Those students with increased confidence will have or will develop a higher level of self-efficacy and will become more persistent, engaged, and have positive thought patterns and emotional reactions; they will gain feelings of serenity in dealing with difficult tasks (Pajares, 1995). Those who feel less confidence, self-conscious or humiliated with being placed in remedial coursework, or like a failure will lose their commitment to pursue a college education and drop out. According to Pajares (1995), low self-efficacy causes the less confident students to shy away from problems they deem hard to solve; because things appear tougher and foster stress and a narrow vision of how best to solve a problem, these students expend less effort on activities and will most likely not be successful in remedial

or developmental courses. Without success through remediation, their best solution then becomes to drop out of college.

Purpose of the Study

Through the lens of self-efficacy (Pajares, 1995), the purpose of this predominantly qualitative study was to examine the thoughts and feelings of recent high school graduate mathematics students who were placed in remedial mathematics programs at the college level after taking a placement test to determine their perceived level of ability. The voices of students who experienced remedial or developmental courses provided information needed to answer questions about the impact of their placement and helped explain the phenomenon of staying in college or dropping out prior to completing a degree.

This purpose was achieved by answering the following research objectives:

1. Describe the thoughts and feelings of recent high school graduate mathematics students who have been placed in remedial mathematics programs at the college level;
2. Analyze those thoughts and feelings through the lens of Pajares (1995) self-efficacy;
3. Report other realities revealed; and
4. Assess the usefulness of Pajares (1995) for explaining phenomenon under review.

Procedures

This study used predominantly qualitative methodology to investigate the phenomenon of academic success and failure for students who had recently graduated from high school and were placed in remedial college math classes. Qualitative research

is used when the researcher is seeking to understand behavior from the participant's point of view and allowing students' voices to emerge is an approach best suited to qualitative methods (Miles & Huberman, 1994). Interviews were the main source of data because understanding the perceptions of the remedial students was at the core of this study. Analyses of academic records and the observations served to describe the sample and supplement and triangulate the interview data. A detailed description of the methodology may be found in Chapter 3.

Researcher

I grew up in a large family in a small farming community, am a single middle-aged female, and live in the same small college town where I received my BS and MS degrees. My math teaching career began at age 21 and then lapsed for 14 years due to a very oppressive high school principal who later lost his administrative license. I have taught high school and as an adjunct math instructor, and presently teach at a four-year regional public university with about 2,300 students. I have seen many students struggle with math and require a great deal of assistance, even through math remediation. Some students only needed a refresher course while others, at the opposite end of the spectrum, needed the full-blown developmental coursework. Many students have been helped through remedial or developmental classes. I have also seen many students give up for various reasons and drop out of college that were taking developmental or remedial math courses.

With my mathematical background and familiarity as a remedial instructor, certain biases exist in the way that I present and analyze the data. I have tried to keep those biases to a minimum by expressing my personal beliefs.

Data needs and sources

Creswell (1998) defines qualitative research as “an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting” (p. 15).

Because the purpose of this study was to investigate students’ perceptions of being placed in remedial math classes, data needs included this information specifically gathered through interviews. Also needed was demographic and background information from each participant to build a profile for each student involved.

Recent high school graduates who were remedial math students were the main focus with primary use of interviews, supplemented by observations, demographic questionnaires, and a survey instrument. The site for the research was a mid-western state university’s remedial math class that was taught by a very diligent math instructor who markedly had great success with remedial math students. I gained access and approval by requesting permission from the Oklahoma State University Institutional Review Board to use human subjects for the research and then went through the mid-western university’s Institutional Review Board, and finally through the mid-western university’s math department.

Data collection

Collection of the data was through observations of the participants in class and follow-up in-depth interviews that were made towards the end of the semester. For students that dropped out, an interview was done at that time to gain an immediate response to the participant’s feelings as to their decision for leaving college.

One class of remedial math students was observed during class sessions in one semester as students were presented with new material. “Observation entails the systematic description of events, behaviors, and artifacts in the social setting chosen for study” (Marshall & Rossman, 1989, p. 79).

The determination of using one class was made to avoid factors that could arise between two separate remedial math classes which may alter the outcome of the research. The study participants were remedial math students who were first-time freshmen directly out of high school.

After several observations of the classes, purposively chosen students who were recent high school graduates were interviewed, audio tape-recorded and the interviews were transcribed and constituted the main source of data for this study. The interviews were supplemented by review of the questionnaires and background information from each student. “The interview is one of the main data collection tools in qualitative research. It is a very good way of assessing people’s perceptions, meanings, definitions’ of situations and constructions of reality” (Punch, 1998, pp. 174-175).

The following information was asked of my participants during the interviews:

1. Why were you asked to join this class?
2. Do you feel that this was an appropriate placement for you?
3. How do you feel now that you have had an opportunity to learn the material presented in this class?
4. What are your future plans?

During the observations and upon interviewing, I looked for indications as Pajares (1995) noted could be present, where students might tend to avoid difficult tasks or have

low aspirations or a weak commitment towards their goals. I listened to see if students dwelled on their personal deficiencies or obstacles they encountered and if they were ready to give up quickly in the face of difficulty. Also, I looked for signs of stress and listened to see if they would say they struggled with math, could not do math or were not very smart. On the other hand, I watched to see if some students approached the remedial course as a challenge, became engrossed in activities, had set high goals, and then remained strongly committed to those goals. I looked for quick recovery from a setback and listened to hear words of assurance that success was met, that these students had gained a very positive attitude and good feeling of doing well while in the class.

Data Analysis

In analyzing the data, the interviews were transcribed and then checked for overall general themes. “The most fundamental operation in the analysis of qualitative data is that of discovering significant classes of things, persons and events and the properties which categorize them” (Marshall & Rossman, 1989, p. 113). All participants were given a different name to protect their identity. The questionnaires gave additional information that aided in the analysis of all the data, such as brighter students had more or less effect from the placement into remedial or developmental classes. The additional information included such items as pre- and post- Accuplacer test scores, high school GPA, ACT or SAT scores, age, gender, time lapsed since last math class, etc.

Through the lens of Pajares’ (1995) self-efficacy, students that become more confident will take a more active part in class, be willing to answer questions, and persevere in solving problems. “Students with greater confidence work harder and longer and are less anxious” (Pajares & Miller, 1997, p. 214). Whereas, those students who lose

confidence will be more withdrawn and anxious, have increased absenteeism, and be quick to give up rather than persevere; some will actually drop out of school. Pajares (1995) summarized that students with low self-efficacy may see things as being more difficult than they really are, which leads to greater stress and a narrower vision of how best to solve a problem.

These paradigmatic traits of high and low self-efficacy were the factors that helped to answer my research objectives and guided my study. In Chapter 3, I gave a detailed description of my methods used to extract information from my participants which allowed these same identifiers to emerge as generalized themes.

Significance of the Study

Developmental education can be effective (Boylan, Bonham, Claxton, & Bliss, 1992; Waycaster 2001) but what about the large percentages of remedial/developmental students that are failing or not being retained. All students deserve the opportunity to overcome their lack of mathematical skills and develop mathematical proficiency to pursue their career goals and dreams. Without the math skills, they may not be able to choose the college major needed to meet their goals (Hall & Ponton, 2005). This study answered some questions as to the factors associated with remedial or developmental classes that influence students to drop out or stay in college and therefore may lead to developed guidelines for professional educators in this area.

Theory

For many years, tutoring or providing assistance to postsecondary students that lacked academic skills or knowledge has been commonly accepted. Ever increasing numbers of students are placed in remedial or developmental programs as more students

are going to college, including those that are not as prepared to gain the knowledge needed for present day jobs. But no standard assessment guidelines are used by colleges and universities to see if the efforts of remedial or developmental programs are successful or if these courses may have an effect on the student. A study of more than 100 two and four-year institutions by Boylan, Bonham, and Bliss (1994) revealed that only a small number executed any systematic evaluations of their developmental programs. These evaluative assessments should not only measure success of the program through completion rate, but also answer whether students are successful in college-level courses and being persistent in pursuing their career choices.

The students, in most cases, are not to blame for their lack of preparation and may not complete a degree, but society can expect to endure the repercussions that may develop. “The education of the so-called ‘remedial’ student is the most important educational problem in America today...[as] providing effective remedial education would do more to alleviate our most serious social and economic problems than almost any other action we could take” (Astin, 2000, p. 130). Additionally, Astin disclosed that failing to find the means to educate remedial students means the continuation and most likely worsening of problems with health care, unemployment, crime, welfare, racial tensions, the misdistribution of wealth, and citizen disengagement from the political process.

The under-prepared students, those whose learning achievement has not kept pace with our ever-changing technological world, are contributing to the growing and perplexing situation that affects all segments of society. With many under-prepared students failing or dropping out, state and federal tax revenues are affected as they

increase with increased numbers of college-educated people (Newburger & Curry, 2000). Also, voting behavior is more prominent with those that have more schooling, higher incomes, and good jobs (Day & Gaither, 2000) and our democratic system relies on an educated public to be actively involved in the political process.

Without the successful education of remedial students, the workforce will see increasing shortages. “Juxtaposing the poor mathematical performance of students with the skills necessary to function in the 21st century workplace... [will result] in a serious mathematical readiness deficit among present and future American workers” (Hagedorn, Siadat, Fogel, Nora, & Pascarella 1999, p. 262). By 2020, “According to the Bureau of Labor Statistics, the nation will face a prospective deficit of about 12 million workers with at least some college education” (Callan & Finney, 2002, p. 26) which explains why attaining a college degree is crucial to maintain an educated workforce for our society.

A very large part of the future workforce will be from minority and low socioeconomic groups who, as mostly first-generation college students, are not presently afforded the best educational opportunities at all levels (Callan, 2006). According to Terenzini, Cabrera, & Bernal (2001), low SES students are not as likely to enroll in postsecondary education as high SES, and if they do, they are less likely to complete a four-year degree. Also, without a bachelor’s degree, they are likely to earn less, be employed in lower-status jobs, and for the few that get a bachelor’s, they are less likely to attend graduate or professional school. Without some form of postsecondary education, opportunities for these young adults will be greatly diminished; they will “fall behind in competing for a good job and in achieving or maintaining a high standard of living” (Callan, 2006, p. 6).

To maintain a thriving economy, every student must acquire the knowledge and skills necessary to prosper economically and live sufficiently (Altbach et al., 2001). A postsecondary education for many will be the key to keeping this country a vital nation with citizens that take an active stance in contributing to society. Learning the necessary skills is crucial for the existence of a strong America with civically engaged citizens (Learning Matters Inc., 2005) which defines a college education as a societal investment, not a personal one (Astin, 2000).

Practice

Students today have richly layered and complex experiences and researching the underlying causes and perceptions through listening to student voices can strengthen the work of remedial and developmental educators (Higbee, Arendale, & Lundell, 2005). By investigating students' feelings and attitudes with being placed in developmental or remedial classes, this study will make a contribution to students' greater learning abilities and personal belief in what they are able to accomplish. The results of this study could inform students; possibly enable them to understand their own difficulties with math, even lead them to be more persistent. Also, it may help these students see that the stigmatization associated with taking remedial courses is unwarranted and that these courses are beneficial and for some, even necessary in acquiring their dreams.

Providing a greater depth of knowledge, the results of this study will help teachers to teach more effectively, allowing them to see what changes need to be made, enabling students to become more efficient and effective learners.

By understanding students struggling with mathematics at the postsecondary level, professionals can offer better assistance both during and before college and

can help identify appropriate remediation techniques...Many struggling students are not identified as requiring special services for math during secondary school [and] it is becoming increasingly evident that students need help understanding mathematics, especially with the world rapidly evolving scientifically and mathematically. Many college students encounter mathematics difficulties, which can eventually act as a gatekeeper to earning a college degree. (McGlaughlin, Knoop, & Holliday, 2005, p. 223)

Also, with more attention brought through research to remedial or developmental programs, the secondary and postsecondary institutions will move towards working together and collaborating to decrease the numbers that require remediation. With the knowledge that comes from this research, goals can be developed to enhance learning at the high school level and in developmental or remedial courses. A route to these goals will be created by the faculty involved and a method for assessing performance will be developed. Those that teach remedial or developmental courses will also come to see the vital importance of those classes and not feel a loss of prestige or view the teaching of the under-prepared as demeaning.

Also, this study could change prevailing beliefs for those that think remediation is unnecessary and too costly and also for those that think that students are not meant to be in college or cannot learn. All students, despite race or income level, deserve to be given the same educational opportunities and the students that are experiencing the greatest problems in math need greater attention and also more support. Because enrollment in postsecondary institutions by students with documented learning difficulties is increasing, researchers must begin to focus on the needs of this particular group (Mercer, 1997).

Research

I am interested in learning why students are experiencing an effect, possibly changing their initial career choice or deciding to drop out of college altogether or feeling serene with the challenge, after being placed in remedial or developmental courses. Being required to take remedial or developmental programs can be shocking to some and felt to be a welcome challenge by others. There has been little qualitative research on how developmental or remedial students and programs are literally seen in four-year institutions and especially lacking is how the students view their placement in remedial courses such as math. By listening to students' voices, the question will be answered as to whether students are more likely to drop out or be persistent in pursuing a degree for their career choices.

Chapter Summary

Every student is entitled to the best education that can be provided for each of them. Since jobs presently require a greater degree of knowledge, students today need to have some form of postsecondary education to be able to make a decent living for them and to be able to provide for their families. Since many students do not learn everything at the high school level, they require additional training in college to gain the information needed to complete a degree. The required remedial or developmental classes that some students need in college are through no fault of their own, mostly through a lack of preparation in high school. This research has given traditional students the opportunity to express their inner thoughts about being placed in remedial or developmental classes that, in some cases, they paid extra for and may or may not count towards a degree. Through the students' voices, the research should answer whether remedial placement causes

feelings of challenge or of failure for some or drives students from degree completion. Also, the research will show that without changes to better prepare more in high school and the continued help for students through remediation, society may see fewer college graduates over time rather than the increased numbers that are needed today in our global market.

Reporting

The following chapters will give greater insight as to the importance of this study and allow the reader to see the numerous reasons that have led to the intensity of the problem and the need for remediation. Chapter 2 is an in-depth review of the literature and includes reasoning behind the needs and shortcomings of remedial and developmental programs. Methods of conducting this study are outlined in Chapter 3, followed by the presentation of the general themes in Chapter 4 and data analysis in Chapter 5. The final chapter highlights the conclusions of this study and reflects upon future research in this area.

CHAPTER II

REVIEW OF LITERATURE

“The unleashed power of the atom has changed everything save our modes of thinking and we thus drift toward unparalleled catastrophe” --Albert Einstein

This literature review examines the consequential aspects that are associated with being placed in a remedial or developmental math program to understand the feelings and attitudes of traditional age freshmen at a four-year university. More specifically, this review addresses the historical shift in education that transformed the educational process of secondary and postsecondary institutions in the name of progress and the chain of events that led swelling numbers down the remedial or developmental path. There is discussion of ill-planned reforms, forced mandates, and standardized testing that have contributed to thousands of under-prepared students needing assistance, resulting in the creation of a formal remedial or developmental program for reading, writing, and mathematics. The necessity for student preparation to succeed at the college level is referenced as increasing job-skills knowledge is needed for advancing technology. Also, the review presents the roles of ethnicity and socioeconomic status that play a vast part in growing numbers needing remediation while generating a shortage in the work pool.

Under greater scrutiny is the problem behind the vast numbers of under-prepared students enrolling in college that lack the skills to complete their degree and are required to remediate. On the other side is the remedial or developmental assistance that is supposed to help, but often drives students from degree completion. Consideration is then given to the possibilities that stand between the assistance of remediation and the students' success of completion, with special attention towards one's self-efficacy.

College Preparation Needed for Success

Students, in most cases, need some form of postsecondary education to be able to earn a moderate living (Callan & Finney, 2002). Many are choosing to go to college but are not prepared upon graduating from high school (Bettinger & Long, 2007). If these students are not prepared for college-level courses then they will need special preparation through math remediation to build necessary skills, or their ability to succeed in other courses or disciplines may be hampered (Johnson & Kuennen, 2004). Without participation in any remedial or developmental programs or activities, approximately two million students would drop out of postsecondary education every year (McCabe & Day, 1998).

Reform and Secondary Education

In the past, officials have attempted several waves of reform, believing students would learn more, get the best education possible, or become adequately prepared for our increasingly high-tech jobs. Both, the 1957 launching of the Russian satellite, Sputnik and the release of *A Nation at Risk* in 1983, led to pouring billions of dollars into education with massive changes but the outcome did not change; students seemed to be even less prepared than before the reforms (Altbach et al., 1999/2005; Mercer & Harris,

1993; O'Banion, 1997). Despite good intentions and concurring about the specific or intended direction, many of the reforms lacked theoretical and practical essence (Hofmeister, 1993). Therefore, the reforms did not produce desired outcomes leaving students to lose a great deal of educational opportunities, especially those with lower abilities and achievement levels (Mercer & Harris, 1993). The missed educational opportunities meant that the students were not fully prepared; did not gain the knowledge needed for the next level of education or, in some cases, the skills to even get a job.

Many graduates are not prepared for jobs directly after high school as “80% of sustainable jobs today require some education beyond high school and 65% of the workforce need skills that include advanced reading, writing, mathematical, critical thinking, and interpersonal group skills” (Phipps, 1998, p. viii). Our nation is under pressure to compete in a global economy forcing growing demands for ever-higher levels of that knowledge and skills (Callan & Finney, 2002). With technological advances, jobs will continue to require even greater skills. The need for more advanced skills will create the need for more advanced learning and “those individuals who are...knowledge workers will have an increased importance in [our] global economy” (Tierney, 1999, p. 7) as the 21st century students continue to need even greater knowledge for advancing information-age employment (McCabe & Day, 1998).

Over the past two decades our educational systems have become globally embedded and our educational institutions are under continual intense pressure to adapt the curriculum and promote more and better learning to meet the changing needs of the labor market (Broadfoot, 2000). Broadfoot also noted that, in these times of this global economic competition, our government and society has become obsessed with

international rankings of measured educational outcomes which has led to even more efforts of reform.

Another such reform, a policy mandate, was the No Child Left Behind (NCLB) Act of 2002 which required states to fill the nation's classrooms with highly qualified, knowledgeable, and experienced teachers. Since the teachers, who may or may not have had a degree in the field they were teaching, had to test and assess, analyze and report results, develop professionally, and be held accountable, students lost instruction time and valuable learning opportunities. Some parts of the curriculum were getting short-changed to make time for improving the test scores, which actually lowered the quality of education in the schools (Popham, 2004). Prior to the NCLB Act, Toch (1991) had already expressed that increased standardized testing was to blame for our student's mediocre level of learning as the testing drove down the level of instruction; schools need higher academic standards to prepare students for higher education and thinking skills jobs. Implementing mandates leaves little time to give students the attention they deserve, especially for students that do not try as hard and need motivation or do not learn as quickly as others.

There are numerous issues and reasons surrounding the lack of preparation at the high school level. Besides being laden with mandates and devoting time to test preparation, lower socioeconomic schools, those which are largely made up of students that are eligible to participate in the federal free or reduced-price lunch program, do not have the funds to hire quality teachers, or in many cases, teachers that have a degree in the subject being taught (Darling-Hammond, 2004; Haycock, 2001). Some believe the rigor of high school mathematics is too low for students to be prepared at the college

level (Hoyt & Sorenson, 2001). Others feel that some students are not meant for college-level work (Cronholm, 1999; Marcus, 2000; Trombley, 1998) since the students did not acquire or learn the needed skills for whatever reason.

Under-Prepared Students

Thousands graduate from high school each year and most seek a college or other advanced education to acquire a job to earn a living. “College-level learning has become increasingly important to the economic prospects of states and nations, as well as to the life opportunities of the individuals who reside there” (Callan & Finney, 2002, p. 25). Many students now realize the importance of mathematical knowledge and some form of postsecondary education for meeting career aspirations (Stage & Kloosterman, 1995).

Of the thousands of high school graduates, the majority should be academically prepared to go on to college. But research is pointing out the fact that

Traditional undergraduates are... coming to college more poorly prepared than their predecessors. As a result, there is a growing need for remediation. According to a national survey of student affairs officers... nearly three-fourths (74%) of all colleges and universities experienced an increase within the previous decade in the proportion of students requiring remedial or development education at two-year (81%) and four-year (64%) colleges. Today, nearly one-third (32%) of all undergraduates report having taken a basic skills or remedial course in reading, writing, or math [and] colleges and universities have a poor reputation in providing effective remediation (Altbach et al., 2001, p. 46).

For those that choose college as their path, many discover through placement tests or other form of testing, or ACT or SAT cut-scores, they are viewed as under-prepared; they

appear to lack the skills required by the institution for taking college-level courses. Most colleges then require that the students must successfully complete remedial or developmental courses in the deficient areas before being allowed to take college-level course work. The enigma propagated here is that “lower level course placement may have implications for student attitudes toward college and the motivation to stay in school” (Walker & Plata, 2000, p. 25) and we know very little about how students’ attitudes and values affect their academic success (Lundell & Higbee, 2000).

In 1987, the American Association for Higher Education defined “under-prepared” as being incapable, or unexposed, or trained not to achieve or culturally threatened by learning. Despite the meaning, numerous high school graduates lack adequate academic preparation for higher education and the less-prepared students are more likely to need remedial assistance to do college level work (Bettinger & Long, 2007; Hoyt & Sorenson, 2001; Parsad & Lewis, 2003). Nearly 33 percent of all students entering our colleges and universities are under-prepared (Boylan, 1999a) and 46 percent of U.S. college students who have earned more than ten credits have been enrolled in at least one remedial course (Adelman, 1999).

The need for remedial courses for under-prepared students has continued to increase over the past thirty years and the two-year community colleges are providing the majority of remediation (Breneman & Haarlow, 1998; Boylan, 1999b; Ignash, 1997; Smittle, 2003). In 1995, the National Center for Education Statistics (NCES) found that 29 percent of all freshmen required remedial education at four-year universities and 41 percent at two-year institutions (Hoyt & Sorenson, 2001). By 2000, 80 percent were taking remedial classes at public four-year institutions and 98 percent at public two-year

institutions (Parsad & Lewis, 2003). With vast numbers taking remedial courses at two-year colleges, attrition for these students at a four-year institution is unlikely. “The majority of students who start out at a two-year institution never receive a baccalaureate degree” (Duranczyk & Higbee, 2006, p. 22). With the vast numbers requiring assistance through remediation and many dropping out of college, changes need to be made but at what level of education should the changes occur.

For some time, the pre-collegiate educational system has been blamed for students being under-prepared (Mills, 1998). As a result, colleges and high schools strengthened the math requirements in the 1980’s but the numbers were still increasing for those who did not have adequate math skills for college (Duncan, 2000). In 1994, according to the National Council of Teachers of Mathematics (2000), all states were required to adopt challenging academic standards in the core areas of mathematics. In 2000, the standards were again changed and presented as a better and more workable revision. Policymakers suggested that schools needed to require more rigor and more units of math in high school. However, requiring more units of math in high school does not ensure students’ acquisition of the information (Duncan, 2000). Students are not learning adequately to be prepared for a postsecondary education and their lack of knowledge has been, in society’s eyes, demonstrated through international test scores (Broadfoot, 2000).

U.S. high school students academically lag behind their counterparts in other industrialized countries (Hagedorn et al., 1999). The Trends (formerly Third in 1995) in International Mathematics and Science Study (TIMSS) tested the math and science knowledge of over a half-million students from 40 plus nations at different grade levels in 1995 and 2003 and the results indicated that U.S. students were outperformed by several

countries in mathematics with little improvement between testing years (Lemke & Gonzales, 2006). Also, the Program for International Student Assessment (PISA) in 2003, which focuses on mathematics literacy, or the ability of 15-yr-olds to apply mathematical skills to a real-life context, showed that “U. S. 15-yr-olds performed worse than more than about half of their international peers” (Lemke & Gonzales, 2006, p. 24). The results from these tests, that have depicted that American students are only average math students to some and in some instances, below average, has outraged business leaders, bureaucrats, and many others across America. Through America’s outrage, more reform has been set in motion and pushed colleges and universities to change. Stricter acceptance policies have been made as well as trying to gain the best and brightest students (Newman et al., 2004).

Even though some colleges and universities have strict acceptance policies, many students are still specifically unprepared for college-level mathematics and math-related courses (Hagedorn et al., 1999). “Among the 1992 12th-graders who enrolled in postsecondary education between 1992 and 2000 ... 27% had to complete at least one remedial mathematics course” (Chen & Carroll, 2005, p. 11). Freshmen totals increased about 300,000 nationwide from fall 1995 to fall 2000 but the statistics did not vary; 22 percent of entering freshmen undertook remediation in mathematics (Parsad & Lewis, 2003). Reports from the NCES show that, nationwide, of all entering college freshmen, 24 percent are required to take remedial mathematics (Merisotis & Phipps, 2000).

In a 15 state and 80-some-odd community colleges’ experiment in 2002, findings showed that 61 percent of the students needed a remedial math course (Ashburn, 2007). Ashburn added that the more distressing fact was that two years later only 17 percent, on

average, had successfully completed their remedial coursework and moved on to college-level math.

The Maryland Higher Education Commission did a study on remediation and found that students who took college-preparatory courses in high school and immediately attended a two-year institution, 40 percent needed math remediation (Phipps, 1998) but the numbers did not account for Maryland students that did not follow the college track curriculum. Also the study noted that at one of the community colleges, 73 percent of college-preparatory students needed math remediation. Not all institutions in all states have as large of percentages requiring remediation, but as the rates of enrollment increase in postsecondary education as in the past 30 years (Parsad & Lewis, 2003), many students that have difficulty with math or are not fully prepared for college-level math courses will still need some type of help, possibly remediation.

Remediation is necessary for many of the under-prepared as college is becoming a way of life for most to succeed. However, the actual word “remediation” or “remedial”, according to Astin (2000), has a negative inference or implication that something needs to be fixed or “remedied.” Astin added that the actual association with ‘remediation’ can make students feel inferior. For the students that did very well in high school math, being required to remediate comes as quite a shock (Walker & Plata, 2000). How can students’ math skills and credentials be good enough to graduate from high school and only a short time later in college, be lacking to the point they are placed in remedial math classes.

The stigmatization students feel in college as a failure at the high school level (Phipps, 1998) can, by being required to take remedial math, make students feel like they failed. But without a remedial math course, “substandard math skills are expected to

hinder a student's ability to succeed in other university courses and meet graduation requirements" (Johnson & Kuennen, 2004, p. 25).

Some remedial students may have some serious difficulties with math but many just have low "scores on some form of normative measurement—standardized tests, school grades, and the like" (Astin, 2000, p. 132). According to Fleischner and Manheimer (1997), approximately 5-6% of school-age students have significant difficulty in mathematics. But not a lot of research exists on college students encountering difficulties with math (Strawser & Miller, 2001). Of the school-age students with significant difficulties that may choose college, they will need more assistance but can benefit from the higher skills level brought to the workforce (Breneman & Haarlow, 1998). The added attention and acquired skills will give them greater opportunities in life even if they drop out of college. But are these remedial students dropping out because they feel inferior or because they give up, feeling they cannot do the math.

All students do not learn at the same time or at the same pace as their peers (O'Banion, 1997). Some students will actually feel "tension and anxiety that interfere[s] with the... solving of mathematical problems" (Richardson & Suinn, 1972, p. 551) and may become extremely nervous, nauseous, or not be able to hear the teacher or be able to concentrate (Godbey, 1997). Other factors that may have contributed to students' lack of math skills might include: (a) a time factor with long periods between math classes or a lack of practice; (b) a fear of math; (c) excessive absences; (d) thinking math ability or inability is hereditary; (e) a negative experience with a teacher; (f) having a learning disorder or disability or poor study skills; (g) a lack of motivation or interest or a general

negative attitude about school; or (h) a low self-esteem or self-image (Godbey, 1997) which may sink even lower with required remediation.

In a study by Johnson and Kuennen (2002), findings suggested that math skills were critical to student performance in other disciplines even though students that needed remedial math did not do as well as their nonremedial counterparts. Also from the study, Johnson and Kuennen found that the remedial students that had completed their remedial coursework had a better grasp of basic mathematical concepts than the remedial students that had not completed their remedial coursework.

Some students do not complete a degree after being required to take remedial or developmental math courses. Even with assistance through remediation, students enrolled in remedial math are less likely to earn a degree or certificate (Parsad & Lewis, 2003); the more remediation they need, the more likely they are to drop out (Jerald & Haycock, 2002). Research shows that 50 percent of all students never make it to graduation while 67 percent drop out of community colleges (Learning Matters, Inc., 2005) and “underprepared students have historically been the ones most likely to drop out at any level of education” (Astin, 2000, p. 130). Astin also reports that overall dropout rates among the poorly prepared are rather high, with only 20 percent completing a degree in six years compared to 80 percent of the best prepared students. However, those students who complete the basic skills requirements through a remedial or developmental math program have a better chance to succeed academically (Bettinger & Long 2007; Haeuser, 1993; Phipps, 1998).

The students that complete remedial or developmental math and go on to college-level courses have been blamed for a decrease in the academic rigor of college-level math

courses. “Proponents and opponents alike point to the effects of remedial education on the quality, accountability, and efficiency of higher education institutions” (Merisotis & Phipps, 2000, p. 68). The 1993 release of *An American Imperative* stressed how the rigor of college-level courses had been dragged down (O’Banion, 1997). Also, diplomas were being awarded to students lacking knowledge normally associated with a college degree; therefore, the quality of the degree may not have the same meaning today as it once did. The excellence of a higher education institution is defined primarily by its resources and reputation, enrolling top students for greater prestige, which makes the under-prepared student bad news for higher education (Phipps, 1998), creating yet another factor for those that require any remediation to feel branded as a failure or lower their self-esteem.

To add to the feelings that a remedial student may be experiencing is the fact that many faculty view the teaching of under-prepared students as being “unglamorous, unimportant, and—in many institutions—demeaning” (Astin, 2000, p. 131). Astin attributes these negative feelings, on the part of the teacher, to under-prepared students taking more time, being harder to educate, posing a threat to the institution’s excellence, and reflecting the remedial students’ poor performance or failure back on the faculty. Also, Seese (1994) expressed that some faculty feel a loss of prestige when teaching remedial or developmental courses. Creating even more adverse perceptions, Astin (2000) added that many institutions hire outsiders or cheap labor to do the remediation leading remedial or developmental students to think that their education is not valued.

According to Boylan, Bonham, Jackson, and Saxon (1994), 72 percent of those teaching developmental or remedial courses are part-time. This pattern suggests a debilitating preference by the colleges and universities, making it harder for the under-

prepared who need more time with the instructors. For this reason, developmental education research has indicated the importance of full-time, informed and well-trained professionals to work with remedial math students, especially for those at risk or most likely to fail without benefit of trained instructors (Roueche & Roueche, 1993, Smittle, 2003). These students need to have their non cognitive needs met as well as their cognitive and be taught by motivating teachers who want to teach remedial students (Smittle, 2003), not instructors who do not have the commitment or the desire, much less a positive attitude.

The question is whether teachers' negative attitudes are felt or sensed by the remedial or developmental students. Duranczyk and Higbee (2006) conveyed that non-cognitive factors can impact student achievement as well as interest in mathematics. Attitudes of others can affect one's confidence in their ability to learn mathematics (U. S. Department of Education, 1998) and especially for remedial or developmental mathematics students (Higbee & Thomas, 1999).

What constitutes remedial or developmental courses varies from institution to institution and many colleges and universities feel that acknowledging that they enroll students who require remediation is not in their best interests (Merisotis & Phipps, 2000). In fact, numerous higher education institutions view the under-prepared as a threat to their academic reputation (Astin, 2000) generally because their excellence is defined by what students bring to college rather than by the value added (Moore, 2004). Legislators and the public question the necessity of remediation, especially due to the high costs, and are joined by university officials in the debate of who should be responsible for teaching and paying for remedial or developmental courses and even more so as resources have

gotten tighter (Ignash, 1997). Also, Ignash indicated that as the debates have intensified, so has the push for accountability; being held responsible for student outcomes in public funded entities. The debates and the negative climate surrounding remediation has led some four-year institutions to quit providing remedial or developmental programs thus making the stigma associated with needing remediation even more pronounced. Ignash (1997) added that these four-year institutions believed that they should not be required to offer the courses since remediation is not college-level education.

Remediation

Remediation has become a common term in the literature but understanding its necessity and origins makes the ramifications of remediation clearer. A synopsis of the related literature will provide a better understanding as to how remedial or developmental math education arrived at its present form of practice to assist those that are under-prepared and possibly give reason to the waning interest in mathematics that is prevalent today.

The Historical Roots of Remediation

Until the late 1800's, education in the liberal arts generally meant taking courses in Latin, Greek, mathematics, elocution and rhetoric, the sciences or natural philosophy, and moral philosophy with physical education also a part of the curriculum (Altbach, Berdahl, & Gumport, 1999/2005; Colby, Ehrlich, Beaumont, & Stephens, 2003). Early U.S. colleges were designed for and limited to a small number of white male members of an economic and social elite; each institution had no specialized faculty, no distinct departments, and a single professor that might lecture or recite all of the previously mentioned subjects as the method of instruction (Colby et al., 2003). Colleges were

intended to serve society and societal demands became more complex over time impelling institutions to move from elite to mass education (Altbach et al., 1999/2005; Newman, Couturier, & Scurry, 2004). Societal demands, increasing technological advances, and the need for more knowledgeable workers led to greater political involvement in higher education over time (Altbach et al., 1999/2005).

“During the nineteenth century, college curriculum and entrance requirements steadily increased [and]....as a result of increasing rigor...more students arrived at college with insufficient academic preparation” (Stephens, 2001, p. 2). Stephens articulated that under-prepared students had to be accepted to insure income and to keep higher institutions operating. The acceptance of these students led to the first remedial education program being offered and institutions across the nation then followed suit with preparatory departments (Casazza, 1999) as the political involvement of higher education became more active.

After the Civil War, social and economic factors pushed higher education to expand rapidly which included greater industrialization, an influx of immigrants, and the Morrill Federal Land Grant Act of 1862 (Altbach et al., 1999/2005; Colby et al., 2003). The Act of 1862 along with the Morrill Act of 1890 opened the doors to a more diverse group of students and led to increasing numbers of under-prepared being admitted (Casazza, 1999; Stephens, 2001).

During this century, reform was more eminent with a move towards general education. Land-grant institutions were established to teach agricultural and mechanical courses to support a growing industrial economy (Merisotis & Phipps, 2000; Phipps, 1998) and the need to provide a more practical education (Kezar, Chambers, Burkhardt,

& Associates, 2005). New university leaders saw a need to replace “the old standardized core curriculum that concentrated on classical learning and religious themes with a new model that combined specialization in a major field with breadth obtained through a sampling of courses in other disciplines” (Colby et al., 2003, p. 29). One of the leaders, Harvard’s President Charles Eliot, expressed that introducing students to new areas or fields of learning and allowing them more flexibility would make the curriculum more exciting and engaging to the students (Bennett, 1997).

Financial instability led colleges and universities to begin competing for students to stay open and admitted students that were not fully prepared for the rigor of college. Towards the last of the 19th century about 238,000 were enrolled in all of higher education with more than 40% of the first-year college students participating in pre-collegiate programs (Ignash, 1997; Levine, 1978).

“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... and adoption of the German university model which stressed specialization” (Colby et al., 2003, p. 28). Within the 20th century, under-prepared student numbers were continually increasing as enrollments heightened. “Due to increased competition for students among higher education institutions...underprepared students continued to be accepted at growing rates (Merisotis & Phipps, 2000, p. 69). “Over half the students enrolled in Harvard, Princeton, Yale, and Columbia did not meet entrance requirements and therefore were placed in remedial courses” (Phipps, 1998, p. 3).

At the end of World War II, many veterans took advantage of the GI Bill with vast numbers enrolling and many needing remediation. By 1946, over a million

servicemen had enrolled, and in the next seven years, 2.5 million had been admitted to institutions of higher education, with a large majority of them requiring remedial courses (Casazza, 1999). The numbers of under-prepared continued to grow with open admissions policies after the Civil Rights Act of 1964 and the Higher Education Act of 1965 (Altbach et al., 1999/2005). These policies gave access to all, created massive growth in higher education, and granted educational opportunities to special needs students, more women and minorities, and students with low socioeconomic backgrounds (McCabe & Day, 1998; Prieto, 1997).

During the 1960's and 1970's, as national test scores measurably declined, the continued influx of poorly prepared students led colleges and universities across the nation to put formal remedial programs into place (Duncan, 2000). By the 1970's, many students were first-generation college students who scored poorly on academic tests, but college was their way to increased social mobility (Casazza, 1999; Stephens, 2001). Mandated testing then led to more higher education institutions implementing remedial programs in the 1970's and 1980's and today many students continue to require assistance through remediation, especially in math.

The unfortunate realization is that little to no progress has occurred in reducing the need for remediation from then to today. As access to higher education increased, numbers in postsecondary institutions enrolled in remedial or developmental courses continued to rise and this trend is ongoing; the vast numbers of under-prepared students still exist. Students are not achieving sufficiently in academics in high school and lack the skills to advance their education at the postsecondary level. Without some level of

postsecondary education, these students may not be able to meet a traditional middle-class standard of living.

Remediation Today

Remedial instruction has been an essential part of higher education for more than a century and is nourishment for the minds of the under-prepared. Specially designed programs to assist under-prepared students have been offered at the postsecondary level since the first formal program at the University of Wisconsin in 1849 (Breneman & Haarlow, 1998; Brier, 1984; Taylor, 2001) and even earlier at Harvard, tutors in Greek and Latin were provided (Merisotis & Phipps, 2000; Phipps, 1998; Waycaster, 2001).

Remediation provides opportunities for students who lack the academic skills to succeed in postsecondary education (Parsad & Lewis, 2003). Bahr (2004) says that

The goal of postsecondary remediation is to raise the basic skills of students up to the minimum level necessary for success in college-level coursework, further educational advancement, and functional participation in a democratic society. It is ... intended to restore opportunity for those who would be relegated to meager wages, poor working conditions, and low socioeconomic status. (p. 4)

The efficacy of remediation has been the saving grace of many students for numerous years but being required to remediate has a lasting effect, a very negative effect on those that do not successfully complete the classes. To add to the problem, lower academic standards and persistence rates have resulted with remedial or developmental education being increasingly provided to under-prepared students (Altbach et al., 1999/2005) causing many public officials to be extremely concerned about the perceived devaluation of a college degree (Ignash, 1997). Because of the consequential aspects that have

evolved concerning remediation and the actual participation being stigmatized as something bad or belittling, the matter should be examined to better serve the students.

Costs and Benefits of Remediation

Remediation offers opportunity for both students and the institutions in which they are enrolled. Without the substantial number of students, Mills (1998) inferred that institutions could be cut off from a source of enrollment which could create large financial consequences. Mills added that the institutions admit and retain these students who otherwise would not likely enter and be successful at the collegiate level.

Colleges can be hurt financially without the students that require remediation or do not perform as well in college as some, but the institutions can also earn a bad reputation for not retaining these students. Also, some higher education institutions are seeing funding being decreased, their budgets are lowered if students are not retained (Adam, 2007).

Students at some institutions have to pay more for remedial or developmental courses as they are an added expense for the college or university. However, without any remediation some students would not be able to get a degree. The benefits far outweigh the costs in that the students gain knowledge and society reaps rewards. In a report by The Institute for Higher Education, Phipps (1998) asserted that remediation will continue to be a core function of higher education and a good investment for society as the alternatives can range from unemployment to low-wage jobs and welfare participation and incarceration. Going to college results in greater economic benefits to the public through increased tax revenues, greater productivity, reduced crime rates, and increased

quality of life; institutions of higher education produce citizens that will contribute to the common good through greater civic engagement (Newman et al., 2004; Phipps, 1998).

Some students must take remedial or developmental math classes multiple times, making the situation even more disparaging and more costly. Less than one-half are successful on their first attempt in a remedial or developmental math course and a high percentage who fail are minorities who likely have less access to more qualified teachers (Stage & Kloosterman, 1995; Walker & Plata, 2000). The remedial or developmental math program is not working as well as it should with all students since many are not reappearing in mainstream college life (Haycock, 1996). Walker & Plata (2000) reported that some studies have shown that a remedial or developmental math program does not improve students' mathematics ability while other studies showed that remedial or developmental math does help in some cases. Low success rates in remedial or developmental math may be related to the inability of younger students to overcome shock and feelings of inferiority when placed in remedial or developmental math courses, especially if they were successful in high school algebra (Walker & Plata, 2000).

Student achievement, including math skills, remains unacceptably low (Haycock, 1996). Students are not retaining the information or are not getting the concepts at all. Too frequently students arrive at college unable to compute easily or think critically and this is especially true of minorities and students from low-income families, but the phenomenon is not restricted to them (Haycock, 1996). A very important fact is that ethnicity and socioeconomic status strongly correlates with life chances (Newman et al., 2004) and our educational system is differentially effective for many depending on their

social class, race, ethnicity, language, background, gender, and other demographic characteristics (Duranczyk & Higbee, 2006).

Characteristics of Remedial or Developmental Students

There are no set or distinct descriptors that would overwhelmingly cover all remedial and developmental students; as well, every remedial or developmental course on every campus may also be as unique. The remedial or developmental math students are very diverse as each varies in age, ethnicity, socioeconomic status, and especially in ability.

Many high school graduates find jobs, join the military, start families, or pursue other channels before continuing their education (Ignash, 1997). According to a Southern Regional Education Board (SREB) report, many older students go to college to seek a better job escalating the demand for remediation; older students need help with higher mathematics and writing (Abraham & Creech, 2000) and our legislators and the general public accept that the older students need help through remediation but do not understand as well why those students right out of high school are under-prepared (Ignash, 1997). The SREB report explained that recent high school graduates may have taken a college-preparatory curriculum but still require help because they did not get fully prepared or got low grades, while those that skip mathematics their senior year or do not take college-preparatory classes will need remediation. Some remedial or developmental math students may only need a refresher course to prepare them for college-level math courses where others have little or no prior skills and background knowledge.

The average age for all college-bound students has increased due to more adults seeking to better themselves through a college degree. Among remedial or developmental

students, age ranges from 16 to 60 (Boylan, Bonham, & Bliss, 1994), the majority are white and first-generation (Boylan, Bonham, & White, 1999), one-third are minorities with mostly African American and then Hispanic students, and over 50 percent of them are women (Knopp, 1996). Additionally, one in five students are married (Boylan et al., 1992), two out of five receive financial aid, one in three work 35 hours or more a week, one in ten is a veteran, and three in five are 24 years of age or younger (Knopp, 1996).

The under-prepared developmental students represent approximately one-third of incoming freshmen and create increased challenges for higher education institutions. They not only inflict additional expense for some college and universities, the graduation rate for remedial or developmental students continues to be around 40 percent (Boylan, 1999a) compared to 69 percent of all students completing a degree at private, not-for-profit, four-year institutions and 53 percent at a public four-year institution (NCES, 2003).

In the first year of college, students have always been faced with making the transition from high school to college. As they make the transition, frequently many are asked to be more responsible for their own learning (Wadsworth, Husman, Duggan, & Pennington, 2007). But students today are not only challenged by needing to know more and be more active in their learning environment, they are affected by outside circumstances that create even more conflict for them. More students than ever are coming to college psychologically damaged due to divorce, suicide attempts, eating disorders, and psychiatric reasons (Altbach et al., 2001). Those students that have full or part-time jobs with family responsibilities struggle to meet college demands. Other students feel pressure through family expectations while first-generation students may

sense a lack of support from families that know little of the college experience (Gibbons & Shoffner, 2004). These personal and family experiences may also adversely affect students' social and psychological well-being (Altbach et al., 2001). Many of the students that are immensely affected by external situations or circumstances are students of color or of low socioeconomic background (Ignash, 1997; McCabe & Day, 1998).

The Roles of Race and Ethnicity in Remediation

Haycock (2001) related that gains were made between 1970 and 1988 to close the achievement gap between minorities and whites but the gap has since widened. Haycock added that about 1 in 30 Latinos and 1 in 100 African Americans can do elementary algebra compared to 1 in 10 white students. Also, Haycock expressed that young African Americans are only about half as likely as white students to earn a bachelor's degree by age 29; young Latinos are only one-third as likely as whites to earn a college degree. Immerwahr (2003) reaffirmed this information as he related that Hispanics are less likely to acquire a higher education degree compared to non-Hispanic whites or African-Americans with the reasons ranging from lack of financial resources to the lack of knowledge of how to proceed. Age and ethnicity of students, as well as their enrollment status, are significantly related to performance in remedial or developmental mathematics and college algebra (Johnson & Kuennen, 2004).

According to the New York Times, Texas Southern, an all black institution, had about 33% that required remediation before they could enter college-level courses (Freedman, 2005). Minorities and low socioeconomic groups still comprise the greatest numbers needing remediation; if this pattern persists, mathematics deficiencies will negatively affect success in many college courses and become a limiting factor in

undergraduates' career choices (Walker & Plata, 2000). A continuation of this socioeconomic pattern means students do not successfully remediate to complete college-level courses required for a degree and are bound to low-paying jobs, the same dilemma some of their parents faced. This could become even more imperative as "predictive studies suggest that students of color are the fastest growing segment of the population" (Scurry, 2003, p. 3), making demographics a major concern of education (Olson, 2000). This could mean epic proportions of unemployed who only have the skills for low-skilled jobs that may already be filled, and lead to increasing welfare, intensifying crime, and more taxes to help support those living at the poverty level. A solution to end the growing disparity between whites and students of color, especially when considering our workforce needs, is to have access and ensure degree completion (Newman et al., 2004). However, "Research has shown the culture of low expectations of and for low-income students and students of color, along with a lack of access to rigorous high school curricula, undermines their chances to enter higher education prepared and ready for college-level work" (Newman et al., 2004, p. 161). To add to this already dismal situation, "Colleges and universities have turned their attention and resources from low-income students and students of color to the more affluent and easy to educate" (Newman et al., 2004, p. 166).

The Role of Socioeconomic Status in Remediation

There are multiple aspects and reasons behind so many students not being academically prepared for college. According to McCabe & Day (1998),

Of all [the] factors, poverty correlates most closely with academic deficiency from kindergarten to college. The cyclic relationship between educational

achievement and socioeconomic status has been long established, and current population trends suggest increased poverty among the growing numbers of underprepared Americans if we cannot meet their educational needs. (p. 6)

The poor are destined to remain poor without being offered greater educational opportunities. The success of this nation is dependent upon meeting the challenge of reversing the growth of a permanent and disenfranchised underclass (McCabe & Day, 1998).

For many years, the issue of inequality in schools was avoided or ignored. The poverty level of students and their schools still present a challenge to students' educational progress and achievement (Van Haneghan, Pruett, Bamberger, 2004; Wirt et al., 2004). In the early part of this decade, high school students dropped out of school at six times the rate of their peers from high-income families (Wirt et al., 2004).

A student's skin color, economic status, or background should not dictate his/her educational opportunities (Olson, 2000). Students in high poverty schools are more likely than other students to be taught by teachers without even a minor in the subjects they teach and in predominantly minority high schools, in math, many teachers do not even meet the states' minimum requirements to teach (Darling-Hammond, 2004; Haycock, 2001). These students are being cheated out of even a slim chance to climb out of the poverty level; to ascend the social mobility ladder. According to Newman et al. (2004), "A college education today is...the pathway to social mobility, personal prosperity, and civic engagement" (p. 154).

As if these complex circumstances of race and background were not enough, pressure to do well teems from all angles while laying indirect blame on those needing

remediation. Business leaders want a richer work pool and they want America to be the best competitively; policymakers force mandates because business leaders are infuriated due to low test scores and low skills; parents want their children to succeed and do well in life; and remediation means more money and more years of college. To get the job means getting the degree; the problem is that students may lose interest in pursuing a degree if they continue to have trouble in math and cannot endure undue pressure (Walker & Plata, 2000). This ill-fated predicament creates chaos for the under-prepared, lowers students' self-esteem and their confidence, and leads some to drop out of college entirely, forcing them to settle for lower-paying jobs and diminishing their financial stability.

Do the students that have been placed in remedial or developmental courses drop out because they cannot make the grade, have run out of money, or have entirely different reasons. Are these students feeling like failures for being placed in the remedial or developmental classes such that they cannot concentrate or use math skills they are being taught or have already learned? Would they rather give up than feel self-conscious or humiliated, or do they just not have the confidence to succeed, the self-efficacy to successfully complete their remedial or developmental course.

A Theoretical Perspective of Remediation

The theoretical framework of this study is based on Bandura's theory of self-efficacy and how self-efficacy affects one's motivation to persevere and finally succeed. But also the theoretical framework of constructivism is relevant with the remedial situation as it embodies values and beliefs and building one's knowledge based on what they already know. The under-prepared students need to voice their values and beliefs

because they cannot build on what they did not get; they are asked to start over in remediation to learn the basic math skills. Depending on the level of placement and repeating classes, remedial or developmental students are required to cover Algebra I and II material in one or two semesters which in high school took up to two years. The fast pace can cause students to experience a high level of stress because of how quickly they are expected to learn new material (Stage & Kloosterman, 1995).

Students must feel competent in order to be competent. In other words, students must feel capable of producing designated levels of performance (Bandura, 1994) to be successful at math. Some under-prepared students “enter remedial math believing they already have difficulties learning math” (Stage & Kloosterman, 1995, p. 297) and this may be setting them up for failure; a failure that will have an immense impact on the rest of these students’ lives.

Some teachers do not expect under-prepared students to achieve, to gain the math skills required to complete a college-level math course or math-related courses. High faculty expectations of remedial students contribute to improved performance but it is not really known if low expectations have an impact on student performance (Lundell & Higbee, 2000). “The expectations of others have a powerful impact on...students’ perceptions about themselves and expectations for success” (as cited in Lundell & Higbee, 2000, p. 24).

In a qualitative study by Taylor-Dunlop and Norton (1997), eleven high school students related that teachers talked down to them, the students felt like teachers ignored them and did not care. Taylor-Dunlop and Norton also reported that the students felt more like trying with teachers who were attentive and listened to their needs; those

teachers who were attentive, respectful, helpful, and who listened, were perceived to be caring and concerned about students' social and academic welfare.

Self-Efficacy

A great deal of research has been done showing the relationship between self-efficacy and academic achievement in the area of math (Pajares, 1995; Pajares & Kranzler, 1995; Pajares & Miller, 1995, 1997; Stevens et al., 2004), conveying that students with higher self-efficacy perform better and persist longer than those students who have lower self-efficacy. Given that students with a high self-efficacy expend more effort, readily take on challenges, maintain a strong commitment, and do not avoid difficult tasks (Bandura, 1994) suggests that students not only need the ability and skills to succeed, but they need to develop a strong belief that they are capable of being successful at task completion.

Self-Efficacy Effects from Remedial Placement

As a result of the negative association with remediation, students may develop a low self-esteem and lose confidence or self-efficacy, especially those that are overwhelmed with a feeling of being incapable of doing math, of completing a remedial or developmental level math course. "Self-efficacy beliefs determine how people feel, think, motivate themselves ... and a strong sense of self-efficacy enhances human accomplishment... but people who doubt their capabilities shy away from difficult tasks which they view as personal threats" (Bandura, 1994, p. 71). Math can be seen as a personal threat to remedial or developmental math students since the successful completion of the remedial or developmental math course(s) is required by many institutions before enrolling in a college-level math or math-related course. The threat

then extends to preventing those students from getting the degree they need for the job they want. It is the students' fears and lack of confidence that become a major contributor of failure; it becomes a circle that is difficult to escape.

According to Pajares and Miller (1995),

Social cognitive theorists contend that self-efficacy beliefs...strongly influence the choices people make, the effort they expend, the strength of their perseverance in the face of adversity, and the degree of anxiety they experience...These self-perceptions can be better predictors of behavior than actual capability because such self-beliefs are instrumental in determining what individuals do with the knowledge and skills they have. (p. 190)

Bandura (1986) also asserts that social cognitive theorists believe that how people gauge their own capabilities to accomplish tasks strongly influences their human motivation and behavior.

According to Pajares (1995),

Perceptions of efficacy influence human behavior in three ways. First, they influence choice of behavior. People engage in tasks in which they feel competent and confident and avoid those in which they do not. Second, they help determine how much effort people will expend on an activity and how long they will persevere--the higher the sense of efficacy, the greater the effort expenditure and persistence. Finally, self-efficacy beliefs influence individuals' thought patterns and emotional reactions. People with low self-efficacy may believe that things are tougher than they really are, a belief that fosters stress and a narrow vision of how

best to solve a problem. High self-efficacy, on the other hand, creates feelings of serenity in approaching difficult tasks. (p. 4)

A high sense of efficacy will indeed help students in solving math problems, not to be good problem solvers, but to increase their interest in and attention while working problems; also making the students less apprehensive in their math capabilities (Pajares & Kranzler, 1995). The students in remedial or developmental math will make decisions about whether to engage themselves in working problems or not, how long they will spend trying to work them, and the continuation of future work all based on their level of self-efficacy. "...If individuals lack necessary skills, no amount of self-efficacy will bring about the desired performance, although increased effort, persistence, and perseverance may lay the foundation for skill improvement and better subsequent performance" (Pajares, 1995, p. 22).

Pajares (1995) goes on to say that

Self-efficacy beliefs are important influences on motivation and behavior in part because they mediate the relationship between knowledge and action. That is, environmental, cognitive, and affective factors influence behavior partly by influencing self beliefs. As such, these beliefs are strong predictors of individuals' subsequent performances....The role that self beliefs play in motivating individuals is the primary focus of theoretical perspectives other than social cognitive theory. These include theories about self-concept, attributions of success and failure, expectancy-value, goals, and self-schemas. In the quest for predictive supremacy and practical utility, self beliefs are also in competition with variables that have been identified as influencing students' academic outcomes,

such as anxiety, perceived usefulness, previous experience and achievement, aptitude and ability, gender, race/ethnicity, and socioeconomic status. (pp. 4-5)

A student's perception of capability becomes a very important part of the effort put forth and whether he or she will decide to persist or persevere with future tasks. A huge factor is that "self-efficacy is a strong predictor of academic performances and assessing students' self-efficacy can provide teachers with important insights" (Pajares & Kranzler, 1995, p. 20). Teachers will soon notice that the confidence that students have in their ability pretty much sets the standard for what students will do with the knowledge and skills that they possess (Pajares & Kranzler, 1995). Pajares and Kranzler added that self-efficacy perceptions are then created according to past performance and what students feel they might be able to accomplish. But the remedial or developmental math students that lose confidence in themselves are most likely those that will give up and drop out altogether.

Summary

History and our demanding society have brought education down to the level where thousands of students are under-prepared for college and need remediation to be successful. Advancing technology has driven up the need for greater knowledge than ever before. The students who require remediation have the least control and the most to lose. Because remedial students did not gain the math skills or receive the best education possible in high school, they now have to pay extra through time, money, and in some cases, with forfeiture of their dreams. Even more disheartening is how remedial or developmental students are viewed by the very people, the remedial or developmental

educators, which are supposed to be helping these students acquire needed skills to be successful.

All students need the math skills, the information, and must know the material to be able to get a degree. Without a degree, they do not have the knowledge or skills necessary to acquire a high-tech job, those jobs that pay more than minimum wage and basically ensure greater financial stability. Clearly, the issue of under-prepared students in higher education is critical and presents what promises to be a long-standing challenge for both postsecondary institutions and the larger American society.

Because U.S. colleges and universities moved from elite to mass education, there are astonishing numbers of under-prepared students that are leading to a reduction in the workforce pool; the pool needs to be enriched with individuals that have developed greater skills through college or some form of postsecondary education. To provide optimal career opportunities for all, the cycle of the low socioeconomic status patterns needs to be broken and it can only be broken if the skills are learned, if low-income students and students of color successfully exit a postsecondary program or college. Also, the integrity of the college degree has been questioned; the quality must be boosted back to the level that was once held by all institutions of higher education.

The key players, the students in remedial or developmental courses, should be afforded a chance to voice their opinion and talk about their feelings since they have the most at stake; it is remedial or developmental students' lives and futures that business leaders, policy makers, and street-level bureaucrats are interfering with and misaligning. The students who require remedial or developmental classes need to speak out, voice their feelings since they are receiving mixed messages. These students have the most to

lose and do not have any control over what caused them to end up needing help through remediation. They have to be confused why one institution says they are ready for the next level and then when they get to the next level, they are told they are under-prepared. The attitudes and perceptions of remedial or developmental math students should be heard to give them a say in their learning; their voices will bring knowledge.

Reporting

In the next chapter, Chapter 3, I explain the methodology used in my study. The presentation of my data is given in Chapter 4 followed up by my analysis of my data in Chapter 5. To finish in Chapter 6, I gave a summary of the study, made conclusions and recommendations, and then future research areas were covered.

CHAPTER III

METHODOLOGY

In this predominantly qualitative, explanatory case study I sought to understand how students were impacted by placement in developmental or remedial math classes. This chapter presents the methods used in conducting this study which encompasses an introduction to the researcher, the case study design, data needs and sources, and the selection of the participants. A brief description of the participants is entailed, as well as the data collection process, strategies, and an outline of the collection instruments. Also, included are a brief synopsis of how the methodology evolved as the study progressed, the recording procedures, the processes for analyzing the data, and the limitations of the study.

Researcher

For this study, remedial math students were the main focus and only those students who had just graduated from high school were included. As a math instructor with 17 years of teaching experience, two in high school, four as an adjunct remedial math instructor, and 11 years full-time at the college level, I have seen many students with a wide spectrum of math difficulties that have needed assistance through math remediation. Whether only a remedial refresher or the full-blown developmental

coursework, many students have been helped through remedial or developmental classes. I have also seen many students drop out of college who were taking developmental or remedial math courses.

My interest in the impact on students of placement in developmental or remedial math classes began with my teaching career at the college level. As my concern grew over the years for the students that were dropping out of college after unsuccessfully completing their remedial courses, my interest deepened. I felt that I was not doing enough to keep the students motivated, not teaching effectively, since some were not gaining the material needed to pass the class. With each semester, I was even more troubled as to why students were just giving up, telling me they could not do math and would not ever be able to get math regardless of how hard they would try.

After 15 years of teaching math in higher education, I believed that I should be able to understand or see some explanation for this phenomenon. I wanted to know why these students that were dropping out were so different from those that were successful in the remedial program; why some students were so negative and others positive about the remedial experience. Searching for explanations for how and why events happen is “an ideal design for understanding and interpreting observations of educational phenomena” (Merriam, 1988, p. 2). Thus, this study evolved.

Case Study Design

The explanatory case study method is the most suitable paradigm for this study because the phenomenon being investigated is unique with “how” and “why” questions posed, context-bound and the researcher has no control over behavior, and the focus is on contemporary events (Hartley, 2004; Yin, 1994, 2003). This study focused on the

attitudes and feelings perceived by first-time freshmen remedial math students that had been placed in a remedial math program to understand how the placement impacted those students. According to Hartley (2004), “The key feature of the case study approach is...the emphasis on understanding processes as they occur in their context” (p. 332).

In a phenomenological study, the need to have all participants experience the phenomenon is essential (Creswell, 1998). In this study, the phenomenon was the impact on students with being placed in a remedial math class after recently graduating from high school. The focus was on traditional age (18-20 years old) first-time college freshman required to take remedial math classes after taking a placement test for level of placement (Accuplacer) at a four-year public institution. “The focus of qualitative inquiries is on describing, understanding, and clarifying a human experience . . . [and] requires collecting a series of . . . full and saturated descriptions of the experience under investigation” (Polkinghorne, 2005, p. 139).

Institutional Review Board Process

Permission to do the research using human subjects was gained through the Institutional Review Board (IRB) process at Oklahoma State University. Guidelines, regarding informed consent, by the IRB were met by disclosing the nature of the research and how the participants’ private information would be handled. After receiving the OSU board’s approval (see Appendix A), I went through the same process at the mid-western state university’s IRB. I then contacted the math department chair at the same mid-western university to explain my plan, choose a class, and go over my schedule that would occur during the semester. Before beginning my study, I spoke with the instructor who taught the remedial math class. Together we went over the plan and came up with a

time-line for me to initially visit with the class and later do my observations at times that would be the least disruptive to the class.

Study Site

I contacted the mid-western university's research specialist to find out the breakdown of race and various other bits of information for the university population during the 2008 fall semester (See Appendix B). The average annual enrollment of the small public mid-western university is around 2,000 students with multiple ethnic backgrounds represented. The official enrollment numbers included 1.35 percent International, 4.58 percent Black, 5.44 percent Native American, 0.48 percent Asian, 3.90 percent Hispanic, and 84.24 percent White. Also, 41 percent were males while 59 percent were females. During the semester, the majority of the students attending the university were full-time, 64 percent, and the majority of the freshman, 87 percent, came directly out of high school.

Participants

To keep my study bounded, I chose a single remedial math class. Choosing only one class allowed me to know this case study well and make necessary changes instantly as the study progressed. "Optimizing understanding of the case study requires meticulous attention to its activities" (Stake, 2005, p. 444).

I wanted my sample to be representative of the university population as a whole as Yin (2003) depicted that a "representative or typical case" is one that is "informative about the experiences of the average person or institution" (p. 41). To make my sample comparative, I included equitably, genders, high and low socioeconomic status (SES),

high and low ACT scores, urban and rural hometowns, and parents with college as well as first generation students as participants.

Students. My focus was on first-time freshmen who had recently graduated from high school. Those who agreed to be participants, were already 18 or older and recent high school graduates, and had signed consent forms (see Appendix C), were then given demographic questionnaires (see Appendix D) to get the students' background information.

With the demographic information I was able to choose my small purposeful sample, reflective of the mid-western university's population numbers. The large majority, 80 percent, were white. The other participants were Black, Native American, or Hispanic. I chose to omit the International and Asian demographic due to being less than two percent each of the university population.

The majority of the participants were female (60%) and had family incomes over \$50,000 (60%). Parents with college and first generation students were both represented with 30 percent of the participants having one or both parents attending, the other 70 percent were first generation students. Also, the majority (80%) were from small rural hometowns and the ACT scores varied somewhat, from 16 to 21, with only 30 percent having a 19 or higher. High school GPAs ranged from a 2.60 to a 3.93, with 70 percent having a 3.25 or higher GPA. The last high school math class was taken by 50 percent of the participants in their senior year, 40 percent in their junior year, and 10 percent in the sophomore year.

The individuals picked for my sample were those who could provide relevant descriptions of the phenomenon being studied since they had the experience and were

willing to reflect and verbally describe the experience through interviews (Polkinghorne, 2005). This purposeful selection led to the collection of information-rich data as the small number of participants chosen provided accounts from different perspectives about their experience. I reviewed Accuplacer and ACT test scores and the demographics to provide the rich, thick description of the individuals and their circumstances (Hartley, 2004). To find out why students may or may not be impacted by placement in the remedial class, I talked to them and got them to open up about their feelings with their placement in remedial math. Also, I made observations and then did the interviews to gain other pertinent information about the students that allowed me to link the data to Pajares' (1995) beliefs of self-efficacy.

Faculty. The students were not my only participants; I gained information from the math instructor teaching the course. The instructor provided insight as to the student's abilities and her perception of what was happening with her students. She indicated why some of the students did not attain a level of achievement; this additional information provided reasons about those that would not completely open up during the interviews.

Getting students to achieve was important to this instructor. To keep her students motivated, she worked diligently with them and assured them that it was okay to make mistakes; they would learn from them. She encouraged them to keep trying and inspired them to want to succeed. To avoid embarrassment or shame for their placement in the class, she assured them the class was beneficial for their college education; the remedial help would mean better grades in college-level math and math-related courses.

I have seen many of my own students, especially those that were not successful in their remedial math courses, be embarrassed about their grades. Students being taught by

another instructor may not open up to an outsider about their true feelings. To gain the students' trust and get them to open up to me about what was going on with their placement in the class, I tried to spend extended time with them. "Qualitative case study is characterized by researchers spending extended time on site, personally in contact with activities and operations of the case, reflecting, and revising descriptions and meanings of what is going on" (Stake, 1995, p. 450).

Data Collection

Data collection in qualitative research is gleaned through multiple processes over a period of time, which requires the researcher to do fieldwork, such as recording observations of behavior and responses of subjects in their personal environment, and interviewing the subjects to gain their perspective (Merriam, 1988). Yin (1994) believes that these various methods of data collection are necessary as "any finding or conclusion in a case study is likely to be much more convincing or accurate if it is based on several different sources of information" (p. 92). Therefore, data collection and analysis make up the qualitative researcher's major research techniques, techniques that result in a richly descriptive product that establishes meaning to the mass of data. To help me discern the meaning, I would have to find out more background information about the students through other means.

Demographic Questionnaires. Multiple sources are needed to provide depth to the case (Creswell, 1998) and demographic questionnaires provided background information about the students. The demographics that I gathered were relevant as the data served to describe my sample. The questionnaire (see Appendix D) included such beneficial information as age, gender, race, socio-economic status, urban or rural home address, and

parents' educational attainment that helped to characterize whether the students were first generation college students. Also included were high school math grades, the time that had passed since each student's last math class, high school GPA, ACT or SAT scores, and Accuplacer pre- and post-test scores (Accuplacer pre-test scores came from the Registrar's Office as the students had not kept them and post-test scores came from the math department chair at the end of the fall semester).

To attain the background information, I met with the students. At the end of the second week of the semester, I introduced myself to the remedial math class and let the students know my intentions. I knew my initial presence would have an effect and I wanted some time to pass so that the efficacy levels that were impacted would already be so by placement in the remedial math class.

To gain the confidence of my participants, I built trusting relations. I assured the students that their identity would be protected by using other names to keep anonymity. I tried to make them feel totally secure in the fact that no one would ever find out their private information; this knowledge would be kept confidential by being locked up in my home office of which I had the only key. Also, they were told that they were free to stop being participants at any time and that acceptance or refusal would not affect their grade in the class.

One by one, every student in the remedial math class then came to my office and the plan for the study was discussed in more detail. The ones that agreed to be actual participants in the study were asked to sign a consent form in my presence. Again, the students were reminded that every measure would be taken to ensure confidentiality and

if they chose to end participation at any point in the study, to inform me. Next, I met with the remedial math instructor to discuss the class dates to make my observations.

Observations. According to Yin (1994, 2003), observations can provide useful information in addition to gathered data, especially about the topic of study. The researcher can see first-hand what the remedial math students are doing during class, how they are reacting to the instructor and subject material, and be able to hear their questions and responses; this information adds a new dimension for understanding the phenomenon being studied.

Observations were made at three, five, seven, and nine weeks into the semester of the class. The only students observed were those who had agreed to be participants. Students were observed in a classroom setting to see if they were prepared for class, e.g., taking their seats, books and notebooks opened, pencil in hand, and ready to go. I also wanted to know if they were attentive. Were they paying attention, taking notes and watching the instructor or were they looking out the window? I looked to see if they were actively participating, answering questions or asking relevant questions, and working actively on problems, or sitting or visiting with friends in the class. Also, I documented other activities students were engaged in such as drinking, eating, or text messaging, or even doing other course homework; I made an effort to see the remedial course and the participants from an outsider's stance. Quickly after the observations, I typed up my field notes to avoid losing or forgetting valuable information.

After completing my last observation, I contacted the participants to set up a time to do the testing and interviews. A case study has to be defined in terms of its theoretical orientation which means placing emphasis on understanding processes alongside their

contexts (Hartley, 2004). To determine each one's level and be able to link to Pajares' (1995) self-efficacy beliefs, the consenting students were given the *Mathematics Self-Efficacy Scale – Revised* (MSES-R) (see Appendix E), a Likert-like scale test, to find out their level of self-efficacy related to math. The students were reluctant to do the testing but I assured them that this test would not affect their performance in the class.

Survey Instrument. The MSES-R (Pajares & Miller, 1995) was administered in this study to gain the students' level of self-efficacy pertaining to math problems and tasks and other college courses. Permission to use the MSES-R was gained through an e-mail directly from Professor Frank Pajares at Emory University of Atlanta, Georgia (see Appendix F).

According to Betz and Hackett (1983), three domains are relevant to a study of math-related self-efficacy by assessing one's capability confidence to (a) solve problems similar to standardized aptitude and achievement test questions, (b) apply mathematics to perform everyday tasks, and (c) satisfactorily pass college courses requiring various degrees of mathematical knowledge. Pajares and Miller (1995) altered and updated the *Mathematics Self-Efficacy Scale* (Betz & Hackett, 1983) questions and after an extensive study found no loss of internal consistency. Further study results (Pajares & Kranzler, 1995; Kranzler & Pajares, 1997) demonstrated the MSES-R was reliable and stable as a multidimensional measure of mathematics self-efficacy.

The Likert-like MSES-R test was used to determine if students had a high or low mathematics self-efficacy. A high self-efficacy would mean that the placement was not a setback, students were confident, tried hard, did not give up in the face of difficulty, were not stressed, were persistent, persevering, and engaged; students would attribute failure to

an insufficient effort and a lack of knowledge that was acquirable, readily recover from failure, and say I can do the math. Whereas, low self-efficacy would represent students that call themselves stupid for being placed in a remedial class, think things were tougher than they really are, are not confident, appear to give up, are stressed, and put forth very little effort. Students with a low self-efficacy seem to be uninterested, or not engrossed in what is being taught, are depressed, and will say that they cannot do math.

The results, from the MSES-R tests, were calculated to determine the level of mathematics self-efficacy for each participant and documented. Documenting everything, specifics and activities, takes time and must begin with the preliminary observations. To then make conclusions about the students' level of self-efficacy and their feelings about their placement, I interviewed each one towards the end of the semester. Interpretations were then made after I got them to voice their feelings and discussed the class in-depth.

Interviews. Interviews can be a very useful tool when doing qualitative case study research by providing data to build a rich description of the case (Merriam, 1988; Yin, 1994, 2003). Yin (1994, 2003) discusses three different types: open-ended, focused, and structured interviews. Open-ended interviews are used to share facts or opinions about certain events, focused interviews follow a set of questions with follow-up probes, and structured interviews are similar to a formal survey. For this study, focused interviews were chosen and designed because the focused interview allows the researcher to target the topic of study (Yin, 1994, 2003).

Towards the end of the semester, the participants were asked to answer questions about their experience with being placed in a remedial math course through in-depth focused interviews (See Appendix G). Most of the interviews were conducted in my

office, (70%) and the rest (30%) were administered in the respondents' dorms for their convenience. Each lasted around 30 to 45 minutes. The purpose of the research was again explained as during the invitation to participate in the study and prior to signing the consent forms, and the respondent was told that the interview would be recorded. The recording device was turned on, time, date, place, and the name of the interviewee was noted, and the interview began.

Every question in the interview had a particular focus or reason for being asked. The first question, "Please tell me about you" (family, high school, & cultural background) was designed to make the participant feel at ease, set the relaxing tone of the interview, and provide more description than the questionnaire really allowed. The next three questions, "Please tell me how things are going for you in this class," "Why were you asked to join this class? Do you feel that this class was an appropriate placement for you?" and "Do you think this class will help you? Why or why not?" made each individual participant really think about their placement in the remedial class and share their actual experiences in the class. To specifically see if an incident stood out in the students minds was the intent behind the fifth question, "When thinking of this class, what event or moment comes to mind first?" and led them to share even deeper feelings about the class. The sixth question "How do you feel now that you had an opportunity to learn the material presented in this class?" led them to reflect about what they learned, if they experienced academic progress, and about the material that was presented. To get each to think about their future plans, what they aspired to be, and if they had changed plans with being placed in remedial math, was the purpose of the seventh question, "What are your aspirations/dreams or future plans? Have you made any changes in your

plans?” and the question would lead to sharing a loss of one’s dreams if a loss existed. The last five questions were based on Bandura’s (1994) sources of influence to develop self-efficacy. The questions included “Describe how you feel about facing challenges,” “As the semester progressed did you find yourself trying harder to solve problems? Why or why not?,” “Have you seen others like yourself go through remedial courses? Were they successful?,” “Has anyone ever told you that you can be successful? With math? In life?,” and “Do you feel like you have mastered algebra?” and were asked to aid in the analysis using Pajares’ (1995) beliefs of self-efficacy. At the conclusion, I asked participants to voice any other relevant information and then the interview ended.

The audio-taped interviews were transcribed by me so the data could be checked for general themes. I also typed up the detailed field notes that were taken on the body language and circumstances surrounding each interview. Pseudonyms were then assigned and used in this study to protect students’ privacy. The names of the participants have only been retained on the informed consent form signed by each individual subject. The tapes and transcriptions were stored at my home office in a locked cabinet during the study, of which I had the only access. The tapes were then destroyed by being burned after the transcriptions and verification was completed. Since the completion of the study, all remaining data, including the pseudonyms that linked to real names, has been locked up. The information kept will continue to be locked up for one year and be destroyed at that time.

Data Analysis

The qualitative researcher is the principal instrument for data collection and analysis (Merriam, 1988). Merriam continues that analysis really occurs “simultaneously

with data collection” (p. 162) but is only possible if the researcher is an instrument of his/her research.

Qualitative research makes use of the researcher’s interpretation of data to provide rich, thick descriptions, to analyze the data for general themes, and to break down those themes or categories into theory or propositions (Yin, 1994, 2003; Merriam, 1988). When analyzing the data, Yin (1994, 2003) recommends four principles that convey high quality analysis: (a) analyze all the evidence; (b) address all major alternative interpretations; (c) ensure the most important aspects are addressed; and (d) the researcher’s own expert knowledge of the case should be brought in the analysis of the case study.

For this study, my experience as a remedial math instructor for the last 15 years provided valuable insight into the analysis of the data. However, my being a math instructor may have caused some participants to be hesitant about opening up completely and sharing their deepest innermost thoughts. Also, the students may have thought I would share the information with the instructor of the class. I tried to keep these thoughts in mind as I completed the review of the data collected.

According to Merriam (1988), the review of all documents includes a vast amount of written, visual, and physical data relevant to the study. Once all of my data from my observation field notes, questionnaires, survey instrument, and transcribed interviews were gathered, I built the categories for possible answers to my research objectives.

To include all the evidence in my analysis, I compared the Likert-like scale figures from the MSES-R tests to other data. Also, I compared Accuplacer test scores, ACT scores, and other numerical information to see if high self-efficacy corresponded

with higher test scores and low self-efficacy with lower scores. I then began to read the transcripts and watch for themes to emerge among the respondents' comments.

Merriam (1988) related that every piece of data can be significant, as small as a single word used to portray a feeling or phenomenon, or as large as multiple pages that depict a particular incident. I began my analysis by reviewing all of my data, including the transcripts of interviews, field notes, and documented information; I looked for commonalities and also aberrant behavior, and assigned each a code.

“Coding is the method of connecting data, issues, interpretations, data sources, and report writing” (Miles & Huberman, 1994, p. 461). Creswell (2003) conveys that 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” (Creswell, 2003, p. 192).

Once all of the material was coded, I looked for issues and important aspects that helped lead me to propositions that linked to Pajares' (1995) self-efficacy beliefs. To continue my analysis, I made careful description of data into key themes and used emerging themes to make those generalizations about the data. To link the data to the theoretical propositions of Pajares' (1995) self-efficacy, I relied on his conceptions that high efficacy leads to success and low efficacy, to failure or dropping out. Gazing through the lens of Pajares, I looked even more intently at the individuals, patterns, or trends that emerged. By contrasting the subjects' perspectives with Pajares (1995) characteristics that identify with high and low self-efficacy, I saw essential aspects and recognized differences and variations in how each related their experience of being placed in remedial math (Polkinghorne, 2005).

The process continued, generalizations were made, and the final round was looking specifically for the emerging themes that related to Pajares' (1995) self-efficacy propositions. All of the comments had been coded, interpretations had been neared, and then the analysis moved towards addressing alternative interpretations to lessen the chance of misconstrued meanings and therefore help lead to triangulation of the data.

Triangulation

The case study “gains credibility by thoroughly triangulating the descriptions and interpretations . . . continuously throughout the . . . study” (Stake, 2005, p. 443-444). To avoid misinterpretation of data, Stake also relates that triangulation allows the researcher to employ “a process of using multiple perceptions to clarify meaning, verifying the repeatability” (p. 454). Besides providing quality assurance, triangulation is designed to promote a complete view of the phenomenon (Merriam, 1988).

By using the Accuplacer pre- and post-test scores, demographic questionnaire, MSES-R survey instrument results, observations, interviews, and other information to triangulate the data, I established credibility to my findings. The dependability and consistency of my results were increased using multiple methods and a variety of data sources (Merriam, 1988), establishing a chain of evidence (Yin, 2003) through a detailed description of the data collection, and using rich, thick description. I supplied an abundance of rich, thick description so that readers could determine if their situation matched closely enough to my research situation for the findings to be transferred (Merriam, 1988). Also, I commented on my past experiences and biases to alleviate researcher bias that likely shaped my interpretations (Creswell, 1998). After I created a master outline, reread the data, and selected quotes to support my findings, I wrote up my

findings. “The case researcher digs into meanings, working to relate them to contexts and experiences” (Stake, 1995, p. 450).

Limitations

Despite every effort was made to design and execute a study that meets all qualitative research criteria standards, there are some limitations to this study. This study was limited to a small sample of participants at one university. The institution is relatively small but does have typical or comparable numbers needing remedial math classes (see Appendix B) as other institutions, large or small, as indicated in the Literature Review. The university is only one of many in the state, with two comprehensive universities, numerous regional universities, several private institutions, and a very large number of two-year community colleges. The admission standards differ for each as well as the demographics of the students enrolled making a possible sample vary somewhat from institution to institution. The same situation would most likely occur from state to state.

Demographics may figure in the study only as smaller or poorer high schools do not have the finances to hire math teachers with a degree in math for their students. Therefore, these students may not be getting exposed to a rigorous mathematics program in high school which may or may not lead to greater numbers being under prepared and needing remedial math in college. Being a small institution with lower tuition, this university receives many lower end SES students from small rural communities.

Choosing this institution as my study site was due to my familiarity with its culture and the small town atmosphere that surrounds every aspect of college life that exists in its walls. My long-standing tenured position with the university has spanned

more than a decade and contributed to miscellaneous issues of access. Being an insider facilitated the local IRB process and the attainment of information that some of my participants were unable to provide. Also, the data that was supplied was easily checked out to ensure correctness.

Merriam (1988) suggests that the researcher must possess characteristics such as good communication skills and being acutely aware of the context, data, and personal bias to create a good case study. As the primary instrument of data collection, this case was both helped and hampered by my being a remedial math instructor at the institution. I was well-known at the university, greeted these students in the halls, and taught and tutored many of their friends. The familiarity helped the students to open up to someone that was not really a stranger to them, not an outsider. Time was enhanced doing the interviews as little time was required explaining who was who. Also, another benefit was my first-hand knowledge as to what was being taught and understanding the language related to the remedial math class leaving more time for rich, thick descriptions. On the downside, there may have been participants that held back some things during the interviews solely because I was an instructor.

Creswell (2003) expresses that a researcher can be seen as intrusive; students may think that another math instructor in the classroom to be even more threatening and intrusive. Creswell adds that a researcher's presence may bias student responses, some researchers may not have good observation skills or be as articulate or perceptive, and interviews depend solely on the view of the participant. Throughout the study, I purposefully engaged in reflection about my possible biases with being not only an instructor at the university, but a remedial math instructor too. From time to time, I

sought advice from peers who were somewhat familiar and those who were unfamiliar to the events of the study. I kept in mind that teachers and students do not perceive things equally and often teachers do not see students in the same manner that students see themselves.

Summary

This chapter addressed the methodology and procedures the study used. It included the researcher, case study design, selection of the sample, strategies for data collection, and procedures for data analysis.

Reporting

In Chapter 4, I present my data and then report my findings in Chapter 5. Chapter 6 includes a summary of the study, conclusions made, recommendations for future research and discussion.

CHAPTER IV

PRESENTATION OF THE DATA

This chapter presents data collected during the fall semester of 2008 using the questionnaires, observations, survey instrument, and interviews of my participants described in Chapter 3. The data portrayed here and its analysis in Chapter 5 provides a deeper understanding of the purpose of my study, the impact of remedial placement on first-time college math students. With pseudonyms to protect my participants' anonymity, the thoughts and feelings of each student who experienced the phenomenon are unveiled through his/her own voice.

Information from the demographic questionnaires provided data to determine my participants' age, ethnic background, SES, hometowns, high schools, and parent's educational attainment. Also, the statistical figures ensured that my sample was representative of the mid-western university's demographics and met the participant criteria. Starting with the demographic facts about the student participants and their classroom, the chapter is divided into several sections. Through each one's profile and story, details are exposed that may have contributed to increasing or decreasing their perceived math capability levels either before or during the study which eventually led to a path of success or failure. The students' and faculty responses are revealed as they depict the themes of failure and success.

The Classroom

The remedial math class was a relatively large class with 35 students enrolled at the first of the semester and required a large room. Gray carpet, which was slightly stained, covered the floor of the white-walled 25 X 40 foot classroom that was arranged in a lecture-type manner, five rows with seven to nine desks in each row. Three evenly spaced, six-foot wide windows draped with white aluminum mini blinds made up one wall, and on the opposite wall, two entrances, one at the front and one in the back of the room. The room was well-lit from sunlight behind the blinds of the three windows and eight four-foot long fluorescent lighting fixtures recessed in the ceiling.

One edge of the 3 X 5 foot teacher's desk was placed against the wall near the first window, opposite the entrance at the front of the room, leaving an open area for the teacher to move about freely between the desk and whiteboard that pretty well covered the front wall. The students' desks were lined up against the wall with the windows and then were evenly spaced across the room leaving just enough space to walk down the aisles in between.

Ms. Keller (a pseudonym) had informed me that the students were allowed to sit in the desk of their own choosing, but then were asked to continue the seating arrangement to aid in taking roll at each class session. Class met from 9 to 9:50, three times a week, on Monday, Wednesday, and Friday mornings. Upon Ms. Keller's arrival to the classroom, the students were expected to be prepared to start class, ready to take notes, or do what had been instructed at their last class meeting. I arrived early for each of my observations and I noted what each of my participants was doing before and during class unless they were absent.

Faculty Background

Ms. Keller had only been teaching one full year prior to the study but brought fresh ideas to the classroom. Many of the students understood and liked her method of teaching, readily learned the material with her numerous and explicit examples, and worked very hard after hearing her strong encouraging words. Ms. Keller made the students feel at ease with needing help with math and she was available to help students with their assignments in and out of the classroom. Ms. Keller's student evaluation remarks portrayed this information as well as my participants' interviews and her passing rate, 65 percent, was higher than the national average of 50 percent.

Student Demographics

All of the participants were 18 or 19 years of age and had just graduated from high school (see Table 1). Four were male and six were female; seven were white and one each, Hispanic, Native American, and Black. Seven of them were from the higher SES level and three from the lower level. Those in the table that are highlighted failed the remedial course.

Elvira, Greg, and Stewart (all student names are pseudonyms) had the lowest high school GPAs on a 4.0 scale, between 2.60 and 2.85, while the rest, Alisa, Debra, Ebony, Edsal, Jacob, Sophie, and Waci, were at 3.25 or above; Jacob's 3.93 was the highest. Alisa, Stewart, and Waci had ACT scores of 16 each; Debra, Ebony, and Sophie each had a 17; Edsal, an 18; Elvira and Greg both had a 19, and Jacob scored a 21. With numbers from 15 to 18, all participants scored below a 19 on their math ACT score; scores below 19 are required to take the Accuplacer test to determine level of placement in math, whether in one of the two remedial levels (see Appendix H) or college-level math.

Table 1

Participants' Demographic Information

Name	Age	Gender	Race	4 pt HS GPA	ACT- Math Score	SES level	Last Math Class	Parents College	Outcome of Class
Alisa	18	F	White	3.28	16-15	Lower	Sr	None	Passed
Debra	19	F	White	3.30	17-17	Upper	Sr	None	Passed
Ebony	18	F	White	3.25	17-16	Upper	Jr	None	Failed
Edsal	19	M	White	3.47	18-16	Lower	Jr	None	Passed
Elvira	18	F	Hispanic	2.83	19-18	Lower	Sr	None	Passed
Greg	18	M	White	2.81	19-18	Upper	Jr	Mother	Failed
Jacob	19	M	NatAmer	3.93	21-17	Lower	Soph	None	Passed
Sophie	19	F	White	3.77	17-16	Upper	Sr	Both	Passed
Stewart	18	M	Black	2.60	16-15	Upper	Sr	None	Failed
Waci	19	F	White	3.59	16-17	Upper	Jr	Both	Passed

Alisa, Debra, Elvira, Sophie, and Stewart had all taken a math class during their last year of high school while Ebony, Edsal, Greg, and Waci's last math class was in the eleventh grade. Jacob had not taken any additional high school math since his sophomore year. Most of the student participants had made good grades in high school math, either A's and B's or B's and C's; only three made a 'D' in one of their high school math courses. Most of them, Alisa, Debra, Ebony, Edsal, Elvira, Jacob, and Stewart, were first-generation college students; Greg's mother had attended college and both of Sophie and Waci's parents had completed college degrees. Of the ten participants in the study, seven passed the class.

Alisa

Alisa was an exceptionally outspoken, boisterous student; I could hear her voice down the hall before she would come around the corner to enter the classroom. She dressed in wildly contrasting colors and insisted on being called by her nickname which she changed about halfway through the semester. During all of the observations, she

spoke up often and loudly, and was most always correct with her answers. Alisa shared in her interview how she was proud of her math grades in high school and was adamant about wanting to do well in the remedial math class.

The irony of Alisa's strong desire to perform well is that she admitted being shocked and somewhat ashamed for being placed in the remedial course. She felt at first that she was wrongfully placed.

I didn't understand at first why I had to be in that [remedial] class [be]cause I've always been good at math, but now I'm glad I did; if I went straight to College Algebra, it would have been a little challenging, this [remedial] class kinda gets me ready for it.

Alisa, who reported always being good at math, later decided that she would make the best of the remedial math class and use it to be a much better student in all areas.

Starting small makes you bigger somehow, [that is] like you start behind and work your way up. I feel like if you already out repeat [outdo yourself] then you don't get any better, but if you start [at] lower levels then you can grow, grow, grow, grow, and never stop.

Alisa passed the remedial math class.

Debra

Dealing with the placement in remedial math was difficult for Debra who was very soft spoken, well-mannered, and dressed very modestly. Debra chose to sit close to the front, was very attentive during the observations, constantly took notes, and pretty much only answered questions when directly asked. Being a little shy, she sounded unsure and spoke quietly when giving some answers, but seemed to speak up when she

was surer of an answer. I had a little difficulty hearing her replies from the back of the room during the first and second observations but had much less trouble during the last two.

Debra shared actually feeling belittled at first when telling others about having to enroll in the remedial math class. This feeling was not because of good grades in high school math because she described her grades as not very good, just average. Debra initially saw the placement in remedial math as having a negative stigma.

At the very first, whenever people would ask me what classes are you taking, when I said I was taking developmental classes, I felt like I was lower, like I was a lower student, but then I don't feel that way anymore because it [the remedial math] helped me, helped me in the long run. Now when I tell people [about the remedial class], it's not that big of deal.

Debra changed her attitude with the negative stigma and needing remediation as the semester progressed. To cope or deal with the placement, she expressed that seeing someone in the same situation as her, struggling a little with math and having to remediate, really helped. Debra told how she and her roommate were enrolled in separate remedial classes taught by Ms. Keller but did their homework together, "We help each other out...and that has really helped me." Debra passed the remedial class.

Ebony

The one that does not quite fit in with the rest of the group is how Ebony could be described. Her clothes were often wrinkled and appeared to be stained, tattered and worn, almost like they had not been properly laundered. Her hair was seldom the same color from one observation to the next or even dyed multiple colors at the same time. She had

numerous tattoos and body piercings and few students ever spoke to her or Ebony to them. Ebony and Alisa seemed to hit it off because they both dressed “out of the norm” for this particular group of college students. During my observations, I noticed that Ebony chose to sit in the back of the room off to one side, visited with Alisa occasionally, and did not pay close attention or take many notes. Ebony only asked a few questions from time to time, but especially when test time was coming up soon.

During one observation, Ebony seemed really nervous, chewed on her pencil a lot, and her cell phone rang with a very loud, hard rock ring tone. She could not answer because students are not allowed to take phone calls during class unless it happens to be an emergency and they have prior permission, such as knowing a relative was in the hospital. Alisa told me later that Ebony’s mother was calling all the time and yelling at Ebony for not getting a job.

During the interview, Ebony would not look at me when she spoke; she looked down most of the time and occasionally gave a quick glance in my direction. She talked about how her high school math teacher never cared and the remedial math instructor made her feel like she could pass the class, that she could do the math. Ebony gave a quick smile as she spoke of Ms. Keller. “I really hate math but Ms. Keller really helps us a lot, like my high school teacher didn’t care if you were passing or not, you either got it or you didn’t –she didn’t care.”

Ebony did not pass the remedial math class and dropped out of school but implied she had hope of doing well through Ms. Keller’s encouragement. Of Ms. Keller she said, “She made us feel welcome; she made us feel like we could ask anything; we could do anything with her, like she was very happy; I liked her from the first day.”

Edsal

Edsal was a very serious student, walked with an air of confidence, held his head high, and looked me straight in the eye as he spoke. He dressed neatly, new jeans and a pressed, collared shirt. During his interview, Edsal shared that he had experienced a very traumatic event in his youth, losing a parent.

I'm kinda a person that likes to overcome stuff; in facing these different challenges has helped me a lot. I have a personal background that challenged me.

I lost my mom in the first grade to cancer; that has been a challenge for me and my brother all through high school and it was something we had to face and we faced it well and we have become stronger and responsible young adults.

Edsal's loss, as he communicated, actually led to a marked increase or greater desire to show his strength; to prove to him and others that he had become a man despite growing up without his mother. I was able to see his strength grow in math with each observation, as his answering questions became more frequent and his asking relevant questions told me he understood the math.

Through this class Edsal implied that he had gained confidence, "I was never really good in high school in math, I've never been very good at math....we just got done taking our last test and I felt pretty good about it and so maybe it will get me into the 'A' range so I will end up the semester [with] a pretty good grade." Edsal did pass the remedial math class.

Elvira

Elvira was the quiet and reserved student, very congenial, with average grades in her high school math classes. She did not dress expensively but still her clothes were

clean and neat, usually jeans and a t-shirt. She did not struggle with or complain about having to take a remedial math course; Elvira did what was asked of her and went with the flow.

I am in this [remedial math] class because I had a low score on my ACT and then we had to take a placement test to see if we would be put in 0 or 00 [intermediate or pre-intermediate level of remedial math]...and because you learn the basics over again before you go into actual college math or college algebra.

During the observations, I noticed that Elvira diligently took notes. She paid close attention but did not ask a lot of questions, she left the asking of questions up to her classmates. Elvira would make an attempt to answer any question that she was asked. She would not always be correct but she did not allow the mistakes to hold her back or keep her from trying to succeed in the remedial math class, "I feel good about this class, I have a good grade...I had to work harder than at the beginning and now I feel better about college algebra." Elvira passed the remedial math class.

Greg

Greg did not have a serious bone in his body and was friendly while teasing everyone. He seemed to never let anything bother him if someone tried to tease back or was good at hiding his true feelings. Greg always dressed in boots, jeans, t-shirt, and his cowboy hat. He was the jester or class clown, always kidding around even before class would begin. Greg stated that he was not trying to be a clown but continued to joke around constantly during every one of the observations. "I'm not the class clown but I like doing work, don't like to be bored, [I] can't learn as much."

When Greg would answer the instructor's questions in class during my observations, he would often make an error. He would then try to cover up the error by making a joke, saying something funny or picking on the teacher, anything to distract the others from his incorrect answer.

During one of the observations, Greg had another student who was not enrolled in the remedial math class bring him a sack of donuts and a bottle of juice for his breakfast. As Ms. Keller wrote a problem on the board, the other student just walked in, found Greg on the far side of the room, and walked over to his desk and set the items down. The incident totally disrupted the class as many were laughing as Ms. Keller turned around, noticed an outsider in the room, and asserted her dismay. Ms. Keller addressed the other student, "What do you think you are doing?" The other student replied, "I am delivering Greg's breakfast as he asked me to do." Ms. Keller suggested that the other student leave at once and told Greg she wanted to see him after class.

Greg related that he liked the teacher even if he could not do the math. "I'm not really doing so hot...she [Ms. Keller] is a good teacher, I am just not comprehending everything...I don't think you can master algebra." Also, Greg remarked that helping others with math benefitted him somewhat. "My roommate was in a lower level of remedial math...I had to help him out some...helping him helped me in a way kinda cause it gives me more experience...the more problems I do then the better I'm off doing." Greg did not pass the remedial math class.

Jacob

Jacob was a quiet and laid back student; he was also an accomplished athlete. He took part in several sports in his small high school, but really loved playing football. He

dressed neatly, new jeans and dress shirt and nothing seemed to bother Jacob, including being placed in the remedial math class. Jacob remarked about how he liked the class and the teacher, but mostly he wanted to succeed in school and sports, and wished to do something with his life. Jacob said, “Ms. Keller is a good teacher, real nice” and when I questioned him about facing challenges, he answered, “Like bring it on; they do not bother me at all.” Jacob expressed in his interview a desire to strive harder, to persevere as the semester progressed.

Things could be going better, but they’re good. I messed up a couple of questions on a couple of tests. My grade is not as high as I want it to be but its fine...As the semester went on I tried harder because I wanted to succeed; I wanted better grades...I think I will do a lot better in regular algebra.

Jacob did pass the remedial math class.

Sophie

Sophie was a nervous student; at times she would chew her nails. She dressed comfortably, mostly jeans and a blouse or t-shirt, but her hair was always in disarray. Sophie disclosed how she had to struggle somewhat her entire life, especially with speech problems and other students making fun of her. She grew up with a highly intelligent brother who did not have to study as hard as she did because everything was easy for him. Sophie admitted, “I personally have had a few academic or education troubles so I know what its like to be frustrated or confused in life.”

During the observations, Sophie loved to shout out answers because, as she conveyed, the class was fun and the material was easy, at least the repeated material from high school covered at the first of the semester. You could hear the zeal in her voice

when she would answer questions but she still had bitter feelings with the placement after working so hard to get where she was, “I was borderline from going into intermediate and [instead of] college algebra; I was real in between but the test said I had to do intermediate [remedial math] ... The test was hard on a computer so that affected the outcome of that.” Sophie did pass the remedial math class.

Stewart

Stewart was a reserved student, very quiet and did not speak unless someone spoke to him first. He dressed in jeans and a t-shirt and always wore his baseball cap. Stewart told me he was the first in his family to go to college. He was successful in his high school math classes but his real desire, as he shared, was to be a professional athlete and enrolling in college was the way to get there. Stewart reported having little confidence in himself when he noted, “Others have told me I can do it [the remedial math].”

During the observations, I noticed that Stewart chose to sit towards the back of the room, came late to class most of the time, and had numerous absences. Ms. Keller had also shared that he seldom ever turned in any homework and when he did offer to turn something in, it was often late. Stewart tried to convince me that he could not do the math, “I need more improvement . . . I don’t think you can actually master algebra . . . This math is different from what I’m used to, maybe teaching styles are different.” Stewart did not pass the remedial math class.

Waci

Waci was the student that wanted to impress everyone with her looks, clothes, and grades as she told me. She liked to always look her best, dressed very neatly in the more

expensive brands of clothes and her hair fixed smartly in an up-to-date style. She strived to accomplish everything she set out to do and felt that everyone should try to excel in every way possible.

During the observations, Waci's voice was loud and confident and she never gave a wrong reply; she may have when I was not present. She answered many questions and asked a great deal more questions, which were always relevant, as the semester progressed. Also, she very diligently took notes.

Waci had shared in her interview that she liked sitting on the front row of the classroom so little could distract her attention and that not going to class meant possibly missing important information. Waci criticized those that missed a lot; she never missed a class and always arrived early so that she would not miss anything.

With fairly good grades in high school math, Waci reported feeling that the placement was a setback at first, especially since, to her, being placed in a remedial math class was not considered impressive. Waci liked people to think of her as an intelligent person and a good student. The placement was a setback for her until she met with complex materials of which she had little knowledge; this new material had not been covered in high school. As the course became a little more difficult with the new material, Waci changed her mind-set and welcomed the help of the remedial math course. She accepted that learning the new material was necessary for her to succeed in other math and math-related courses.

At first, it was easy, but the farther we got into it, it was starting to get a little more complex. This [remedial math class] is going to prepare me for actual algebra...I feel more comfortable going into the more complex levels now.

Waci passed the remedial math class.

All of the student participants shared their thoughts and feelings about the placement but those who were stronger math students in high school had the worst time mentally dealing with the negative stigma associated with remediation. A couple of the participants' pride kept them determined to get through no matter the circumstances. The rest seemed to accept that the placement was essential because they did not perform exceptionally well in math before or on their ACT or Accuplacer tests.

Accuplacer Test Scores

At the mid-western university, the Accuplacer test is given to incoming freshmen with math ACT scores below 19 to determine the level of placement for each student. According to the results, some students are considered ready to be placed directly into college-level math while others are deemed to need one or both levels of remedial math in order to pass future college-level math or math-related courses. The placement test is given a second time to remedial students at the end of the semester to determine their readiness for the next level of math.

The Accuplacer post-test scores are believed to give evidence of what was learned in the remedial math class; and a score of 75 or higher was needed to go on to college-level math (see Table 2). Some participants' scores were worse compared to their first attempt; possibly due to difficulty testing on computers. All other tests for the class, chapter and final tests, are not given on the computer. Edsal and Jacob's Accuplacer scores decreased but each passed the remedial class after taking their class final and gained the points needed to pass the class. Those scoring below a 75 on the placement post-test had to take a final class test and get at least an overall 'C' or 70 percent of the

total points offered in the class to avoid failing the remedial course and continue on to college-level math courses.

Table 2 Accuplacer Test Scores Math Self-Efficacy Levels

Name	Pre-Score	Post-Score		Problems	Tasks	Courses
Alisa	66.4	91.4		5.11	4.89	5.13
Debra	50.9	72.0		4.39	3.72	4.19
Ebony	65.7	69.9		4.22	4.89	4.25
Edsal	50.9	41.0		3.89	5.44	4.69
Elvira	64.5	Absent		4.72	4.28	4.13
Greg	64.5	Absent		4.50	4.56	2.63
Jacob	68.5	63.3		5.06	4.61	4.75
Sophie	67.8	81.6		4.50	3.83	3.88
Stewart	58.3	Absent		3.28	2.06	3.19
Waci	68.5	77.2		5.44	5.67	4.94

Math Self-Efficacy Levels

The MSES-R test was administered to the students to determine their level of confidence in solving math problems, applying math to perform everyday tasks, and pass courses requiring varying degrees of math knowledge. A score of 1.00 meant the student had no confidence at all while a score of 6.00 represented being completely confident. Sometimes students' perceived capability to do math does not match their ability, especially if they have been exposed to sources that heighten their confidence. In these cases, they may tend to overestimate their math capabilities.

As evidenced in Table 2 above, most of the students in this study showed a fairly high level of math self-efficacy on a 6.00 scale. Stewart, who did not pass the class, had the lowest efficacy scores of anyone, Problems, 3.28 and Tasks, 2.06. Ebony's scores were Problems, 4.22 and Tasks, 4.89 and Greg's, Problems, 4.50 and Tasks, 4.56. Greg

and Ebony did not pass the remedial math class, but had some of the higher levels of math self-efficacy.

Student Failures and Successes

During my interviews and observations, I witnessed signs or indications that illustrated the students' desires to successfully complete the class or throw in the towel. Failures and Successes capture the breadth and depth of these data.

Failures

The participants who felt incapable or not confident of doing math did not succeed. Of the three students that failed the course, Ebony, Greg, and Stewart, all had expressed in their interviews that they had a lot of trouble with math, hated math, or felt they could not do math. They were convinced that they could not get the material or do the math no matter how hard they would try. Also, these same three gave a negative reply when asked if they had mastered algebra. Ebony stated that she had "not yet" mastered algebra and Greg related "I don't think you can master algebra." Stewart repeatedly said in his interview, "They say I can do it [the math]." He was definitely pessimistic as he responded "You can only be pretty good at math...you cannot master algebra." In addition to expressing feelings of failure, other factors were mentioned as having had an impact.

Absenteeism. Several of the students who did poorly in the class, either failed or just barely passed, had several absences. Of those Ms Keller expected to fail, she said

Attendance was not good. Several missed classes in the first two weeks and that says to me that they felt the class was not important to them. Those students had very bad attitudes, did not come to class with a pencil or their textbook if they

even bought one, would not do the homework, and would not ask for help from me or get help in the Student Academic Success Center.

Students who did not attend regularly were most often those with a low level of confidence; they did not feel capable of doing the math so did not bother going to class.

Shame or Embarrassment. Some of the students conveyed that they felt ashamed or embarrassed with being placed in remedial math. The negative stigma associated with remediation was embarrassing to most. Some had a history of poor math performance. But, others had good grades in their high school math classes and logic would indicate that they should not have needed remediation. They had difficulty overcoming the negative stigma but usually better understood math and succeeded eventually.

Ms. Keller shared that a few students did not really belong in the remedial math class because they did too well.

Some students just scored inappropriately on their placement test and ended up in my remedial math class, they were bored and should never have had to take the class in the first place. The students that are borderline should be allowed to decide if they could be retested or enroll in the remedial math class, especially if they were not really prepared to take a test. Often students are required to take the Accuplacer [placement test] and are really not prepared at the time.

Underdeveloped Study Skills. Ms. Keller expressed in her interview that one-fourth of the students in the remedial class were not new to her. They were either repeating the course after failing before or had taken the lower level of remedial math which they passed during the previous semester. These students knew the expectations for homework and studying. But, the other three-fourths of the remedial math class, all

first-time freshmen, were not prepared for college life. The transition from high school was a shock for them. Their study skills and class work habits were lacking. Ms. Keller said,

Most of the first-time freshmen related to me that they did not have to do homework in high school and their grades were given to them, they just were not ready for a structured class where they had to take notes to do homework and then take tests.

Successes

Some of the participants reported feeling really good about the remedial math class and what they learned. They were especially thankful about how the material they learned would benefit them in their college-level math and in other math-related courses. Ms. Keller described those that she felt would pass the class.

Of those who I expected to succeed, they were attentive, came to class prepared and were prepared from the very beginning, they turned in their homework and on time, they worked the problems with me, and asked questions, lots of questions in class. I have some of these same students in [college algebra] class this spring and their confidence is apparent. They are even encouraging my other students to be successful.

Several factors played a part in the success.

Teacher Persuasion/Gained Confidence. Several of the participants gained confidence and therefore, increased their level of self-efficacy, during the semester through small successes and the teacher's positive verbal persuasion. Some of those succeeded because the teacher helped them to gain confidence and convinced them that

the remedial math class was necessary to get them to the next level of math. During one of the observations, Ms. Keller expressed that the knowledge and skills acquired in the remedial math class would help the students build a much stronger foundation for their other math and math-related courses. Some students gained confidence a little too late as Ms. Keller remarked, “A few decided over half way through the class that they were not passing and decided they better try to do something about it. They appeared to be more confident, and tried harder, but made their decision too late.”

Determination/Perseverance. When students make the decision for wanting to be successful no matter what it takes, they are the ones who end up passing remedial math. Those are the student participants that spent hours studying and turned in all of the homework and on time. They asked and answered questions in class and they got help outside of class if they needed assistance. In order to succeed, they know or learn that a great deal of time is required, practice is necessary, and studying is of the utmost importance. These students actually learned to persevere.

Witnessing Others' Success. Seeing others succeed or fail academically can be a valuable lesson for many students. The student participants, who found a partner to work with or got outside assistance or tutoring, especially from someone who had previously taken remedial math, discovered that these same people had encountered some of the same problems that they were presently experiencing. Knowing that others have met with academic trials, even if it was not in a remedial math course, allows students to believe that they are not alone in needing some help. Also, seeing someone else succeed gave them the incentive to try harder, persist in trying to solve problems, seek some outside assistance if needed, and not to give up trying.

Summary

After reading and rereading the transcripts, themes repeated in the areas of why the remedial math class was necessary and how the teacher made each student feel okay with being placed in the class. All of the students showed signs of moving up and down the rungs of the self-efficacy ladder. Some expressed their feeling of being embarrassed with needing the class, especially after making good grades in high school math. On the other end, a few shared that their problems with math started very early on. Others related that they were not good in math and needed all the help they could get and really appreciated being placed in the remedial math class.

Ms. Keller had a great deal to do with increasing the level of confidence for many of the participants as she strived to help each one succeed. Only three of my ten participants failed the remedial math class, two are repeating the course in the spring semester, and one student dropped out of school altogether.

Reporting

In the next chapter, I report my analysis of the data presented in this chapter. Finally, in the last chapter, Chapter 6, I summarized the study, made conclusions and recommendations, and discussed future research areas.

CHAPTER V

ANALYSIS OF THE DATA

In Chapter 4, I presented the data that addressed the phenomenon of the impact on first-time college students with being placed in a remedial math course. The purpose of this chapter is to analyze the data and present those findings. The chapter begins with a reassessment of Pajares' (1995) self-efficacy beliefs and how they were used as an analytical lens. I then give an overview of the participants and finally turn to research findings.

Self-Efficacy Reassessed

Perceived self-efficacy is defined as

. . . people's judgment of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with the judgments of what one can do with whatever skills one possesses (Bandura, 1986, p. 391).

Pajares (1995) examined self-efficacy in academic settings and found that it relates to and influences numerous academic outcomes. Pajares and Miller (1995) believe self-efficacy mediates the effect of skills, previous experience, mental ability, and other self-beliefs on these outcomes. They also believe self-efficacy not only affects an individual's degree of

effort, persistence, and perseverance but also to what level they persevere, the level of strength exerted when they face adversity, and the degree of anxiety they experience. Those with a high level of self-efficacy persevere when facing challenges, while those with a low level of efficacy beliefs have doubts about their ability (Pajares & Kranzler, 1995).

Pajares and Kranzler also reported that those with a high level of self-efficacy perform better and persist longer than those with a low level of self-efficacy. They also expend more effort, readily take on challenges, maintain a strong commitment, and do not avoid difficult math problems; they see difficult problems as a challenge to be mastered rather than dangers to be avoided. The students actually get a feeling of serenity in approaching difficult math problems. As reported earlier, high self-efficacy helps students in solving math problems, not to be good problem solvers, but to increase their interest in and attention while working problems. This also helps students be less apprehensive in their math capabilities (Pajares & Kranzler, 1995).

Using Pajares' beliefs of self-efficacy, I kept the characteristics associated with high and low levels of math self-efficacy at the forefront of my thoughts as I read the transcripts. The analysis of this study began with a look at my participants and how they viewed their experiences in remedial math.

Participants

Understanding the background and characteristics of students placed in remedial math is central to this study. Most of the participants were white and first-generation as is typical of today's college developmental classes (Boylan, Bonham, & White, 1999). They brought with them a variety of learning styles and needs, both cognitive and non

cognitive (Smittle, 2003). The participants varied tremendously in math ability, their backgrounds spanned across gender, race, and social class and their math self-efficacy beliefs were very diverse in level, strength, and generality (Pajares, 1997).

Successful Participants

The seven participants, who were successful in the remedial class, Alisa, Debra, Esdal, Elvira, Jacob, Sophie, and Waci, evidenced a high level of math self-efficacy. They did not give up; all had said they either had to “try harder” or really “work” to succeed. These students became even more confident during the study and their interest increased as their doubts decreased with doing math problems. They worked even harder and spoke of how the remedial class had “helped them” and felt “ready” for college-level math. They developed good feelings about math, became less apprehensive over time, had very few absences, and took a more active part in class. As the semester progressed, they asked more relevant questions, were willing to answer questions and were most often correct, and turned in homework on time. Seeing more and more small successes appeared to impact their behaviors. They expended more effort, became intrinsically motivated and even more persistent, and persevered in solving even the most difficult math problems.

Unsuccessful Participants

Ebony, Greg, and Stewart did not succeed; of those, Stewart had a low level of math self-efficacy and the other two overestimated their capabilities as some students tend to do (Pajares, 1996). Ebony’s “I really hate math” and Greg’s “I don’t think you can master algebra” indicated that both did not truly feel capable which depicts a low level of self-efficacy. All three participants did not put forth a high degree of effort and

lost confidence after continuous failures or had very little to start. They persistently became more withdrawn and anxious and their interest decreased as their doubts increased about their capability. They quickly gave up on problems as they developed bad feelings, became even more apprehensive over time, and had increased absenteeism. They did not answer questions unless directly asked and stumbled with their answers, asked fewer questions as the semester progressed, and turned in homework late if at all. They were not seeing success and therefore did not persist in attempting to solve math problems and eventually gave up trying altogether.

Ebony and Greg commented that Ms. Keller had made them feel like they could do the math. She would praise them for getting problems correct, emotionally stimulated them with a positive atmosphere, and made them feel comfortable in the class; they could “ask anything.” Ms. Keller’s positive verbal persuasion may have built their confidence level but the encouragement was not enough to foreshadow the overwhelming doubts they had about their capability. Ebony, Greg, and Stewart were not experiencing the continued little successes like the others and their doubts grew. The lack of success then affected their level of self-efficacy.

Self-Efficacy Revealed

Efficacy beliefs help determine how much effort students will expend on solving math problems, how long they will persevere when confronting really difficult problems or other obstacles, and how resilient they will prove in the face of adverse situations (Pajares, 1996). Seeing success heightens the chance of any future accomplishment and gives those with a high level of self-efficacy a very positive attitude to work even harder despite any difficulties they may encounter (Pajares & Schunk, 2001).

The analysis of data from the ten participants who voiced their experiences from the remedial math class revealed several emergent themes supporting Pajares' academic self-efficacy beliefs. The components of Pajares' self-efficacy beliefs or these student characteristics can be clustered into categories. The first is of past math skills and experiences: Academic Ability and Prior Performance. The second cluster focuses on feelings: Positive Perspectives, Less Apprehension, Growing Interest and Attention, and Feelings of Accomplishment or Serenity. The last focuses on behaviors: Willingness to take on Challenges, No Avoidance and Persistence or Strong Commitment, Stress Management and Quick Setback Recovery, Effort, and Perseverance. Related concepts affecting self-efficacy and other realities or factors of school context included: Witnessing Others' Success, Mastery Experience, Verbal Persuasion, Unsuccessful Outcome, Grade Disparity, Teaching Styles, Teacher Attitude and Quality, Preparation Deficiency, Absenteeism, and School Size.

Past Math Skills and Experiences

Because self-efficacy is affected by prior experiences, the participants called on the beliefs that were developed as a result of previous experience for solving similar math problems that were already familiar to them (Pajares & Schunk, 2001). When the math became unfamiliar, the factor that affected their self-efficacy was the small successes they began to see. To succeed, the student participants then enhanced their efforts.

Academic Ability. Some of the participants in this study generally expressed feelings of being in a lower class; possibly due to not earning college credit for the remedial course. A few of the students openly admitted feeling somewhat stunned and belittled with the placement in remedial math. Alisa, a very different student, made good

grades in high school math and was shocked with the news of being placed in a remedial math program. She “didn’t understand at first why [she] had to be in that class [be]cause [she had] always been good at math.” She had to overcome the initial jolt and then the embarrassment before she decided to exert strength, give her very being to the class and persevere, a sign of a high level of self-efficacy. Alisa’s solace was likely due to Ms. Keller; she made the students feel at ease with the placement in her remedial math class. Alisa stated, “We can ask whatever we want, whenever we want, and she helps us right then and there like a small class.”

Waci, also with good grades in high school, saw the placement as a setback at first. Since she liked to impress others, the placement was an embarrassment to her. The statement “At first it was easy” meant her time was being wasted repeating material. But, as the semester evolved she saw the necessity of the class and how it would help, “the farther we got . . . it was . . . more complex . . . [it will] prepare me for actual algebra.” Waci began to see the remediation as necessary and the new knowledge would help her move towards her picture of perfection in later, more complex courses.

Prior Performance. Regardless of their high school grades and GPAs, all of the participants scored low on their math ACT score, scored low on the Accuplacer and ended up in the remedial class. Enthusiastic in her endorsement of the remedial math class, Sophie was another participant who felt let down at first by the placement in remedial math. She experienced difficulties most of her life due to speech problems but being “borderline from going into intermediate . . . [instead of] college algebra” because “the test was hard on a computer” had Sophie frustrated. The helplessness and frustration

seemed tinged with anger at first, and even bitterness, at the disparity between her high school math grades and the Accuplacer test score.

Despite better than average grades in high school math, Sophie found she had to repeat much of the same material as high school. The course content of developmental classes repeats the basics at first but then is “designed to fill the gaps between high school preparation and college expectations” (Boylan, Bonham, & White, 1999, p. 88). Sophie grew to accept the placement and, with Ms. Keller’s optimism, ended up enjoying the class after realizing the new material would be beneficial in her college-level math.

The students anticipated success without doing a lot of homework, just as in high school. Ms. Keller offered that “Most . . . related to me that they did not have to do homework in high school and their grades were given to them.” The students had to reorient their ways of thinking and doing to become and remain successful in the remedial math class. To be successful, the participants changed their mindset about the placement, overcame the challenge, and gave the class their all. Once these students decided that time and effort were not only important but necessary to learn the material, they saw small successes occur and successful outcomes raise self-efficacy or one’s perceived capability of doing math (Pajares, 1997). An increase in self-efficacy then leads to perseverance and a successful outcome with remedial math. Prior performance such as good grades in high school math or small successes in the remedial class and perceived capability are crucial elements for success in math (Hall & Ponton, 2005).

Feelings

Those with a strong sense of self-efficacy felt competent and capable of doing math (Pajares, 1997). Also, they developed even stronger, more positive feelings through

small successes which created feelings of serenity as they moved on to more difficult problems. Their interest deepened as they became more engrossed in problem-solving and they truly believed they would be successful.

Positive Perspectives. A social issue concerning the remedial placement was addressed by one of the students in remedial math. Ms. Keller encouraged her students to see the remedial class as a positive experience because of the knowledge they would gain. Debra gained a positive perspective about the remedial math class after initially being disappointed and upset with being placed in the remedial math program. She experienced a setback before moving forward, not because of really good grades in high school math, but the negative connotation associated with being labeled as remedial (Higbee & Thomas 1999). When Debra said, “I felt like I was a lower student,” she appeared to express a feeling of being labeled as remedial and the initial shock turned to shame, but she managed to prevail over the situation. When Debra spoke of the roommate and fellow remedial classmate she said, “We help each other out...and that has really helped me,” it seems likely that she had help raising her viewpoint of remediation as well as her math skills. Debra had added, “Now when I tell people, it’s not that big of deal.” Because she recovered quickly with her positive feelings which led to a higher level of self-efficacy, she gained the knowledge and skills that would benefit her in the future.

Less Apprehension/Growing Interest and Attention. Elvira declared that she had to “learn the basics over again.” Even though she had to repeat material, she did not let it bother her; she gave the class her all. As Elvira’s interest and attention increased, her apprehension decreased. Her positive and persevering attitude continued despite new

material being introduced. Elvira said, “I had to work harder than at the beginning.” This was clearly a sign that her confidence and her self-efficacy level had increased.

Feelings of Accomplishment or Serenity. Jacob let nothing bother him; he loved a challenge and had been given one, placement into remedial math, which needed to be mastered. I think the challenge of dealing with the placement and the math problems actually gave him serenity, also a clear sign of a high level of self-efficacy. Jacob was clearly not bothered as he stated, “Things could be going better, but they’re good” and “My grade is not as high as I want it to be, but its fine.”

Behaviors

Changes in behavior occurred as the level of self-efficacy increased. The student participants became more determined and put forth greater effort in order to meet their goals (Pajares, 1996). Also, they challenged themselves with difficult problems rather than avoiding them and attributed any failure to their own inability rather than external causes. Blaming themselves only motivated them to be more persistent and committed; they persevered to achieve success. The participants were motivated to get engaged in the remedial math class because they valued the successful outcome (Pajares, 1996).

Willingness to take on Challenges. Edsal clearly saw himself as motivated to succeed, but his stimulus came from an external factor, the loss of his mother at a very young age. He was pushing himself to prove his maturity and independence. You could hear the resolve in his statement, “[Losing] my mom...has been a challenge for me and my brother...we had to face [it] and we faced it well.” As Edsal’s determination increased after his loss, so did his confidence, to prove to others that he was capable of

succeeding or doing anything he set his mind to doing, this also meant an increase in his level of self-efficacy.

Edsal and Jacob both saw the remediation as another obstacle to overcome, a “challenge to face.” Due to pride, Edsal and Jacob did not show any astonishment or dismay. Why? Because, in their eyes they had to appear to others to be prepared, not shocked, for anything that must be faced in their lives. Edsal “likes to overcome stuff” and Jacob replied that challenges “do not bother me at all.”

No Avoidance/Persistence or Strong Commitment. Jacob blamed himself when he “messed up a couple of questions” on his tests but he did not avoid the difficult problems. He essentially paraphrased his high level of confidence and strong commitment with his statements, “As the semester went on, I tried harder” and “I wanted to succeed” and also, “I wanted better grades.” Jacob had not taken a math class for over two years but that did not impede his determination to succeed; he persisted and his confidence continued to elevate throughout the semester.

Stress Management/Quick Setback Recovery. The demands of basic first year college cause distress for many freshmen but the circumstances are not specific to those students who were placed in remedial math. For some, college is jolting because they did not have to study in high school and still made better than average grades. Students who graduate from high school with respectable grades expect to be generally ready for the future and progressively more, that future includes going to college.

For the remedial math participants who made good grades in high school math and saw themselves as average or better students, being placed in the remedial program was a shock (Walker & Plata, 2000). The placement brought very intense feelings as

these students expected to be able to succeed in college. Debra, Alisa, Waci, and Sophie were by far the most stunned by their placement in remedial math because they had made decent grades in their high school math classes. They did not pass the placement test, none of the participants passed, to go directly into college-level math, but Debra, Alisa, Waci, and Sophie did not expect remediation. Why? Alisa was “good at math,” Debra felt “lower,” Sophie was “borderline” testing on a computer, and Waci saw the remedial class as a setback but they all bounced back quickly. How? Students with a strong sense or high level of self-efficacy more quickly recover their confidence after a setback (Pajares & Schunk, 2001). Elvira was not bothered, “I am in this class because I had a low score on my ACT and then we had to take a placement test.”

Effort/Perseverance. Edsal liked to “overcome stuff,” Jacob “tried harder,” and Elvira “had to work harder” meant they all had to put forth a high degree of effort. All of those that passed had to work hard to succeed, some harder than others. They had to persevere to achieve their goal of success in the remedial math class.

Related Concepts Affecting Self-Efficacy

There are sources or ways to influence self-efficacy so students will feel capable, try harder, and persist in solving math problems. Because students engage in activities in which they feel competent and confident and avoid those in which they do not (Pajares, 1996), the level of self-efficacy for some must be increased in order for them to succeed.

Witnessing Others' Success. Efficacy beliefs can be raised through observing the successes and failures of others. Observed successful behavior allows the individuals to think they too can attain success through persistence and effort.

Mastery Experience. Another way to influence efficacy beliefs, the most powerful method according to Bandura (1986), is through experienced mastery. Individuals gauge the effects of their actions and interpret these effects to create their efficacy beliefs; successful outcomes raise self-efficacy while failures lower it (Pajares, 1997). According to Smittle (2003), mastery of the content is a very important principle to attain when working with remedial or developmental math students. Ms. Keller gave the students in remedial math a chance for success in small increments to improve their mastery experiences. She helped them to experience small successes as she worked problems together with them on the board and then praised them for getting the answers correct. She tried to provide a positive mood in the classroom to lower anxiety and urged her students to get outside help or to come in for assistance. Also, Ms. Keller encouraged her students to ask questions regarding math operations and applications; she helped them to understand that math is the key to many fields of study. To keep them motivated, Ms. Keller related the material to the real world, especially to things that were of interest to her remedial math students.

Verbal Persuasion. Successful performance through small repeated successes and verbal persuasion will strengthen self-efficacy while those who have a low self-efficacy will shy away and most likely avoid the situation rather than to try to complete math problems (Pajares, 1995). Most successes require persistent effort and strong self-efficacy expectations are created through repeated success. As the efficacy becomes stronger through successes, the negative impact of any occasional failures is most likely decreased (Bandura, 1977). Also, the failure setback may not be as extensive as the drop in efficacy

could have been previously; the degree depends on the strength or level of efficacy at the time.

Students not only need ability and skills, they need to develop a strong belief that they possess the necessary ability to do the math and are capable of being successful. How the remedial math students gauged their capability to do math, strongly influenced their motivation and behavior (Bandura, 1986); these self perceptions are better predictors of their behavior as these beliefs determine what the students will do with the knowledge and skills they already possess (Pajares & Miller, 1995).

By plying positive verbal persuasion onto her students, Ms. Keller increased the confidence level of many of the participants and their level of self-efficacy. The students developed a heightened sense of trust with Ms. Keller and even though some liked and trusted her, they still did not feel capable of doing the math. Those that did not succeed may have had the skills but lacked the sense of self-efficacy to use those skills well (Pajares & Schunk, 2001).

Unsuccessful Outcome

Without an increase in self-efficacy for those who were not confident, they were doomed to an unsuccessful outcome. They had low aspirations, a weak commitment to their goal of passing the class, and when faced with difficult math problems, dwelled on their personal deficiencies rather than concentrating on how to be successful in the remedial math class (Bandura, 1994; Pajares, 1995). Also, they slackened their efforts and were slow to recover from their continuous failures which undermined their level of self-efficacy and especially so because their sense of efficacy was not firmly established.

Ebony, Greg, and Stewart were not surprised with the placement in remedial math; they always had trouble with math. Each of them expressed that they could not be successful in remedial math; Ebony, who actually dropped out of school, “hated math” and Greg “[didn’t] think you [could] master algebra.” Stewart was definitely not convinced that he had the capability of being successful with his response, “You can only be pretty good at math . . . you cannot master algebra.” The negative remarks were a sign that Ebony, Greg, and Stewart’s math efficacy levels were low despite their documented results from the MSES-R test that was administered. Along with Ms. Keller’s encouragement, Stewart’s friends and family even tried to help him by offering positive persuasion, “Others have told me I can do it.” But students cannot just be told they can do the math, they must experience success.

Ebony acted like she had confidence in her capability to do math, but I felt that it was a façade; Ebony was experiencing a high from Ms. Keller’s encouraging lectures to the class. However, encouragement alone was not all Ebony needed to increase her confidence and her level of self-efficacy. She needed to see more successes but did not come in for help; she may have also benefitted with mentoring and possibly counseling. She reported that her high school math teacher “never cared” and Ms. Keller “made her feel like she could pass the class”. She was elated that someone cared about her as she seemed to have Alisa as her only friend at college. Her mother was more worried about money and Ebony could not concentrate in class, upset about her mother calling to yell at her about getting a job. She did not experience the true feeling of belonging and humans need the feeling that they belong (Smittle, 2003).

Greg had stated, “I’m not the class clown but I like doing work, don’t like to be bored, [I] can’t learn as much.” Greg did not want to appear as a “clown” to the class or Ms. Keller, yet he continuously made jokes to cover his errors. He loved to be the center of attention and his boredom stemmed from his not understanding rather than boredom causing him not to learn. Greg did not want to be recognized for lacking the knowledge to pass or for what he could not do. Even helping out the lower-level student got him positive recognition, “My roommate was in a lower level of remedial math...I had to help him out some...helping him helped me in a way.”

I also think that Greg did not have the level of self-efficacy that he attested to on the MSES-R; the results were another way for him to joke with me. His situation is not funny as he also needed more than just simple encouragement to build his confidence. Greg did not take college serious and that is most likely the same way he performed in high school. He seriously wanted to take part in the class but he did not know the math. His only way to be included was through the jokes. Also, Greg may have been experiencing math anxiety as he expressed, “I am just not comprehending everything” and his way of dealing with it was making jokes rather than getting bored. Student achievement is related to external factors like math and text anxiety as well as student attitudes toward math (Higbee & Thomas, 1999).

Other Realities or Factors

Other themes came out of the study that were inconsistent or different from self-efficacy but still impacted success. They are important because they not only influenced the success of the remedial math participants but they affected student levels of self-efficacy.

Grade Disparity, Teaching Styles, Teacher Attitudes and Quality

Stewart's high school math grades were A's and B's but did not seem to match up with his ability in the remedial math class. He did not blame himself or attribute his not being successful to his own inability. Ironically, he expressed "This math is different from what I'm used to, maybe teaching styles are different." According to Hall and Ponton (2005), students often choose factors out of their control because they lack the ability to identify the real reason or factors that limit their success. The results of Stewart's MSES-R test, which were the lowest scores of all the participants, positively depicted his low level of math self-efficacy. He was another who could have benefitted with mentoring to give him the motivation and increased level of self-efficacy and confidence to succeed. Stewart lacked clear academic goals; his agenda only included the desire to be a professional athlete.

As mentioned earlier, research dealing with developmental education has depicted the necessity of full-time faculty working with students believed to be at-risk (Roueche & Roueche, 1993; Smittle, 2003). The under-prepared remedial math students can be challenging to their instructors, often far exceeding any challenges that may arise with traditional college students (Smittle, 2003). Teacher attitudes, which may be related to student achievement, can be affected by these challenges and exposes why developmental educators should not include those that do not want to teach remedial courses or only teach for the money.

Some teachers do not have the experience or knowledge to motivate their students and many college faculty often teach the way they were taught (Boylan, Bonham, & White, 1999). These teachers or those with a poor attitude towards the under-prepared

cannot be expected to motivate remedial students normally lacking motivation. The attitude and motivation of the teacher can support or constrain the level of self-efficacy with the remedial math students, especially for those that already have little confidence and are at-risk of dropping out of the class or even out of college.

The students were very lucky to have Ms. Keller as their remedial instructor as she had a very positive attitude which filtered down to her students. She had good evaluations during her first year of teaching and was very effective with a higher pass rate than most colleges and universities. Usually about 50 percent of students are successful on their first attempt in a remedial math course (Stage & Kloosterman, 1995; Walker & Plata, 2000); Ms. Keller's pass rate was around 65 percent. Being full-time and committed to her students, she spent a great deal of time with several outside of class, as a tutor for many and mentor for those that needed encouragement. However, a few that were at-risk of failing did not come in for help. Mentoring may have worked; it is beneficial for many at-risk students (Pascarella & Terenzini, 1991) but encouragement alone is not enough for most developmental or remedial students (Smittle, 2003).

Preparation Deficiency and Absenteeism

Often teachers see their students differently than the students see themselves and Ms. Keller's view of the students who failed was a lack of preparedness. A few of them did not take notes; some did not even buy the book, and consequently, did not turn in any homework. Ms. Keller also said they had numerous absences.

In regard to the absenteeism, Ms. Keller saw the absent students as thinking the class was not important. Most likely, the students who had numerous absences lacked confidence which is, according to Pajares (1995), a sign of a low level of self-efficacy.

Students who lack confidence in their math skills are less likely to engage in math activities that require those skills (Pajares, 1997; Pajares & Miller, 1995). The lack also leads them to believe things are tougher than they really are which fosters stress and depression (Pajares & Schunk, 2001). These students' confidence level, in all probability, was low or had dropped after seeing little to no success as the semester progressed, and therefore their efficacy level followed suit. Also, these students were not motivated to get engaged in the remedial math class because they did not value the outcome; they believed they were not able to pass the class (Pajares, 1996). Attendance was, at this point, somewhat senseless to them.

School Size

For those not afforded the best education possible, especially low-income and racial or ethnic groups, they are usually the ones who do not succeed (Callan, 2006). In this study, the majority of the participants were white but they did come from smaller school systems where they may not have been exposed to quality math teachers with a major in the field of math. The disconnectedness between high school preparation and the demands of college emerged as a powerful theme. It resonated throughout the stories of participants in this study, but especially affected the participants that were not successful in remedial math.

Study Results

It is important to note that several factors had no affect on the results of this study or the outcome of the remedial course such as age, gender, and grades. For age, the relevance was for the students to be first-time college freshmen and all of the participants were recent high school graduates, 18 or 19 years old. The relevance for gender was

purposively selecting a group representative of the whole university population and four were male and six were female. The students had made average grades in high school.

Most of the participants had made either A's and B's or B's and C's in their high school math classes. Three had made a 'D' in one math class in high school but all three passed the university-level remedial math course. Clearly their high school math grades did not negatively impact their success. College and universities rely on GPA's and ACT scores for admission criteria but the GPA's and ACT Scores had little bearing on the outcome for the student participants in this study. According to Steele (1997) and Moore (2004), tests like the SAT or ACT do not accurately predict future performance, especially success in college. The level of math self-efficacy of each participant did, however, have an impact on the outcome of the remedial course as those with a high level of math self-efficacy did pass the class. For those with a low level of self-efficacy or a dropped level, they did not pass the remedial math class.

Summary

The students in the remedial math class decided whether they wanted to work on a problem or considered it too difficult, and if they decided to continue their efforts, how much time they spent trying, and whether or not they would continue to do any future math problems all based on their level of math self-efficacy. The lower the perceived level of self-efficacy, students regarded the math problems as being more difficult much sooner and developed a narrow vision of how best to solve the problems. The higher the level, the students got more involved and actually saw the challenge as exciting and persevered in doing the math.

In this study with these students, there was clearly a relationship between self-efficacy and academic achievement in remedial or developmental math. Pajares' beliefs ring true as the lack of student success within this study can be linked to low student self-efficacy and success with high self-efficacy as those that had or gained confidence through remediation passed the course. Others may have succeeded due to their own determination or willingness to accept challenges which also depicts a high level of self-efficacy.

Reporting

In the upcoming final chapter, I have summarized my study, made conclusions and recommendations, and discussed future research areas that will serve to aid developmental educators with being more effective in the education of the under-prepared students who deserve the best.

CHAPTER VI

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND DISCUSSION

This final chapter provides an overview of this case study and conclusions that were drawn. Also included are implications for practice and research based on the data collected and analyzed from this primarily qualitative research on the impact of placement on college students in remedial math at a mid-western state university. Recommendations for future studies have been proposed with some final thoughts completing the chapter. “Case studies are of value in refining theory, suggesting complexities for further investigation as well as helping to establish limits of generalizability” (Stake, 2005, p. 460).

Summary of the Study

As under-prepared numbers going to college continue to rise (Boylan, 1999a; Miglietti & Strange, 1998; Parsad & Lewis, 2003), the necessity of remediation is crucial for many students to overcome their lack of math skills to matriculate (Altbach et al., 2001; Bettinger & Long, 2007; Hall & Ponton, 2005; McGlaughlin, Knoop, & Holliday, 2005; Weismann, Silk, & Bulakowski, 1997). To fill the gap between high school preparation and college-level math courses through remedial math, students must feel capable of succeeding; their self-efficacy levels must be high enough to want to do the math, complete tasks and persevere.

Purpose and Procedures

The purpose of this study was to examine the thoughts and feelings of recent high school graduate math students who were placed in a remedial math program at the college level after taking a placement test to determine their level of ability. Multiple methods and a variety of sources, including the perspectives of the participants and instructor, were collected and viewed analytically through the lens of Pajares' (1995) self-efficacy beliefs. The purpose was accomplished by conducting in-depth, focused interviews with ten participants, purposively selected to represent the whole student population, in a single remedial math class at a mid-western university. Additionally, the intention was met through observations of the participants in their classroom environment and the analysis of a survey which determined each one's level of self-efficacy.

Data needed for this case study centered on thick, rich descriptions of how the participants felt about being placed in remedial math and their experiences associated with the remediation. Student voices provided information needed to answer questions about the impact of their placement and helped explain the phenomenon of success or failure in the class or possibly dropping out of college.

A broad review of the literature concerning remediation gave insight and thoroughly documented the ramifications and consequences surrounding the continued need for institutions and developmental educators to offer more support to the remedial students in the program. Emerging research related that the success of students in remedial courses has become a societal concern (Astin, 2000; Moore, 2004), not just students going to college to get a better job after degree completion. Little research existed that considered the feelings of the students or how the placement in remedial

courses impacts their lives. This study was done to give students a chance to voice their thoughts and move towards closing the gap between the developmental or remedial system working for some students' success and not others.

After permission to conduct the study and consent from the participants was received, observations were made, interview questions were designed, and electronically recorded interviews were conducted and transcribed, then the mass of data was analyzed to determine themes and categories that emerged. The gathered information was sorted into these categories and examined for evidence of Pajares' (1995) beliefs of self-efficacy.

Findings

The results of this study showed that the level of self-efficacy of my participants played a major role in influencing academic behavior and achievement for these under-prepared students that were placed in remedial math. Those with a high level of self-efficacy met the challenge of the placement with determination and persevered in the remedial math class while those with a low level of self-efficacy had great difficulties and dropped out of the class or out of school.

The instructor engaged the students actively, worked to build the students' self-efficacy levels, and encouraged each to try harder to succeed. For a few however, the encouragement did not prove to be enough. Their self-efficacy levels were not or did not elevate to the point where the students would even want to work harder to solve the math problems or to persevere.

Failure. Greg and Stewart seemed to have felt they would fail because they believed "algebra could not be mastered." Ebony did not think success was in her future

after she saw fewer successes as the semester progressed. She still “hated math” despite Ms. Keller’s encouragement. Pajares’ (1995) would attribute all three’s unsuccessful outcome to a low level of self-efficacy. They lost interest in the face of difficulty, gave up trying because they felt passing the remedial math class was beyond their reach. They needed some outside help but felt it was useless to ask since they were convinced they could not do the math.

Success. Of those who were successful and passed, Alisa, Debra, Sophie, and Waci seemed to have felt a setback with the placement in remedial math while Edsal and Jacob felt challenged. Elvira appeared to be very accepting. Through the lens of Pajares’ (1995), because of their high level of self-efficacy, these students pushed even harder at different degrees of intensity. The higher the level, they participated more readily, worked arduously, pursued their challenging goals, and persisted longer in the face of the adversity (Pajares & Miller, 1995). The students believed they were capable; they felt that they could be successful and this reinforced their motivation (Pajares, 1995). This drive then led them to their success in the remedial math class.

Other Realities

Self-efficacy and academic success are confirmed to be related but other factors also impact success. Success for students in remedial math depends on the understanding and support by caring instructors and by how the institution is prepared to support both the instructor and the students. As stated earlier, the instructor needs the experience or knowledge to motivate their students because the attitude and motivation of the teacher can support or constrain the level of self-efficacy with the remedial math students. The teachers must have the training in order that their pedagogical methodologies meet these

students' needs. Also, the services provided by the institution can help in ways that moderate success. They should portray support, hire caring instructors, provide training for faculty, and show these students that they are valued, despite coming in under prepared, to help them move toward a successful outcome.

Since many remedial math students were not academically prepared at the high school level, high schools may be part of the problem. Teachers at all levels should identify those students with a low level of self-efficacy and weak commitment and work with them. Teachers, counselors, and administrators may be able to provide guidance to those who sabotage their ability to succeed in school by turning around these students' negative beliefs and feeble goals.

Usefulness of Pajares in Findings

The knowledge acquired in this study, by looking at students' responses through the lens of Pajares' efficacy beliefs, can benefit educators, counselors, parents, and other professionals as a useful tool to foster students' self-efficacy to improve academic achievement. This study should enlighten educators about why students fail to meet their expectations and why students who need the most help are rarely seen in the instructor's office during office hours. In the student's mind, nothing is going to help them pass. Why? Because unsuccessful students view their insufficient performance as deficient aptitude; it does not take much for them to lose faith in their capabilities (Bandura, 1994). Failure rates in remedial math continue to be reported at 50 percent and higher (Stage & Kloosterman, 1995; Walker & Plata, 2000). With high quality instruction and a good support structure with mentors and tutors, failure rates could be drastically reduced.

In developmental or remedial math, raising the self-efficacy of all students to a level where students can succeed should be a primary concern of educators. Otherwise, without confidence in math ability, students' educational choices, and ultimately their futures, are limited to areas where math is rarely used and the point is to give the students choices, not limitations.

Conclusions

Self-efficacy, as this study has confirmed, is a key aspect that can unlock doors to students' academic success. This research re-established that students need the skills and knowledge, but they also need to feel confident and competent in order to use those skills well (Pajares & Schunk, 2001) to succeed. But, other factors also impact that success.

Remedial Placement

The actual placement in remedial math does not matter as the level of self-efficacy was not critically affected. Some were impacted by the placement but were able to rise above it; others were unchanged.

Remedial placement flows from failure, those with poor grades and test scores, and success, which represents those who have good grades but poor test scores. Students' grades do not determine placement or academic success.

Other Realities Impacting Success

Other factors make a difference with the impact of success. They can help or hinder a student to the point that they will either succeed or fail the remedial course.

Teachers matter. The quality and attitude of teachers make a big difference. Teacher quality matters because teachers can influence the level of self-efficacy for those who need to gain confidence and feel competent by positive persuasion and experiencing

small successes or ignore them. If teachers choose to ignore them, the students will not feel like trying (Taylor-Dunlop & Norton, 1997) and give up as the three that failed.

But quality teachers work with students in and out of the classroom; they are caring, reflective, receptive and good communicators. They know their content-area well and care about students' learning; they respect all students and embrace diversity. They closely monitor students' progress and reflect about what works and why, and are receptive to change what does not. To be effective, they use various teaching styles and methods because students do not learn at the same time or in the same way (O'Banion, 1997). Quality teachers hold high expectations for their students and encourage them to set high goals and pursue them. They communicate with colleagues as well as their students, build mentoring relationships, and value those bonds that are formed.

Students' own reactions. What students feel or not feel, do or not do, and what they become is determined largely by their perceived level of self-efficacy. How they will react, become depressed and withdrawn or empowered to try harder, depends on how confident and competent they feel about undertaking the necessary steps to achieve their goals.

What high schools do. High schools are limiting the students' choices by not encouraging them to have a strong work ethic, giving grades to the students they did not earn, and not having high expectations for them. This leads students to believe that an education is not important for success in life. Students need to value an education in order for them to set high goals and then work diligently to attain their dreams. If students' level of self-efficacy therefore, is increased during school, their academic behavior would change for the better and motivate the students to succeed.

Also, the forced testing mandates are causing the loss of valuable instruction time for those who need it the most. These students need teachers' time to be better prepared; teachers who will work with them to succeed by changing their level of self-efficacy.

Usefulness of Pajares in Conclusions

The subject of how to change the level of self-efficacy is a mystery for most teachers; they do not have the training. Because it is the key to help students' succeed, teachers need to be aware of the ways to enhance self-efficacy.

Therefore, I conclude that teachers at all levels, with training, could influence self-efficacy for those who need it to succeed. High school teachers will help students to be better prepared for college while developmental or remedial instructors will influence those who have doubts to build a higher level of self-efficacy so that more students will complete the remedial coursework. The higher level of self-efficacy would help these students make better judgments of what they can do with the skills they possess; it would influence their academic behavior. This influential help could lead students who are in danger of failing to a positive outcome; help them to move towards achieving their goals and eventually their dreams.

Pajares' beliefs for influencing self-efficacy may not be the only method for helping students to succeed. There may be other ways, researched or yet undiscovered, that may benefit the student for academic achievement.

Implications for Theory, Practice, and Research

This study supports Bandura's theory of self-efficacy and Pajares' beliefs about its importance within academic settings. But, by giving the students who experienced the impact of placement in remedial math a chance to voice their stories, this research adds a

new perspective to the research that already exists. Curricula and teaching styles and methods could be changed to better meet the needs of students just by listening to their first-hand experiences.

The findings of this study point to several areas that could help to promote higher education policy, practice, and research to better support under-prepared students placed in remedial math and encourage effective collaboration across the K-16 educational systems. Colleges and universities can demonstrate a structure that either supports or constrains the level of self-efficacy for the under-prepared population. Since self-efficacy represents a vital function in one's success or failure in remedial math, institutions should work at increasing the under-prepared students' level of self-efficacy in order for them to develop academic behavior suitable to success in remedial courses.

Other studies have shown that self-efficacy has a significant influence on academic behavior and achievement (Pajares, 1995; Pajares & Kranzler, 1995; Pajares & Miller, 1995, 1997; Pajares & Schunk, 2001; Stevens et al., 2004; Zimmerman, 1997). Therefore, a need exists to develop programs that would foster and promote a high level of self-efficacy so students would have the necessary tools to behave in an academically successful manner. Ideally, this could increase the numbers of high school students that consider college, apply, and remain in college.

Institutional attitude plays a part in under-prepared students' lives as they can be particularly vulnerable to the pressures of college besides being challenged by placement and having difficulty with math. This attitude can be seen in every aspect of a college or university such as in mission statements which depict the values and beliefs of the institution. Mission statements should support and portray that the students being placed

in remedial classes are just as important as the rest of the student population. Also, the students should be assured that every measure or step will be taken to guarantee their degree attainment.

The institution's mind-set toward the under-prepared affects the way these students see their situation with the placement. If the college or university does not value the under-prepared students, as should be depicted in their mission statement and commitment of resources, the students will sense the negative infliction. If the institution's values depict a conflicted image without equally respectful concern for each student through structured support, then the under-prepared might feel constrained by the college. Colleges must enhance the support and structure they now provide the under-prepared, as they need support and structure more than other students (Roueche & Roueche, 1999), especially for those who are at-risk of dropping out.

Instructors should seek out professional development to learn how to build their students' self-efficacy levels. Because it is very important for students to interact with the faculty, mentoring relationships should be sought to promote self-respect and personal growth, build confidence to erase the initial sting or stigma associated with the placement, and to have someone to listen and offer guidance. Through these endeavors, colleges, universities, and faculty can show the under-prepared that their education and presence on campus matters which will help them to feel positive about the remediation.

This research tells us about what is needed for developmental higher education to be successful. According to the findings in this study, quality teachers and mentoring and advisement to build self-efficacy are critical to success for this student group. Remedial programs must be intentionally designed to support development of the mentoring

relationship; it is not sufficient to simply assign a mentor or advisor. The educator or mentor must structure regular meetings with clear goals so the mentoring actually takes place and so students see the sessions as meaningful. Full-time professional staff that is trained and willing to work with this population facilitates student interaction and encourages positive mentoring relationships.

It is crucial to hold developmental math students to high standards so they have the tools to succeed. Under-prepared students need to be actively engaged in talking and working problems and they need to gain confidence.

High expectations are important for students from all backgrounds. Unfortunately, low-income minority students are most vulnerable to differential treatment by the school. If students are to be prepared for college, the literature reflects that a rigorous course of study at the high school level is essential (Adelman, 1999; Breneman & Haarlow, 1998; Callan, 2006).

Colleges would do well to invite and facilitate dialogue with the high schools. With the change from attending high school and attending college, and the amount of time devoted to studying in high school when compared to college, most students experience confusion. An open, sustained conversation about curricula and expectations would encourage sturdier bridges across the two systems. High school students could visit college classes to see that students are actively engaged, taking notes, and studying. High school students need to see that the knowledge is important but also meeting deadlines and guidelines for assignments. This work ethic is one of the greatest differences between high school and college. With institutions of higher education and K-

12 working together, they can prepare students for a smooth transition both physically and academically.

Furthermore, this study somewhat reflected that students are in need of support to understand the application process. For first-generation students who do not have anyone at home to inform them of the college experience, academic procedures and expectations, going to college can be chaotic. Since college and university admissions offices compete for students, they should be pleased to assist. Guidance offices might also request details about college remedial programs since many of the under-prepared population end up being placed in remedial math. Sharing this knowledge with possible college enrollees would help students to understand the impact.

Recommendations for Future Research

This research depicts a need for more investigation of the K-16 notion of how we might bridge college going and college success for those students from different races and socioeconomic levels. For example, the study indicates a need to learn more about how to enrich the minds of the under-prepared to handle college-level academic courses. Patterns that surfaced through the interviews also advocate a need to scrutinize more seriously the effects of increased standardized testing in the K-12 system: Are teachers teaching to the test and how does this impact student learning?

Additionally, the findings allude to a need to expand our understanding of engaging and effective college pedagogy. The literature tells us that many college students are under-prepared and these students particularly learn more effectively with caring teachers, yet developmental or remedial instructors that are hired to teach often do not reflect these realities. So, more work is also indicated in the area of innovative

development structures, to lessen stigma, encourage more collaboration with teachers, and bridge the gap between high school and college. Further research about what works for developmental students would help educators rethink college curriculum and pedagogy to be more effective, more active, and learning-centered.

The framework surrounding developmental education influences the structure of programs for the under-prepared student population; therefore, the structure needs additional exploration. Study findings indicate a particular need for further research to understand the ramifications of Accuplacer testing and the placement of the under-prepared students. Another study could be conducted at this site to examine the effects of the program's mentoring and interactive support structure after it is put into place. It will be important to determine if the college continues to place the borderline students in remedial math and, if not, to see how and if these students succeed in college-level courses. A quantitative study might examine the effects of retention and graduation rates for these same groups.

More effort is needed to investigate the repercussions when public colleges eliminate development or remedial courses for under-prepared students completely from the curriculum which force the more affluent toward private institutions or those that cannot afford them, to community colleges. Chances for transfer rates to be improved for community colleges or, more importantly, achievement rates for degree completion are considerably diminished.

Also, a longitudinal study could be done to follow-up with the participants interviewed. It would be both interesting and valuable to learn if they graduated with a four-year degree from the mid-western university and how each later viewed the remedial

experience after graduating or leaving the university. If their view did indeed change, a study of this nature might also pursue why and in what ways. For instance, how might they see their participation in remedial math in light of their student loan burden, and graduate school and career experiences or prospects? Any extensions of this research could alleviate future problems and create a better path to a viable K-16 educational system.

For future research, one could look at women's achievement level in math since there are so many one-parent households with the mother being the dominant head. The majority of students in remedial courses are women and that is most likely due to the majority of college enrollees being female. Also, many are older students that have not had a math class in more than a year or in some cases, in several years.

We presently have teachers in our elementary schools today teaching our youth math incorrectly, i.e. to add fractions by adding the numerators and then adding the denominators without finding a common denominator. The quality of teachers could be studied in the future as well as the attitude of teachers towards students that perform poorly. It does take more effort to motivate the low achievers. Also, students' performance may be affected by those teachers with low expectations for some students.

Additionally, future research could include the study of learning styles since all students do not learn in the same way or at the same time. There is more information available today as to how students learn and are motivated by pointing out the relevance of their learning.

Since SAT, ACT, and placement tests are used to determine a student's readiness to take college-level courses, each could be reviewed in future research. Are the tests

measuring what needs to be measured? It is possible that some students are being placed in remedial courses only because they are not good at taking tests.

Final Thoughts

We know that “judgments of one’s knowledge, skills, strategies, and stress management . . . enter into the formation of efficacy beliefs” (Zimmerman, 1997, p. 205) so what is missing; putting the self-efficacy theory into instructional practice. If educators are trained to know the components of self-efficacy and the sources of information that can affect it, then they are capable of developing strategies to increase self-efficacy. This approach could only lead more remedial math students to succeed.

Once self-efficacy to succeed is lost, it must be restored, but maintaining self-efficacy is not a guarantee of success. Before students can build self-efficacy to a level to be successful in remedial math, they must first believe that they are capable of success. Positive verbal persuasion by the teacher or peers, experiencing small successes, and seeing others like them succeed are ways to increase the level of self-efficacy and convince a student that he/she can achieve success, despite placement in remedial math.

I find it astounding that the Accuplacer, a standardized, 12-question computer placement test, creates havoc or life-changing experiences for some math students who were placed in remedial math and can still be the saving grace for others. Of course, sending all students directly into college algebra is setting many up for failure, and in some cases, multiple times as most colleges require the math course for general education requirements. Many lack the knowledge or ability necessary as well as the confidence and the self-efficacy, to pass a college-level math course and need the remediation. For

some, it is the lack of a work ethic needed to study in college; they did not require much study time in high school.

All high schools should require a rigorous Algebra III for seniors, a math course that would fill the gap between high school preparation and college demands and provide a segue to college, at least for the 60 percent that are going on to some type of advanced secondary education. With a pre-college algebra course in high school that reviews the basics and builds mathematical skills, I feel we would see greater numbers of students who would not require remediation and still be successful in college-level math and math-related courses.

The instructional delivery system has to be shaped as developmental or remedial students learn in ways not generally accommodated through traditional instruction. The students need to be actively involved using a variety of instructional methods, goal-setting is critical to maintain the motivation that led them to enroll in college. These students need to feel connected, hear positive verbal feedback, have mentoring and contact with the teacher outside the classroom. Also, they must be taught with diversity in mind. “The use of sound, research-based, developmental education practices can yield positive outcomes for students” (Boylan, Bonham, & White, 1999, p. 99).

REFERENCES

- Abraham, A. A., & Creech, J. D. (2000). Reducing remedial education: What progress are states making? *Educational Benchmarks: 2000 Series*. Atlanta, GA: Southern Regional Education Board.
- Adam, M. (2007). Re-claiming an old social contract: College for low-income students. *Education Digest*, 72, 60-66.
- Adelman, C. (1999). The new college course map and transcript files: Changes in course taking and achievement, 1972-1993. 2nd Ed. National Institute on Postsecondary Education, Libraries, and Life-long Learning. Washington, DC: Office of Educational Research and Improvement. (ERIC Document Reproduction Service No. ED434647)
- Altbach, P. G., Berdahl, R. O., & Gumport, P. J. (Eds.). (2005). *American higher education in the twenty-first century: Social, political, and economic challenges*. 2nd Ed. Baltimore, MD: Johns Hopkins University Press. (Original work published 1999)
- Altbach, P. G., Gumport, P. J., & Johnstone, D. B. (Eds.). (2001). *In defense of American higher education*. Baltimore, MD: Johns Hopkins University Press.
- Ashburn, E. (2007, April 20). An \$88-Million experiment to improve community colleges. *Chronicle of Higher Education*, 53, p. A32-34.
- Astin, A. W. (2000). The civic challenge of educating the underprepared student. In T.

- Ehrlich (Ed.), *Civic responsibility and higher education* (pp. 124-146).
Phoenix,AZ: Oryx Press.
- Bahr, P. R. (2004). The rough and rocky road of remediation: Racial inequalities in postsecondary remedial mathematics (Doctoral dissertation, University of California, Davis, 2004). *Dissertation Abstracts International*, 65, 2154.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84, 191-215.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (Vol. 4, pp. 71-81). New York: Academic Press.
- Bennett, D. C. (1997). Innovation in the liberal arts and sciences. In R. Orrill (Ed.), *Education and democracy: Re-imagining liberal learning in America* (pp. 131-149). New York: College Entrance Examination Board.
- Bettinger, E. P., & Long, B. T. (2007). Addressing the needs of under-prepared students in higher education: Does college remediation work? Cambridge, MA: National Bureau of Economic Research.
- Betz, N. E., & Hackett, G. (1983). The relationship of mathematics self-efficacy expectations to the selection of science-based college majors. *Journal of Vocational Behaviour*, 23, 329-345.
- Bottoms, G., & Carpenter, K. (2003). Factors affecting mathematics achievement for students in rural schools. (Research Brief). Atlanta GA: Southern Regional Education Board. (ERIC Document Reproduction Service No. ED477284)

- Boylan, H. R. (1999a). Demographics, outcomes, and activities. *Journal of Developmental Education*, 23, 2-8.
- Boylan, H. R. (1999b). Exploring alternatives to remediation. *Journal of Developmental Education*, 22, 2-10.
- Boylan, H. R., Bonham, B. S., & Bliss, L. (1994). Who are the developmental students? *Research in Developmental Education*, 11, 1-4.
- Boylan, H. R., Bonham, B. S., Claxton, C., & Bliss, L. (1992, November). *The state of the art in developmental education*. Paper presented at the First National Conference on Research in Developmental Education, Charlotte, NC.
- Boylan, H. R., Bonham, B. S., Jackson, J., & Saxon, D. P. (1994). Staffing patterns in developmental education programs: Full-time, part-time, credentials, and program placement. *Research in Developmental Education*, 11, 1-4.
- Boylan, H. R., Bonham, B. S., & White, S. R. (1999, Winter). Developmental and remedial education in postsecondary education. In G. H. Gaither (Ed.), *Promising Practices in Recruitment, Remediation, and Retention: New Directions for Higher Education* (Vol. 108, pp. 87-101). San Francisco: Jossey-Bass.
- Breneman, D. W., & Haarlow, W. H. (1998, July). Remediation in higher education. *Symposium on remedial education: Costs and consequences, Fordham Report 2*, 1-57. Washington DC: Thomas B. Fordham Foundation. (ERIC Document Reproduction Service No. ED422770)
- Brier, E. (1984). Bridging the academic preparation gap: An historical view. *Journal of Developmental Education*, 8, 2-5.
- Broadfoot, P. (2000). Comparative education for the 21st century: Retrospect and

- Prospect. *Comparative Education*, 36, 357-371.
- Callan, P. M. (2006). Introduction: International comparisons highlight educational gaps between young and older Americans. In *Measuring Up 2006: The National Report Card on Higher Education*. San Jose, CA: The National Center for Public Policy and Higher Education.
- Callan, P. M., & Finney, J. E. (2002). Assessing educational capital: An imperative for policy. *Change*, 34, 24-30.
- Casazza, M. E. (1999). Who are we and where did we come from? *Journal of Developmental Education*, 23, 2-7.
- Chen, X., & Carroll, C. D. (2005). *First-generation students in postsecondary education: A look at their college transcripts. Postsecondary education descriptive analysis report* (NCES 2005-171). Washington, DC: National Center for Education Statistics, U.S. Department of Education.
- Colby, A., Ehrlich, T., Beaumont, E., & Stephens, J. (2003). The broader undergraduate context. In (Series Ed.) *Educating citizens: Vol. 1. Preparing America's undergraduates for lives of moral and civic responsibility* (1st ed., pp. 23-48). San Francisco: Jossey-Bass.
- Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage Publications.
- Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage Publications.
- Cronholm, L. (1999, September 24). Why one college jettisoned all its remedial courses. *Chronicle of Higher Education*, 46, p. B6-7.

- Darling-Hammond, L. (2004). Inequality and the right to learn: Access to qualified teachers in California's public schools. *Teachers College Record*, 106, 1936-1966.
- Day, J. C., & Gaither, A. L. (Eds.). (2000). *Voting and registration in the election of November 1998* (Publication No. P20-523RV, pp. 1-12). Washington, DC: U. S. Census Bureau.
- Dilworth, M. E. & Imig, D. G. (1995). Professional teacher development. *The ERIC Review*, 3, 5-11. Washington, DC: Office of Educational Service and Improvement. (ERIC Document Reproduction Service No. ED381136)
- Duncan, R. E. (2000). The relationship between math preparation in high school and math skills of entering college students (Doctoral dissertation, Oklahoma State University, 2000). *Dissertation Abstracts International*, 62, 107.
- Duranczyk, I. M., & Higbee, J. L. (2006). Developmental mathematics in 4-year institutions: Denying access. *Journal of Developmental Education*, 30, 22-31.
- Einstein, A. (1946, May 25). Atomic education urged by Einstein [Telegram to the editor]. *New York Times*, p. 11.
- Everett, E. B. (1999, November 5). Eliminating remedial courses in college is not the way to raise standards [Letter to the Editor]. *Chronicle of Higher Education*, p. B3.
- Fleischner, J. E., & Manheimer, M. A. (1997). Math interventions for students with learning disabilities: Myths and realities. *School Psychology Review*, 26, 397-413.
- Freedman, S. G. (2005, August 3). Little-noticed crisis at black colleges. *The New York Times*, p. B7.

- Gibbons, M. M., & Shoffner, M. F. (2004). Prospective first-generation college students: Meeting their needs through social cognitive career theory. *Professional School Counseling, 8*, 91-97.
- Godbey, C. (1997). *Mathematics anxiety and the underprepared student*. Murfreesboro: Middle Tennessee State University. (ERIC Document Reproduction Service No. ED426734)
- Haeuser, P. N. (1993). *Public accountability and developmental (remedial) education*. Arnold, MD: Anna Arundel Community College, Office of Planning and Research. (ERIC Document Reproduction Service No. ED356003)
- Hagedorn, L.S., Siadat, M. V., Fogel, S. F., Nora, A., & Pascarella, E. T. (1999). Success in college mathematics: Comparison between remedial and nonremedial first-year college students. *Research in Higher Education, 40*, 261-284.
- Hall, J. M., & Ponton, M. K. (2005, Spring). Mathematics self-efficacy of college freshman. *Journal of Developmental Education, 28*, 26-28, 30, 32-33.
- Hartley, J. (2004). Case study research. In C. Cassell & G. Symon (Eds.), *Essential Guide to Qualitative Methods in Organizational Research* (pp. 323-333). London: Sage Publications.
- Haycock, K. (1996). Thinking differently about school reform. *Change, 28*, 12-18.
- Haycock, K. (2001). Closing the achievement gap. *Educational Leadership, 58*, 6-11.
- Higbee, J. L., Arendale, D. R., & Lundell, D. B. (2005). Using theory and research to improve access and retention in developmental education. *New Directions for Community Colleges, 2005*, 5-15.

- Higbee, J. L., & Thomas, P. V. (1999, Fall). Affective and cognitive factors related to mathematics achievement. *Journal of Developmental Education*, 23, 8-10, 12, 14, 16, 32.
- Hofmeister, A. M. (1993). Elitism and reform in school mathematics. *Remedial and Special Education*, 14, 1-8.
- Hoyt, J. E., & Sorensen, C. T. (1999). *Promoting academic standards?: The link between remedial education in college and student preparation in high school*. Orem: Utah Valley State College, Department of Institutional Research & Management Studies.
- Hoyt, J. E., & Sorensen, C. T. (2001). High school preparation, placement testing, and college remediation. *Journal of Developmental Education*, 25, 26-34.
- Hunt, J. B., Tierney, T. J., & Carruthers, G. (2006). *American higher education: How does it measure up for the 21st century?* (Report Number 06-02). San Jose, CA: National Center for Public Policy and Higher Education. (ERIC Document Reproduction Service No. ED491912)
- Ignash, J. M. (Ed.). (1997, Winter). Implementing effective policies for remedial and developmental education. *New Directions for Community Colleges*, No. 100, 25(4). San Francisco: Jossey-Bass. (ERIC Document Reproduction Service No. ED413965)
- Illich, P. A., Hagan, C., & McCallister, L. (2004). Performance in college-level courses among students concurrently enrolled in remedial courses: Policy implications. *Community College Journal of Research and Practice*, 28, 435-453.

- Immerwahr, J. (2003). *With diploma in hand: Hispanic high school seniors talk about their future*. (Report Number NCPPE-R-03-2). San Jose, CA: The National Center for Public Policy and Higher Education. (ERIC Document Reproduction Service No. ED477423)
- Jerald, C., & Haycock, K. (2002). Closing the gap. *School Administrator*, 59, 16-18, 20, 22.
- Johnson, M., & Kuennen, E. (2002). *Does remedial math matter? Evidence of the cross-disciplinary effects of requiring remedial math*. University of Wisconsin Oshkosh, Department of Economics and University of Wisconsin Stout, Menomonie, Department of Mathematics. Retrieved March 20, 2007, from:
http://www.uwosh.edu/faculty_staff/johnsonm/imrfe/pdf/johnsonkuennen_remedi_almath.pdf
- Johnson, M., & Kuennen, E. (2004). Delaying developmental mathematics: The characteristics and costs. *Journal of Developmental Education*, 28, 24-29.
- Kezar, A. J., Chambers, T. C., Burkhardt, J. C., & Associates (2005). *Higher education for the public good: Emerging voices from a national movement*. San Francisco: Jossey-Bass.
- Knopp, L. (1996). Remedial education: An undergraduate student profile. *American Council on Education: Research Briefs*, 6, 1-11.
- Kranzler, J. H., & Pajares, F. (1997). An exploratory factor analysis of the mathematics self-efficacy scale – revised (MSES-r). *Measurement and evaluation in counseling and development*, 29, 215-228.

Learning Matters Inc., New York. (2005, June 23). Hersh, R. H., & Merrow, J. (Eds.).

Declining by degrees: Higher education at risk. Retrieved April 11, 2006, from

<http://www.decliningbydegrees.org>

Lemke, M., & Gonzales, P. (2006). *U. S. student and adult performance on international*

assessments of educational achievement: Findings from the condition of

education 2006 (NCES 2006-073). U. S. Department of Education. Washington,

DC: National Center for Education Statistics.

Levine, A. (1978). *Handbook on Undergraduate Curriculum*. San Francisco: Jossey-

Bass.

Lundell, D. B., & Higbee, J. L. (Eds.). (2000). Research in developmental education:

What do we need to know? In H. Boylan (Ed.), *Proceedings of the Intentional*

Meeting on Future Directions in Developmental Education (pp. 24-28).

Minneapolis: Minnesota University, Center for Research on Developmental

Education and Urban Literacy.

Marcus, J. (2000, Winter). Revamping remedial education. *National CrossTalk*, 8(1).

San Jose, CA: National Center for Public Policy and Higher Education. Retrieved

January 29, 2007 from:

<http://www.highereducation.org/crosstalk/ct0100/news0100-revamp.shtml>

Marshall, C., & Rossman, G. B. (1989). *Designing qualitative research*. Newbury Park,

CA: Sage Publications.

McCabe, R. H. (2003). *Yes we can! A community college guide for developing*

- America's underprepared* [Abstract]. Washington, DC: American Association of Community Colleges, League for Innovation in the Community College. (ERIC Document Reproduction Service No. ED475435)
- McCabe, R. H., & Day, P. R., Jr. (Eds.). (1998). *Developmental education: A twenty-first century social and economic imperative*. Laguna Hills, CA: League for Innovation in the Community College. (ERIC Document Reproduction Service No. ED421176)
- McGlaughlin, S. M., Knoop, A. J., & Holliday, G. A. (2005). Differentiating students with mathematics difficulty in college: Mathematics disabilities vs no diagnosis. *Learning Disability Quarterly*, 28, 223-232.
- Mercer, C. D. (1997). *Students with learning disabilities*. 5th Ed. Upper Saddle River, NJ: Prentice Hall.
- Mercer, C. D., & Harris, C. A. (1993). First invited response: Reforming reforms in mathematics. *Remedial and Special Education*, 14, 14-19.
- Merisotis, J. P., & Phipps, R. A. (2000). Remedial education in colleges and universities: What's really going on? *Review of Higher Education*, 24, 67-85.
- Merriam, S. B. (1988). *Case study research in education: A qualitative approach*. San Francisco: Jossey-Bass.
- Miglietti, C. L. & Strange, C. C. (1998). Learning styles, classroom environment preferences, teaching styles, and remedial course outcomes for under prepared adults at a two-year college. *Community College Review*, 26, 1-19.
- Miles, M. G., & Huberman, A. M. (1994). *Qualitative data analysis*, 2nd Ed. Thousand Oaks, CA: Sage Publications.

- Mills, M. (1998). From coordinating board to campus: Implementation of a policy mandate on remedial education. *Journal of Higher Education*, 69, 672-697.
- Moore, R. (2004, Fall). Do colleges identify or develop intelligence? *Journal of Developmental Education*, 28, 28-30, 32-34.
- National Association for Developmental Education. *Definition of developmental education*. Retrieved May 22, 2007, from:
<http://www.nade.net/aboutDevEd/definition.html>
- National Center for Education Statistics. (2003). *Remedial education at postsecondary degree granting institutions in fall 2000*. Washington, DC: U.S. Department of Education, Author.
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.
- Newburger, E. C., & Curry, A. (Eds.). (2000). *Educational attainment in the United States* (Publication No. P20-528, pp. 1-7). Washington, DC: U. S. Census Bureau.
- Newman, F., Couturier, L., & Scurry, J. (Eds.). (2004). *The future of higher education: Rhetoric, reality, and the risks of the market*. San Francisco: Jossey-Bass.
- O'Banion, T. (1997). *A learning college for the 21st century*. Phoenix, AZ: Oryx Press.
- Olson, L. (2000). Children of change, 2000 & beyond: The changing face of American schools. (Report No. UD-034545). *Education Week*, 20, 31. (ERIC Document Reproduction Service No. ED458326)
- Pajares, F. (1995). *Self-efficacy in academic settings*. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA, April 18-22, 1995. (ERIC Document Reproduction Service No. ED384608)

- Pajares, F. (1996, Winter). Self-efficacy beliefs in academic settings. *Review of Educational Research*, 66, 543-578.
- Pajares, F. (1997). Current directions in self-efficacy research. In M. Maehr & P. R. Pintrich (Eds.), *Advances in Motivation and Achievement*. (pp. 1-49). Greenwich, CT: JAI Press. Retrieved on April 11, 2008 from:
<http://www.des.emory.edu/mfp/effchapter.html>
- Pajares, F., & Kranzler, J. (1995). *Role of self-efficacy and general mental ability in mathematical problem-solving: A path analysis*. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA, April 18-22, 1995. (ERIC Document Reproduction Service No. ED387342)
- Pajares, F., & Miller, M. D. (1995). Mathematics self-efficacy and mathematics performances: The need for specificity of assessment. *Journal of Counseling Psychology*, 42, 190-198.
- Pajares, F., & Miller, M. D. (1997). Mathematics self-efficacy and mathematical problem solving: Implications of using different forms. *Journal of Experimental Education*, 65, 213-228.
- Pajares, F., & Schunk, D. H. (2001). Self-beliefs and school success: Self-efficacy, self-concept, and school achievement. In R. Riding & S. Rayner (Eds.), *Perception*. (pp. 239-266). London: Ablex Publishing. Retrieved on April 11, 2008 from:
<http://www.des.emory.edu/mfp/PajaresSchunk2001.html>
- Parsad, B., & Lewis, L. (2003). Remedial education at degree-granting postsecondary

- institutions in fall 2000: Statistical analysis report* (NCES 2004-010).
Washington, DC: National Center for Education Statistics, U.S. Department of Education.
- Pascarella, E. T., & Terenzini, P. T. (1991). *How college affects students*. San Francisco: Jossey-Bass.
- Phipps, R. (1998). *College remediation: What it is, what it costs, what's at stake*. (Report No. HE-032020). Washington, DC: Institute for Higher Education Policy. (ERIC Document Reproduction Service No. ED429525)
- Polkinghorne, D. E. (2005). Language and meaning: Data collection in qualitative research. *Journal of Counseling Psychology*, 52, 137-145.
- Popham, W. J. (2004). Curriculum, instruction, and assessment: Amiable allies or phony friends? *Teachers College Record*, 106, 417-428.
- Prieto, C. R. (1997). *The higher education act: Access into the 21st century*. Retrieved January 22, 2007, from: <http://nadedocs/heahist.htm>.
- Punch, K. F. (1998). *Introduction to social research*. London: Sage Publications.
- Redovich, D. (2003). Higher education. [Review of the book *Increasing access to college: Extending possibilities for all students*]. *Teachers College Record*, 105, 50-54.
- Richardson, F. C., & Suinn, R. M. (1972). The mathematics anxiety scale: Psychometric data. *Journal of Counseling Psychology*, 19, 551-554.
- Roueche, J. E., & Roueche, S. D. (1993). *Between a rock and a hard place: The at-risk student in the open-door college*. Washington, DC: Community College Press.
- Roueche, J. E., & Roueche, S. D. (1999). *High stakes, high performance: Making remedial education work*. Washington, DC: Community College Press.

- Scurry, J. E. (2003). *Access and achievement building block: Making the case for all to achieve*. (Report No. HE-036039). Brown University: A. Alfred Taubman Center for Public Policy and American Institutions. (ERIC Document Reproduction Service No. ED478809)
- Seese, L. (1994). Revising the mathematics department. *Third International Conference for Community College Chairs and Deans*. Phoenix, AZ. (ERIC Document Reproduction Service No. ED367422)
- Smittle, P. (2003). Principles for effective teaching in developmental education. *Journal of Developmental Education*, 26, 10-12, 14, 16.
- Stage, F. K., & Kloosterman, P. (1995). Gender, beliefs, and achievement in remedial college-level mathematics. *Journal of Higher Education*, 66, 294-311.
- Stake, R. E. (2005). Qualitative case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage Handbook of Qualitative Research*, 3rd Ed. Thousand Oaks, CA: Sage Publications.
- Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist*, 52, 613-629.
- Stephens, D. (2001). *Increasing access: Educating underprepared students in U. S. colleges and universities past, present, and future*. Johnson City: East Tennessee State University. Retrieved on April 18, 2006 from:
<http://faculty.etsu.edu/stephen/misc/increasingaccess.htm>
- Stevens, T., Olivarez, A., Jr., Lan, W. Y., & Tallent-Runnels, M. K. (2004). Role of mathematics self-efficacy and motivation in mathematics performance across ethnicity. *Journal of Educational Research*, 97, 208-221.

- Strawser, S., & Miller, S. P. (2001). Math failure and learning disabilities in the postsecondary student population. *Topics in Language Disorders, 21*, 68-84.
- Taylor-Dunlop, K., & Norton, M. (1997). Out of the mouths of babes: Voices of at-risk adolescents. *Clearing House, 70*, 274-278.
- Taylor, S. S. (2001). Bogged down in the basics? *Community College Week, 13*, 6-8.
- Terenzini, P. T., Cabrera, A. F., & Bernal, E. M. (2001). *Swimming against the tide: The poor in American higher education*. (College Board Report No. 2001-1). New York: College Board.
- Tierney, W. G. (1999). *Building the responsive campus: Creating high performance colleges and universities*. Thousand Oaks, CA: Sage Publications.
- Toch, T. (1991). *In the Name of Excellence*. New York: Oxford University Press.
- Trombley, W. (1998). Remedial education under attack. *National CrossTalk, 6*, 1.
- San Jose, CA: National Center for Public Policy and Higher Education. Retrieved January 29, 2007 from:
<http://www.highereducation.org/crosstalk/ct0798/news0798-remedial.shtml>
- U. S. Department of Education. (1998). *Pursuing excellence: A study of U. S. twelfth-grade mathematics and science achievement in international context* (NCES Publication No. 98-049). Washington DC: U. S. Government Printing Office.
- Van Haneghan, J. P., Pruet, S. A., & Bamberger. (2004). Mathematics reform in a minority community: Student outcomes. *Journal of Education for Students at Risk, 9*, 189-211.

- Wadsworth, L. M., Husman, J., Duggan, M. A., & Pennington, M. N. (Spring 2007). Online mathematics achievement: Effects of learning strategies and self-efficacy. *Journal of Developmental Education*, 30, 6-8, 10, 12-14.
- Walker, W., & Plata, M. (2000). Race/gender/age differences in college mathematics students. *Journal of Developmental Education*, 23, 24-29.
- Waycaster, P. (2001). Factors impacting success in community college developmental mathematics courses and subsequent courses. *Community College Journal of Research and Practice*, 25, 403-416.
- Weissman, J., Silk, E., & Bulakowski, C. (1997). Assessing developmental education policies. *Research in Higher Education*, 38, 187-200.
- Wiens, M. (1998). A is for assessment and accountability. *Research in Developmental Education*, 15, 1-6.
- Wirt, J., Choy, S., Rooney, P., Provasnik, S., Sen, A., & Tobin, R. (2004). *The condition of education, 2004* (NCES 2004-077). Washington, DC: National Center for Education Statistics, U.S. Department of Education. (ERIC Document Reproduction Service No. ED483070)
- Yin, R. K. (1994). *Case study research: Design and methods*. 2nd Ed. (Applied Social Research Methods Series, V. 5). Thousand Oaks, CA: Sage Publications.
- Yin, R. K. (2003). *Case study research: Design and methods*. 3rd Ed. (Applied Social Research Methods Series, V. 5). Thousand Oaks, CA: Sage Publications.
- Zimmerman, B. J. (1997). Self-efficacy and educational development. In A. Bandura (Ed.), *Self-efficacy in changing societies* (pp. 202-231). New York: Cambridge University Press. (Original work published 1995)

APPENDICES

Appendix A

Oklahoma State University Institutional Review Board

Date: Tuesday, July 01, 2008
IRB Application No ED0883
Proposal Title: Self-Efficacy and Remediation of Higher Education Mathematics Students

Reviewed and Expedited
Processed as:

Status Recommended by Reviewer(s): Approved Protocol Expires: 6/30/2009

Principal
Investigator(s):

Nancy Kilian	Adrienne Hyle
808 5th	325D Willard
Alva, OK 73717	Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,


Shelia Kennison, Chair
Institutional Review Board

Appendix B

From: Poe, Daresa
Sent: Tuesday, January 20, 2009 1:24 PM
To: Kilian, Nancy
Subject: Request

Nancy:

Here are the numbers you requested for Fall 2008:

Total Enrollment	2076
Males	844 = 41 %
Females	1232 = 59 %
International	28 = 1.35 %
Black	95 = 4.58 %
Native American	113 = 5.44 %
Asian	10 = 0.48 %
Hispanic	81 = 3.90 %
White/Unknown	1749 = 84.24 %

First Time Freshmen 322
Of these 281/322 came directly from high school = 87 %
Of these 139/322 needed some level of remedial math = 43 %

Total Full-Time Students	1320 = 64 %
Total Part-Time Students	756 = 36 %

Please let me know if you have any questions.

Daresa Poe, M.Ed.
Institutional Research Specialist

Appendix C

CONSENT FORM

Project Title: Self-Efficacy and Remediation of Higher Education Mathematics Students

Investigator: Nancy Kilian (Graduate student at Oklahoma State University)

Purpose: You are invited to participate in a research study being conducted at Northwestern Oklahoma State University regarding how placement in remedial mathematics impacts students. The information sought will be your thoughts and feelings about being placed in a remedial mathematics course. Personal information (demographics, ACT scores, etc) will be gathered on each student and kept confidential by being locked in a cabinet in my home office that I have the only access. This data can define specific trends that may exist for those that are asked to remediate.

Procedures: If you decide to participate, you will be asked to take a test where you will rate your degree of capability to do math, not actually solve problems, or perform in other academic areas. This test will in no way affect your grade in this class. Completion of the test will take around 30-45 minutes as it contains 52 questions. Also, participation will require time to do one or two interviews, 30-45 minutes each, to find out your thoughts and feelings about your placement in remedial mathematics. These interviews will be audio-taped and conducted in the privacy of my office, after hours if necessary, in your home, or anywhere you will feel at ease. They will be kept locked up at all times and for one year 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 ordinarily encountered in daily life. You may possibly feel emotional discomfort when answering questions about your personal thoughts and feelings.

Benefits: The only benefit is that your participation will help researchers learn more about how placement in remedial mathematics impacts students. Society can benefit from this research as your voice can help others to understand the reasons behind so many students dropping out of college after being placed in a remedial math class and what may have led you to needing remediation.

Confidentiality: Any information that is obtained in connection with this study and that can be identified with you will remain confidential. The data will be stored in my personal computer (no internet access) which will be locked up where I have the only access. In written results, participants' identities will not be disclosed. Research records will be stored securely and only researchers and individuals responsible for research oversight will have access to the records. It is possible that the consent process and data collection will be observed by research oversight staff responsible for safeguarding the rights and wellbeing of people who participate in research.

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

Contacts: If you have any questions later, you may contact - Nancy Kilian, 808 5th, Alva, OK 73717, 580-327-8581 or ngkilian@nwsu.edu or Dr. Adrienne Hyle, Advisor, 325D Willard Hall, OSU, Stillwater, OK 74078, 405-744-9893 or adrienne.hyle@okstate.edu. If you have questions about your rights as a research volunteer, you may contact Dr Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-1676 or irb@okstate.edu.

Participating Rights: Participation is totally voluntary. Your decision whether or not to participate will not prejudice your future relation with Northwestern Oklahoma State University. Also, if you decide to participate, you are free to discontinue participation at any time without any reprisal, penalties, or consequences of any kind.

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy of this form has been given to me.

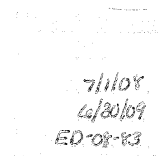
Signature of Participant

Date

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

Signature of Researcher

Date



Appendix D

Questions for Demographic Profile

Please indicate age _____ Please indicate gender Male _____ Female _____

Please indicate race or cultural background: African American Asian/Pacific Islander
Caucasian Latino/Mexican Native American Other _____

Hometown _____

Please list the math classes taken in high school and the grade received after completion.

Prior to this class, when was your last math class? _____

Please indicate your final high school GPA (on a 4 point scale). _____

Please indicate your overall: SAT score _____ (or) ACT score _____

Please indicate your: Math SAT score _____ (or) Math ACT score _____

Please indicate your: Accuplacer test score _____

Did one or both of your parents have a college degree? _____

Appendix E

QUALITATIVE RESEARCH TOOL

The MSES-R has three sub-scales: tasks, courses and problem-solving. The items are given in three sections below. Each item was assessed by using a 6-point Likert-type scale with 1 designating “not confident at all” and 6 designating “completely confident.”

Items of the MSES-R

Tasks Sub-Scale

How much confidence do you have that you are able to successfully perform each of the following tasks?

1. Add two large numbers (e.g., $5739 + 62543$) in your head.
2. Determine the amount of sales tax on a clothing purchase.
3. Figure out how much material to buy in order to make curtains.
4. Determine how much interest you will end up paying on a \$675 loan over 2 years at 14 3/4% interest.
5. Use a scientific calculator.
6. Compute your car's gas mileage.
7. Calculate recipe quantities for a dinner for 41 when the original recipe is for 12 people.
8. Balance your checkbook without a mistake.
9. Understand how much interest you will earn on your savings account in 6 months, and how that interest is computed.
10. Figure out how long it will take to travel from City A to City B driving 55 mph.
11. Set up a monthly budget for yourself.
12. Compute your income taxes for the year.
13. Understand a graph accompanying an article on business profits.
14. Figure out how much you would save if there is a 15% mark down on an item you wish to buy.
15. Estimate your grocery bill in your head as you pick up items.
16. Figure out which of two summer jobs is the better offer; one with a higher salary but no benefits, the other with a lower salary plus room, board and travel expenses.
17. Figure out the tip on your part of a dinner bill split 8 ways.
18. Figure out how much lumber you need to buy in order to build a set of bookshelves.

Courses Sub-Scale

Please rate the following college courses according to how much confidence you have that you could complete the course with a final grade of “A” or “B.”

1. Basic college math
2. Economics
3. Statistics
4. Physiology
5. Calculus
6. Business administration
7. Algebra II
8. Philosophy

9. Geometry
10. Computer science
11. Accounting
12. Zoology
13. Algebra I
14. Trigonometry
15. Advanced calculus
16. Biochemistry

Problem-Solving Sub-Scale

Suppose that you were asked the following math questions in a multiple choice form. Please indicate how confident you are that you would give the correct answer to each question without using a calculator.

1. In a certain triangle, the shortest side is 6 inches. The longest side is twice as long as the shortest side, and the third side is 3.4 inches shorter than the longest side. What is the sum of the three sides in inches?
2. ABOUT how many times larger than 614,360 is 30,668,000?
3. There are three numbers. The second is twice the first and the first is one-third of the other number. Their sum is 48. Find the largest number.
4. Five points are on a line. T is next to G. K is next to H. C is next to T. H is next to G. Determine the positions of the points along the line.
5. If $y = 9 + x / 5$, find x when $y = 10$.
6. A baseball player got two hits for three times at bat. This could be represented by $2/3$. Which decimal would most closely represent this amount?
7. If $P = M + N$, then which of the following will be true?
 1. $N = P - M$
 2. $P - N = M$
 3. $N + M = P$
8. The hands of a clock form an obtuse angle at _____ o'clock.
9. Bridget buys a packet containing 9-cent and 13-cent stamps for \$2.65. If there are 25 stamps in the packet, how many are 13-cent stamps?
10. On a certain map, $7/8$ inch represents 200 miles. How far apart are two towns whose distance apart on the map is $3 \frac{1}{2}$ inches?
11. Fred's bill for some household supplies was \$13.64. If he paid for the items with a \$20 bill, how much change should he receive?
12. Some people suggest that the following formula be used to determine the average weight of boys between the ages of 1 and 7: $W = 17 + 5A$ where W is the weight in pounds and A is the boy's age in years. According to this formula, for each year older a boy gets, should his weight become more or less, and by how much?
13. Five spelling tests are to be given to Mary's class. Each test has a value of 25 points. Mary's average for the first four tests is 15. What is the highest possible average she can have on all five tests?
14. $3 \frac{4}{5} - 1/2 = \underline{\hspace{2cm}}$.
15. In an auditorium, the chairs are usually arranged so that there are x rows and y seats in a row. For a popular speaker, an extra row is added, and an extra seat is added to every

row. Thus, there are $x + 1$ rows and $y + 1$ sets in each row, and there will be $(x + 1)$ times $(y + 1)$ seats in the auditorium. Multiply $(x + 1)(y + 1)$.

16. A Ferris wheel measures 80 feet in circumference. The distance on the circle between two of the seats is 10 feet. Find the measure in degrees of the central angle SOT whose rays support the two seats.

17. Set up the problem to be done to find the number asked for in the expression “six less than twice $4\frac{5}{6}$.”

18. The two triangles shown on the right are similar. Thus, the corresponding sides are proportional, and $AC / BC = XZ / YZ$. If $AC = 1.7$, $BC = 2$, and $XZ = 5.1$, find YZ .


Appendix F

From: Prof. Frank Pajares [mpajare@emory.edu]
Sent: Thursday, August 21, 2008 6:05 AM
To: Kilian, Nancy
Subject: Re: Mathematics Self-Efficacy Scale - Revised

You don't need to purchase it. You're welcome to use it.

<http://des.emory.edu/mfp/MSPub-MFP2008Base.html>

The password for published documents is "XXXXXXX"

Prof. Frank Pajares 
Samuel Candler Dobbs Professor of Education
Division of Educational Studies
1784 N. Decatur Rd., Suite 240
Emory University
Atlanta, GA 30322

Tel: (404) 727-1775/Fax: (404) 727-2799

Web: <http://des.emory.edu/mfp>

--- On Wed, 8/20/08, Kilian, Nancy <NGKilian@nwosu.edu> wrote:

From: Kilian, Nancy <NGKilian@nwosu.edu>

Subject: Mathematics Self-Efficacy Scale - Revised

To: "mpajare@emory.edu" <mpajare@emory.edu>

Date: Wednesday, August 20, 2008, 5:39 PM

Dr Pajares,

I am working on my dissertation "Self-Efficacy and Remediation of Higher Education Mathematics Students" at Oklahoma State University in Stillwater, Oklahoma and would like to purchase the Mathematics Self-Efficacy Scale – Revised instrument to administer to my subjects. I would sincerely appreciate your sharing the information about whom I would need to contact to make the purchase.

Thank you very much for your time.

Nancy Kilian

Instructor of Mathematics

Mathematics and Computer Science Department

Appendix G

Questions for Interview

1. Please tell me about you. (Family, high school, & cultural background)
2. Please tell me how things are going for you in this class.
3. Why were you asked to join this class? Do you feel that this class was an appropriate placement for you?
4. Do you think this class will help you? Why or why not?
5. When thinking of this class, what event or moment comes to mind first?
6. How do you feel now that you have had an opportunity to learn the material presented in this class?
7. What are your aspirations/dreams or future plans? Have you made any changes in your plans?

(Based on Bandura's 1994 sources of influence to develop self-efficacy)

8. Describe how you feel about facing challenges.
9. As the semester progressed did you find yourself trying harder to solve problems? Why or why not?
10. Have you seen others like yourself go through remedial courses? Were they successful?
11. Has anyone ever told you that you can be successful? With math? In life?
12. Do you feel like you have mastered algebra?

(Thank individual for participating in this interview. Assure him or her of confidentiality of responses and potential future interviews).

Appendix H

2008 UNDERGRADUATE CATALOG

COURSE DESCRIPTIONS

MATHEMATICS COURSES (MATH)

0013 Pre-Intermediate Algebra

A course to teach the basic ideas in theory and application of several areas of mathematics. The student will be prepared to complete Intermediate Algebra. Course covers real numbers, simple algebraic expressions, linear equations in one variable and consumer multiplication. *This course does not fulfill degree requirements.*

0123 Intermediate Algebra

A course designed to meet the curriculum deficiency for beginning freshman or transfer students. The course includes elementary algebra to give the student an adequate mathematical background. *Does not count as degree requirement.*

VITA

Nancy G. Kilian

Candidate for the Degree of

Doctorate of Education

Dissertation: SELF-EFFICACY AND REMEDIATION OF HIGHER EDUCATION
MATHEMATICS STUDENTS

Major Field: Higher Education

Biographical:

Personal Data:

Education:

Earned Bachelor of Science in Mathematics at Northwestern Oklahoma State University, Alva, Oklahoma 1977.

Earned Master of Education at Northwestern Oklahoma State University, Alva, Oklahoma 1990.

Completed the requirements for the Doctorate of Education in Higher Education at Oklahoma State University, Stillwater, Oklahoma in December, 2009.

Experience:

Northwestern Oklahoma State University, Alva, OK	1/94 – Present
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Medford Public High School, Medford, OK	8/92 – 5/93
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Boise City Public School, Boise City, OK	8/78– 5/79
--	------------

Professional Memberships: None

Name: Nancy G. Kilian

Date of Degree: December, 2009

Institution: Oklahoma State University

Location: Stillwater, Oklahoma

Title of Study: SELF-EFFICACY AND REMEDIATION OF HIGHER EDUCATION
MATHEMATICS STUDENTS

Pages in Study: 156

Candidate for the Degree of Doctorate of Education

Major Field: Higher Education

Scope and Method of Study: High school graduates go to college every year unable to do college-level math. For most, this lack of knowledge requires remediation which may or may not fulfill that gap. This qualitative study examined the thoughts of under-prepared students in a remedial math class at a four-year university. This research used focused interviews to understand the participants' feelings as they voiced their experiences and also incorporated observations, demographic information, and a survey instrument that reported each one's level of math self-efficacy.

Findings and Conclusions: From this study, findings show a strong relationship between success or failure in remedial math and one's belief in capability or level of self-efficacy. The successful participants were more confident, competent, and tried hard while those that did not succeed were stressed and lacked confidence in their capability to do math; they did not feel competent. Academic success requires a higher level of self-efficacy.

ADVISER'S APPROVAL: Adrienne Hyle
