DEVELOPMENTAL MATHEMATICS:

STUDENTS' PERCEPTIONS OF THE

PLACEMENT PROCESS

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CHAPTER I

INTRODUCTION

Many recent National Science Foundation and United States Department of Education grants have funded programs to ease students' transition from high school to college. These programs designed for specific communities often involve the local community college in what is referred to as "bridge" programs. A "bridge" program typically involves an agreement between a high school and community college to prepare students for college entrance through college placement test preparation, completion of study skills courses, and participation in developmental courses if necessary. Frequently, these courses involve mathematics since students entering college need more remediation in mathematics than in any other subject (Merisotis & Phipps, 2000). Since community colleges have taken on the role of providing developmental education, a renewed national focus on community colleges as transition agents has been seen across America.

In this transition from high school to college, the placement process employed by each community college could determine the ultimate success or failure of students. The process in community colleges for assigning students to appropriate mathematics classes often includes a placement test, consultation with a counselor, and placement in a mathematics course based solely on pre-defined cutoff scores. For many students, this placement test becomes a high stakes test with the consequence of added tuition cost and

added time before the completion of a program. While studies show that many students are underprepared for college coursework, research has also shown that other factors such as test review can influence placement test scores. Community colleges must consider the placement process employed and its impact as a way to increase the students' success and retention.

Background of the Study

From the onset, community colleges have provided education for all students including underprepared and underrepresented students. The colleges serve local communities by providing transitional programs for enrollment in four-year institutions, two-year degrees and work skill classes for specific businesses in the community. Recent events in the societal and political arena have precipitated changes in the way that society views the role of community colleges in higher education. Due to the high unemployment rate in our society and the need for retraining to meet job demands, many students have enrolled in college opting for the lower tuition offered by community colleges. The high cost of postsecondary education has caused many students to recognize the benefits of the cost effective community college courses (KOCO, 2009).

In the political arena, Jill Biden, the wife of United States Vice-President Biden and a professor at Northern Virginia Community College, recognizes the value the community college experience provides for a large majority of Americans (Biden, 2009). Concerning community colleges, Biden stated "I have always said community colleges are one of America's best kept secrets – and I am so pleased that now we have a president who is highlighting their contribution, making a historic commitment to higher education, and bringing more and more students to colleges like Hudson Valley so they, too, can gain the

skills and the confidence they need to succeed in a new era" (2009, para. 6). President Obama has charged community colleges with the responsibility of retraining America's displaced workers (Lothian, 2009). Obama has stated that the "hard truth is that some of the jobs that have been lost in the auto industry and elsewhere won't be coming back" (2009, para. 4). Obama placed the responsibility of retraining these workers on the community colleges since "jobs requiring at least an associate degree are projected to grow twice as fast as jobs requiring no college experience"(2009, para. 5). From a professional perspective, community colleges have the task of preparing students for the future job market while maintaining standards that will allow students the opportunity of continuing their educations. Therefore, community colleges must use provide opportunities for students to learn characteristics that will prepare them to be better students, effective employees and involved community members.

In the early years, the role of community colleges began with the goal to provide post-secondary education to underrepresented members of the American population, particularly those members of society who did not typically attend college. While most four-year institutions developed strict admission requirements based on a variety of factors including ACT/SAT scores and grade point average, community colleges maintained policies of open admission, accepting anyone who applied. Community colleges offered a true democratic approach to education because they allowed any student to enroll in college and removed the economic and social barriers put in place by other institutions of higher learning. Community colleges promoted the American dream of starting with nothing and gaining everything through hard work. The fact that community colleges admitted everyone

who applied meant that many students were unprepared in a variety of manners—academically, financially, and socially.

Educators had to develop methods to allow these hardworking students to reach a level of education that prepared them for jobs and further education. One of these approaches evolved into developmental, or remedial, education programs. Designed to help students reach a college appropriate preparedness level, the mathematics developmental coursework may take from one to four semesters to complete. Many students needing remediation also depend on postsecondary financial assistance that often has time limits of two to three years. Because many schools have college algebra as a prerequisite for various other courses, the length of time necessary to complete the developmental mathematics courses causes a delay in the students' ability to finish their goals of completing a program in a timely manner, thus causing financial hardships.

Originally called junior colleges, the first junior/community college started in 1901 with the intent to make higher education accessible and affordable to a wider section of the American public. These students included the traditional type of students along with rural students, women, workers, minorities, and those who had performed poorly in previous schoolwork. In 1921, the American Association of Junior Colleges created an organization to support, communicate, and promote the ideals of the community college. With the passage, in 1940, of the G.I. Bill of Rights, the number of community colleges increased because of the funding provided, and they began to serve a greater number of students (Mellow, 2000). In 1930, about 440 junior colleges existed with an average of 160 students per institution. By 1940, approximately 610 junior colleges enrolled over 400 students per institution (Cohen & Brawer, 2003). Following this quick growth rate, community colleges set about to meet the

needs of the local communities by enrolling more students, including underrepresented students, and working with businesses to meet their needs. A major mission for community colleges became the preparation of students for success in achieving two- or four-year degrees. Ultimately, community colleges evolved into institutions with comprehensive missions designed to support communities, serve individual students, assist underrepresented student groups, and meet the needs of the business and trade industries (Mellow, 2000).

Due to their relatively small size and broad missions, community colleges have the ability to adapt quickly (Cohen & Brawer, 2003). Therefore, community colleges have received attention recently as being agents of change for the future (Lothian, 2009). The downturn in the United States economy has played an important part in the recent public revelation that there exists a need for the specific qualities community colleges offer – particularly, affordable education for all students, specifically underprepared students. To facilitate the educational goal attainment of students, community colleges must continue to find ways to increase the success of students in remedial courses designed to prepare students for college level coursework. Success in these remedial courses may lead to higher retention rates used as a factor in determining the effectiveness of the community college.

More first-time students enroll in remedial mathematics courses than in reading or writing courses (Merisotis & Phipps, 2000). To gain entrance into college level coursework, students must score above a certain level on the ACT. This score varies with the higher education institution. According to the ACT website, 67% of students scored above the college readiness benchmark in English, 53% in reading, but only 42% scored above the college readiness benchmark in mathematics (ACT, Inc., 2010). Typically, students gain entrance into remedial mathematics classes after taking a placement test. Best practices in

course placement suggest that different student attributes should factor into assignment for the most appropriate mathematics course. For instance, a single range of test scores could place students with a strong background in algebra into the same class as students with a weaker background in algebra. Some students might need a brief, refresher course while others would need the full, intensive course. Students' retention in college is often impacted by their placement in the developmental mathematics courses and their rate of satisfaction with their experiences in the course (Armington, 2002).

In an attempt to improve student satisfaction in developmental mathematics courses, colleges have started experimenting with the pace of classes. Pace means the amount of time it takes to complete the entire curriculum required for the course. The course could be faster-paced, such as taking a sixteen-week course and compressing it into an eight week course with the same amount of class times required, or to expand the format to include an individualized self-paced course. The Research Planning Group for California Community Colleges (2007) considered self-pacing when linked with computer-assisted learning. Self-pacing is defined as students working at their own pace to complete the required coursework. Computer-assisted learning would encompass instruction delivered by video via computer, problem solving using software, and other forms of tutoring based on the use of the computer. Self-pacing requires discipline, dedication, and focus. When linked with mathematics research, self-pacing shows a continuum of results from success to failure to no difference in the mathematical learning (The Research Planning, 2007).

The lack of clarity from the results of the previous studies is probably more of a consequence of the differences among the students who enroll in remedial mathematics classes than any other characteristic. Recent literature reported that community colleges are

using faster-paced remedial mathematics classes with no foundational research as a basis for this decision (Achieving the Dream, 2007). Within the developmental mathematics community, a need exists to consider placement criteria for enrolling students in faster-paced courses. This study compared student feelings of proper course placement with student factors of satisfaction with the pace of course, length of time since the last mathematics course had been taken, and the grade received on the placement test to gain insight into the placement process at this particular community college.

This study took place at a small southwestern community college with an enrollment of approximately 3000 students. This community college originated as a municipal junior college. Of the many municipal junior colleges in existence in the late 1930s, this school is one of six still in existence today. Originally, communities in this state supported municipal junior colleges with no outside funding with the purpose of educating the students at home during the first two years of college. The intent was, after completing the two-year programs, the students would transfer to a four-year institute (Balyeat, 1948). In the early years, this community college operated from the third floor of the local high school and later from the basement of the Presbyterian Church (Reynolds, 2008).

Community colleges in this state served the purpose of preparing students to attend a four-year institution (Simpson, 2003). Not until 1969 did the State Regents for Higher education recognize the need to fund this particular community college. This college still lists as its mission to provide a general education, prepare students for transfer to four-year institutions, and prepare those with a poor educational background for future employment (Reynolds, 2008).

At the community college in this study, the developmental mathematics placement process consists of several steps. Students who score less than 19 on the Mathematics subscore of the ACT test must take the Computer Adaptive Placement Assessment and Support System (COMPASS) Placement Test developed by ACT, Inc., a company that provides educational testing services (ACT, Inc., 2006). The score on the placement test places the student into one of three developmental courses. The course used for this study was the first course, Basic Mathematics. Several factors could affect student feelings of proper placement including satisfaction with the pace of the course. The current placement process was developed over 10 years ago. A few items on the mathematics placement test have changed, but the same process has been used for many years with little review or evaluation.

The Problem Statement

The problem raised in this study was that no single mathematics placement process works best for all community colleges. Previous research has shown that the placement process is crucial to the success and retention of students, but current studies have not highlighted student perceptions concerning the placement process employed at this southwestern community college. Each community college is uniquely based on its own community, making it important that this particular community college considers its students' perceptions including their satisfaction with the pace of a basic mathematics course, their feelings of proper placement, the length of time since their last mathematics course, and the score received by these students on the placement test. If a relationship exists among these components, then these factors could be used as the basis for decisions to change the placement process and the delivery of courses to increase student retention and success.

Although none of the retention models were developed for community colleges, they have been used to explain retention at this level. Tinto (1988) states in his model of college student retention that students leave college due to the lack of congruency between student factors and institution factors. In other words, certain student and institution factors will raise retention rates for students. Tinto's theoretical model uses student academic ability and motivation as they relate to the college's academic and social attributes to explain the student's commitment to persist and to meet an educational goal. For community college students, the goal may be to continue to a four-year institution, attain an associate degree, or to complete a full year of study to fulfill requirements for a specialized employment program. Tinto states the higher the desire to persist with a goal, the higher the retention. While Tinto's research used four-year institutions, other studies have used his model at the community college level with meaningful results. Mohammadi (1994) found that student attrition rates, the rate at which students leave college, were higher for non-traditional students and that the need exists to identify all known variables that might affect attrition or retention. Course placement and satisfaction with the pace of the course represent known variables that might affect attrition.

Purpose of the Study

The purpose of this mixed methods study was to describe student perceptions of the placement process used for placement of students in a Basic Mathematics course at a southwestern community college and to determine if a relationship existed between student satisfaction with placement and other factors such as pace of course and scores on the placement test. For the purpose of this study, the students were categorized as either "traditional" or "nontraditional." In this study, traditional students refer to any student in the

age range of eighteen to twenty-two years. Students older than twenty-two were classified as nontraditional. The researcher observed that students in her Basic Mathematics class showed varying degrees of satisfaction and persistence. Traditional students appeared more frustrated at repeating material that they saw as “elementary” or low-level mathematics. This study investigated the student perceptions concerning the mathematics placement process and student perceptions concerning the COMPASS Placement Test versus the department created pretest. The research compared the curriculum addressed on the COMPASS Placement Test with the curriculum addressed on the department created pretest. Lastly, the study considered the relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received in the COMPASS Placement Test. The results will be used to inform faculty and counselors concerning the placement process used at this southwestern community college.

Research Questions

The questions the study addressed were

1. What are Basic Mathematics students’ perceptions of the placement process for developmental mathematics courses?
2. What are Basic Mathematics students’ perceptions of the placement test versus the department created pretest subject matter and Basic Mathematics course curriculum?
3. How does the COMPASS Numerical Skills/Prealgebra Placement Test compare to the Departmental Pretest given to all Basic Mathematics students?

4. Is there a relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS Placement Test?

Significance of the Study

The results of this study will prove helpful for the faculty at the community college who make decisions concerning the format in which developmental mathematics classes are offered and how students are placed in these classes. Retention researchers have found that the concern for increased retention rates must be addressed by each individual community college (Wild & Ebbers, 2002). Therefore, the findings from this study may not be generalizable to another community college because of the differences that exist among the colleges. Nonetheless, other schools could consider the results of this study in assessing the possibilities for restructuring their placement process. A further significant feature of this research involves the information it adds to current research concerning retention of students in developmental mathematics classes. The study contributes to the existing knowledge concerning factors that affect retention and methods to better serve community college students and could lead to further research regarding these factors.

Delimitations

This study took place within the confines of one community college in a southwestern state. Within the college, the study took place in the first developmental mathematics class. The researcher accessed scores from the COMPASS Numerical Skills/Prealgebra placement test. In the Basic Mathematics classes, surveys were given to students from the summer semester and fall semester. Two students from the summer semester class and two students from the fall semester classes were also interviewed.

Limitations

The results of this study were limited to the community college in a rural area of the state. The community college offers three developmental mathematics courses. The course sequence is Basic Mathematics, Elementary Algebra, and Intermediate Algebra. One opportunity for acceleration exists through a class that combines Elementary and Intermediate Algebra into one course. Students may bypass developmental courses by retaking the placement tests. Only students in the Basic Mathematics course were surveyed and interviewed. Satisfaction of students in other developmental courses was not addressed. The researcher has heard both negative and positive comments from students concerning the placement process.

Definition of Terms

Developmental courses. Developmental courses, also known as remedial courses, are courses designed to prepare underprepared students for college-level classes.

Pace of course. The length of time it takes to complete a course.

Fast-pace course. For this study, a fast-pace course is defined as one that meets the same number of hours as a regular sixteen weeks course, but the course will be completed in eight weeks.

COMPASS test. A placement test developed by ACT, Inc, once known as the American College Testing Program. COMPASS stands for computer-adaptive college placement test.

Placement test. A placement test is an assessment used to determine the placement of students in developmental coursework.

Non-traditional student. For this study, a non-traditional student is over twenty-two years of age

Traditional student. For this study, a traditional student is eighteen to twenty-two years of age.

Conclusion

This dissertation was organized using the five-chapter format. The first chapter presented an introduction, background of the study, the problem statement, the purpose, the research questions, the significance of the study, the delimitations, the limitations, and terms used in the study. The second chapter addresses literature related to this research topic and provides a framework through which to view the study. The third chapter outlines the methodology of the study and discusses the research design, the participants, the setting, instrumentation, procedures, data analysis, ethical considerations, and the role of the researcher. The fourth chapter offers the results of the analysis. The fifth chapter includes the findings, the summary, and implications for future studies.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this literature review is to examine previous research as it relates to the developmental mathematics placement process. The significance of the literature review pertains to the information found that relates to this study. Therefore, the literature review focuses on the following:

1. Developmental or remedial mathematics education since these programs form part of the foundation for this study;
2. An overview of retention of students since this characteristic makes the placement process important to the institution and the students;
3. Course placement processes as considered part of the mathematics remediation program; and
4. COMPASS®, the computer adaptive college placement test used in this research.

The researcher addresses these topics from broad perspectives of developmental mathematics and retention and then narrows to a specific perspective as related to this study. Key phrases and words used for the search included college retention, persistence, community colleges, retention theory, college student attrition, factors affecting retention, pace of class, length of class, developmental education, developmental mathematics

education, postsecondary remedial education, traditional college students, nontraditional college students, college mathematics placement tests, ACT COMPASS Placement Test, and the history of community colleges. The literature review involves synthesizing the reports of literature concerning the topics listed above. Using this information, the researcher addresses the gaps in research that this study attempted to fill.

Remedial (Developmental) Education

Developmental education, also known as remediation, refers to the practice of offering college preparatory classes in a postsecondary setting for academically unprepared students. While many people might consider this a relatively new phenomenon, American colleges have offered these courses since the founding of the first college. Understanding how this study adds to prior research requires an overview of the history of remediation in the United States, the individual student factors that have been considered in an attempt to explain the need for remediation, the connection between mathematics remediation and retention, and a summary of the best practices of remedial mathematics education at other institutions. This study will consider the prior studies in developmental education to frame the research concerning the placement process at one southwestern community college.

Boylan and White (1987) describe the history of remediation in higher education in the United States as beginning with the establishment of the first postsecondary school, Harvard College. The educators at Harvard College found the first students deficient in their studies of Latin. Therefore, the students received instruction in this subject before they continued on to other areas of their education. In the first half of the nineteenth century, postsecondary education began to gain in popularity, but many students arrived

unprepared for the experience. At the time, many of the colleges were privately funded, so the only entrance requirement was the ability to pay. In these early years, most students were white, wealthy, and male, thus, the unprepared student was white, wealthy, and male. These unprepared students presented a dilemma for college educators who attempted to set high standards for college entrance, but who could not turn away the tuition money provided by these students. The popularity of college attendance and the social status of achieving a level of higher education provided the opportunity for administrators to create a solution for the unprepared student in the form of college preparatory schools, the first being at the University of Wisconsin established in 1849. Within forty years, college preparatory programs became the norm (Boylan & White, 1987).

When the industrial revolution occurred, the need for a variety of educational opportunities to meet the wide range of student characteristics rose. More students needed a technical education focused on learning specific skills. This movement led to the development of more technical skills and higher educational levels for the nontraditional student. While these students did not meet the criteria for general, four-year college admissions, they represented a segment of the American public requiring postsecondary education. Another segment of the population requiring post-secondary education was the African-American community. At this time, postsecondary African-American education programs consisted of a large number of remedial classes. Due to the lack of comparable opportunities as experienced by their white counterparts, the African-American students arrived on campus unprepared. The educators at these schools developed remedial education courses to assist the advancement of the African-American

population. Women represented still another facet of society who sought a post-secondary education. The era's dominant population of white males viewed women as incapable of performing well at the postsecondary level. The fact was that discriminatory practices at the secondary level left many women unprepared for the rigors of a college education. Because of the large number of underprepared students, remedial education was firmly ensconced in postsecondary education through these facilities and the college preparatory programs. The college preparatory program would still be in existence in most four-year institutes today if two-year institutions had not offered a more cost-effective alternative to these programs (Boylan & White, 1987).

At the end of World War II, many veterans took advantage of the Veteran's Adjustment Act of 1944. The services provided for the veterans mirrored many of the programs considered as part of the modern day comprehensive developmental education programs. Enrollment grew tremendously during this time, but colleges did not want to turn away veterans and thus admission standards varied. However, the baby boom generation created such a huge population of college students that universities tightened admissions standards to control enrollment, which meant that many underprepared students turned to community colleges. Therefore, university remedial classes declined as admission standards increased at the four-year institutions (Boylan & White, 1987). Although remediation course offerings declined at four-year institutions, recent events have led to the need for an increase in remediation programs with the emphasis on community colleges as the providers of these courses.

Remediation programs have increased in recent years, but the process that led to the increase appears to be another phenomenon of the baby boom generation more than a

decline in the educational preparation of American students. Therefore, according to Boylan, Bonham, and White (1999), postsecondary educators face two paths as related to remedial education. The first path involves improving secondary education to the extent that remedial education at the postsecondary level is almost nonexistent. Although secondary education standards may increase, students still arrive at college unprepared due to life choices made by students such as dropping out, delaying the start of post-secondary education, or choosing an initial career that does not require post-secondary training. To be successful, students would still need remedial courses. The second path requires denying admission to postsecondary education institutions to unprepared students. This option defies the tenets of a longstanding American value that education should be available for all students. Instead of attempting to eliminate remedial education, postsecondary schools must embrace the opportunity to educate the entire American population. Since the students surveyed in the present study were enrolled in a Basic Mathematics course, they represent unprepared students whether traditional or non-traditional students.

In an attempt to monitor remedial education programs, the state that is the setting for this study has collected statistics on remediation efforts annually since 1991. The data were collected from the State Regent's Unitized Data System. These statistics form the foundation for the current 2009 report of remediation programs in the state. Nationwide, community colleges provide sixty percent of the remedial courses offered at the postsecondary level. In this state, the percentage is seventy-nine. Of the fall 2007 freshmen enrolled in postsecondary institutions in this state, 36.8% required remediation and 31.8% required remediation in mathematics. Of nontraditional students, 44.7%

require some form of remediation as opposed to 34.8% of traditional students (Oklahoma State Regents, 2009). The characteristic of "nontraditional student" appears to affect the level of remediation required. Traditional student status versus non-traditional student status is one of the factors considered in the survey of student perceptions related to the placement process in the present study.

To find factors that would decrease remediation rates, researchers have studied characteristics that shape the need for placement of students in remedial courses. Factors studied include, but are not limited to, environmental factors, including high school coursework, type of student, and type and size of institution. Students entering college arrive with a host of characteristics that influence the need for remediation. In a study of 1,780 first-year college students enrolled in remedial and non-remedial mathematics classes at 23 institutions, researchers found that students enrolled in non-remedial mathematics classes had several advantages over those enrolled in remedial classes. Students enrolled in non-remedial classes showed advantages in the following areas: parental income level, high school coursework, parental education, college study style, high school GPA, mathematics enrollment, high school study habits, socioeconomic status, encouragement, perceptions of teaching, and non-minority status. Each of these characteristics proved to have an effect on mathematics success (Hagedorn, Siadat, Fogel, Nora, & Pascarella, 1999). Another study used a survey to compare responses of 500 underprepared and prepared community college freshmen. The study found that the two groups varied in high school coursework, grade point average, ethnicity, degree goals, and attitudes (Grimes & David, 1999). All of these differences exist from situations encountered by the student before entering college. This study considers several prior

factors including length of time since the last mathematics course and the grade received in the last secondary mathematics course.

By studying the history of remedial courses, one sees a positive effect on retention resulting from remediation of students, especially in mathematics. In a study of 29 community colleges and technical programs, Gerlaugh, Thompson, Boylan, and Davis (2007) collected data that showed a correlation between the number of students who passed developmental courses and their rate of retention. Another study at Utah Valley State College researched freshmen cohorts over a three-year period that included over 7600 students. The research showed that as the number of remedial classes a student needed to take to gain enrollment in on-level courses increased, the dropout rate for that student increased. The area in which students need remediation is mathematics. In Hoyt's (1999) study, 44% of the students required courses in remedial mathematics. Therefore, it would seem that the number or the kind of remedial mathematics courses a student is required to take has an effect on his or her retention rate. A further study of six freshmen cohorts revealed that having taken remedial mathematics courses increases the chance that the student will be successful in college algebra (Oklahoma State Regents, 2009) and thus, this success affects retention rates. In a study of 85,894 students at 107 community colleges, Bahr (2008) compared the college-level mathematics outcomes in terms of achieving success in college mathematics coursework between remedial students and non-remedial students. He found that both groups achieved success at the college mathematics level. These studies reflect the influence that the placement process used to place students in remedial mathematics courses has on the retention rate of those

students. To achieve this success, research has shown that certain practices in remedial mathematics courses have proven more successful at increasing retention rates.

Several researchers have written papers summarizing the information gleaned from years of research concerning best practices in developmental education. As stated in the definitions, developmental education includes all of the services related to remediation. For the purpose of this study, the researcher considered only those practices related to developmental mathematics and retention rates. Best practices in remediation addressed several factors that affect remediation. For remedial programs to be successful in helping students, they (the programs) must include requiring mandatory assessment and placement, supporting developmental education throughout the entire institution, and employing a comprehensive approach to developmental education. Other suggestions by the same research consisted of providing constant orientation and support activities, enforcing strict attendance policies for remedial classes, disallowing late registration for developmental classes, providing professional development for developmental instructors, encouraging the use of a variety of classroom assessment techniques and providing more avenues for the students to pass the course (Boylan, Bonham, & White, 1999).

Other research stressed the need to help students develop an intrinsic desire to succeed since many developmental students lack this quality (Reynolds, 1997, 2003). Hunt (1997, 2002) reiterated the need for mandatory placement and mandatory assessment while McClory (1997, 2002) followed this with the student's need to master each unit of study. A veteran instructor of developmental mathematics courses at a community college, Moon (1997, 2002) stated his observations paralleled some of the

findings of Boylan. Through his teaching, Moon discovered that attendance must be required, class sizes must be small, mastery of each section is required, and a base of knowledge must exist for students to be successful. Roueche, et al. (1968, 1973), promoted the importance of mastery learning. This study listed structure and varied teaching methods as best practice for remediation (as cited in Boylan & Saxon, 2005). According to Cross (1976), only 10% of students needing remediation will reach their goals if the students are not offered the appropriate remedial coursework. The synopsis of best practices in developmental education leads to the importance of finding which best practices work best for individual institutions. The research addressed in this study was designed to lead to a method of finding best practice for this community college concerning the placement of students in the first developmental mathematics course.

When considering best practices, instructors and researchers have contemplated the effects of self-efficacy. Bandura (1995) defines self-efficacy as a person's belief in his capability to create a plan and execute the measures associated with the plan. In a study of 350 students, Pajares and Miller (1994) found that self-efficacy affected student mathematics performance more than any other factors including prior experiences in mathematics, level of secondary mathematics courses taken, and mathematics anxiety. Pajares and Miller theorize that self-perception influences mathematics students through initial participation, persistence, and thought patterns associated with the activity. Students who have had success in mathematics willingly participate in the courses. By achieving success in mathematics courses, students build the desire to persist and think positively concerning their abilities related to mathematics. Conversely, students who have not enjoyed mathematics are more likely to choose not to persist due to negative

thought patterns all related to self-efficacy. Furthermore, students placed in remedial coursework already have at least one negative event associated with mathematics the placement test score that placed them in developmental mathematics.

More non-traditional students require remediation than traditional students (Oklahoma State Regents, 2009). As the goal of higher education goes from developing well-rounded citizens to producing workers strong in processing skills, students with weak mathematics backgrounds will find it harder to enter four-year institutions and attain jobs (Losak & Miles, 1992). Thus, the role of the community colleges in providing remedial education has a healthy future. This future requires proper placements of students to provide the best scenario for them to achieve their postsecondary goals. Thus, this research study provides information pertinent to remediation and student retention at one community college. The plan used provides the framework for other community colleges to assess their own programs. The study is framed within the research of retention, which is affected by remedial education. When analyzing the retention rates of community colleges, administrators and faculty agree that the relationship of remedial classes to retention deserves special consideration (Bailey & Alfonso, 2005).

Retention

Recent news stories have linked completion of post-secondary education with providing hope for a stable future of the general American population. According to these reports, rescuing an ailing economy includes the support provided by community colleges and the efforts they make at increasing retention rates. Community colleges provide the most economical opportunity for retraining America's unemployed citizens. However, students seeking training must meet their own goals of completing a program of study to

be successful. Retention rates are used as an indicator of the success of a community college in helping students reach their goals. What exactly are retention rates? To address the dimension of retention at postsecondary institutions, the following topics will be considered: the definition of retention for universities and community colleges, a brief history of retention in community colleges in the United States, theories of retention, an overview of remediation as it relates to retention and a discussion of ways the issues of retention relate to this research.

Just as each higher education institution has its own unique characteristics, so, too, do the issues related to retention rates at each institution vary accordingly. The definition of "retention" for four-year institutions does not pose the same problem in understanding as it does in community colleges. Four-year institutions have missions that focus mainly on the education of the individual student, and retention at these institutions is defined simply as the rate at which students finish a bachelor's degree within the requisite six years (Seidman, 2006a). Using this same definition for community colleges would mean the rate at which students finish an associate's degree in three years. However, community colleges have mission statements that encompass providing classes for the community, classes for work advancement or enhancement and classes for students who choose to continue their education at a four-year institution after attending the community college for one year (Mendoza, Mendez, & Malcolm, 2009). For this reason, the definition of retention at community colleges must differ from that of four-year institutions. Each community college should create its own definition of retention that encompasses the factors that identify the uniqueness of that institution. A good starting point for defining retention for a community college would be to consider the rate

at which the students completed their goal – associates degree, going on to a four-year program, attaining class credits for job advancement - in a timely manner (Mohammadi, 1994; Wild & Ebbers, 2002). Interestingly, the need for a definition of retention has not always been a consideration for higher education as related by the next section on the history of retention.

Seidman (2005) describes the history of retention in higher education in the United States as evolving through nine eras. See Table 1 for a list of events leading to today's community college profile. These periods span about four hundred years. In the early history of higher education in the United States, no one considered retention to be a problem because graduation was not an issue. Students studied to learn, not to achieve a grade or a diploma. These students became lifelong learners as they left the institutions mainly to become pastors. This "Retention Prehistory" period lasted about three hundred thirty years until the mid-1850s (Seidman, 2005). Between the 1850s and 1900s, higher education began to edge toward the need for the concept of retention. Students began to consider degree attainment as a worthy goal, extracurricular activities as defining the person and the rejection of authority's rules as a type of "bonding" activity. While researchers might see the encouragement of these actions as methods to increase retention, the idea was neither well defined nor tracked. At about this time, the Morrill Land Grant Colleges Act created at least one land grant institution in every state. Even though this act created numerous universities, postsecondary enrollment nationwide actually declined (Seidman, 2005).

From the 1900s to the 1950s, educators considered methods to increase enrollment, saw increased enrollment due to industrialization, and began to recognize the

need to consider student retention rates. College degrees became a mark of distinction and the concept of attrition, closely related to retention, emerged as a mark of an elite institution. Student failure was a form of success. Higher attrition rates were an indicator of the rigor of the university. In the 1930s McNeely conducted the first study of what was termed student mortality rate. This study is considered the first study related to student retention. During this time period, junior colleges, now known as community colleges, began and this state became one of the first states to promote junior colleges (Simpson, 2003; Vaughan, 1995, 2000). Oddly enough, in 1938, seventy percent of the students in this state's junior colleges transferred to four-year institutions (Simpson, 2003). One of the few colleges that tracked retention was a junior college that recorded a retention rate of 25% in 1928.

The G.I. Bill and the launch of the Sputnik triggered the National Defense Act of 1958 and the Higher Education Act of 1965 which caused Americans to view a college education as an attainable goal during the time of "Dealing with Expansion" (Seidman, 2005). Whether to better themselves or the nation, attaining a college education was in vogue and colleges experienced increased enrollment. Community colleges saw their purpose as one of preparing students who lacked a strong educational background to successfully attend and graduate from a four-year institution (Simpson, 2003).

During the 1970s, student enrollment was no longer increasing at postsecondary institutions. College administrators looked for ways to increase enrollment and the real importance of retention emerged. Retention became a statistic used as a measure of success. At first, educators only considered what psychological factors caused student attrition. Student attrition rate is defined as the rate at which students leave an institution.

Table 1

History of Student Retention in the United States

Period title	Time period	Events
1) Retention prehistory	(1600s – mid 1800s)	• Graduation from college not an issue, so retention not relevant
2) Evolving toward retention	(mid-1800s – 1900)	• Degree attainment begins • College student lifestyle develops
3) Early developments	(1900-1950)	• Industrialization Increases enrollment • McNeely's initial study of student "mortality rate" • First junior colleges • Attrition rates a sign of college rigor
4) Dealing with expansion	(1950s)	• G.I. Bill • Launch of Sputnik • College education becomes mark of distinction
5) Preventing dropouts	(1960s)	• Community colleges gain importance as educators recognized the need for remedial education
6) Building Theory	(1970s)	• Enrollment levels no longer increasing • Retention theories emerged as colleges began to focus on ways to increase graduation rates
7) Managing enrollments	(1980s)	• Retention research escalated as colleges saw students as consumers of education
8) Broadening horizons	(1990s)	• Variety of ideas for retention implemented
9) Current and future trends	(early twenty-first century)	• Research involves individual plans for each institution

Note. Seidman, 2005

The emphasis on retaining students was on factors that predicted a student's success in attaining a degree. Spady introduced the first theoretical model concerning interaction of factors leading to retention (Seidman, 2005). This model served as a forerunner to Tinto's first model that led to his Interactionalist Theory of Retention conceived during the "Building Theory Era." Other theorists of this time included Astin with his idea that involvement increased retention and Kamen who theorized that the larger more prestigious institutions offered a better social climate that decreased student attrition (Seidman, 2005).

The next period of "Managing Enrollment" increased the need for research in retention as strategists looked for best practices in retention. During this time, various campus strategies such as freshman enrollment events evolved as ways to increase retention. Over the last two decades, research to increase retention has flourished as institutions used many strategies in an effort to implement retention plans. Researchers in the "Current Trends" phase of retention now suggest creating individualized plans for each institution as administrators recognize the importance of the uniqueness of each college setting (Seidman, 2005). A need exists for the state in which the study took place to encourage these individualized plans concerning retention since this state ranks fourth from the bottom in retention in a comparison with other states. The state's average retention rate for two-year colleges is 43.9% while the national average is 51.8% (NCHEMS Information Center, 2009).

Research on retention relies heavily on the retention models of Tinto (1987), Bean and Metzner (1985) and Astin (1984) (as cited in Seidman, 2005) although none of the models was developed for the community college setting. Early research by Spady

(1971), McNeely (1937), and Summerskill (1962) attributed attrition to many factors such as personality characteristics, the size of the institution, and the time necessary to complete the degree (as cited in Seidman, 2005). Tinto's Interactionalist Model has been the model used for numerous studies most notably by Braxton (1997) who empirically tested the fifteen factors proposed by Tinto. Using this model, Tinto theorized that the interaction of precollege factors, along with goals and commitments and current college social and academic factors, integrate to affect retention (Hoyt, 1999). Bean and Metzner's model focuses on organizational characteristics that influence student satisfaction and thus retention. This model addresses environmental factors that affect the retention of non-traditional students rather than academic factors (Bailey & Alfonso, 2005; Seidman, 2005; Seidman, 2006a). Astin's Theory of Involvement states that students involved in academic and social aspects of college have a higher retention rate (Seidman, 2006b; Seidman, 2005).

Since the purpose of this study is to consider student perceptions of different aspects of the placement process that involves students and to examine the relationship between student feelings of proper and improper placement and satisfaction with pace of class, this research follows a combination of Tinto's Interactionalist Model and Astin's Model, which stresses student involvement. The researcher has taken into consideration the fact that none of the models previously discussed was developed for the community college setting (Bailey & Alfonso, 2005).

Research related to retention evolved through decades of observations of student attrition. Hopes of increasing retention rates initiated much of the research reviewed for this study. The research included remedial education as an area that affects retention. In a

study of three consecutive freshmen classes at a state community college, Hoyt (1999) found that high remediation rates have a negative correlation with retention rates. The research showed that the majority of students who tested into three different developmental areas were not retained. For community colleges, this poses a problem given that, traditionally, one of the missions of community colleges includes preparing the underprepared student for academic success at the college level. Correct placement of students affects student success in the developmental courses. Therefore, the next section addresses research concerning the course placement procedures.

Course Placement Procedures

Placement policies play an important role in the success or failure of a developmental education program and can then have an effect on retention rates. Hoyt (1999) conducted research that showed a negative relationship between students enrolled in at least three developmental areas and these students' retention rates. On the other hand, Gerlaugh, et al. (2007) found a positive correlation between passing remedial coursework and retention rates. The method an institution uses for placement can affect the retention rate of the school.

The purpose of a placement policy is to direct students to a beginning course that allows for success in the overall sequence of coursework in that subject matter. To allow for this guidance, the majority of community colleges in the United States have mandatory placement assessments (U.S. Department of Education, 2003). The schools may use standardized placement tests such as the COMPASS, developed by ACT, Inc., used at the community college in this study, or the schools may create a placement test for their own department. Schools using a standardized test have the choice of using the

cutoff scores provided by the testing company or cutoff scores determined by the institute to place students in developmental courses. The expectations for the COMPASS Placement test are addressed in the next section. Many community colleges stop the placement process at this point and use only the score on the placement test. This placement procedure is the least costly to the university in terms of immediate cost and processing enrollments in a timely manner. However, in terms of student success, this practice could increase attrition as students become discouraged with the added coursework.

For testing companies, though, this practice is optimal. The COMPASS testing guide states "The key to helping students achieve academic success is how to use their COMPASS scores to place them in the most appropriate mathematics courses" (ACT, Inc., 2007). However, research on placement processes show that multiple measures are most effective in properly placing students. Many studies have been conducted that show that the use of multiple measures provide for better placement accuracy. Measures used include placement test scores, high school grade point average, grade in the last high school mathematics course taken, the high school mathematics course sequence and the number of years since the last mathematics course taken. The last four were better predictors of success than the placement test scores (Armstrong, 2000; Marwick, 2002).

The American Mathematics Association of Two-Year Colleges (AMATYC) advocates that each school develop a placement procedure tailored to the institution. The position of AMATYC states

> "A college placement team, led by faculty from the mathematics department, should develop policies and procedures to be used for the placement of all two-

year college students entering the mathematics curriculum. These procedures should be applied equitably to all students and use an analysis of multiple measures, which may include:

- High school and college records
- Scores on college entrance examinations
- Scores on placement tests

In addition, student success can be impacted by less quantifiable factors such as motivation; family and work obligations; special student needs; and educational, career, and personal goals. These may also be factors to consider. In all cases, the placement team should make the final decision regarding placement based on an analysis of multiple measures" (AMATYC, 2007, para. 2)

For schools using multiple measures, the typical placement process involves student admission, placement testing, and student self-report of high school grade point average, grade in the last mathematics class, the number of years since the last mathematics class, and high school mathematics course work completed. The student then meets with a counselor who enrolls the student (Marwick, 2002). This course placement may be required or recommended.

This study focused on a community college that has mandatory placement in developmental courses based on placement test scores. Schools that use a mandatory placement procedure must make sure that the placements are valid (Hadden, 2000). Improper placement can result in two possible outcomes. Students can be placed in courses that do not challenge them, or they can be placed in courses that are too challenging. In the first scenario, the student could become bored resulting in skipped

classes with the possibility of failure in the course. In the second, the student could be overwhelmed with the coursework and drop out of college completely (Askt, 1991). When considering placement in remedial courses, institutions must recognize the costs in time and money associated with improper placement.

In developing a placement process, schools must consider the characteristics of students at their institution and the individual characteristics of each student. Post entry characteristics fall into the categories of social and academic integration. In a retrospective study of 9400 community college freshmen, Fike and Fike (2008) found that academic integration factors of success in developmental reading and developmental mathematics classes, taking an internet course, and semester hours attempted in the first semester positively affected retention rates. In a four-year longitudinal study of community college freshmen, Mohammadi's (1994) findings support the link between semester hours attempted and retention. This information points to the efforts of underprepared students to make up time lost by meeting remedial requirements. High placement test scores proved to be indicators of retention in two studies (Etheridge, 2000; Cofer & Somers, 2000). This could be due to the idea that higher placement test scores mean less remediation and a faster progression through the required coursework. This information gives credence to the idea that students need to move through the remedial classes at a faster pace.

In a study at a western community college that tracked three freshmen classes from 1993 to 1995, Hoyt (1999) used logistic regression to gain more insight into the relationship between remediation and persistence and, thereby, retention. Hoyt found that, as a student required more remedial classes, the probability of that student being

retained at the college decreased. At the community college that is the setting for this study, students initially placed in the Basic Mathematics course must complete three semesters of mathematics to reach the first college-level mathematics class. Students may attempt to take another placement test to skip the next level of developmental mathematics, but very rarely do students score highly enough on the placement test to skip the next class. According to Hoyt's research, the students enrolled in this type of class have a higher risk of dropping out. While research shows that remediation in mathematics increases success rates in college algebra (Oklahoma State Regents, 2009), consideration must be given to the amount of time spent to complete the goals the student has set.

To encourage students to meet their goals and complete their programs in a timely manner, students must feel empowered by the choices they make and their experiences with the pace of the class. Surveys exist to measure satisfaction with many aspects of college life including the impact of the institution, faculty, instruction, involvement, schedules, and assistance provided. However, this researcher found no research related directly to satisfaction with the pace of a developmental mathematics class and retention. A few reports indicated that some colleges are experimenting with a variety of courses that are offered in varying formats and time frames. For instance, Mountain Empire Community College in Virginia offers two faster-paced courses for students who score near the cutoff score on the mathematics placement test. Placement of students in these faster-paced courses requires passing Algebra I in high school, score on the placement test and faculty permission. The course offerings occur once each semester and allow students to complete the requirements for two developmental mathematics courses in one

semester. In a regular sixteen-week semester, the first course will take five weeks and the second course will require ten weeks. If students succeed in these courses, they receive three credits for both classes (Achieving the Dream, 2007). However, no research studies have shown the effectiveness of such a program. Satisfaction with the pace of a class and changing the pace of a developmental mathematics class both present areas for research.

COMPASS Placement Test

While many factors affect retention, Hoyt (1999) found that the success of a student in the first semester had a strong correlation with retention. Therefore, proper placement in the first semester becomes crucial to retention. As discussed, proper placement procedures should include but not be limited to placement testing. Since the COMPASS test has been shown to predict proper placement (Donovan & Wheland, 2008), the community college in this study uses this placement test to satisfy mandatory placement into developmental classes as required by many states including the state in this study (Achieving the Dream, 2005). This section of the literature review addresses research concerning the COMPASS test and the importance of aligning placement tests with course curriculum.

The COMPASS Placement Test was developed by ACT, Inc., with initial meetings occurring between 1985 and 1989. General specifications for tests were set and the original advisory panels began in 1990. The first technical and content specifications for questions were developed by these advisory panels. The first members of the advisory panels, college faculty, counselors, and testing staff from higher education institutions, met with ACT staff to develop what is now known as the COMPASS Placement Test (ACT, Inc., 2006).

If used extensively, the comprehensive COMPASS system includes placement testing, evaluation of the test scores, diagnostic testing and data for use in institutional reports. The COMPASS manual lists the following as uses for the system:

"Placement testing

Skill diagnosis and related instruction support efforts

Supplemental placement testing

Parallel use with other assessment information

Educational progress and exit testing

Comprehensive self-contained assessment

Entry-to-exit tracking and reporting

Early intervention and enrollment advising"

(ACT, Inc., 2006, p. 2)

The COMPASS placement system has two types of mathematics tests – the placement test and the diagnostic test. The placement test is used to produce placement scores in one of five domains. These five domains are Numerical Skills/Prealgebra, Algebra, College Algebra, Trigonometry, and Geometry. The diagnostic test offers more in-depth information about individual student skills. The community college in this study uses only the placement test. While the COMPASS manual indicates that the two tests are distinct, the manual also states that the Numerical Skills/Prealgebra test contains seven diagnostic divisions. These divisions are basic operations with integers, basic operations with fractions, basic operations with decimals, positive integer exponents, ratios and proportions, percentages, and averages (ACT, Inc., 2006). This study considered these divisions as they correspond to the Basic Mathematics curriculum.

The COMPASS Placement Test is a computer adaptive test. A computer adaptive test allows for changes in item selection, test administration, and test scoring according to the institution's goals and the individual needs of the student. Computer adaptive tests are designed to quickly assess students for optimal placement in a timely manner. Due to the adaptive nature, each student could receive a different test. The process of testing involves choosing a starting point for students. For unprepared students, the initial domain should be pre-algebra, but for students who have had exposure to beginning algebra, the suggested initial domain is algebra. The COMPASS test allows for the same calculator usage guidelines as the ACT. These guidelines are only useful if students know them before testing and are informed of the importance of the placement tests (Hoyt, 1999). This study determined if this practice was being used at the community college in this study. The manual suggests that the control of these decisions should be given to the individual institution. The site administrators have flexibility in choosing length, precision, and range of content. Cutoff scores may be set using expert judgment of the instructors at the institution, cutoff scores of similar institutions, or local, regional, or national norms (ACT, Inc., 2006).

The COMPASS mathematics placement test is comprised of about 1200 test items. The sources for these items are uncirculated items from the ACT Assessment Program, ACT test item pools and items specifically written for the COMPASS. The items have been tested for content validity and have been externally and internally reviewed for fairness, sensitivity, and soundness. The tests have placement validity, which is defined as the percentage of students who were correctly placed given the chosen cutoff score. The test has been checked for predictive validity that involves the

correlation between the test scores and successful completion of the course advised for the student (ACT, Inc., 2006). Point-to-point theory states that predictive validity is increased as the skills measured on a test correspond more closely to the skills needed for success in a course (Asher & Sciarrino, 1974). This implies the need for a close analysis of the test subject matter and the curriculum covered in the Basic Mathematics course.

As ACT recognizes, four possible placement outcomes exist when using the COMPASS. These outcomes are that 1) the student will be properly placed and successfully complete the course, 2) the student will be properly placed and fail the course, 3) the student will be improperly placed and successfully complete the course, or 4) the student will be improperly placed and fail the course. (ACT, Inc., 2006; Ruiz, 2007) The purpose of using the placement test is to increase the percentage of students who fall into the first and fourth categories. Correctly predicting the success of students in the prescribed math course is a matter of concern for community colleges. While the placement test is important to proper placement, the use of multiple measures may prove to increase the percentage of students who are placed properly.

Summary

The emphasis placed on remediation and retention for assessment of effectiveness of postsecondary education gives false credence to the idea that no gaps exist in the research related to these two areas. In a quantitative study of 27,816 students at sixty-five four-year institutions, Schreiner (2009) found a positive relationship between satisfaction and retention. However, Schreiner's satisfaction survey did not include satisfaction with the pace of the class as defined in this study. Researchers have studied self-paced classes, but no research concerning the effects of the pace of class on retention exists. This literature

review points to the importance of gaining the student's perception when considering proper placement procedures. The methods used in this study to gain insight into this community college's placement program will prove useful to other schools as they consider the possibility of increasing the percentage of properly placed students

CHAPTER III

METHODOLOGY

The purpose of this mixed methods study was to describe student perceptions of the placement process used for placement of students in a Basic Mathematics course at a southwestern community college and to determine if a relationship exists between student satisfaction with placement and other factors such as pace of course. Qualitative data was collected and analyzed to gain insight concerning student perceptions of the testing process, preparation for testing, information concerning testing procedures, proper placement and placement test subject matter compared to course curriculum. Quantitative data was collected and analyzed to compare feelings concerning placement with student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS Placement Test. Data was collected from students in an eight week Basic Mathematics course and from students in a sixteen-week Basic Mathematics course. The data from the two classes concerning satisfaction with pace of course was compared. This third chapter addresses the research design as well as procedures used to collect, analyze and interpret the data. This study focused on the following research questions.

1. What are Basic Mathematics students' perceptions of the placement process for developmental mathematics courses?
2. What are Basic Mathematics students' perceptions of the placement test versus the department created pretest subject matter and course curriculum?
3. How does the COMPASS Numerical Skills/Prealgebra Placement Test compare to the Departmental Pretest given to all Basic Mathematics students?
4. Is there a relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS Placement Test?

Research Design

Since the data gathered for this study included student perceptions and analyzing relationships between factors, the researcher chose a mixed methods design. Qualitative data is better suited for investigating perceptions while quantitative data provides the avenue for analyzing relationships between factors. The study attempts to give a clear illustration of certain aspects of the placement process for Basic Mathematics students at this community college. Along with this illustration, the researcher attempted to gain information that will help increase proper placement for these students. Therefore, the qualitative research had the purpose of exploring student perceptions of the placement process while the quantitative research revealed any relationships that existed between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the Compass Placement Test. The quantitative research was also used to explore differences between fall versus summer and traditional versus nontraditional student responses.

The researcher chose the mixed methods design as explained by Creswell (2009). According to Creswell, using quantitative and qualitative data at the same time results in a more powerful study than either one separately. Creswell states that both methods are used to gain increased understanding of the phenomenon in question. For this researcher, using both methods allowed insight into student perceptions while allowing for the exploration of relationships between these perceptions and the student factors. More emphasis was placed on the qualitative portion of the research due to the emphasis of the research on the student perception of the placement process.

The qualitative study involved a case study framed in an interpretivist paradigm. The case study included results from a survey that solicited students' perceptions concerning the placement process and interviews conducted with four students after the survey. In the paradigm of interpretivism, the researcher finds many constructed truths. Reality depends on the view of the participants. The interviews were used to gain further insight into student views concerning the placement process. According to I. Seidman (2006), researchers use interviews as a way of showing the views of individuals concerning their experiences. In this study, constructed knowledge combined the views of the participants and considered each student's view separately.

Participants

Students from the one summer course and three fall courses of Basic Mathematics were asked to participate in the survey for this study. Eighty-two students responded to the survey. Students who responded to the survey reported general demographic information, such as age and gender, and information specific to this study, such as length of time since their last mathematics class. Based on responses to the survey

concerning the placement process and placement test, four student respondents were chosen to participate in an interview session. One traditional student and one nontraditional student were chosen from each semester, two from the summer semester and two from the fall semester.

The demographic data collected from students taking Basic Mathematics at the community college provided a description of the general respondents. Of the 82 respondents, forty-four were traditional students between the ages of 18 and 22, and thirty-eight students were non-traditional, over 22 years of age. Thirteen of the respondents were from the summer semester. Sixty-nine students from the fall semester responded. Certain group descriptors stood out from the rest. For instance, 76% of the respondents were females. Yet, the general population at the community college is 67% female. Students between the ages of 18 and 24 comprise 63% of the community college that compared to 61% of the respondents within this age range (Higher Learning Commission Self-Study, 2009). The mean mathematics COMPASS Placement Test score for respondents was 30 and the median was 28. 5. The range of scores was 17 to 61. The community college in this study uses a score of 46 or less to place students in Basic Mathematics. Sixty percent of all respondents were unemployed. Sixty-one percent of the nontraditional respondents were unemployed. Sixty-seven percent of the students planned to transfer to another university after completing goals at the community college. Eighty-three percent of the students attended school full-time. Seventy-five percent of traditional students reported receiving a “C” or better in Algebra II. Thirty-two percent of the traditional students responded that they successfully completed a mathematics course during their senior year of high school. Seventy-one percent of all students reported that

it had been more than a year since the last mathematics course taken. Appendix A contains a table that gives the demographics of the respondents based on count and percentage.

Based on responses to the survey, the researcher contacted four interviewees who had expressed concerns with the present system of placement. Only traditional versus nontraditional, summer versus fall enrollment, and responses to the survey factored into the selection process. Gender was not a factor. That all four respondents were female was probably a result of the high percentage of females enrolled in the courses. The interviews took place in a vacant classroom on the campus of the community college in this study. When contacted, all four students seemed eager to be interviewed and ready to give their view of the placement process. The students were given fictitious names to protect their identity. The interviewees were Judy – a summer semester nontraditional student, Gina – a summer semester traditional student, Mary – a fall semester nontraditional student, and Kara – a fall semester traditional student.

Judy, the summer nontraditional Basic Mathematics participant, came to the interview early and was ready to talk. She appeared to be in her forties, had blond hair, blue eyes, and wore blue jeans and a blue jean jacket. During the interview, she shared a little of her past and her plans for the future. She has attempted several times to complete her education, but she has not been successful. She plans to be a Special Education teacher. The only placement test she was required to take was mathematics. Her interview responses revealed that she has learned to evaluate her own actions and needs. This was shown in her response to the researcher's query concerning her intent to take Basic Mathematics. She responded, "I didn't want to, I needed to." She plans to earn her

"associates in the event that I get side-tracked again." In discussing her future, Judy appeared to be a person who has realized that life circumstances may change the path to the goals she has set.

Gina was a traditional, summer, Basic Mathematics student. She was a stylishly dressed, medium build African American. Her first comment had to do with the placement test, and she was prepared to share. As the interview progressed, it became apparent that she felt that having an attendance policy for a college course was demeaning. The fact that she was required to attend a zero-level class fueled a rebellion in her that she felt eventually resulted in her failure in the course. Gina took the English and mathematics placement tests. She placed into Developmental Reading and Basic Mathematics based on her scores. On the third attempt, she passed Basic Mathematics. During her junior year of high school, she took Algebra II, but she did not take mathematics during her senior year of high school. She is a Business student and plans to get her master's degree.

Mary was a nontraditional, fall, Basic Mathematics student. She had grayish blonde hair, was medium build, and appeared to be about 55 years of age. During the interview, she revealed she was closer to 65. As the interview evolved, it became apparent that Mary had an agenda in mind. Mary dropped out of school when she was in tenth grade to work for her family. She eventually received her G.E.D. In her lifetime, she has adopted eleven children and lost two of her own. She took placement tests for English, mathematics, and reading. She placed out of developmental English and reading, but scored two points below the cutoff score for mathematics. As an older adult with her life experiences, she was adamant that older adults should be treated differently. She

plans to get her bachelor's degree in sociology. Her career plans include becoming an advocate for Native American children born with Fetal Alcohol Syndrome and drug abuse disorders. According to her statements, she wants the degree to go along with the work she has been doing for the past 25 years. She admits to receiving training over the years, but no college credit for the coursework she has completed. She loves to help others and states, "I've got one lady here in math that this is her second time taking basic math because she don't get it and I've been working with her. . . I've got tricks that . . . us old folks know."

Kara was a traditional, fall, Basic Mathematics student. She exuded youthful enthusiasm when we finally met after three attempts. She was a dark-haired, brown-eyed American Indian dressed in casual attire, jeans, and a sweatshirt. This was Kara's first semester of college as she had just graduated from high school in the spring. She took two tests in English and mathematics. She is learning that she needs to be in control of her college experience which is evident through such comments as "I kind of wish I was in a higher math because it puts me behind now in school" and "I have to take summer classes." Her last mathematics course was Algebra II during her junior year of high school. She blamed her poor performance on the placement test because she did not take a mathematics course during her senior year and expressed a desire that a refresher course had been offered before testing.

Setting

The Basic Mathematics course is the first course of three developmental mathematics courses offered at this community college. Before being placed in the Basic Mathematics course, students participated in a placement process. If a student had not

taken the ACT or scored below a 19 on the mathematics subscore on the ACT, the student was supposed to take the Computer Adaptive Placement Assessment and Support System (COMPASS) test. Student placement in a mathematics course depends on the placement test score. A student could be placed in Basic Mathematics, Elementary Algebra, Intermediate Algebra, College Algebra, or Trigonometry based on this test score. The Basic Mathematics course is the first of three developmental courses that students take before taking a college-level mathematics course. The use of a calculator is permitted on the COMPASS test. Students may take the placement test more than once and advance to the next level of mathematics if the new score is high enough. The placement test scores of students enrolled in Basic Mathematics placed them in the lowest possible mathematics course.

The course is designed for students with little or no knowledge of mathematics, and is not intended as a refresher course. According to the American Mathematics Association for Two-Year Colleges, developmental mathematics courses should equip students with the mathematics necessary to fulfill their goals, progress students through the curriculum in a timely manner, allow students to develop problem solving techniques and help students learn methods of dealing with mathematics anxiety (Blair, 2006). This particular course equips students and aids them in developing problem solving skills. Unless the individual instructor deems it necessary, students do not learn coping techniques for mathematics anxiety. The length of the semester determines the length of the class. Specific goals for the course do not include progressing students through the curriculum quickly. Students at this school may retest to skip a course in the sequence of developmental mathematics courses. However, research shows that it is not advisable to

allow placement testing for class advancement once the student begins coursework (Geraci, 2008).

The Basic Mathematics course was designed for students with no prior knowledge of mathematics and is therefore classified as a remedial course. Although the course is not for credit, it is listed as a three-credit course. Students must receive a C or better to progress to the next course, Elementary Algebra. During a sixteen-week semester, the students meet two and a half hours per week. In the eight week course, students meet five hours a week. The content includes operations with whole numbers, fractions, decimals, percentages, and integers taught using a traditional lecture approach. The summer adjunct instructor was a science instructor enlisted to teach the summer course due to a lack of available mathematics instructors. The fall instructor served at the community college as a mathematics instructor and coach. The students receive a small amount of exposure to skills based equation solving with proportions. Participants included students enrolled in this course during a summer session and fall session.

In this Basic Mathematics course, students take a pretest on the first day of class. By consensus of the mathematics faculty, students are not allowed to use a calculator in this course. On the first day of class, the instructor presents the syllabus with the course offerings. For most students, this is the first time they see the objectives of the course. After this first introduction to the course, students may begin to form an opinion concerning the COMPASS Placement Test. The posttest for the course is embedded in each test given throughout the course of the class. The final exam for the course is generally not comprehensive.

The other two courses in the sequence, Elementary Algebra and Intermediate Algebra, are supposed to contain curriculum aligned for student success in College Algebra. Elementary Algebra focuses on equations, inequalities, simplifying exponential expressions, and operations with polynomials. The curriculum for Intermediate Algebra focuses on factoring polynomials, simplifying rational expressions, solving absolute value equations and inequalities, and simplifying radical expressions. Each instructor uses a different method. These methods range from strictly lecture to lecture mixed with class projects. In some classes, the students are encouraged to use a website to practice homework. However, the instructor must choose to promote the use of this homework site. No graphing is taught in the sequence of the three developmental mathematics courses. However, students are expected to know how to graph when they enter College Algebra.

Instrumentation

The quantitative data collected for this study emerged from the placement test scores and the survey given to the Basic Mathematics students. Information collected from the survey, interviews, testing manuals, course objectives, and test content served as qualitative data. The data used for the qualitative portion of the study was collected from a carefully devised survey instrument, a comparison of the COMPASS Numerical Skills/Prealgebra Placement Test and departmental pretest, and semi-structured interviews with students. The interviewer used a question guide to keep the questions focused during the interview (Seidman, I., 2006). This interview protocol is provided in Appendix C. According to Creswell (2009), one of the advantages to conducting a mixed method study is that quantitative and qualitative data can be collected at the same time.

Survey

To collect quantitative data, the survey instrument had questions concerning demographic information, satisfaction with the pace of the course, satisfaction with length of time since the last mathematics course, the last secondary mathematics course, and students' feelings of proper placement. Seven question items concerning satisfaction were scored using a Likert-type scale from 1 to 5 with 1 being strongly disagree and 5 being strongly agree. Three post-secondary developmental mathematics instructors reviewed these questions for content validity. According to Litwin (1995), content validity results when individuals familiar with the content matter of the survey review the instrument. The instructors reviewed the questions and offered suggestions for revisions of the questions based on their knowledge of the subject. The survey also contained free response questions for the qualitative portion of the study. After making the suggested revisions, a pilot survey was given to a group of Basic Mathematics students. These students discussed the survey, offered suggestions, and analyzed the survey topics. Each survey was coded for the respondent. Their suggestions are reflected in the revised instrument used for this study. A Cronbach alpha of 0.74 was calculated for the Likert-type questions to determine internal reliability of the survey.

To gain insight into student perception of the placement process, the last section of the survey contained 11 open-ended questions to prompt student thoughts. The students were asked to comment on items such as the last mathematics course taken, the length of time since the last mathematics course, perception of the placement process, and feelings concerning proper placement. Each Likert-type question also provided an

opportunity for students to explain their responses. These comments were included in the qualitative analysis. A copy of the survey is included in the appendix B.

COMPASS Numerical Skills/Prealgebra Placement Test

The COMPASS Placement Test is computerized, untimed, and allows the use of a calculator. It is also adaptive which means the test changes for each student based on the answer to the previous question. Schools may choose longer tests to achieve a more accurate placement of students (ACT, Inc., 2006). The placement test pre-algebra subscores are comprised of the following topics: "operations with integers", "operations with fractions", "operations with decimals", "positive integer exponents, square roots, and scientific notation", "ratios and proportions", "percentages", and "averages" (ACT, Inc., 2006). As currently used, the COMPASS test has been measured for content validity for all of the questions in its data bank (ACT, Inc., 2009).Although each test is different depending on student answers, the reiliabity has been determined to be 0.88 (ACT, Inc., 2006). Student scores on the COMPASS were recorded using the respondent's code.

Departmental Pretest

As an assessment instrument, the instructors at the community college created the departmental pretest several years ago. It has been used along with an embedded post-test to assess the increased mathematical knowledge of basic mathematic students. Although no documentation exists to show the validity of the test, the test could be shown to have face validity based on the information that several mathematics instructors reviewed the test when using it as a pretest. The twenty-question, multiple-choice test is scored each semester by individual instructors using a scoring machine.

Interviews

Four semi-structured interviews were conducted using a digital voice recorder. The researcher used an interview guide. Using purposeful sampling, students for the interview process were chosen based on responses to the satisfaction and free response questions on the survey instrument. Patton (2002) describes purposeful sampling as a technique used to select participants based on the purpose for the research. Respondents for the interviews were chosen based on age and responses to the survey. One traditional student and one nontraditional student were chosen from each semester. After reading each survey, surveys were separated by semester and then by traditional versus nontraditional students. Perusing the surveys, the researcher looked for respondents whose written responses raised more questions. The non-traditional summer respondent stated that she had been placed correctly in Basic Mathematics but also stated that the college should offer a course for students who did not know how to add and subtract. Basic mathematics is intended to be the course for students lacking in the basic skills such as adding and subtracting. Alluding to the finality of the placement test, the fall non-traditional student expressed embarrassment at having been placed in Basic Mathematics and wished she had been able to study for the test. The traditional summer student stated that the counselor used her ACT score for placement, so she never took the placement test. The last student chosen, fall traditional, stated that the placement test included items that she had not learned in high school. All of these responses raised questions concerning the placement process. Next, the surveys were ordered with the surveys raising the greatest number of questions first. The first respondent in each category was asked to participate in the interviews. If this respondent had refused to participate, the

next person in that category would be contacted. However, the first respondent in each category did participate in the interview process. The interview process was used for further insight into student comparison of the COMPASS Placement Test and course pretest, student satisfaction with the placement process and student perception of the placement process. Varying in length from thirty minutes to one hour, these interviews were conducted in a vacant classroom at the community college at varying times during the school week. The interviews were conducted over the course of two weeks during the fall semester.

The data collection took place over the course of two semesters. Students in the summer semester Basic Mathematics course received the opportunity to respond to the survey, as did students in three fall semester Basic Mathematics courses. After reviewing the surveys, the researcher chose two students from each semester to interview in order to clarify responses and gain further insight. In a mixed method study, as questions arise the researcher can adapt the study to answer these questions. No other data collection methods were deemed necessary. However, as the researcher deemed that certain responses needed clarification, then the interviews were adapted to show these questions.

Procedures

This research was conducted over a period of two semesters. During the summer semester, permission to conduct the research was received from both institutions. During the eighth week of the summer semester, the summer Basic Mathematics students signed consent forms to participate in the research and responded to the surveys. The consent form is included in Appendix D. Each survey was marked with a unique number to match the survey information to student information accessible through the college database

concerning placement test scores. The surveys were locked in the researcher's file cabinet for later use. During the fifth week of the fall semester, students from three Basic Mathematics classes signed consent forms and participated in the survey. At this time, interviewees were chosen and contacted. Interviews with all four interviewees were conducted and digitally recorded over a two-week period beginning the seventh week of the fall semester. After each interview, the researcher recorded descriptions and impressions in a journal. The researcher transcribed the interviews in a timely manner after each interview. After collecting this data, student responses from all the surveys were coded for the qualitative content analysis.

In qualitative content analysis, the researcher must first choose what information to analyze (Mayring, 2000). Using the survey, the researcher chose the survey free-responses as the data to be analyzed. Next, analysis rules should be set, categories for the analysis chosen, and data sorted into the set categories. In this study, the researcher used the inductive approach to set the rules and choose the categories. Each question on the survey was matched to the research questions, categories were selected based on the research questions, and data was used to form categories for use in the content analysis. Periodically, as the data was analyzed, categories were affirmed or revised. After categorizing each response, the researcher checked responses for correctness of category placement. Random responses were chosen for recoding for comparison to previous categories.

The content analysis of the COMPASS Placement Test and departmental pretest occurred over the last week of November followed by analysis of the quantitative data and coding of the student interviews. For the content analysis of the tests, differences and

similarities between the two tests led to themes used to set the categories for the analysis. The researcher examined test-making standards, the COMPASS Placement Test, the departmental pretest, and the COMPASS test manual(COMPASS, 2006) to develop the categories of purpose, authors, subject matter as related to course content for the Basic Mathematics course, standards for multiple-choice tests, placement decisions associated with the test, and administration of the test.

Data Analysis

Quantitative Data Analysis

The researcher analyzed quantitative data to determine the relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS Placement Test. The analysis was made using the Statistical Package for Social Sciences (SPSS) version 19.0 to screen the survey data. Two survey items produced data that had to be reverse coded. Before analysis, the researcher reviewed the data for data entry errors and missing information. Descriptive statistics were calculated for demographic information.

To answer the fourth question, the variables of student feelings of proper placement, satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS placement were analyzed using bivariate correlation. Because the variables were ordinal and non-parametric, a Spearman rank correlation coefficient was used to compare the variables.

Qualitative Data Analysis

The qualitative data was analyzed to determine student perceptions of the placement process and the placement test as compared to pretest subject matter. In the paradigm of interpretivism, the researcher finds many constructed truths. For this study, the researcher used content analysis to consider the written responses of students to survey questions concerning student perceptions of the placement process and placement test. Interviews provided added insight into student thoughts concerning the placement process, the testing procedure, and final determination of course placement.

The researcher explored the COMPASS Placement Test and the departmental pretest using content analysis. The analysis included sample test items from the COMPASS and actual test items from the placement test. To compare the tests, the researcher analyzed documents using the categories of purpose, authors, subject matter as related to course content for the Basic Mathematics course, standards for multiple-choice tests, placement decision associated with the test, and administration of test. These categories developed mainly through open coding of the COMPASS test manual (ACT, Inc., 2006). As with all case studies, the researcher considered emerging patterns to answer the research questions (deMarrais & Lapan, 2004).

Ethical Considerations

In keeping with adherence to school policies, the researcher will consider ethical issues at all times. The researcher is certified through the Institutional Review Board and was approved for permission to conduct the research. The researcher coded all submissions from participants to protect their identity. Participants received and signed an informed consent form about their rights and their agreement to participate.

Role of the Researcher

The researcher played an active role in all phases of this research. In the quantitative phase, she collected the data from the survey and community college and conducted the analysis on the data. In the qualitative phase, the researcher analyzed the data for emerging patterns. The potential for bias in the first phase is almost nonexistent but very strong in the second phase. The researcher's advisor and committee members served as deterrents to bias in this study.

Summary

The purpose of this mixed methods study was to describe student perceptions of the placement process used for placement of students in a Basic Mathematics course at a southwestern community college and to determine if a relationship existed between student satisfaction with placement and other factors such as pace of course and scores on the placement test. Research instruments and data analysis for each research question follow:

1. What are Basic Mathematics students' perceptions of the placement process for developmental mathematics courses? Insight into student perception of the placement process was provided in the survey, analyzed using emerging patterns, and used to conduct interviews. The interviews provided further insight into student views and were analyzed using emerging patterns.
2. What are Basic Mathematics students' perceptions of the placement test versus the department created pretest subject matter and course curriculum? Student perceptions concerning this question were found using qualitative information

collected from the survey, analyzed using emerging patterns, and used to conduct interviews. The interviews were analyzed for emerging patterns.

3. How does the COMPASS Numerical Skills/Prealgebra placement test compare with the departmental pretest given to all Basic Mathematics students? This question was measured by conducting a content analysis that compared the COMPASS Numerical Skills/Prealgebra placement test with the departmental pretest. The data was analyzed using emerging patterns.
4. Is there a relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS Placement Test? This question was measured using data collected from the survey and student transcripts. The data was analyzed using inferential statistics.

This chapter addressed the methodology used for this mixed methods study including the design, participants, setting, instrumentation, procedures, and data analysis. Chapter IV contains the data analysis results followed by the summary, conclusions and recommendations in Chapter V.

CHAPTER IV

RESULTS

This study used a mixed methods strategy to examine students' perceptions of the placement process used for assigning students to a Basic Mathematics course at a southwestern community college and to determine if a relationship existed between student satisfaction with placement and other factors such as pace of course and scores on the placement test. The quantitative and qualitative data provided an in-depth perspective concerning the research questions addressed. These questions were

1. What are Basic Mathematics students' perceptions of the placement process for developmental mathematics courses?
2. What are Basic Mathematics students' perceptions of the placement test versus the department created pretest subject matter and Basic Mathematics course curriculum?
3. How does the COMPASS Numerical Skills/Prealgebra Placement Test compare to the Departmental Pretest given to all Basic Mathematics students?
4. Is there a relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course, and the score received on the COMPASS Placement Test?

This chapter presents data collected to answer these questions. The first section addresses the results from the surveys and the interviews that correspond to student perceptions of the placement process for developmental mathematics courses. Next, results from the surveys and interviews showing the students' perceptions of the COMPASS Mathematics Placement Test versus the departmental pretest are given. Following this section, the content analysis comparing the COMPASS Mathematics Placement Test with the departmental pretest is presented. The last section addresses the

Table 2

Research Question with Corresponding Survey Item

Research question number	Research question	Survey item Number
1	What are Basic Mathematics students' perceptions of the placement process for developmental mathematics courses?	15, 16, 19, 20, 21, 23, 24, 27, 28
2	What are Basic Mathematics students' perceptions of the placement test versus the department created pretest subject matter and course curriculum?	21, 22, 23, 25, 26, 29, 30
3	Is there a relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS Placement Test?	12, 13, 14, 15, 16, 17, 18

question concerning the relationship between student feelings of proper placement and factors of student satisfaction with pace of course, length of time since the last

mathematics course, and scores received on the COMPASS Placement Test. Table 2 provides three of the primary research questions along with the the corresponding survey item.

Students' Perceptions of the Placement Process for Developmental Mathematics Courses

Survey Responses

The survey given to Basic Mathematics students as well as the interview responses provided the data used to examine students' perceptions of the placement process for developmental mathematics courses. Items 13-19 on the survey provided data and offered the following responses: "5, Strongly Agree; 4, Agree; 3, Neutral; 2, Disagree; 1, Strongly Disagree." Each of these items also included the opportunity to explain the answer. Providing this option allowed for further validation of the research (Patton, 2002). The items each had a quantitative as well as qualitative portion.

Survey quantitative items that provided information concerning student views of the placement process were items 15, 16, and 19. Item 15 presented students with the statement, "I think the placement test and placement procedure placed me in the correct course for my abilities." The results (Tables 3 and 4) to this item indicated overall agreement with this statement. The mean score for all students on this item was 3.9 with only nine (11%) students responding with disagree or strongly disagree. Fifty-nine (72%) students strongly agreed or agreed and 14 (17%) remained neutral. Of those responding neutral, three indicated through their comments that they felt misplaced by the process. Sixty-one percent of summer semester students strongly agreed or agreed on this item while 74% of the fall semester students agreed or strongly agreed.

Table 3

Correct Course Placement Associated with Student Ability, Descriptive Statistics (Item15)

Respondents	n	M	SD
All Students	82	3.9	0.98
Traditional Students	44	3.6	0.91
Nontraditional Students	38	4.2	0.97
Summer Semester Students	13	3.9	1.33
Fall Semester Students	69	3.9	0.89

Note. 5 Strongly Agree; 4 Agree; 3 Neutral; 2 Disagree; 1 Strongly Disagree

Table 4

Correct Course Placement Associated with Student Ability, by Count (Item 15)

Respondents	Strongly Agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
All Students	24 (29%)	35 (43%)	14 (17%)	8 (10%)	1 (1%)
Traditional Students	7 (16%)	20 (45%)	11 (25%)	6 (14%)	0 (0%)
Nontraditional Students	1 7 (45%)	15 (39%)	3 (8%)	2 (5%)	1 (3%)
Summer Semester Students	7 (53%)	1 (8%)	3 (23%)	1 (8%)	1 (8%)
Fall Semester Students	17 (25%)	34 (49%)	11 (16%)	7 (10%)	0 (0%)

These responses were further analyzed by separating the data into traditional versus nontraditional student responses. Twenty-seven of the 44 traditional respondents, 61%, responded agree or strongly agree to correct placement in Basic Mathematics. Six traditional students, 14%, felt they had been misplaced and 11 students responded neutral. Of the 39 nontraditional students, 82% strongly agreed or agreed to correct placement, 8% were neutral, and 8% disagreed or strongly disagreed. However, six nontraditional students commented on a need for a refresher course. Within the traditional students, the data was grouped by the students who successfully completed a mathematics course during their senior year of high school and those who had not taken a mathematics course their senior year. Three of the students who responded with "neutral" commented on an incorrect course placement. One of the students stated, "I could handle more and harder math." Of the 24 traditional students who participated in a mathematics class during the last year of high school, 14 said that they were successful. Of these, ten responded as having had Algebra II or higher and six had Mathematics of Finance. Of these 14 students, ten, 71%, affirmed correct placement in Basic Mathematics. One student commented, "the test was accurate" while another stated, "I'm really needing to know these basics." Thirty-five of the 44 traditional students reported receiving a "C" or better in Algebra II. Yet, sixty-one percent (27) students, responded with agree or strongly agree to correct placement in Basic Mathematics.

Comments from the students validated their responses and gave insight into their perception of the test. Of those who commented favorably, the majority commented on their need to review basic mathematics. Ten students commented that the course was too easy, and three students expressed concern that the COMPASS test was not accurate.

Item 16 posed the statement “I could have completed basic math in eight weeks of a 16 week semester. In other words, I could have completed this course at a faster pace.” This item measured student perception of correct course placement based on the pace of

Table 5

Correct Course Placement Associated with Pace of Class, Descriptive Statistics (Item 16)

Respondents	n	M	SD
All Students	82	3.3	1.24
Traditional Students	44	3.6	1.13
Nontraditional Students	38	2.9	1.24
Summer Semester Students	13	3.7	1.14
Fall Semester Students	69	3.2	1.24

Note. 5 Strongly Agree; 4 Agree; 3 Neutral; 2 Disagree; 1 Strongly Disagree

the class. The responses to this item are shown in Tables 5 and 6. In response to this item, 47% of the students strongly agreed or agreed that they could have moved at a faster pace than 16 weeks, 23% responded with neutral, and 30% chose to disagree or strongly disagree. The mode for all students was agree. Traditional students strongly agreed or agreed 64% of the time, and nontraditional students agreed or strongly agreed at only 39%. Of the summer semester students enrolled in the 8 weeks course, twenty-three percent disagreed with a shortened semester course. The fall semester students agreed at a rate of 45% with 25% neutral. The greatest disconnect appeared to occur between the traditional and nontraditional students. Seventeen of the 48 students who commented on this item indicated that the course material was too easy for them. One student responded

Table 6

Correct Course Placement Associated with Pace of Class, by Count (Item 16)

Respondents	Strongly Agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
All Students	15 (18%)	24 (29%)	19 (23%)	16 (20%)	8 (10%)
Traditional Students	10 (23%)	18 (41%)	7 (16%)	7 (16%)	2 (4%)
Nontraditional Students	5 (13%)	6 (16%)	12 (31%)	9 (24%)	6 (16%)
Summer Semester Students	4 (31%)	4 (31%)	2 (15%)	3 (23%)	0 (0%)
Fall Semester Students	11 (16%)	20 (29%)	17 (25%)	13 (19%)	8 (11%)

to item 15 with “I am not very good at math” and to item 16 with “I’m a fast learner.” Ten students responded to item 15 as needing Basic Mathematics, but then on item 16, they thought the curriculum was too easy. Some just wanted a refresher course. On the other hand, one student commented on the desire to take the time to learn the meaning of the mathematics, and another student commented on having children and her desire to have extra time for the homework. Of the 20 traditional students who took a mathematics course during their senior year of high school, four commented on the need for time to comprehend mathematics, but seven said the mathematics was too easy for them. Sixty-five percent of these students responded strongly agree or agree to being able to complete the course at a faster pace, 15% responded with neutral, and 20% responded disagree.

Students were asked to respond to "I am concerned about the number of semesters it will take me to finish my mathematics requirements to complete my goals." Forty-eight percent of all students "strongly agreed" or "agreed" with this statement. Twenty-five percent of the students responded disagree or strongly disagree. Twenty-seven percent responded neutral. Of the respondents who responded neutral, several comments had an air of resignation such as the student who said, "You do what you have to do." Of the 40 students who commented, nineteen voiced concern over the amount of mathematics classes seemingly required for goal completion. One student commented about the need to take zero-level courses for no credit as a reason for not finishing in a timely manner. Five other comments also revealed a lack of understanding of the purpose of developmental mathematics courses. For example, students wanted college credit for

Table 7

Correct Course Placement Associated with Goal Completion, Descriptive Statistics (Item 19)

Respondents	n	M	SD
All Students	81	3.3	1.15
Traditional Students	44	3.4	.99
Nontraditional Students	37	3.2	1.33
Summer Semester Students	12	4.0	.91
Fall Semester Students	69	3.2	1.17

Note. 5 Strongly Agree; 4 Agree; 3 Neutral; 2 Disagree; 1 Strongly Disagree

taking developmental mathematics coursework. Students lack understanding that the purpose of developmental courses is to provide students the opportunity to achieve the academic level necessary for college entrance. Nontraditional students responded more vigorously with 27% strongly agreeing while only 12% of traditional students strongly agreed. However, 55% of traditional students strongly agreed or agreed while 42% of nontraditional students strongly agreed or agreed. Fifty-eight percent of the summer semester students and 46% of the fall semester students strongly agreed or agreed. Overall, students appear to be concerned about the length of time for goal completion. Results to this item are shown in Tables 7 and 8.

Table 8

Correct Course Placement Associated with Goal Completion, by Count (Item 19)

Respondents	Strongly Agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
All Students	15 (19%)	24 (29%)	22 (27%)	15 (19%)	5 (6%)
Traditional Students	5 (12%)	19 (43%)	11 (25%)	8 (18%)	1 (2%)
Nontraditional Students	10 (27%)	5 (13%)	11 (30%)	7 (19%)	4 (11%)
Summer Semester Students	5 (42%)	2 (16%)	5 (42%)	0 (0%)	0 (0%)
Fall Semester Students	10 (14%)	22 (32%)	17 (25%)	15 (22%)	5 (7%)

To enable further research concerning the placement process, the survey asked students to respond to six free response items concerning the placement process. The first of these items, number 20, stated the fact that students entering a community college

must have a certain ACT score in mathematics or take a placement test. The question asked if the student was aware of the process and then asked for further clarification concerning the time when the student was made aware of this fact. The yes and no responses to the items were not as revealing as the student responses to the prompt to give more information concerning how and when they learned of the process. Their responses fell into the four categories of at enrollment, before enrollment in high school, before enrollment by networking, or at the time of the survey. Table 9 provides a

Table 9

Student Report of Time When Informed of ACT Test Score Requirement, by Count (Item 20)

Respondents	At Enrollment n (%)	During High School n (%)	Before Enrollment by Networking n (%)	At the Time of the Survey n (%)
All Students	26 (45%)	9 (16%)	21 (37%)	1 (2%)
Traditional Students	13 (42%)	9 (30%)	7 (23%)	1 (3%)
Traditional with Mathematics during Senior Year	8 (50%)	5 (31%)	3 (19%)	0 (0%)
Nontraditional Students	13 (48%)	0 (0%)	14 (52%)	0 (0%)
Summer Semester Students	3 (30%)	1 (10%)	5 (50%)	1 (10%)
Fall Semester Students	23 (49%)	8 (17%)	16 (34%)	0 (0%)

breakdown of student responses to this item. The most revealing responses were given by traditional students who had taken mathematics during their senior year and succeeded in

the class. Of the sixteen students responding to this item, only 31% claimed that their high school counselor informed them of the need to have a 19 on their ACT to take college-level classes at the community college. Fifty percent of these students learned about the process at enrollment while the other 19% admitted to getting information through networking. According to the student responses, 98% of the students received information concerning this requirement. Fifty-three percent of the students knew before enrollment about the ACT score requirement, and 45% of the students found out during the placement process.

When asked, respondents shared about preparation for the mathematics placement test. Students who claimed that they prepared for the test were asked to give the number of hours spent in preparation. Only four students studied for the test. Two students reported studying for two hours, one student studied for about six hours, and one student studied for twenty-four hours.

When asked the question "What did you know about the mathematics placement test before you took the test?," the majority of the students, 74%, responded "Nothing." Student responses were sorted into the three categories of no prior knowledge, knowledge concerning the use of the test for placement, and knowledge concerning the mathematics involved. Student responses by count are provided in Table 10. Two students indicated the perception that the test was timed.

Students gave a total of 99 responses to item 24, which asked students what support they would use to help raise their mathematics placement test scores and allowed for multiple responses. One student stated "anything that would help pass it." Table 11 shows the responses by count. The responses fell into the categories of needing a

Table 10

Student Report of Prior Knowledge of Placement Test , by Count (Item 23)

Respondents	No Prior Knowledge n (%)	Test Used for Placement n (%)	Knowledge of Mathematics Involved n (%)	Timed Test n (%)
All Students	53 (74%)	14 (20%)	2 (3%)	2 (3%)
Traditional Students	26 (70%)	8 (22%)	1 (3%)	2 (5%)
Nontraditional Students	27 (79%)	6 (18%)	1 (3%)	0 (0%)
Summer Semester Students	8 (73%)	3 (27%)	2 (3%)	2 (3%)
Fall Semester Students	45 (73%)	11 (18%)	2 (3%)	2 (3%)

refresher course, desiring practice problems, wanting tutoring, studying, or nothing. Twenty-five of the students said they would do nothing or left this response blank leaving 57 students who responded affirmatively to desiring some form of test preparation. Non-traditional students appeared to desire a refresher course more than traditional students did; more traditional students wanted practice problems than did nontraditional students. One of the students who replied “nothing” stated, “I needed to start at the beginning” indicating the possibility that he was claiming ownership of responsibility for correct placement. The second part of this item asked students how much time they would devote in one week to preparing for the test. One student responded, “as much as I could.” On average students would spend about ten hours to prepare, but the median was five hours. Sixty students responded that they would spend a few hours preparing for the test even though only fifty-seven responded to the form of preparation desired.

Table 11

Student Response to Support for Placement Test Preparation , by Count (Item 24)

Respondents	Refresher Course n (%)	Practice Problems n (%)	Tutoring n (%)	Studying n (%)	Nothing or No Response n (%)
All Students	19 (19%)	26 (27%)	15 (15%)	14 (14%)	25 (25%)
Traditional Students	8 (15%)	17 (33%)	8 (15%)	6 (12%)	13 (25%)
Traditional with Mathematics during Senior Year	4 (17%)	9 (38%)	5 (21%)	3 (13%)	3 (13%)
Nontraditional Students	11 (23%)	9 (19%)	7 (15%)	8 (12%)	13 (25%)
Summer Semester Students	3 (23%)	2 (15%)	1 (8%)	3 (23%)	4 (31%)
Fall Semester Students	16 (19%)	24 (28%)	14 (16%)	11 (13%)	21 (24%)

Students were asked to describe their feelings about the mathematics placement process and suggest any ideas that might increase the likelihood of students successfully navigating the placement process. The following list of student responses represents the variety of suggestions for the placement process and the reliability of the test to suggest appropriate placement.

Respondent suggestions included

- "If they would give you ways to prepare and study an idea of what maths about"
- "knowing what was on the test"
- "to be able to take as many times as you need to"
- "maybe a study guide to give out to study w/before the test"

- “Test review”
- “A review before the test”
- “Studying more”
- “Study material”
- “Start the placement test with a easier math level and go up and see if you get higher”
- “Wasn’t prepared”
- “Consideration of age. I was never required to take algebra. Even though I want to learn, pre or elem would work better for me.”

Feelings expressed concerning the reliability of the test to place students in the appropriate course were

- “The process is a good way to test out what you know for now.”
- “ I couldn’t answer a lot of questions b/c I didn’t have time”
- “I think it's good so people who need the help can get it instead of being thrown into College Algebra”
- “Think it put me in the right class”
- “The testing process works great.”
- “It was more challenging than a review

  to hard for a placement test”
- “Good idea to take the test for everyone”
- “I think that is good because it lets the student know were he or she is and what they need to do about it.”

- "I think it was very good, a person who is not good at math would possibly give up if they was put in a class they couldn't do."

For the next questions, each student was asked to give suggestions for a developmental program schedule that would meet their individual needs. Of the 61 students who responded, 14 indicated that they were happy with the status quo, but one of these students requested study material for the placement test. One student said, "I like it the way it is." One student requested a class that met for one hour each day. Fifteen students expressed a desire for faster-paced or combined courses. Two students requested self-paced courses and indicated a need for slower paced coursework. The community college in question provides one combination course of Elementary and Intermediate Algebra. However, one student asked for this combination. Specific suggestions concerning the pace of class are provided in the following list.

- "I think the classes should be offered as 8 weeks classes depending on your score"
- "Get done with basic math faster to move on"
- "Taking it all in one semester"
- "make it faster completion time"
- "basic math 8 weeks and elementary algebra"
- "I would have them all together"
- "I would leave elementary algebra and just go to intermediate"
- "They should make all three courses one combined"
- "If they're 0 level, I would probably make them all 8-week courses"

Interview Responses

In the interview process, the researcher asked the four students to share their perception of the placement process. The four students included two summer semester students and two fall semester students. The students interviewed for the summer semester were Gina, a traditional student, and Judy, a nontraditional student. Students interviewed for the fall semester were Kara, a traditional student, and Mary, a nontraditional student. The following paragraphs describe the interviewee responses to items concerning the placement process.

Gina began her description of the placement process voicing concern over the placement test. Her main concern was that the placement test did not cover material relative to the course curriculum. She also stated that the school did not tell her about the placement test. She was placed in Basic Mathematics and found out from friends that she could take the placement test. Gina's perception of events could be affected by her attendance issues. During freshman orientation at this southwestern community college, students receive information about the characteristics of a good student. These characteristics include the student's responsibility for knowledge about the placement process. Gina did remember that the Basic Mathematics course syllabus contained information about the characteristics of a good student, but she did not mention attending freshman orientation. Because of her attendance problems, Gina may have missed the opportunity to receive information about the placement test.

Having been in school in other programs, Judy planned to take Basic Mathematics. She voiced the need to get her associate's degree before attempting to move on to her bachelor's degree. When asked about the placement process, she stated

that her test scores put her in Basic Mathematics. She felt strongly that the Basic Mathematics class was a waste of her semester. Judy was resigned to spending more time in school, but she seemed to resent the time she was forced to spend in Basic Mathematics.

The researcher asked each interviewee about the general placement process. Kara responded by describing the placement test process. She said it took her about two hours to go through the placement process because of all of the testing. After going through the process and being placed, Kara stated that she wished the school offered just a refresher course. She said, “I think that it would be a whole lot easier than to sit there a whole semester of Basic Math. Kind of just to get things you need when you started off.” Kara commented about being behind in her degree plan.

Mary’s first response to the question about the placement process had to do with her Free Application for Federal Student Aid, F.A.F.S.A., application. She stated that the application was the only thing she knew to do. She then went to the community college enrollment office. She said, “I had no clue I would have to test.” She stated that no one told her the progression of the process. She just performed the process one step at a time. She said, “We need more awareness of what the process is. As an older student coming back, most of us, a lot of us have never been to college. . . a lot of us just got our G.E.D. and went on.” She added, “I didn’t realize I was gonna have to study for each class, uh, the amount of homework involved. There’s a lot that needs to be put out there for public knowledge.” When the researcher asked about freshman orientation, Mary responded, “Well, I’d already been in school for a month and a half before we did the seminar.” When asked for suggestions for the placement process, Mary suggested that the school

send out programs just as “Vo-tech sends out programs.” She wanted “information in my hands and I would, ah, I could have looked it over and saw what I need to do, checked it out, and when I got here I could have been prepared to do what I needed to do.” Mary voiced that coming to the campus to enroll or coming to class was not an issue. She would like to know how to find information about the enrollment process and the college experience before arriving on campus.

Students’ Perceptions of the COMPASS Placement Test versus the Departmental Pretest and Basic Mathematics Curriculum

The data used to answer this question came from student responses to free response items on the student survey and the interviews conducted with students. The items from the survey were numbers 21, 22, 23, 25, 26, and 29. These free response items elicited statements concerning preparation for the mathematics placement test, information concerning student knowledge of permission to use a calculator on the placement test, knowledge of the placement test before taking the test, student feelings after receiving test scores, student views of the COMPASS Placement Test versus the departmental pretest, and ideas for support that would increase the likelihood of successful completion of the mathematics coursework.

When students arrive for enrollment, the placement process begins. Counselors advise students based on their previous test scores. If a student’s ACT score is less than 19 on the Mathematics subscore, then the student must take a placement test before he or she can proceed with enrollment. The counselor instructs the student to proceed to the testing center on campus where the student takes the COMPASS Placement Test. If the student wants to prepare for the test, the college website offers a page of test preparation

material. However, preparation must be completed before taking the test, and the test must be taken before enrollment can be completed. When the students do not ask about test preparation prior to arriving for enrollment, they may feel unprepared to take the test.

Item 21 asked respondents about preparation for the mathematics placement test. Only four respondents replied affirmatively to studying for the placement test. If students prepared for the test, they were asked to give the number of hours spent in preparation. Of the four students who studied for the test, two students studied two hours, one student studied six hours, and one student studied twenty-four hours. Even though they studied, the students still placed into Basic Mathematics.

Mary shared in her interview, “I think that if I was aware I was going to have to take a test, I would have brushed up.” Prior to the placement test, the last time Mary reviewed any mathematics was about seven years before. She commented that she wished she could start from where she stopped instead of backing up every time she started back to school. Gina found out about the placement test through a friend. After the placement test, she felt that she should be in Basic Mathematics because the test was hard for her.

Students were asked for a yes or no response to knowledge concerning the use of calculators on the placement test. Thirty-three students responded that they did not know they could use a calculator. Of the 45 students who responded that they knew calculators were allowed, 39 students stated they found out at the testing center. Only two respondents knew before the day of the test that they could use a calculator. Of the respondents who did not know they could use a calculator, 16 43% believed that using a calculator would have helped them improve their score. Comments included “I made simple mistakes” and “there were questions I needed it for.” Eighteen of the respondents

49% did not want to use the calculator. Samples of student comments were “I didn’t understand a lot of it,” “because I didn't know how to work the problems,” “the calculator isn't the problem. Knowing the order of operations is my problem,” and “I try not to use a calculator so I can learn better.” Three of the respondents believed that they could not use the calculator on the test. Sixty percent of the traditional students would have used the calculator while 33% would not. Of nontraditional students, 59% would not have used the calculator while 32% welcomed the option.

Gina commented on the calculator usage, “It took me about, maybe 30 minutes, but I also didn’t know that I could use a calculator. I got a scrap sheet. I didn’t know that I could use them. The lady didn’t say anything to me when I . . . I guess she just said, you know, here’s your test. She didn’t give me a time limit or anything. I don’t think” and “I took the test, and I was just like . . . and then, I think the teacher that I had over the summer, she told us that on your test you can use your calculator and everything else. I was like, they didn’t even . . . that, I just took the test like guessing off the top of my head, counting on my fingers, taking it, thinking that I was cheating for counting on my fingers and I kept checking like maybe she’ll see me and, but you know, so I didn’t . . . I wasn’t notified about . . . I could use a calculator or I think it would have been a lot easier with . . . if I’d had that.”

When considering the placement process, data from item 23, “What did you know about the mathematics placement test before you took the test?”, was included in the findings. This information was recorded in Table 10. Seventy-five percent of the respondents replied that they had no prior knowledge of the placement test. Student responses revealed the three categories of 1) no prior knowledge, 2) knowledge

concerning the use of the test for placement, and 3) knowledge concerning the mathematics involved. Responses included such comments as “It would determine my placement level” and “that there were a lot of algebra problems.”

Next, students were asked to state how they felt when they saw their mathematics placement test scores. The question asked students to explain their feelings. “Perceived self-efficacy refers to beliefs in one’s capabilities to organize and execute the courses of action required to manage prospective situations. Efficacy beliefs influence how people think, feel, motivate themselves, and act” (Bandura, 1995, p. 2). Students’ perceptions of the ability to succeed in a mathematics course will influence the amount of commitment and effort the student will expend toward reaching those goals. For this reason, student responses to item 25 would explain feelings that could critically affect their ability to succeed in Basic Mathematics. Their perception of the COMPASS Placement Test could have a direct impact on their success in the Basic Mathematics course if they perceive the two as being intertwined. Therefore, student responses to item 25 and item 26 provide insight concerning student perceptions of the comparison of the COMPASS Placement Test and departmental pretest.

Student responses to this item were organized into six themes. The themes that emerged were students’ feelings that they could have done better, feelings associated with poor performance in mathematics, feelings that the student will have to take more mathematics courses, feelings that performance is based on the length of time since the last mathematics class, feelings of acceptance or resignation, and feelings that they should have studied or did study. Table 12 gives the responses to item 25 by count. Thirty-three percent of all students indicated a feeling that they should have scored higher

while 50% of traditional students who had mathematics their senior year gave a response that included a statement about scoring better. A higher percentage of traditional students suggested that they could have scored better than nontraditional students. Twenty-five percent of all students gave responses showing a belief that they are not good at

Table 12

Student Report of Feelings Caused by Placement Test Scores , by Count (Item 25)

Respondents	Could Have Scored Better n (%)	Student Feels as if Not Good at Math n (%)	Student Will Have to Take More Math n (%)	Length of Time Since HS Math or Age n (%)	Expected Outcome n (%)	Student Stated Need to Study n (%)
All Students	22 (33%)	17 (25%)	3 (4%)	10 (14%)	14 (20%)	2 (3%)
Traditional Students	14 (38%)	11 (30%)	3 (8%)	0 (0%)	8 (22%)	1 (3%)
Traditional Students with Mathematics Sr. Year	9 (50%)	0 (0%)	2 (11%)	0 (0%)	6 (33%)	1 (6%)
Nontraditional Students	9 (28%)	6 (19%)	0 (0%)	10 (31%)	6 (19%)	1 (3%)
Summer Semester Students	4 (44%)	0 (0%)	0 (0%)	3 (33%)	1 (11%)	1 (11%)
Fall Semester Students	19 (32%)	17 (28%)	3 (5%)	7 (12%)	13 (22%)	1 (2%)

mathematics while 20% stated that they expected the level of the score they received. The following are sample student responses in each category. Each of these responses could be construed to have an effect on self-efficacy. Each of the students who gave these responses could be positively or negatively affected by self-efficacy, or each student's determination to succeed could positively or negatively affect self-efficacy.

Better Scores

- "Bad, I thought I did better in the math."
- "I felt like I could have done better"
- "I felt like I should have known more math just because I've worked hard in my math classes in high school"
- "Felt that I could've did better, because I already should've known this"
- "Bad cause I thought I could have done better"
- "I felt bad and that I did a lot better because I love algebra"
- "I felt disappointed, I thought I was good at math."
- "I felt upset because I knew the stuff on the test but didn't prove it."
- "Disappointed, I thought I knew math a lot better than I scored"
- "I was embarrassed because I felt with a few reminders I could have at least made it to the next level of math."
- "I was very upset because I thought I at least would be in elementary algebra"
- "I did terrible. I was shocked. At the time I thought I was doing the problems correctly."

Feelings of Inadequacy in Mathematics

- "Felt kind of stupid, because I barely knew how to work the problems"

- “I knew it would be low. I'm not good at math.”
- “I felt ok because I already knew I was bad at math”
- “Bad because I'm not good at math”
- “I felt a little disappointed but I knew I'm terrible at math”

Student Will Have to Take More Math

- “I felt I would have to spend more time than I had to on math because of the test”
- “Bad, because I knew I would havt to take basic math and have no hours for it.”

Length of Time since High School Math or Age

- “Concerned. Long time since I done math.”
- “I felt I could have done better, but I have not did math in a long time, so I was not that disappointed.”
- “They were low but I knew it would be that way because of how long its been for me since high school”
- “I was ok with it because I hadn't been in school in 20 years.”
- “I was embarrassed because I'm 36 years old and got a very low score”
- “I felt dumb, but then again 10 yrs. Later that's kinda expected. Esp. when you couldn't prepare for this test.”

Expected Outcome

- “I felt that it was pretty descent”
- “I knew it was going to be that way”
- “I felt fine because I knew I needed to improve my skills”
- “Well I knew it would be low so am used to it. I use to fill bad about it but it is what it is”

- “I thought I did fine. I did the best I could.”
- “I already knew my feelings were accurate.”

Student Stated Need to Study

- “Disappointed, because I like to pass test, even tho I know I didn't study, I still expected to pass.”
- “I was upset I didn't do that well and after I studyed. I was scared I was not going to do well in class.”

During the interviews, Gina said, “I didn’t know if there was anything I could do about it, like until I was told by a friend that you know, you can test out of these classes. That’s whenever I tried to take action, but. . . The test wasn’t what I expected it to be, so I was like ‘Okay, go with the flow I guess’.” Missing the cutoff score by two points, Mary stated, “I was disappointed, uh, that I was put in Basic Math . . . because I didn’t feel like I needed to be there.” She added, “We need more awareness of what the process is. As an older student coming back, most of us . . . a lot of us have never been to college.”

Item 26 asked , “Do you feel that the mathematics placement test covered material that matched the pretest you took in Basic Mathematics? Please explain.” Student responses to this item revealed that 53% of the respondents felt that the COMPASS Placement Test content matched the departmental pretest content. A higher percentage of nontraditional students thought the test content matched on the two exams than did traditional students. Thirty-two percent of all students did not think the test content matched, and 15% were not sure. Individual responses revealed interesting comments as shown in the following lists.

Test content matched

- “Yes, they both seemed very accurate.”
- “Yes, just basic things”
- “Sure it did. That's why it was Basic”
- “Yes, it covered addition and subtraction”
- “Yes and I almost feel like I could take the test now and make a better grade and not have to take the rest of the classes.”
- “Yes, but being out of school for twenty-five years was not condusive to coming in cold and taking the test”

Test Content Did Not Match

- “NO! The placement test had problems we never had in high school.”
- “No, mine was all x+y=3”
- “no my placement was all decimals”
- “The placement test was harder”
- “It's scattered a little. So to me it was harder than the basics.”
- “No, I do not feel that the problems correctly tested me for my basic math skills”
- “No, it covered more things that you could learn in an algebra class.”
- “no the test was harder had more algebra and stuff”
- “Not sure if test content matched”
- “I would have to look at them side by side”
- “I'm not sure. I only got to answer 4 questions.”

During the interview process, the researcher asked the students to give their perception of the COMPASS Placement Test versus the departmental pretest. The students were then asked to compare two sets of questions, five questions from the

Table 13\

Test Comparison Questions

COMPASS Placement Test	Departmental Pretest
1. A restaurant occupying the top floor of a skyscraper rotates as diners enjoy the view. Ling and Sarah notice that they began their meal at 7:00p.m. looking due north. At 7:45p.m., they had rotated to a view that was due south. At this rate, how many degrees will they rotate in one hour? A. 90^o B. 180^o C. 240^o D. 270^o E. 400^o	1. Write as a percent. 2.84 A. 284% B. 2.84% C. 28.4% D. None of these E. 0.0284%
2. Nick needs to order 500 pens from his supplier. The catalog shows that these pens come in cases of 24 boxes with 10 pens in each box. Nick knows that he may not order partial cases. What is the fewest number of cases he should order? A. 2 B. 3 C. 18 D. 21 E. 50	2. The sale price on a shirt is 20% off the listed price. What would you pay for the shirt if the listed price is $45.00 and there is a sales tax of 7%? A. Not enough information B. You have got to be kidding me C. None of these D. $32.85 E. $38.52
3. At a school picnic, 1 junior and 1 senior will be selected to lead the activities. If there are 125 juniors and 100 seniors at the picnic, how many different 2 person combinations are possible? A. 25 B. 100 C. 125 D. 225 E. 12500 F.	3. Perform the indicated operation(s). 7.2-(0.5)(1.7) A. 6.35 B. 11.39 C. 11.35 D. None of these E. 6.39

Table 13 (continued)

Test Comparison Questions

COMPASS Placement Test	Departmental Pretest
4. Jennifer's best long jump distance increased by 10% from 1990 to 1991 and by 20% from 1991 to 1992. By what percent did her best long jump distance increase from 1990 to 1992? A. 32% B. 30% C. 20% D. 15% E. 2%	4. Subtract the fractions. Write the answer in lowest terms. $\frac{7}{8} - \frac{1}{12}$ A. $\frac{3}{2}$ B. $\frac{19}{24}$ C. $1\frac{1}{2}$ D. $\frac{19}{20}$ E. None of these
5. A restaurant has 10 booths that will seat up to 4 people each. If 20 people are seated in booths, and NO booths are empty, what is the greatest possible number of booths that could be filled with 4 people? A. 0 B. 1 C. 2 D. 3 E. 5	5. Reduce $\frac{54}{63}$ A. $\frac{18}{21}$ B. $\frac{8}{9}$ C. $\frac{54}{63}$ D. $\frac{6}{7}$ E. None of these

COMPASS placement sample test and five questions from the departmental pretest, and give similarities and differences between the two sets of questions. The COMPASS Placement Test questions were placed on blue index cards, and the departmental pretest questions were on pink index cards. The questions from both the sample COMPASS

Placement Test and the departmental pretest are shown in Table 13. Each student interviewed was asked to pick a problem randomly from each set and work the problem. The following paragraphs describe the student responses.

As a traditional student, Gina voiced her concern that the COMPASS mathematics placement test was not "Basic Math oriented." She thought that the placement test had more algebra than "stuff like 1+1." She commented that the test was not what she expected, but she alluded to a belief that the college enforced the placement rules to help students. When asked to compare the two tests, she stated that the pretest was simple and implied that the placement test was more challenging. When asked to compare the two sets of questions, Gina described the COMPASS Placement Test as "like a lot of word problems" and the departmental pretest as "these look like more fractions." Gina expressed that she thought the "pink ones are a little easier, 'cause I don't do well with word problems, they really confuse me. I almost look at word problems and just kind of move on to the next one 'cause I don't want to read it and go through." In her interview, Gina stated that she had to take a reading test and was enrolled in a reading course.

The researcher then picked up the questions from each set, put the pink ones aside, mixed up the blue ones, and asked Gina to pick a card. The researcher gave Gina paper and a pencil to be able to work the problems she picked from the stack. Gina chose question 4 from the COMPASS Placement Test questions. Gina's first response was "I'm not really good with percentages either." The researcher asked her to explain her thoughts, so Gina said, "Ummm, I would probably look at it, 10 percent, 20 percent, and

then go to 30 percent ‘cause it says . . . and then that’s just the way I would probably do it if I was guessing. I wouldn’t really know how to work it out.”

The researcher then asked Gina to pick a card from the pink ones. Gina chose question 5 from the pretest questions. Gina talked through this one. Even though she was given paper and pencil at the beginning of this exercise, Gina still asked for permission to use the paper and pencil. She said, “I’m trying to think, is 9 times 6 54? I’m pretty sure it is.” Through these examples, Gina confirmed her perception that the placement test was more challenging for her than the pretest.

As a traditional student, Kara graduated from high school and headed straight to the community college. She remembered well taking the placement test. She admitted to attempting to perform well on the test, but she felt that following the crowd and not having a mathematics class during her senior year hurt her scores on the test. Her assessment of the placement test was that it was difficult because “it went straight into like Trig and Algebra. And I think it should have started out more Basic Math first.” She recalled that she answered about five or six questions before the test stopped. Kara thought the departmental pretest was much easier. She thought the subject matter on it was similar to ninth grade mathematics.

The researcher then asked Kara to look over the two sets of questions. Kara stated that the blue set, the COMPASS Placement Test, looked like simple word problems while the pink set, the departmental pretest, looked more difficult because it had more fractions. Going through the same process as with Gina, the researcher asked Kara to pick a problem at random from the COMPASS test questions. The researcher encouraged Kara that she wanted to know her thought process and supplied Kara with paper and a pencil.

At random, Kara chose question four. She read the question and stated, “This is kind of like . . . this is kind of like Basic . . . I think you can do this in your head, ‘cause I know it’s B.” She did not write anything down but continued to talk through the problem. When the researcher asked for an explanation, Kara responded, “’Cause it increased by 10% from 1990 and then by 20, then it would increase 30, because it’s . . . I mean you’re adding it pretty much.”

Kara next chose question one from the departmental pretest set. She stated, “I’ve always known to move the decimal. I think it’s one or two places. It should be A . . . 284%. That’s not right. Twenty-eight point four ‘cause you move it one place.” Kara answered questions from both tests without writing anything down. She attempted to organize her thoughts verbally.

As a nontraditional student, Judy had taken the placement test at least twice that she could recall. She remembered that the test was “like a foreign language.” Her memory of the COMPASS Placement Test was sketchy, but she did remember that it took about thirty minutes. Her only statement about the placement test was that it was a fair assessment. The researcher then showed Judy the two sets of questions and asked her to share any similarities or differences she saw. Judy looked at the COMPASS Placement Test set and said, “Well, these are all word problems and these are not as wordy,” as she pointed to the departmental pretest set. Again pointing to the departmental pretest, she stated, “Well, this . . . allows you to simply work the problem rather than over here trying to figure out what the problem is.” She pointed back to the COMPASS Placement Test.

The researcher took Judy through the process of picking a problem and providing her with paper and a pencil. Judy chose question five from the COMPASS Placement

Test. She read the question, stated, “I really don’t like word problems,” and proceeded to read the question again under her breath. She then decided that the answer was E. When prompted to explain her answer, she said “Well because if 20 people are seated in booths and no booths are empty that means that some of the booths might be occupied by one person, some might be occupied by three, some might be occupied by one, so that’s fine, they’re just not all full. Because we know that ten booths times four is 40. If only 20 people are occupying ‘em, they’re just not all full. So, none are empty. What is the greatest possible number of booths that could be filled with four people? Well, that . . . none. Because there’s people in all of them because it says ‘and no booths are empty.’ So none can be filled with four people because they can only seat four people each. So none – A.” The researcher praised Judy for her sharing her thoughts. Judy wrote down information she picked out from the problem and the number 40. She also wrote down her response – A.

When asked to pick a question from the departmental set, Judy chose number two. As she read the question, she got louder. “What would you pay for the shirt if the listed price is 45 dollars and there is a sales tax of seven percent? Uhh, 4.50, 9 dollars that would be 36, and 7% tax, (writes on paper) 5, 10, 38.52 . . . E,” she said. The researcher asked Judy to share her explanation. Judy said, “Well, you take your twenty percent, uh, of 45 dollars is 9 dollars, so you subtract 9 dollars from 45 and that’s 36. Then you multiply by the sales tax of 7 percent times 36 and you add the 2 dollars and 52 cents to the 36 so that’s 38.52.” After the researcher praised Judy for explaining her answer, Judy responded, “I can shop. I just can’t do algebra.” The only thing that Judy wrote on her

paper was the multiplication of 36 and 7 and the answer. She did not use a decimal for the percent.

A nontraditional student, Mary first started college in the fall semester. She took the placement test as part of the placement process. She missed the cutoff score for placing into Elementary Algebra by two points. She stated that the testing process took her a total of about seventeen minutes. This time period covered the time it took her to complete three placement tests in English, mathematics, and reading. She remembered that there were about twenty-five questions on the mathematics portion of the test. She recalled that her test was mainly basic mathematics using four operations and some algebra. She did not comment on the Basic Mathematics pretest but rather on the Basic Mathematics curriculum. The researcher then directed her to consider the two sets of questions. Mary pointed out that the departmental pretest had "two percentages. That's just division. That's algebra or pre-algebra," and "this is basically subtraction and addition and that kind of stuff." In looking at the COMPASS Placement Test, she said, "This stuff I know how to do but it has been many a year." She stated that she had never seen a problem like question three from the pretest. . . "the way it's wrote. I would have no clue what it meant." After reading the COMPASS Placement Test problems, she stated that she could probably work most of those without writing anything down. The researcher then provided Mary with paper and a pencil and had her pick a problem from the COMPASS Placement Test examples. At random, Mary picked question three. She stated, "I'm not sure if I understand the question." She then decided her course of action which was "basically you're dividing by how many times two will go into 125 . . . 62, and that's not right, 25 . . . because it's not one of the answers. 'A' would be your closest

answer." As Mary shared her response, she wrote the long division problem on the paper.

The researcher thanked Mary for sharing her thoughts and asked her to choose a problem from the set of departmental pretest questions. Mary chose number three and sighed. She stated, "That is multiplication, I believe. I don't have a clue. I know you do this first. Okay, you multiply . . . you do the parentheses first. One times 7 is seven. Zero times 5 is 0. Seven times two is fourteen. Nine and seven . . . the answer would be . . . hmmm, if I'm doing it right. The answer should be 7. It would be D, none of the above." Mary wrote the problem down, then wrote "14-7" but that was all she knew to do.

Question item twenty-nine concerned student responses to support they needed to succeed in Basic Mathematics. Students were allowed to give their perception of the term "support." This question pertains mainly to the Basic Mathematics curriculum rather than to the pretest. This question attempts to elicit student perceptions of support necessary for the successful completion of the Basic Mathematics course. Student perceptions of support that would help them succeed included tutoring, studying, and more practice problems. One student commented that it would help to be able to do all the work at school. One student recognized that this community college "offers tutoring which is the support I need." Other students wanted more practice problems because "repetition is the key." Several students suggested study sessions. One student stated "studying – asking questions if needed making sure I get it." At the time of this study, tutoring was offered at this community college. Since the study was completed, tutoring is offered to select students serviced through grants. The community college does not have a tutoring lab for all students.

The surveys and interview process revealed these students had differing views on the COMPASS Placement Test and departmental pretest, but each of the students interviewed expressed concern over the subject matter and rigor of the placement test as compared to the subject matter and rigor of the Basic Mathematics course. Gina believed that if the test had more of the Basic Mathematics curriculum then she could have passed the test. Gina stated that the placement test was "too difficult for the class." She said, "When I got there, I was fully shocked at what I learned. Like, it was easy stuff." She also stated that she felt that "it was a waste of time." She did not understand the reason for being in the course and suggested that she should have started in Elementary Algebra or Intermediate Algebra. Kara voiced a desire to progress more quickly. She stated that she did not mind taking the Basic Mathematics but that the course needed to progress more quickly so she would be prepared for algebra. She perceived that the COMPASS Placement Test did not match the Basic Mathematics curriculum. Judy expressed a concern that the Basic Mathematics course was a waste of her time. She voiced that she did not need a full semester of Basic Mathematics but that an overview would have sufficed. She expressed the concern that "those that did not know multiplication and division coming in took too much class time away from the new material being learned." Judy stated that she felt that the instructor spent too much time reviewing mathematics facts because the other students needed the review. Mary expressed that she felt that she had lost a full semester in Basic Mathematics. She stated, "I could have been in my prealgebra and getting to where I needed to go on with it. And, from what I've learned, I'm ahead of the class because just what we've talked about already refreshed my memory to go back and do it. So . . . I think a refresher course." These interviews

revealed the students' perception of a lack of congruity between subject matter on the COMPASS Placement Test and the Basic Mathematics curriculum.

Content Analysis Comparison of COMPASS Placement Test and Departmental Pretest

At the two-year institution that provides the setting for this study, most students striving for an associate's degree must take a college-level mathematics course. Direct placement into one of the two courses that meet this requirement, Mathematics in Society or College Algebra, requires a score of at least 19 on the ACT. Students who do not score at least 19 or who have not taken the ACT must take the COMPASS Placement Test unless they choose to be placed in the beginning-level mathematics course, Basic Mathematics. The student's score on the placement test determines whether the student is placed into Basic Mathematics, Elementary Algebra, Intermediate Algebra, or possibly College Algebra. The COMPASS Placement Test consists of five different levels of mathematics beginning with Numerical Skills/Prealgebra. The students may begin at any level. Their answers determine whether they move up or down in the progression for placement. The students taking this test have varied backgrounds including mathematics education, age, family obligations, and job responsibilities. The placement of students in the proper mathematics course is intended to help students pass through the progression of mathematics courses without failing.

Students who did not score a 19 on the ACT who must navigate the placement process at this community college have two opportunities to evade the first course of Basic Mathematics. The students who score well on the COMPASS Placement Test may move into a higher course or they score at least 70 percent on the department-created

pretest and progress to the next course. During the enrollment process, counselors suggest the COMPASS Placement Test for students who did not score 19 or above on the mathematics subscore or for students who did not take the ACT. In the student service building, a testing center provides the means for a student to test whenever the student arrives for enrollment. The student signs in at the testing center, receives paper, pencil and a four-operation calculator, and begins testing at a computer. The testing center contains nine computers situated for privacy. As soon as the student finishes testing, the student receives a report of the scores. The student takes this report to the counselor to finish the enrollment process. Students must wait 48 hours before testing again and may retest twice during the semester.

The Basic Mathematics course instructors administer the pretest at the beginning of each semester to their Basic Mathematics students as part of the course. If a student scores 70% or above, the instructor advises the student on the options available. The options include staying in Basic Mathematics, dropping Basic Mathematics to enroll in Elementary Algebra, or taking the Elementary Algebra pretest in an attempt to place into Intermediate Algebra. Rarely does this process occur. As the primary stakeholders, students could assume that the two tests are similar since they have the same results for placement.

To compare the COMPASS Numerical Skills/Prealgebra placement test and the Basic Mathematics pretest, the researcher conducted a qualitative content analysis. Content analysis was used to explore the similarities and differences between the two tests. When the purpose of research is to gain insight into a topic, content analysis brings pattern recognition to the forefront. Specifically, an inductive approach is used when

prior knowledge of the research topic does not exist or is limited (Mayring, 2000). Proceeding through this inductive approach involved examining test-making standards, exploring both tests (COMPASS Placement Test and the Basic Mathematics departmental pretest), searching for themes, considering the context of the tests, and collecting data about the tests. This process emerged into the research categories used to compare the tests. The categories are purpose, authors, subject matter as related to course content for the Basic Mathematics course, standards for multiple-choice tests, placement decisions associated with the test, and administration of the test. Most of these categories emerged from open coding of the COMPASS test manual (ACT, Inc., 2006). Since the pretest was created by instructors at the community college, no similar manual exists for the pretest. Information concerning the formation of the pretest came from informal interviews with current mathematics instructors who traced the verbal history of the pretest. In going through the process of comparing the tests, the researcher chose categories based on emerging themes after analyzing both tests and related documents or information that appeared multiple times. The following description depicts the process and reports the results.

Purpose

When designing assessments, the writer must consider the purpose of the test (American Education Research Association, 1999). The community college in this study uses the COMPASS test specifically for course placement even though the manual is very clear about the advantages of using the test for placement, skills diagnosis, early intervention, retention efforts, and exit testing (ACT, Inc., 2006). One of the express purposes of the COMPASS test is course placement. On the other hand, the departmental

pretest was not created as a placement test. The pretest was created to be paired with a course-embedded posttest to measure a student's mathematical progress. Since the purpose of the pretest is to measure a student's knowledge of course content, mathematics department instructors determined that students who scored well on the pretest would be successful in the next course. While the test was intended as a measure of students' educational growth, the rationale given by the instructors follows the intent of testing standards (Standards, 1999). Therefore, the pretest now serves as an alternative to the placement test. The pretest has no data associated with it that indicates its validity or reliability as a placement test. The initial purpose of the COMPASS test was very different from the pretest.

Authors

Authors of mathematics tests must be knowledgeable of the content considered for testing. Creators of the COMPASS test understand this aspect of test creation. The manual was very descriptive concerning the process used to find qualified writers. A panel of experts and content consultants working for ACT, Inc., the company that created the COMPASS test, determined the content included in each placement test. Test item writers must submit a sample of items, be approved, and then submit items for review. Test item writers receive a guide for writing test items with instructions for writing items at different cognitive levels. COMPASS test item writers are considered experts in the mathematics content necessary to develop these tests (ACT, Inc., 2006). While the authors for the pretest did not have access to an item writer's guide, they were the instructors hired by the community college to teach mathematics. This implies their expertise in the knowledge of mathematics necessary to teach the Basic Mathematics

course. The original test was written several years ago and has undergone at least one revision that occurred about five years ago. The instructors involved in each process had master's degrees in education or in mathematics. While the test item writers for the COMPASS received more training in item writing, both sets of authors appear equally qualified to create content specific mathematics items at this level.

Subject Matter as Related to Course Content

The next category concerns the subject matter of each test and the manner in which the subject matter relates to the Basic Mathematics course content. The course objectives for Basic Mathematics were compared to the pretest and a sample COMPASS Numeric Skills/Prealgebra practice test (ACT, Inc., 2004). Because each COMPASS test is different, a sample test supplied by ACT was used to compare test item content (ACT, Inc., 2009). Besides comparing course outcomes to the two tests, the two tests were also compared to the COMPASS contents listed for the Numerical Skills/Prealgebra test. Helpful information emerged through the comparison of the two tests to the course content and to the COMPASS test content. Table 14 shows the comparison. Table 20 shows a comparison of the Basic Mathematics course objectives to the COMPASS test content.

The COMPASS practice test had no items that represented seven of the course objectives. In the Basic Mathematics objectives, applications were listed as separate objectives. Of the fourteen problems on the COMPASS practice test, eight involved an application. Four of the items on the Basic Mathematics pretest did not meet course objectives. Five of the items on the COMPASS practice test did not meet course objectives. Question two on the

Table 14

Comparison of Items on COMPASS Numerical Skills/Prealgebra Practice Test, Departmental Pretest, and Basic Mathematics Course Objectives

Basic Mathematics Course Defined Objectives	Item Number on Pretest	Item Number on COMPASS
Whole Numbers		
1. Read and write whole numbers in word form and digit form.	1	
2. Add, subtract, multiply, and divide whole numbers.	2	1,6
3. Round whole numbers to specified place value.		
4. Simplify expressions using the order of operations. (Several items satisfied this criteria, but item 3 was specifically intended to meet this criteria)	3	1
5. Solve application problems involving whole numbers.		6
Fractions		
1. Identify characteristics of fractions and mixed numbers.		3
2. Write fractions in lowest terms by using prime factorization.[a]	5	3,4
3. Multiply and divide fractions and mixed numbers.	6	4
4. Add and subtract fractions and mixed numbers.	8, 9	3,4
5. Simplify expressions involving fractions and mixed numbers.	5,6,8,9	
6. Solve application problems involving fractions.		5
Decimals		
1. Read and write decimals in word form and digit form.	10	
2. Round decimals to specified place value.	0	
3. Add, subtract, multiply, and divide decimal numbers.	12	
4. Convert fractions to decimals and vice versa.	11	5
5. Simplify expressions involving decimals.	12	5
6. Solve application problems involving decimals.	13	5
Ratios and Proportions		
1. Define and use ratios.	15	
2. Define and use proportions.	14	9,10
3. Solve application problems involving proportions	13,15	10
Percents		
1. Define and use percents.	16, 17	11,12
2. Solve application problems involving percent	18	11,12
Total Items That Meet Objectives	16	
Test Items that do not meet Objectives	4, 7, 19,20	2,6,8,13,14

[a]The students had to simplify fractions, but they did not necessarily have to use prime factorization.

COMPASS practice test and questions 19 and 20 on the pretest represent basic operations with integers. The questions are found in Table 15.

Questions three and four on the COMPASS Numerical Skills/Prealgebra practice test and items five, six, eight, and nine from the pretest satisfy the requirement for basic operations with fractions. These questions are shown in Table 16. Each of the four questions concerning fractions on the departmental pretest covers one operation. For example, question 6 involved dividing a mixed number by a fraction. While there are different manners to simplify this expression, the standard method would involve changing the dividend to an improper fraction, changing the operation to multiplication, and inverting the divisor, commonly known as the invert and multiply strategy. Students may then choose to simplify and multiply or vice versa. Upon viewing the problem, it

Table 15

Questions Involving Integers

Question 2, COMPASS Practice Test

2. The lowest temperature on a winter morning was -8°F. Later that same day the temperature reached a high of 24°F. By howmany degrees Fahrenheit did the temperature increase?
   A. 3°
   B. 8°
   C. 16°
   D. 24°
   E. 32°

Question 19, Departmental Pretest

19. Simplify the following expression.

$$(-6)(5)-(-4)$$

   A. -26
   B. 26
   C. -34
   D. 34
   E. None of these

Question 20, Departmental Pretest

20. Simplify the following expression.

$$(-5)^2 - 2^4$$

   A. -41
   B. -26
   C. 17
   D. 9
   E. None of these

Table 16

Questions Involving Fractions

Question 3, COMPASS Practice Test

3. If $\left(\frac{3}{4}-\frac{2}{3}\right)+\left(\frac{1}{2}+\frac{1}{3}\right)$ is calculated and the answer reduced to simplest terms, what is the denominator of the resulting fraction?

A. 24
B. 12
C. 6
D. 4
E. 3

Question 4, COMPASS Practice Test

4. $\frac{1}{2}+\left(\frac{2}{3}\div\frac{3}{4}\right)-\left(\frac{4}{5}\times\frac{5}{6}\right)=$

A. $\frac{1}{16}$ B. $\frac{17}{27}$ C. $\frac{13}{18}$ D. $\frac{7}{9}$ E. $\frac{5}{6}$

Question 5, Departmental Pretest

5. Reduce $\frac{54}{63}$

A. $\frac{18}{21}$
B. $\frac{8}{9}$
C. $\frac{54}{63}$
D. $\frac{6}{7}$
E. None of these

Question 6, Departmental Pretest

6. Perform the following.

$$4\frac{1}{3}\div\frac{5}{6}$$

A. $\frac{26}{5}$
B. $3\frac{7}{9}$
C. $\frac{34}{9}$
D. $\frac{68}{18}$
E. None of these

Question 8, Departmental Pretest

8. Subtract the fractions. Write the answers in lowest terms.

$$\frac{7}{8}-\frac{1}{12}$$

A. $\frac{3}{2}$
B. $\frac{19}{24}$
C. $1\frac{1}{2}$
D. $\frac{19}{20}$
E. None of these

Question 9, Departmental Pretest

9. Add. Write the answers in lowest terms.

$$1\frac{2}{3}+1\frac{3}{4}$$

A. $3\frac{5}{12}$
B. $\frac{42}{12}$
C. $2\frac{17}{12}$
D. $\frac{7}{2}$
E. None of these

may seem simple. However, previous research indicates that students consistently

struggle in their attempts to understand fractions (Tatsuoka, 1984). Though seemingly straight-forward questions, each of the questions involving fractions includes multiple steps. The items from the COMPASS practice test involve multiple operations and include order of operations. Each of the six questions from both tests has the opportunity for students to make multiple mistakes. Question three on the COMPASS practice test requires that students simplify the expression and then analyze their response to the question. The questions on the COMPASS test require students to perform more steps than do the questions on the departmental pretest.

Questions 9 and 10 from the COMPASS practice test correspond to items 13, 14, and 15 on the pretest. These questions are listed in Table 17. What follows is a comparison of these questions. Question 9 on the COMPASS test and the departmental pretest question 14 both test the same skill of simplifying a proportion. However, the COMPASS test item results in a whole number solution while the departmental pretest question results in an improper fraction that must be simplified. Students at this level have often been taught to change improper fractions to mixed numbers. This belief in correct procedures could result in an incorrect answer since the mixed number equivalent is not an answer option. For students who have studied ratios and proportions, question 15 on the departmental pretest requires a routine application. Question 10 on the COMPASS test requires a more analytical response that assumes a higher level of reasoning. Question 13 on the departmental pretest might be considered routine except that students must convert ounces to pounds or vice versa to compare prices. In this

Table 17

Question 9, COMPASS Practice Test

9. What value of x solves the following proportion?

$$\frac{9}{6}=\frac{x}{8}$$

A. $5\frac{1}{3}$

B. $6\frac{3}{4}$

C. $10\frac{1}{2}$

D. 11

E. 12

Question 10, COMPASS Practice Test

10. If the total cost of x apples is b cents, what is a general formula for the cost, in cents, of y apples?

A. $\frac{b}{xy}$

B. $\frac{x}{by}$

C. $\frac{xy}{b}$

D. $\frac{by}{x}$

E. $\frac{bx}{y}$

Question 13, Departmental Pretest

Find the best buy (based on the price per ounce).

13. Brand A: 27 oz. for $0.44
Brand B: 2.5 lbs. for $0.64 (Remember 1lbs. = 16 oz.)

A. Equal value.

B. None of these.

C. Not enough information.

D. Brand A.

E. Brand B.

Question 14, Departmental Pretest

Find the unknown number in the proportion.

14. $\frac{n}{4}=\frac{5}{6}$

A. None of these.

B. $\frac{6}{20}$

C. $\frac{20}{6}$

D. $\frac{10}{3}$

E. $\frac{5}{24}$

Question 15, Departmental Pretest

Use a proportion to solve the problem.

15. The scale on a map is 3 inches equal to 19 miles. How many miles are represented by 18 inches?

A. 114 miles

B. Not enough information

C. None of these

D. 54/19 miles

E. 288 miles

category, the COMPASS test offered one skills-based question and one question that involved an analysis. The departmental pretest had one skills-based question and two applications problems, one of which required an analysis.

Questions 11 and 12 from the COMPASS practice test required using percentages. This topic is represented by questions 16, 17, and 18 on the pretest. These questions are presented in Table 18. The COMPASS test questions and question 18 on the departmental pretest represent applications while the pretest questions 16 and 17 require skills developed through practicing with percentages. At first glance, questions 16 and 17 appear straightforward. However, question 16 may confuse students since many students think that the decimal equivalent of percents should be less than one. For example, in the interviews, Kara worked this problem. She stated, "I've always known to move the decimal. I think it's one or two places. It should be A . . . 284%. That's not right. Twenty-eight point four 'cause you move it one place." Question 18 may have bias for students more experienced with shopping. As Judy said in the interview, "I can shop. I just can't do algebra."

When comparing the content on the COMPASS Numerical Skills/Prealgebra Placement test with the Basic Mathematics course objectives using Tables 19 and 20, eight of the content items listed for the COMPASS test have no corresponding course objective. Five of the 22 course objectives do not fall into a COMPASS Placement Test category.

Many items included in the COMPASS test have no corresponding course objective in Basic Mathematics as shown in Table 20. One section of the Basic Mathematics course objectives covers whole number operations, but integer operations

Table 18

Questions Involving Percentages

Question 11, COMPASS Practice Test

11. On a math test, 12 students earned an A. This number is exactly 25% of the total number of students in the class. How many students are in the class?
    A. 15
    B. 16
    C. 21
    D. 30
    E. 48

Question 12, COMPASS Practice Test

11. This year, 75% of the graduating class of Harriet Tubman High School had taken at least 8 math courses. Of the remaining class members, 60% had taken 6 or 7 math courses. What percent of the graduating class had taken fewer tha 6 math courses?
    A. 0%
    B. 10%
    C. 15%
    D. 30%
    E. 45%

Question 16, Departmental Pretest

16. Write as a percent.

    2.84

    A. 284%
    B. 2.84%
    C. 28.4%
    D. None of these
    E. 0.0284%

Question 17, Departmental Pretest

17. 4 is what percent of 5?
    A. 0.8%
    B. 80%
    C. None of these
    D. 8.0%
    E. 125%

Question 18, Departmental Pretest

18. The sale price on a shirt is 20% off the listed price. What would you pay for the shirt if the listed price is $45.00 and there is a sales tax of 7%?
    A. Not enough information
    B. You have got to be kidding me
    C. None of these
    D. $32.85
    E. $38.52

are not included in the objectives. The topics of exponents, square roots, and scientific notation addressed on the COMPASS test have no matching course objectives in Basic Mathematics. Other topics addressed on the COMPASS test that do not have matching Basic Mathematics course objectives are averages, multiples and factors of integers, number theory and counting and simple probability. These incongruent categories account for 43% of the test items in the COMPASS test pool.

Standards for Multiple-Choice Tests

The COMPASS test items were written using three target cognitive levels (ACT, Inc., 2006). These levels correspond to the three categories suggested for use in writing multiple-choice test items (Center for Faculty Excellence, 1990). ACT test writers use basic skills questions, application questions, and analysis questions that correspond to the three suggested levels of recall, application, and evaluation. The Center for Faculty Excellence describes recall questions as those that require students to reiterate facts, application questions as those that require students use prior knowledge to solve a problem, and evaluation questions as those which require students to choose a plan of action based on information provided. Tables 21 and 22 show test matrices for the COMPASS Practice Test and the departmental pretest show the cognitive level of each question, the percentage of questions in each level, and the number of items on the test representing each content category (Center for Faculty Excellence, 1990). The Compass Practice test was comprised of 40% Basic Skills questions and 60% Application questions. Eighty-five percent of the departmental pretest consisted of basic skills questions with only 15% representing application items.

Haladyna, Downing, and Rodriguez (2002) conducted research that validated

Table 19

COMPASS Numeral/Prealgebra Placement Test Content Matched with Departmental Pretest Items and COMPASS Practice Test Items

COMPASS Numeral/Prealgebra Placement Test Content	Items in Test Pool	Percentage of Items in Pool	Item Number from Pretest	COMPASS Practice Test Questions (15 questions)
Basic operations with integers	57	17	2,3, 19, 20	1,2
Basic operations with fractions	58	17	5, 6, 8, 9, 11	3,4
Basic operations with decimals	48	14	10, 12,13	5,6
Exponents, square roots, and scientific notation	44	13		7,8
Ratios and proportions	30	8	13, 14, 15	9,10
Percentages	50	14	16, 17, 18	11,12
Conversions between fractions and decimals	2	less than 1	11	
Multiples and factors of integers	6	2	4,7	
Absolute values of numbers	9	3		
Averages (means, medians, and modes)	31	9		13,14
Range	4	1		
Order concepts (greater/less than)	3	less than 1		
Estimation skills	1	less than 1		
Number theory	2	less than 1		
Counting problems and simple probability	6	2		
Total	351	100		
Test Items that do not meet content requirements			1	

multiple-choice item writing guidelines. For this content analysis, the researcher used the item writing guidelines to analyze the questions on the COMPASS practice test and the departmental pretest. The guidelines consisted of five sections that covered content,

Table 20

COMPASS Numeral/Prealgebra Placement Test Content Matched to Basic Mathematics Course Defined Objectives

COMPASS Numeral/Prealgebra Placement Test Content(Percentage of Items in Test Pool):	Basic Mathematics Course Defined Objectives:
Basic operations with integers (17%)	Add, subtract, multiply, and divide whole numbers. Simplify expressions using the order of operations. Solve applications involving whole numbers.
Basic operations with fractions (17%)	Write fractions in lowest terms by using prime factorization. Multiply and divide fractions and mixed numbers. Add and subtract fractions and mixed numbers. Simplify expressions involving fractions and mixed numbers. Solve application problems involving fractions.
Basic operations with decimals (14%)	Add, subtract, multiply, and divide decimal numbers. Simplify expressions involving decimals. Solve application problems involving decimals.
Exponents, square roots, and scientific notation (13%)	
Ratios and proportions (8%)	Define and use ratios. Define and use proportions. Solve application problems involving proportions.
Percentages (14%)	Define and use percents. Solve application problems involving percents.
Conversions between fractions and decimals (<1%)	Convert fractions to decimals and vice versa.
Multiples and factors of integers (2%)	
Absolute values of numbers (3%)	
Averages (means, medians, and modes) (9%)	
Range (1%)	
Order concepts (greater/less than) (<1%)	
Estimation skills (<1%)	
Number theory (<1%)	
Counting problems and simple probability (2%)	
Pretest Items that Do Not Match Any COMPASS Numerical/Prealgebra Content	Read and write whole numbers in word form and digit form. Round whole numbers to specified place value. Identify characteristics of fractions and mixed numbers. Read and write decimals in word form and digit form. Round decimals to specified place value.

format, style, composition of the stem, and composition of the choices. Since ACT, Inc. hires people specifically to write, edit, and test items, one would expect the questions on the COMPASS to follow these guidelines. Even though this would be a reasoned

Table 21

Test Matrix for Cognitive Level on the COMPASS Practice Test

COMPASS Numerical Skills/Prealgebra Test Content	Basic Skills (Level 1)	Application (Level 2)	Analysis (Level 3)	Percent of Test for Each Objective
Basic operations with integers	1	2		14.3%
Basic operations with fractions	4		3	14.3%
Basic operations with decimals		5,6		14.3%
Exponents, square roots, and scientific notation	7		8	14.3%
Ratios and proportions	9		10	14.3%
Percentages		11, 12		14.3%
Conversions between fractions and decimals				0%
Multiples and factors of integers				0%
Absolute values of numbers				0%
Averages (means, medians, and modes)		13, 14		14.3%
Range				0%
Order concepts (greater/less than)				0%
Estimation skills				0%
Number theory				0%
Counting problems and simple probability				0%
Percent of Test Devoted to Each Level	29%	50%	21%	

assumption, the researcher still compared the sample questions to the list of guidelines. The questions followed closely to the guidelines set forth in the list. However, the departmental pretest showed room for improvement when compared with the guidelines.

The researcher analyzed the departmental pretest items for each section. In the content section, one of the guidelines stated, “Avoid trick items.” Pretest item 13 contains a parenthetical statement that students may overlook. The phrase is not bolded. Item 14 contains two equivalent correct answers. The directions do not say to simplify the solution. Questions 13 and 14 would classify as trick items. The pretest had no problems

Table 22

Test Matrix for Cognitive Level on the Departmental Pretest

Basic Mathematics Course Defined Objectives By Groups	Basic Skills (Level 1)	Application (Level 2)	Analysis (Level 3)	Percent of Test for Each Objective
Whole Numbers	1, 2, 3			15%
Fractions	5, 6, 8, 9			20%
Decimals	10, 11, 12			15%
Ratios and Proportions	14	13, 15		15%
Percents	16,17	18		15%
Test Items that Do Not Match Objectives	4,7,19,20			20%
Percent of Test Devoted to Each Level	85%	15%	0%	

in the formatting or style section. In the stem writing section, item 14 violated the guideline that the directions in the stem be clear and concise. Many problems with the pretest emerged when the researcher analyzed the answer choices. Item 14 violated the guideline that suggested making sure there is only one answer. The next guideline stated that the answer locations should be varied. In this test, the authors used A seven times, B four times, C none, D six times, and E three times. The next guideline states that questions choices should be in logical or numerical order. One of the questions follows this guideline. Another guideline advises the careful use of "None of the above." Every question on the departmental pretest has a "None of these" response, but the placement in order of choices varies. Another guideline for writing choices advises against giving away answers by providing absurd choices such as the one found in item 18, "You have got to be kidding me." The last guideline that was violated contained the suggestion of making all distracters believable. The previous choice for number 18 violated this guideline. The departmental pretest was not constructed following the multiple-choice item writing guidelines.

Placement Decision Associated With the Test and Administration of the Test

Associated with the comparison of the two tests is the placement decision, which is base on the student's test score. The placement decision is made using predetermined set scores. Students who score 46 or below on the COMPASS Placement Test are assigned to the Basic Mathematics. When the students finish the COMPASS Placement Test, the testing software scores the test and the results are delivered to the students within ten minutes. The student receives a printed report containing the score and a suggestion for course placement. The departmental pretest is administered the first day

that the course meets. After the students take the test, instructors score the test. Since the primary purpose of the pretest is not for placement, the instructor may not score the tests quickly. The instructor may inform students if they score above 70%. If the student wants the pretest to be used for placement, the student must request that the test be scored quickly. The responsibility rests with the student for the departmental pretest to be used as a placement test.

Relationship Between Student Feelings of Appropriate Course Placement and Student Factors of Satisfaction with Pace of Course, Length of Time Since the Last Mathematics Course and the Score Received on the COMPASS Placement Test

The fourth research question concerned the relationship between the variable of student feelings of appropriate course placement and the variables of student satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS placement. With a mixed methods study, the researcher may change the study based on data collected during the study. Based on student comments on the survey and during the interviews, the relationship between the variables of satisfaction with pace of course and length of time since the last mathematics course was investigated. These variables were analyzed using descriptive statistics and compared using bivariate correlation. The data was tested for normal distribution and found to be asymmetrical. Because the variables were ordinal and non-parametric, the researcher used a Spearman rank correlation coefficient. The data for students' feelings of improper placement was collected from responses to item 15 on the student survey, "I think the placement test and placement procedure placed me in the correct course for my abilities." This item was reverse coded. Student responses to items 13, 14, 16, 17 and 18 were used

for the variable of student satisfaction with pace of course. Item 14 was also reverse coded. Students who responded, “strongly agree” to satisfaction with Basic Mathematics taught in sixteen weeks would probably not respond “strongly agree” to believing in their ability to complete the course at a faster pace. Items 13 through 18 allowed students to choose the options of “5, Strongly Agree; 4, Agree; 3, Neutral; 2, Disagree; 1, Strongly Disagree.” Each of these items also included the option of explaining the answer. The responses to “length of time since the last math class” were separated into five categories. A time interval of less than a year was assigned a 1, from 1 to 3 years was assigned a 2, 4 to 6 received a 3, the interval from 7 to 10 years was given a 4, and more than 10 years was assigned a 5. Test scores were assigned ranks with COMPASS test scores less than 20 being assigned a 1, 21-25 received a 2, scores of 26-30 received a 3, scores from 31-35 received a 4, and scores above 35 received a 5.

Table 23

Descriptive Statistics for Variables

Variable	Median	Mean	SD
Feelings of Placement (n=82)	2	2.11	0.98
Satisfaction with Pace of Course (n=82)	3	3.13	0.76
Time Since Last Mathematics Course (n=78)	2	3.11	1.38
Placement Test Score (n=81)	3	3.00	1.42

The relationships were tested using the Spearman rank correlation coefficient, r_s. This question resulted in three hypotheses. The first hypothesis stated that there was a relationship between the variable of students' feelings of proper placement and student satisfaction with the pace of the course. The second hypothesis maintained that there existed a relationship between the variable of students' feelings of proper placement and student COMPASS test scores. The third hypothesis stated there is a relationship between the variable of students' feelings of proper placement and length of time since the last mathematics class. The mean and standard deviation for each of these variables is displayed in Table 23. Since the placement scores were reverse coded, a low score on placement indicates proper placement while a high score would indicate improper placement. For the variable of satisfaction with pace of course, a high score would reveal dissatisfaction with pace of course. Although 82 students responded to the survey, one did not have a test score and four did not respond to the item about length of time since the last mathematics course.

The first comparison explored the relationship between the students' feelings of proper and improper placement and student satisfaction with pace of course. The results are shown in Table 24. Using Spearman rank correlation coefficient, r_s. a relationship between the students' feelings of proper placement and student satisfaction with pace of

Table 24

Relationship Between Feelings of Proper Placement and Satisfaction with Pace of Course,(n=82)

Spearman rank correlation coefficient	.420
Significance ($p<0.05$, 2-tailed)	0.000

course, was tested for significance. The statistics produced were r_s=.420, p<.001, n=82. Therefore, at alpha level 0.05, there is a significant relationship between students' feelings of proper and improper placement and student satisfaction with pace of course.

The second comparison stated that there was a relationship between students' feelings of proper placement and the length of time since the last mathematics course. There was no relationship between student feelings of proper placement and the length of time since the last mathematics course with alpha level of 0.05. According to the test for significance, no correlation exists between the two variables, r_s=- .209, p=.067, n=78. This information is presented in Table 25.

Table 25

Relationship Between Feelings of Proper Placement and Length of Time Since Last Math Course,(n=78)

Spearman rank correlation coefficient	-.209
Significance (p<0.05, 2-tailed)	0.067

The researcher then investigated the relationship between students' feelings of proper placement and the score received on the COMPASS Placement Test. Through

Table 26

Relationship Between Feelings of Proper Placement and COMPASS Mathematics Placement Test Scores,(n=81)

Spearman rank correlation coefficient	-0.011
Significance (p<0.05, 2-tailed)	0.925

correlation testing, the researcher found no significant relationship between the two variables, r_s=- .011, p=.925, n=81. The results are presented in Table 26.

The last relationship explored concerns the variables of satisfaction with pace of course and length of time since the last mathematics class. Using the Spearman rank correlation coefficient, at the alpha level of 0.05, r_s=- .254, p=0.035, n=78, a relationship existed between student satisfaction with pace of course and length of time since the last mathematics course. This information is displayed in Table 27.

Table 27

Relationship Between Satisfaction with Pace of Course and Length of Time Since Last Mathematics Course, (n=78)

Spearman rank correlation coefficient	-0.254
Significance (p<0.05, 2-tailed)	0.035

Conclusion

In this research project, responses from the 82 students provided insight into student perceptions of the placement process and their view of the COMPASS Placement Test versus the departmental pretest. Interviews conducted with four students provided a broader understanding of student views. A content analysis was conducted to compare the COMPASS Placement Test and departmental pretest. The factors of student feelings of proper placement and the variables of student satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS placement were tested for correlation. Both quantitative and qualitative analyses focused exploring the placement process for the Basic Mathematics students at this southwestern

community college to provide information to increase the effectiveness of factors that have been shown to increase retention.

The first question concerning students' perceptions of the placement process resulted in 72% of the students stating they had been properly placed. Sixty-one percent of students who reported receiving a "C" or better in Algebra II felt they had been placed correctly in Basic Mathematics. Explanations to responses indicated that students felt a need to review basic mathematics prior to taking the placement test. Although students claimed correct placement, they responded affirmatively to being able to complete the course at a faster pace. Respondents revealed an anxiety associated with the length of time required to complete the coursework. In the free response section, 98% of students answered that they had been told about the ACT test score requirement, but only 25% knew anything about the mathematics placement test. Students shared requests for types of test preparation material and gave suggestions to improve the pace of the course.

The second question in the study addressed students' perceptions of the COMPASS Placement Test versus the departmental pretest. Student responses to this portion of the research revealed students believed there was an incongruity between the subject matter of the placement test and the curriculum in Basic Mathematics. The majority of students felt the tests covered the same content, but the students' comments showed they did not think the subject matter of the placement test and the curriculum in Basic Mathematics were the same. The issue of student preparation again arises as only four students admitted to studying for the placement test.

The third research question dealt with a comparison of the COMPASS Numerical Skills/Prealgebra Placement Test and the departmental pretest. A content analysis of the

two tests revealed that the COMPASS Placement Test and departmental pretest contained questions that did not meet the course objectives. Twenty-one percent of the questions on Compass Placement Test were written at the analysis level. Eighty-five percent of the departmental pretest was written at the basic level, and none of the questions were written at the analysis level. The COMPASS Placement Test followed the guidelines for writing multiple-choice questions while the departmental pretest did not.

The fourth question examined the relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS Placement Test. A significant relationship was found to exist between student feelings of proper placement and student satisfaction with pace of course at the alpha level of .01. Due to findings in the qualitative portion of the study, satisfaction with pace of course was compared to length of time since the last mathematics course. A relationship was found to exist between these two variables at the alpha level of .05.

Chapter 5 contains a discussion of the results of this study along with an analysis of the results. Emerging themes will be explored, implications from the research will be examined, and recommendations for future research topics will be given concerning the research questions addressed in this study.

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CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this mixed methods study was to describe student perceptions of the placement process used for placement of students in a Basic Mathematics course at a southwestern community college and to determine if a relationship existed between student satisfaction with placement and other factors such as pace of course and scores on the placement test. During the course of the study, themes emerged that allowed for insight into student views concerning the placement process. This chapter addresses these themes as they relate to the individual questions and to the research as a whole.

This mixed method study used qualitative and quantitative analyses to extract information concerning student perceptions of the placement process. The student survey responses, interview responses, and content analysis of the tests used for placement revealed common themes that emerged through the various forms of analysis. These themes answered the following research questions:

1. What are Basic Mathematics students' perceptions of the placement process for developmental mathematics courses?
2. What are Basic Mathematics students' perceptions of the placement test versus the department created pretest subject matter and Basic Mathematics course curriculum?

3. How does the COMPASS Numerical Skills/Prealgebra Placement Test compare to the Departmental Pretest given to all Basic Mathematics students?
4. Is there a relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS Placement Test?

Patterns developed into themes in the analysis of data using qualitative and quantitative methods. Participants were community college students enrolled in Basic Mathematics courses during two different semesters. All students responded to a survey, and four students participated in interviews used to gain insight into the survey responses. A content analysis comparing the COMPASS Placement Test and the departmental pretest was conducted. Through the analysis of data, the following themes emerged: lack of clear communication with the student, responsibility of the student, and the desire for students' to be heard.

In this chapter, response patterns associated with each question will be addressed. A discussion on the emergent themes follows the analysis of response patterns. After considering both of these topics, recommendations associated with the study and implications for future research will be provided.

Students' Perceptions of the Placement Process for Developmental Mathematics Courses

The first question addressed the students' perceptions of the placement process for developmental mathematics courses. The placement process begins with the initial contact between the student and the college. This contact could be at the point when the student goes to the college website to get enrollment information or when the student appears at the college and requests help for enrollment. The process continues until the

student is placed in courses for the current semester. The process includes the testing process used for placement in English, reading, and mathematics. Student perception of the placement process may be affected by the required coursework. For instance, if the course curriculum is too easy for the student, the student may find fault with the placement process and feel as though the class was a waste of time. Therefore, the placement process ends when students enroll, but student perceptions and evaluations continue throughout the semester.

Student responses concerning the placement process were positive. Seventy-two percent of the students believed that they were correctly placed into Basic Mathematics. Even most of the traditional students affirmed correct placements. Seventy percent of students who had taken a mathematics class during their senior year affirmed their placement as appropriate. On the other hand, forty-seven percent of students responded affirmatively to having a desire for a faster-paced course. Sixty-nine percent of traditional students and 39% of nontraditional students wanted a course that moved more quickly through the material allowing for a quicker progression through the required mathematics course sequence. This corresponds to the percentage, 48%, of students concerned with the length of time it would take to meet their goals. Askt (1991) stated that students drop out when they feel overwhelmed by the length of time necessary to complete coursework. In this study, the length of time does not pertain to assignments but the actual length of time it takes to navigate through the developmental mathematics coursework. These findings fall under the theme of student responsibility. In an attempt to help students succeed, many student decisions such as attendance and choice in course placement have been changed to mandatory attendance and mandatory placement as described in this

study. Student responsibility has been deemphasized as academic success has been emphasized. In this study, the majority of students recognized the need for the Basic Mathematics coursework, but they had concerns about meeting their goals and completing the program requirement, whether as an associate's degree or a prescribed program. The students indicated a need to be given the opportunity to complete the coursework in a timely manner and take responsibility for their own learning.

Students revealed their receipt of information concerning enrollment occurred at the point of personal contact when the students actually appeared on campus to enroll. Forty-five percent of the students found out about the ACT test score requirements at this time. Very few students prepared for the placement test prior to taking it, and most students responded to knowing very little about the test. In hindsight, students wanted preparation material. Nineteen percent of students wanted a refresher course, 20% voiced a desire for practice problems, and 15% said they would benefit from tutoring. Thirty-three percent of traditional students would prefer practice problems while nineteen percent of nontraditional students wanted practice problems. Twenty-three percent of nontraditional students would prefer a refresher course. The community college in this study provides links on its website for test preparation. Few students knew of this option. The theme of the need for clear communication emerged through analysis of this data. Student responses verified this theme. Students referenced a desired to know the test content beforehand. This information is accessible through links to test preparation websites provided on the community college website. Students also voiced a desire to have the option to retest. The community college allows the students to take the test twice in a semester and even offers another written placement test option. These statements by

students indicated a lack of effective information dissemination methods used by the college for the placement testing process. Overall, students indicated satisfaction with the placement process, but their responses indicated a need for better communication with the college concerning the testing process.

Students' Perceptions of the COMPASS Placement Test versus the Departmental Pretest and Basic Mathematics Curriculum

The second question considered students' perceptions of the COMPASS Placement Test versus the departmental pretest. The COMPASS Placement Test is given to any student who has not scored the minimum of 19 on the ACT mathematics subscore. Students scoring 46 or below on the COMPASS Placement Test are automatically placed into Basic Mathematics. Upon entering the Basic Mathematics course, students take a departmental pretest. If a student scores 70% or above on the pretest, the instructor may approach the student with the option of dropping Basic Mathematics to enroll in Elementary Algebra. In this manner, the departmental pretest serves as a placement test. Students responded to survey questions concerning these two tests.

Through their comments, students revealed that they did not study for the COMPASS Placement Test. One student even stated that you could not study for the test. The students arrived at enrollment unprepared to take the test. In response to the question concerning calculator use, the majority of students found out when taking the test that calculators were allowed. Seventy-five percent of the students had no prior knowledge of the test.

Student interviews revealed that student perception of the tests varied from one student to another and that even the same student's perceptions varied. Gina admitted to

disliking reading, so she perceived that the COMPASS test questions were more difficult. Kara thought the COMPASS Placement Test items were harder but then struggled with the rules associated with a departmental pretest item. Student interviews revealed the differences associated with student perceptions of both tests.

In their responses to student perceptions concerning the two tests, students demonstrated knowledge of self. Their responses to the questions exposed their views concerning the tests. Several students were confused by their scores on the COMPASS Placement Test. Comments such as "I felt disappointed, I thought I was good at math" indicated this confusion. This confusion concerning the COMPASS Placement Test score could lead to conflicts with self-efficacy. Self-efficacy includes the way in which a person perceives his abilities (Bandura, 1995). A student whose test score does not match his perceived abilities could experience a conflict resulting in doubt over his ability to succeed in the course and even in college. This conflict could be magnified by the students' belief that the subject matter on the COMPASS test was the same as the subject matter on the departmental pretest. One student alluded to the idea that the tests had to be the same because they both resulted in Basic Mathematics placement.

The emerging themes in this section correspond to student responsibility and communication. Students who felt that the placement test incorrectly assessed their abilities showed a knowledge of self that should be considered when guiding students through the enrollment process. Communication of COMPASS Placement Test rules prior to testing would allow students to shoulder more of the responsibility for test scores. In this manner, the themes of communication and student responsibility mesh together through the analysis of responses to this question.

Content Analysis Comparison of COMPASS Placement Test and Departmental Pretest

The third question concerned a content analysis used to compare the COMPASS Numerical Skills/Prealgebra Placement Test and the departmental pretest. This content analysis described the purpose, content, placement decision process, authors, and rigor of each test. To compare the two tests, a COMPASS practice test and the departmental pretest were used. The COMPASS Placement Test manual provided in-depth information about the test. Many differences between the two tests surfaced.

The analysis of the two tests revealed differences in the initial purpose, placement decision process, rigor, standards, and content of the two tests. The COMPASS Placement Test was designed as a test to be used to determine student knowledge for placement in mathematics courses. The departmental pretest was developed for use as an assessment of student knowledge upon entering the Basic Mathematics course. The two tests have very different initial purposes. The placement decision process for the COMPASS Placement Test transpires from the computer analysis of the student's test score. The placement decision using the departmental pretest depends on the instructor's analysis. The rigor, content differences and standards will be addressed in the following paragraphs.

The rigor of the COMPASS Placement Test was compared to the departmental pretest using a test matrix to compare the tests at three different cognitive levels of Basic Skills, Application, and Analysis. The COMPASS practice test was 29% basic skills, 50% application, and 21% analysis. The departmental pretest was 85% basic skills and

15% application with no questions classified as analysis. This data indicates that the rigor of the two tests was very different.

The two tests revealed an incongruity in subject matter. On the list of COMPASS Placement Test content items, eight of the items have no corresponding Basic Mathematics course objectives. Five of the Basic Mathematics course objectives do not match a COMPASS Placement Test category. One of the Basic Mathematics test items did not match any COMPASS Placement Test category. The differences in the two tests used for placement could cause confusion for students concerning the importance of correct placement.

The last comparison between the two tests addressed differences found using the standards and guidelines used to create multiple-choice tests. One could expect the COMPASS Placement Test to follow the standards and guidelines developed for creating good multiple-choice tests. When the COMPASS practice test questions were evaluated using the standards and guidelines, the questions did prove to follow the standards and guidelines. The departmental pretest did not follow the standards and guidelines. The errors in the departmental pretest appear mainly in the stem choices. However, one glaring error exists in answer choices. No answer choice was “C”.

The content analysis of the two tests revealed striking differences. The only similarity exists in that the authors of both tests were knowledgeable in mathematics. The study of differences between the tests reveals a lack of communication between instructors and placement counselors concerning the use of the tests for placement. Knowledge of the placement process becomes the responsibility of the student, but the student must first be given a placement test that reflects the content of the course.

Relationship Between Student Feelings of Proper Placement and Student Factors of Satisfaction with Pace of Course, Length of Time Since the Last Mathematics Course and the Score Received on the COMPASS Placement Test

The fourth research question considered the relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS Placement Test. When qualitative analysis exposes other possible questions, the researcher may consider the new question as well. In this research, the analysis showed a need to compare satisfaction with pace of course and length of time since the last mathematics course. This relationship was also explored. The findings associated with this question provide a better foundation for recommendations from this study.

To answer this question a bivariate correlation using Spearman rank correlation coefficient tested for the relationship between the variable of proper placement and the other three variables. Only one significant relationship existed between the variables tested. The variable of proper placement had a significant relationship with pace of course at the alpha level of .01. If the student was placed properly, the student was more likely to be satisfied with the course. A Spearman rank correlation coefficient was used to test the added comparison of satisfaction with pace of course and length of time since the last mathematics course. A significant negative correlation existed between these two variables at the .05 alpha level.

According to research, student retention is affected by the student's satisfaction with the course (Armington, 2002). Proper placement and length of time since the last mathematics courses are both factors worth considering when looking for indicators of

student satisfaction. Giving students the opportunity to voice an opinion on their placement could result in more effective placements and more satisfied students thus improving retention. Boylan, et al. (1999) found that students need to be given more avenues to passing a course. These avenues can be discovered by listening to the students. The emergent theme revealed through this question involves giving the students a chance to be heard.

Emergent Themes

The four research questions had three themes threaded throughout the student responses. The first theme concerned the need for better communication. The second theme exposed the need to promote student responsibility for learning and choice. The third theme developed as the students' desire to be heard. A discussion of these themes follows.

For most people, communication can be one way or two ways. In the first emergent theme, the communication was one-way. The students felt a need to receive communication concerning the enrollment process. In this instance, good communication was good advertisement. The information should reach the target audience. Personnel assigned to the responsibility of information dissemination may deliver it in a variety of manners. The communication should be monitored to determine which methods are most effective with the variety of target audiences. Enrollment specialists must recognize that a single method of communication will not serve everyone and that supplying information in any form such as written material or through a website was unproductive unless that information was shared directly with students. Students wanted practice problems, and the college provided the problems. However, somewhere communication was disrupted

because students did not know about the availability of the practice problems. One student suggested that the college offer Elementary Algebra and Intermediate Algebra in one semester, but the college does offer that sequence. Again, the information did not make it to the student. Most students found out at the testing center that calculator use was allowed. Again, the timing of the communication became an issue. As Judy said in her interview, she wanted a pamphlet "in her hands" so that when "I got here I could have been prepared to do what I needed to do."

The second theme, the need to promote student responsibility, has long been a concern among college professionals. In the 1980s when colleges began to consider students as consumers of education (Seidman, 2005), a portion of the responsibility for student success moved to administrators and then to faculty. The faculty and administrators share the responsibility to extend the opportunities for success, but one must also recognize that there exists a responsibility for the student to work hard and participate whole-heartedly (Davis & Murrell, 1994). In this study, students voiced a desire to choose faster-paced courses. These same students stated that the Basic Mathematics course was the correct course placement for them. Together, these two items show students' willingness to take responsibility for their own learning. Astin (1984) stated in his theory of involvement that students will be more likely to persist if they are involved in campus life. The research in this study shows that students believe they will persist if they are given the responsibility of succeeding.

The third theme emerged as the students' need to be heard. The first theme of communication was one-way communication to disseminate information to the students. The communication associated with the third theme involves a two-way dialogue. Freire

stated, “dialogue was the encounter in which the united reflection and action of the dialoguers are addressed to the world which was to be transformed and humanized,. . . .” (2007, p. 88). Dialogue was not meant to be one-way or heard and tossed aside. Dialogue must exist in a realm of commitment to a cause. This commitment is not blind but recognizes faults and loves in spite of disagreements. The commitment exists not just as words but also in actions, thus dialogue includes words accompanied by deeds (Freire, 2007). The student who stated that “basic math, uh, I think it was a waste of my time,” needs to be heard just as well as the student who said, “I need to improve my skills before I enter a higher level of math.” Students voiced concern over the length of time necessary for goal completion. Student opinion does exist as a factor and should be considered in placement. When a student is not allowed to follow a faster-pace of coursework, the student may get discouraged and choose not to continue goals at a slower pace or to continue at another school.

The interactionalist model of student retention states that students will persist due to the interaction of several different personal and institutional factors (Tinto 1987). The themes that emerged in this study focus on improvements that could easily affect student feelings of connection with the college. The one factor that affects college outcomes more than any other was “the degree to which students are integrated into the life of the campus, interact with faculty and peers, and are involved in their studies” (Davis & Murrell, 1994, para. 4). The first action of communicating in the placement process would be a method of integrating students into campus life. The second action of encouraging knowledge of student responsibility would connect students by involving them in their own learning. The third theme of giving students the opportunity to be heard

materializes as interaction between faculty and students. The themes emerging from the research give rise to implications concerning the study.

Implications

The results of this study have implications for the student placement process at the community college in this study and for other colleges struggling with the implementation of a strict placement policy. The administration, faculty, and counselors hold the keys to success for students in appropriate course placement, student support services, and even proper placement testing. These avenues to completion of goals should vary based on individual characteristics of the students such as traditional students versus non-traditional students, grades in high school mathematics courses, and students' perception of their own ability. On the other hand, students hold the attributes necessary for their own success in areas such as recognition of their current level of knowledge of mathematics, self-efficacy, and dedication to meeting their goals. As each emergent theme appeared, so did the accompanying action.

The first theme of communication concerning the placement process involves action in the form of information dissemination. While it would be simple to say that the information on the website could be presented in a more eye-catching manner, the website had other information that was just as important. To highlight one section over another was not feasible. Therefore, information concerning the student placement process could be compiled into a pamphlet distributed to area high schools, the local newspaper, and distributed before the beginning of each semester through local advertisements. One student suggested that information be shared in the same way as the local career center. The local career center follows the aforementioned pattern.

Action associated with the second theme of promoting student choice and responsibility could involve a more deliberate approach by faculty to teach students of expectations regarding responsibility. Students must understand what behaviors result in satisfactory academic achievement. While students must understand their responsibilities, faculty must also be willing to be involved with students in teaching these responsibilities. Students who interact with peers and faculty will be more likely to develop a sense of responsibility to themselves and others. When given the opportunity to fail or succeed, responsible student will choose to succeed (Davis & Murrell, 1994).

The third theme involves allowing students to voice an opinion in placement. This does not mean just allowing students to state their case, but informing the student of placement test scores, giving them enough information to make an informed decision, and then allowing students to choose a suitable course. Students could be given more flexibility if placement test scores fell in a range of scores instead of using a cutoff score for placement. This option could involve offering a variety of different paced courses during different semesters. For instance, one option might be to offer Basic Mathematics and Elementary Algebra spread over the fall semester and the winter session. Students could then take Intermediate Algebra during the spring semester. This option would allow students to complete the sequence from Basic Mathematics to College Algebra in one year if students took College Algebra as a summer course. Faculty and students would need to be flexible in accepting new approaches to scheduling, coursework, and placement to allow students to progress at a faster pace.

The findings of this research imply that students need better avenues of communication, more choices, and need to be more involved in the course selection

process as responsible students. Due to low rates of retention, colleges have tightened control on student enrollment in an attempt to increase retention rates. The implications from this study will allow the tight controls to remain, but also will give students an opportunity to grow within these constraints.

Recommendations for Future Research

The purpose of this study was to consider student perception of the placement process including placement testing and course placement. The study further analyzed data to determine if a relationship existed between student satisfaction with placement and factors such as pace of course and scores on the placement test. Through analyzing the data associated with this study, several recommendations for future research arose. These recommendations were the following:

- This study focused on student perceptions of the placement process. Future research could be conducted to consider faculty perceptions of the placement process and then compare faculty perception to student perceptions of the placement process. This research would follow the same framework as the current study but would give a broader perspective of the placement process.
- An extension of this study could monitor the Basic Mathematics students progress through the developmental sequence. Using a mixed methods design, a study could be conducted to record students' feeling of appropriate placement compared to the students' grades in mathematics courses as well as goal completion. Furthermore, the study could include a qualitative portion concerning students' perception of their ability in mathematics, reasons for those perceptions, and how the students actually perform in the course sequence.

- Again, the focus of this study was the perception of Basic Mathematics students concerning the placement process. Students enrolled in Elementary Algebra and Intermediate Algebra follow a similar placement process. A similar case study approach would be useful in determining the view of these students in order to add another dimension to student perception of the whole placement process.
- Instructors at this community college often have students for subsequent courses. One instructor could possibly have the same students through the whole sequence up to College Algebra. A mixed methods study could follow the students in a Basic Mathematics course who stayed with the same instructor along with those who chose different instructors. The study would include quantitative data in the form of pass rates of the students and the perception of students in each of the groups.
- The interviews raised questions concerning students' problem solving abilities. A case study could be conducted to compare students' problem solving skills on textbook word problems, reading proficiency, and problem solving skills with applications that the students encounter in their own lives.
- While this study considered the viewpoint of traditional and nontraditional students, a case study on traditional or nontraditional students as they navigated through the placement process could reveal in-depth information concerning the particular trials of being a traditional or nontraditional student who enters college unprepared. A case study including interviews and student journals could add to the research concerning traditional and non-traditional students.

- The previous recommendation leads to an idea for further analysis that could be quite revealing. Future research could involve a case study of traditional students placed into developmental courses who successfully completed a secondary school college preparatory mathematics course within the last year.
- Another possible extension to this study could be to consider the learning styles of students enrolled in Basic Mathematics courses. A similar framework to the one used in this study could compare student learning styles to their perception of the course and perception of the placement process with information collected from a survey, learning styles test, observations, and interviews.
- The study found that students wanted the option of taking coursework at different paces. Suggestions include determining which pace course offerings work best to increase retention at this community college. A quantitative longitudinal study could track the students' successful completion of goals at the community college according to which pace of class the student chose. Variables to consider would include ACT scores, the pace chosen for each mathematics course, and whether students participated in study sessions before taking the COMPASS Placement Test. The study could be short term or long term.
- In this study, students voiced concern over the difference in their actual placement test scores and their perceived score. Future research could include a case study that would compare a students' self-efficacy with students' perceived scores and students' actual placement test scores.
- Student responsibility emerged as an issue in this study. Most of the students in this study were first semester students. Future research should include comparing

first semester students' knowledge of responsibility with second semester students' knowledge of responsibility through a mixed methods study.

- In this study, the majority of students taking the Basic Mathematics course were female. A qualitative case study using interviews might reveal insight concerning this phenomenon. Participants could be traditional and non-traditional female students. Respondents could be questioned concerning learning styles, previous experiences with mathematics, and life choices. These students' experiences in the community college mathematics courses could be recorded.

While this study looked specifically at Basic Mathematics students' perception of the placement process at a particular community college, the findings suggest that further research using the framework of this study will give insight into several different areas. The suggestions for future research concern a variety of topics that could affect research areas such as developmental education, retention, student self-efficacy, and bridging the gap between high school and college curriculum.

Concluding Remarks

The findings from this research verify the importance of this study to the organization of the community college in this study and to provide the structure for other community colleges to conduct similar research. The questions addressed by this study were as follow:

1. What are Basic Mathematics students' perceptions of the placement process for developmental mathematics courses?

2. What are Basic Mathematics students' perceptions of the placement test versus the department created pretest subject matter and Basic Mathematics course curriculum?
3. How does the COMPASS Numerical Skills/Prealgebra Placement Test compare to the Departmental Pretest given to all Basic Mathematics students?
4. Is there a relationship between student feelings of proper placement and student factors of satisfaction with pace of course, length of time since the last mathematics course and the score received on the COMPASS Placement Test?

The purpose of the study was to describe student perceptions of the placement process used for assignment of students to a Basic Mathematics course at a southwestern community college and to determine if a relationship existed between student satisfaction with placement and other factors such as pace of course and scores on the placement test. Through qualitative and quantitative analysis using surveys and interviews, the answers to the research questions revealed student perceptions regarding the placement process from the first contact between the student and the community college through the students' reaction to the Basic Mathematics curriculum. The study showed that college personnel and students must learn to communicate concerning this process to increase efficiency, student satisfaction, and retention. Students must learn to take responsibility for the placement process, but they must be given all the information necessary to make informed decisions. If communication is increased and students take responsibility, then students will perceive that they have a voice in the placement process. Otherwise, students will continue to feel dissatisfied with portions of the placement process.

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APPPENDICES

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Appendix A
Demographic Data

Demographic Data

		Total	Traditional	Non-traditional	Fall	Summer
1	Age					
	18-22	44 (54%)	44 (54%)	0 (0%)	41 (50%)	3 (4%)
	22-25	6 (7%)	0 (0%)	6 (7%)	5 (6%)	1 (1%)
	26-30	13 (16%)	0 (0%)	13 (16%)	10 (12%)	3 (4%)
	31-40	11 (13%)	0 (0%)	11 (13%)	10 (12%)	1 (1%)
	41-70	8 (10%)	0 (0%)	8 (10%)	3 (4%)	5 (6%)
2	Gender					
	Male	18 (22%)	13 (16%)	5 (6%)	15 (18%)	3 (4%)
	Female	62 (76%)	30 (37%)	32 (39%)	53 (65%)	9 (11%)
3	Employed					
	Yes	33 (40%)	18 (22%)	15 (18%)	27 (33%)	6 (7%)
	No	49 (60%)	26 (32%)	23 (28%)	42 (51%)	7 (9%)
4	Hours Worked per Week					
	0-20	11 (13%)	9 (11%)	2 (2%)	9 (11%)	2 (2%)
	21-40	16 (20%)	8 (10%)	8 (10%)	14 (17%)	2 (2%)
	40+	6 (7%)	2 (2%)	4 (5%)	4 (5%)	2 (2%)
5	Goals After Community College					
	Transfer to a university	55 (67%)	36 (44%)	19 (23%)	47 (57%)	8 (10%)
	Full-time employment	22 (27%)	7 (9%)	15 (18%)	18 (22%)	4 (5%)
	Part-time employment	3 (4%)	1 (1%)	2 (2%)	2 (2%)	1 (1%)
	Other	3 (4%)	1 (1%)	2 (2%)	3 (4%)	0 (0%)
6	Student Status					
	Full-time	68 (83%)	39 (48%)	29 (35%)	57 (70%)	11 (13%)
	Part-time	12 (15%)	3 (4%)	9 (11%)	10 (12%)	2 (2%)
7	Marital Status					
	Married	26 (32%)	15 (18%)	11 (13%)	26 (32%)	0 (0%)
	Never Married	48 (59%)	38 (46%)	10 (12%)	44 (54%)	4 (5%)
	Divorced	11 (13%)	1 (1%)	10 (12%)	8 (10%)	3 (4%)
	Widow/Widower	2 (2%)	1 (1%)	1 (1%)	2 (2%)	0 (0%)

8	Children in Home					
	0	34 (41%)	37%	4 (5%)	33 (40%)	1 (1%)
	1 to 2	34 (41%)	10 (12%)	24 (29%)	24 (29%)	10 (12%)
	3 to 5	10 (12%)	2 (2%)	8 (10%)	8 (10%)	2 (2%)
	5+	2 (2%)	0 (0%)	2 (2%)	2 (2%)	0 (0%)
9	Completed High School Course with "C" or Above					
	Algebra I	49 (60%)	34 (41%)	15(18%)	41(50%)	8(10%)
	Geometry	35 (43%)	29 (35%)	6(7%)	31(38%)	4(5%)
	Algebra II	40 (49%)	33 (40%)	7(9%)	37(45%)	3 (4%)
	Math of Finance	17 (21%)	12 (15%)	5(6%)	16(20%)	1(1%)
	Trigonometry	5 (6%)	2 (2%)	3 (4%)	3 (4%)	2(2%)
	Other (Pre-Algebra, Basic Math, Applied Math, or Other Specialized Class)	9 (11%)	0 (0%)	9 (11%)	6 (7%)	3 (4%)
	Other - Algebra III	1 (1%)	1 (1%)	0 (0%)	1 (1%)	0 (0%)
10	Mathematics Course Necessary to Meet College Goals					
	Basic Mathematics	4 (5%)	0 (0%)	4 (5%)	4 (5%)	0 (0%)
	Elementary Algebra	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Intermediate Algebra	5 (6%)	2 (2%)	3 (4%)	4 (5%)	1 (1%)
	Mathematics in Society	4 (5%)	2 (2%)	2 (2%)	4 (5%)	0 (0%)
	College Algebra	49 (60%)	27 (33%)	22 (27%)	38 (46%)	11 (13%)
	Trigonometry	1 (1%)	1 (1%)	0 (0%)	1 (1%)	0 (0%)
	Calculus I, II, III	5 (6%)	5 (6%)	0 (0%)	5 (6%)	0 (0%)
11	Took Mathematics During Senior Year					
	Yes	39 (48%)	24 (29%)	15 (18%)	36 (44%)	3 (4%)
	No	43 (52%)	20 (24%)	23 (28%)	33 (40%)	10 (12%)
	If Yes, Student Was Successful	22 (27%)	14 (17%)	8 (10%)	21 (26%)	1 (1%)
12	Length of Time Since the Last Mathematics Class					
	1 year or Less	20 (24%)	20 (24%)	0 (0%)	19 (23%)	1 (1%)
	More than 1 Year and Less than 5 Years	25 (30%)	19 (23%)	6 (7%)	22 (27%)	3 (4%)
	Five Years or More	34 (41%)	1 (1%)	33 (40%)	25 (30%)	9 (11%)

Appendix B
Basic Math Student Survey

Please answer the following questions. Pace is defined at the number of weeks it takes to complete a Basic Math class. Basic Math is the first no-credit developmental math class offered at this college.

Demographic Information

Name _____ Student ID _____

1. What is your age?

   _____18 – 22 years old _____22 – 25 years old _____26 – 30 years old

   _____31- 40 years old _____41 - 70 years old

2. What is your gender?

   _____Male or _____Female

3. Are you employed?

   _____Yes or _____No

4. If you are employed, how many hours a week do you work?

   _____0 - 20 _____21 – 40 ____40+

5. What are your goals after leaving this college?

   ____Transfer to a university
   ____Full-time employment
   ____Part-time employment
   ____Other. Please describe. _____

6. How many credit hours are you taking this semester? _____

7. What is your marital status?

_____Married _____Never Married _____Divorced
_____Widow/Widower

8. How many children do you have living with you?

_____0 _____1 - 2 _____3 – 5 _____5+

9. Which high school math courses did you complete with a grade of C or better?

_____Algebra I
_____Geometry
_____Algebra II
_____Math of Finance
_____ Trigonometry
_____Other. Please list _____

10. What is the highest level of mathematics you need to complete your program/goals?

_____Basic Mathematics
_____Elementary Algebra
_____Intermediate Algebra
_____Math in Society
_____College Algebra
_____Trigonometry
_____Calculus, I, II, IIII
_____Other. Please explain answer.

_____

11. Did you take mathematics during your senior year of high school?

_____Yes or _____No

If yes, were you successful? Please give the class you took and explain your answer.

12. How long has it been since your last mathematics class?

Questions Related to Satisfaction with pace of class.

To what extent do you agree with each of the items listed below. Please circle the number of your response.

5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2= Disagree, 1 = Strongly Disagree

13. I believe that other students feel that basic math could be completed in 8 weeks.

5	4	3	2	1
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Please explain your response:_____

14. I am satisfied with Basic Math being taught in one semester (16 weeks).

5	4	3	2	1
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Please explain your response:_____

15. I think the placement test and placement procedure placed me in the correct course for my abilities.

5	4	3	2	1
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Please explain your response:_____

16. I could have completed basic math in eight weeks of a 16 week semester. In other words,

I could have completed this course at a faster pace.

5	4	3	2	1
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Please explain your response:_____

17. I would be willing to use online tutoring services if it would help me complete the basic math course more quickly.

5	4	3	2	1
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Please explain your answer:_____

18. While receiving the same credit hours, I would like to finish my basic math class in a shorter period of time.

5	4	3	2	1
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Please explain your answer:_____

19. I am concerned about the number of semesters it will take me to finish my mathematics

requirements to complete my goals.

5	4	3	2	1
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Please explain your answer:_____

Open Response Questions:

Please answer the following questions with regard to the mathematics placement process.

20. When a student enters a community college and does not have a certain ACT score in mathematics they must take a placement test.

    Were you aware of this process? ____Yes or ____No

    If so, how?

    If not, how did you find out?

21. Did you prepare for the mathematics placement test? _____Yes or _____No

    If you answered yes, how much time did you spend preparing? _____ hours

22. Did you know you could use a calculator on the mathematics placement test?

    _____Yes or _____No

    If you answered yes, when did you find out that you could use a calculator on the placement test? _____

    If no, do you believe that you would have scored higher if you had known that you could use a calculator on the test? _____Yes or _____No

    Please explain your answer.

23. What did you know about the mathematics placement test before you took the test?

24. What support would you have used prior to the placement test to assist you in raising your score on the mathematics placement test? Examples of support include items such as practice problems, tutoring, a short refresher course.

    If you think you would have used support, how many hours would you have been willing to spend in one week using this support to prepare for the test?

25. How did you feel when you saw your mathematics placement test score? Why did you feel this way?

26. Do you feel that the mathematics placement test covered material that matched pretest you took in Basic Mathematics? Please explain.

27. Describe your feelings concerning the mathematics placement process. Please give any ideas you think would increase your ability of successfully navigating the placement process.

28. What suggestions do you have concerning the time it takes to complete the developmental math courses – Basic Math, Elementary Algebra, and Intermediate Algebra? In other words, if you were going to design a developmental mathematics course schedule to fit your demands, what would it be like?

29. What support would make you more successful in your math classes?

30. Do you have any other comments or suggestions regarding the pace or schedules for the developmental math courses?

Appendix C
Interview Protocol

Interviewer: Hello, (name of participant). Thank you for allowing me to interview you. I want to ask you some questions concerning the placement process. I will be recording this interview. If you do not understand a question, you may ask for clarification. It is your choice to answer or NOT answer any of the questions. Do you agree with or have any questions concerning this process? (Wait for response)

I am going to record your responses on this digital voice recorder. Only the researchers will have access to the recordings and transcripts of the recordings. These recordings and transcripts will be labeled so that your name is not attached to them. Do you agree for your interview to be recorded? (Wait for response)

Interviewer: (Concerning first research question) Tell me about your experience with the placement process in general.

1. What stands out in your memory about the process?
2. How long did the whole process take?
3. Did anyone talk with you about the process before, during, or after the process?

Tell me about your experiences with the mathematics portion of the placement process.

1. What stands out in your memory about this portion of the process?
2. How were you placed in this Basic mathematics course?
3. How did you feel about the process as you went through it?
4. How do you feel about the process now?

(After each question, wait for response.)

Interviewer: (Concerning second research question) Tell me about the COMPASS Placement Test.

1. What do you remember specifically about the test? (Give student paper to share responses.)
2. Approximately how many questions did you answer?
3. Approximately, how long did it take you to complete the placement test?
4. What was your general opinion of the test?

Tell me about the pretest you took the first day of your Basic Mathematics course.

1. What do you remember specifically about the test? (Give student paper to share responses.)
2. Approximately, how long did it take you to complete the placement test?

3. What was your general opinion of the test?
4. How do you think the placement test and the pretest are similar? Different?

(Interviewer will share a few of the pretest questions with students and ask their opinion on the items.)

Interviewer: Based on your survey, you stated "_____". Tell me about that statement.

Interviewer: Is there anything else about the placement process, testing procedures, or the developmental mathematics program you would like to share at this time?

Appendix D
Script for Recruiting Participants

Hello - My name is Linda Goeller and I am a faculty member from the Mathematics Department at Seminole State College. I am also a graduate student at Oklahoma State University. I am here to ask you to participate in my research study. This is a study about different aspects of the placement process used for placement of students in a basic mathematics course at Seminole State College . You are eligible to be in this study because you are enrolled in this Basic Mathematics course.

If you decide to participate in this study, you will complete a survey today. The survey will take about twenty minutes. The survey consists of questions concerning your perspective of the placement process and demographic questions such as age and graduation date.

Two of you will be contacted later to participate in an interview. The interviews will take place in an empty classroom in Tanner Hall at Seminole State College. The interview will include questions about your perspective of the placement process at Seminole State College and your method of answering questions similar to those on the mathematics placement test and those on the pretest. During the interview, you may be asked to clarify a response that you gave on the survey.

Remember, this is completely voluntary. You can choose to be in the study or not. If you'd like to participate, you may fill out the consent form and then the survey. If you choose not to participate, you do not have to fill out the form. If you need more time to decide if you would like to participate, you may also call or email me with your decision. My information will be on the consent form.

Do you have any questions for me at this time?.

If you have any more questions about this process or if you need to contact me about participation, I may be reached at my office phone which is 405-382-2055 or at my office, room 13.

Thank you so much.

Institutional Review Board Approval

Oklahoma State University Institutional Review Board

Date:	Tuesday, July 20, 2010
IRB Application No	ED1097
Proposal Title:	Developmental Mathematics: Students' Perspectives of the Placement Process
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 7/19/2011

Principal Investigator(s):

Linda S. Goeller
35276 E. 119 Rd.
Earlsboro, OK 74840

Patricia Jordan
247 Willard
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.

X 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 H. Kennison

Shelia Kennison, Chair
Institutional Review Board

SEMINOLE State COLLEGE
P.O. BOX 351 • 2701 BOREN BOULEVARD • SEMINOLE, OK 74818-0351 • PHONE: (405) 382-9950
Office of the Vice President for Academic Affairs

July 20, 2010

Oklahoma State University Institutional Review Board
219 Cordell North
Stillwater, OK 74078

To Whom It May Concern:

The research study titled "Developmental Mathematics: Students' Perspectives of the Placement Process" by Linda Goeller has been approved by Seminole State College.

Seminole State College has approved an IRB for this research study to be done at this institution.

Sincerely,

Paul Gasparro, Ed.D.
Vice President for Academic Affairs

VITA

Linda Smith Goeller

Candidate for the Degree of

Doctor of Philosophy/Education

Thesis: DEVELOPMENTAL MATHEMATICS STUDENTS' PERCEPTION OF THE PLACEMENT PROCESS

Major Field: Professional Education /Mathematics Education

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy/Education in Professional Education Studies at Oklahoma State University, Stillwater, Oklahoma in May, 2011.

Completed the requirements for the Master of Education in Mathematics Education at Northeastern State University, Tahlequah, OK in 2005.

Completed the requirements for the Bachelor of Science in Accounting at Oklahoma State University, Stillwater, OK in 1985.

Experience:

2009 to present Mathematics Instructor, Seminole State College, Seminole, OK
2004 to 2009 High School Mathematics Teacher, Keys Public Schools, Park Hill, OK
2006 to 2007 Adjunct Instructor, Northeastern State University, Tahlequah, OK.
1995 to 2006 Adjunct Instructor, Northeast Oklahoma A & M, Miami, OK
1995 to 2004 High School Mathematics Teacher, Jay Public Schools, Jay, OK

Professional Memberships:

National Council of Teachers of Mathematics
Oklahoma Mathematics Association of Two Year Colleges
Kappa Delta Pi, International Honor Society in Education
Research Council on Mathematics Learning

Name: Linda Smith Goeller Date of Degree: May, 2011

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: DEVELOPMENTAL MATHEMATICS STUDENTS' PERCEPTION OF THE PLACEMENT PROCESS

Pages in Study:164 Candidate for the Degree of Doctor of Philosophy

Major Field: Professional Education /Mathematics Education

Scope and Method of Study:

Eighty-two students participated in this mixed methods study. The study used qualitative and quantitative data to consider the perceptions of students concerning the placement process at a southwestern community college. Student satisfaction was compared to other factors such as pace of course and scores on the placement test. A survey was administered to participants in a summer and fall semester. Two students from each semester participated in interviews to provide more insight concerning the placement process. A content analysis comparing the placement test and a departmental pretest was performed.

Findings and Conclusions:

Seventy-two percent of the students stated they had been properly placed. A content analysis was conducted to compare the COMPASS placement test and a departmental pretest. Differences were found between the two tests, but student comments indicated a belief that the two tests were similar. A significant relationship was found between students' feelings of proper and improper placement and student satisfaction with pace of course at a 0.05 alpha level. A significant relationship was also found to exist between student satisfaction with pace of course and length of time since the last math course when using a Spearman rank correlation at the alpha level of 0.05. Emerging patterns that developed from this study concerned communication, student responsibility, and student input. The study revealed that college personnel and students must learn to communicate clearly concerning the placement process to increase efficiency, student satisfaction, and retention. Student responsibility emerged as a key component in increasing the effectiveness of the placement process. In order for communication and student responsibility to increase, students must be given a voice in the placement process. The research in this study opened up many other questions concerning the placement of students in developmental mathematics courses.

ADVISER'S APPROVAL: Dr. Patricia Jordan