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An Investigation of the Performance in College Algebra of Students Who Passed the Summer Developmental Program at Mississippi State University

Martha Hall Pratt

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AN INVESTIGATION OF THE PERFORMANCE IN COLLEGE ALGEBRA OF
STUDENTS WHO PASSED THE SUMMER DEVELOPMENTAL
PROGRAM AT MISSISSIPPI STATE UNIVERSITY

By

Martha Hall Pratt

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in Education
in the Department of Curriculum and Instruction

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Candidate for Degree of Doctor of Philosophy

At Mississippi State University (MSU), students who do not meet full admission requirements may enroll in the Summer Developmental Program (SDP). During this ten-week summer program, students take four developmental courses to prepare them for college-level courses. MA 0003 Developmental Mathematics is the course designed to prepare these students for MA 1313 College Algebra. In addition, the Department of Mathematics and Statistics at MSU offers MA 0103 Intermediate Algebra to prepare students for MA 1313 College Algebra. The purpose of this study was to determine

(a) whether there were correlations between student grades in MA 0003, MA 0103, and MA 1313, (b) whether students' grades in MA 0003 and MA 0103 would predict

their grades in MA 1313, and (c) whether their grades in MA 0003 would predict their grades in MA 0103.

A Pearson product-moment correlation coefficient was performed on the data. The results showed that there were statistically significant correlations between grades in MA 0003 and MA 0103, between grades in MA 0003 and MA 1313, as well as between grades in MA 0103 and MA 1313 ($p = 0.05$). Linear regression was used to find the equations to predict students' grades in MA 1313 from their grades in MA 0003 and MA 0103 and predict grades in MA 0103 from grades in MA 0003. An analysis of the results revealed that the higher the grade a student received in the lower-level mathematics courses, MA 0003 and MA 0103, the higher the grade the student received in the college-level mathematics course, MA 1313.

Based on this study, further research was recommended to investigate the success of the SDP students in courses above the level of MA 1313 and their success in graduating from MSU. Because the Department of Mathematics and Statistics at MSU has made changes in the college algebra course, MA 1313, since this study, further research should be conducted to investigate the performance of the SDP students in the "new" college algebra.

DEDICATION

I would like to dedicate this to my children, Casey and Courtney, who always believed in me and made sacrifices so that I could complete this degree. Thanks for always being there.

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CHAPTER I
INTRODUCTION

Mississippi State University

From its beginning in 1878, Mississippi State University (MSU) has been known as “The People’s University” (*Bulletin of the Mississippi State University*, 2001). MSU is a comprehensive, public, land-grant institution classified as Doctoral/Research-Extensive by the Carnegie Foundation. The enrollment at MSU is over 16,000 students of which approximately 13,000 are undergraduate students and approximately 3,000 are graduate students. About 75% of the students are residents of Mississippi, 20% are from out-of-state, and 5% are international students representing more than 60 countries. Minority students comprise about 20% of the student body. Approximately 53% of the student body are male, and approximately 18% are students with disabilities (*MSU General Facts and Figures*, Retrieved January 11, 2005). The university has 52 academic departments and eight colleges and schools offering graduate and undergraduate programs in architecture, agriculture, the arts, business, education, engineering, the humanities, natural resources, science, social and behavioral sciences, and veterinary medicine. MSU also maintains four research and extension centers located throughout the state.

Background

Of the eight colleges and schools at MSU, the largest is the College of Arts and Sciences (A & S). It provides the fundamental training for students who want to become college graduates. All undergraduate students take more than half of their courses during the first two years at MSU in A & S (*Bulletin of the Mississippi State University*, 2001). A & S offers curricula in the fine arts, the humanities, the sciences, and the social sciences, as well as professional curricula for students who take their professional training elsewhere such as medical, dental, and law schools. These curricula prepare students for one or more academic disciplines. There are nearly 300 faculty members in the 16 departments within A & S (*MSU College of Arts & Sciences*, Retrieved March 26, 2005).

The largest department in A & S is the Department of Mathematics and Statistics (DMS), which consists of approximately 40 faculty members and about 50 graduate students. In addition to the courses required for bachelors', masters', and doctoral degrees in mathematics and statistics, college-level mathematics courses required for degrees in other academic areas are taught by the faculty and some of the graduate students in the DMS (*MSU Department of Mathematics & Statistics*, Retrieved March 26, 2005).

In the early 1970s, the faculty in the DMS was concerned with the variation in the levels of the basic mathematical skills of incoming freshmen. Data collected between 1970 and 1973 indicated that approximately 60% of the students in college algebra made a grade of C or higher. The content in the college algebra course at that time was essentially the topics covered in a high school algebra course. However,

students needed to know more content than the topics covered in the college algebra course in order to be prepared to take more advanced mathematics courses.

Therefore, even though students passed college algebra, many were still inadequately prepared for the more advanced mathematics courses considered essential for a quality undergraduate degree (DMS, 1980 January).

In 1973, the DMS attempted to better prepare students for courses subsequent to college algebra by changing the content in the college algebra course, MA 1153. Strengthening the content taught in the college algebra course raised the standards in the course; however, raising the standards in the college algebra course resulted in a drop to only 40% of the students receiving a grade of C or higher. The faculty in the DMS unanimously agreed that the standards of the existing college algebra course needed to be upgraded to adequately prepare students for more advanced mathematics courses. In order to better meet the needs of students who were academically unprepared and to maintain the new standards in college algebra, the DMS introduced a basic algebra course (DMS, 1979 October).

This basic algebra course was offered for the first time in the fall of 1978. It was offered under the number MA 1993 to indicate it was an experimental course offered on a trial basis. MA 1993 Fundamentals of Algebra was designed to provide the basic skills that students needed to master before taking college algebra. After discussion among the faculty about this basic algebra course, the chairman of the DMS established a committee to make recommendations about the basic algebra course (DMS, 1979 October). Upon recommendations made by the committee, the faculty voted to offer the proposed basic algebra course as a regular course within the

DMS. However, since a course can only be offered for two academic years under an experimental number, the proposed course, MA 1103 Fundamentals of Algebra, replaced MA 1993 in the fall of 1980 (see Appendix A for catalog description and course outline for MA 1103 Fundamentals of Algebra). At this time, all beginning students took two mathematics examinations during orientation, one in algebra and one in trigonometry. Students who made a score less than 11 on the algebra examination were recommended to enroll in MA 1103 (DMS, January 1980).

In the spring of 1980, the Mississippi Board of Trustees of State Institutions of Higher Learning (IHL), which is the constitutional governing body of Mississippi's eight public universities, mandated each of the universities provide a developmental program in mathematics. Entering freshmen with an American College Test (ACT) mathematics score less than 12 were recommended to enroll in the developmental mathematics course. IHL specifically required that the developmental mathematics program have a minimum of five contact hours per week and include some laboratory or tutorial work. In order to satisfy the IHL requirements for developmental mathematics, the Department of Mathematics and Statistics essentially changed MA 1103 to MA 0003 Developmental Mathematics and added MA 0002 Developmental Arithmetic, a laboratory course (DMS, 1980 March).

The laboratory course, in addition to the developmental mathematics course, still did not cover all the topics students needed to prepare them for college algebra. In order to bridge the gap in content between Developmental Mathematics and College Algebra, the DMS created MA 1103 Intermediate Algebra in fall 1984. The number for Intermediate Algebra later changed to MA 0103 to indicate it did not

count toward a degree and was not computed in a student's grade point average (GPA). Additionally, the college algebra course number changed from MA 1153 to MA 1313. Even though neither the developmental mathematics courses nor the intermediate algebra course counted toward graduation, these courses were the only courses offered by the university to prepare students for college algebra. Later, changes in preparing students for college-level work were made by the university based on mandates by IHL because of a lawsuit.

As a result of the Ayers' lawsuit, filed in 1975 by a group of Mississippians seeking compensation for African-American students and Mississippi's Historically Black Colleges for past denial of equal educational opportunity in Mississippi's system of public four-year colleges, IHL mandated a statewide admissions policy for all universities. Under this policy, IHL put in place system-wide admission standards beginning with the 1995 – 1996 school year. The uniform admission standards were to eliminate the prior segregative effects of the previous admissions standards (*Ayers v. Fordice*, 1995). Students who meet the uniform admission standards are granted full admission to any public university in the state of Mississippi (see Appendix B for IHL's uniform admission standards). However, students who do not meet the regular admissions standards may be admitted with "academic deficiencies." These students must complete an academic screening process designed by IHL to determine whether the student will benefit from remediation and what the remediation should be. Items considered include high school performance, ACT/SAT scores if available, placement testing, special interests and skills as well as other noncognitive factors.

ACCUPLACER was chosen by IHL as a placement instrument for Mississippi's eight

public universities (Dr. William R. Smith, personal communication, September 23, 2005). Starting in 1996, ACCUPLACER scores were used to determine whether incoming freshmen had the required skills to be successful in freshmen-level courses or whether they needed to be placed in developmental courses.

ACCUPLACER is a battery of computer-adaptive tests that integrates testing, scoring, reporting, placement criteria, course selection, and information on academic performance of incoming freshmen. Faculty from two-and four-year colleges developed items on ACCUPLACER. ACCUPLACER tests have consistent 0.9 reliabilities with national normative data submitted by more than 350 institutions (College Entrance Examination Board and Educational Testing Services, 1998). Even though ACCUPLACER contains a battery of eight tests, IHL chose the Reading Comprehension, Sentence Skills, and Elementary Algebra tests to assess students' skill levels in reading, English, and mathematics (see Appendix C for sample questions from ACCUPLACER). The Reading Comprehension test consists of 20 questions designed to measure how well a student understands what he/she reads. The Sentence Skills test consists of 20 questions involving sentence correction and construction shift. The Elementary Algebra test consists of 16 questions pertaining to operations of integers and rational numbers, operations with algebraic expressions, and skill in solving equations, inequalities, and word problems. All three tests are untimed. Students who make a minimum score of 80 on Reading Comprehension, a minimum score of 86 on Sentence Skills, and a minimum score of 60 on Elementary Algebra are eligible to enroll in an IHL university (J. O'Bannon, personal communication, November 11, 2004).

At the end of the screening process, a student is placed in one of the categories: full admission or full admission with academic deficiencies. A student with academic deficiencies must enroll in both the Summer Developmental Program (SDP) and the Year-long Academic Support Program. Both of these programs were established at each of the universities as part of the settlement in the Ayers lawsuit (Ayers v. Fordice, 1995). The SDP is an intensive program that concentrates on fundamental skills of reading, writing, and mathematics essential for success in freshman-level courses. The Year-Long Academic Support Program is designed to help students admitted with academic deficiencies, as well as other volunteer students, with their freshmen courses.

Summer Developmental Program at Mississippi State University

The SDP at MSU began in the summer of 1996. During this ten-week summer program, students enroll in four developmental courses: EN 0003 Developmental English, LSK 0003 Developmental Reading, MA 0003 Developmental Mathematics, and LSK 0023 Developmental Studies Laboratory. Only students in the SDP are allowed to enroll in these courses. These developmental courses neither count toward a degree nor are they used to compute the student's GPA.

Students meet English, reading, and mathematics classes each morning for approximately one hour. Instruction is the traditional lecture style. Each instructor makes out his/her own formative evaluation instruments for their particular course. However, the final exam in each course is a statewide, standardized exam. The final

exam is made by a committee consisting of a representative in the discipline from each of the eight institutions. The final exam counts between 50 and 75 % of the final course grade; the actual percentage that the final exam counts in the final course grade is determined each year by the Council of Chief Academic Officers for the IHL Board.

Students also spend approximately two hours each afternoon in the computer lab. The lab is housed in the library. Instructors in the SDP plan the activities that take place during lab time, and a graduate assistant supervises the lab and helps students with the tutorial software. Each instructor designates a test day and is available in the lab to help students the day before the test. Lab time may also be used for professionals from Student Support Services to counsel students about such things as study skills and test anxiety.

To successfully complete the SDP, students must pass all four courses. Upon successful completion of the program, students receive a “certificate” that allows them to be admitted to any public university in Mississippi.

At the end of the SDP, students once again take the ACCUPLACER as a post-test. The post-test ACCUPLACER scores along with recommendations by the course instructors determine whether students who successfully completed the SDP enroll in college-level courses or intermediate courses (D. Daniels, personal communication, August 3, 2004). If their scores on the elementary algebra section of the ACCUPLACER are 73 or higher, they may enroll in college algebra. If their scores are below 73, they are recommended to enroll in intermediate algebra. In addition, all students who successfully complete the SDP must enroll for the fall and spring

semesters in the academic support course, LSK 0023 Developmental Studies Laboratory (Office of Academic and Student Affairs of the Board of Trustees of State Institutions of Higher Learning, 2004).

Purpose of Study

Before the summer of 1996, students at MSU who demonstrated weaknesses in mathematics enrolled in either MA 0003 Developmental Mathematics or MA 0103 Intermediate Algebra. Students were placed in these classes based on their ACT mathematics score. Beginning in the summer of 1996, students who did not pass the university screening were required to enroll in the SDP, and, as a part of the SDP, they had to take MA 0003 Developmental Mathematics. After successfully completing the SDP, students were advised to enroll in either MA 0103 Intermediate Algebra or MA 1313 College Algebra, based on results from the ACCUPLACER post-test given at the end of the SDP and on the instructor's recommendation. The purpose of this study was to determine if there are statistically significant correlations between student grades in MA 0003 Developmental Mathematics, MA 0103 Intermediate Algebra, and MA 1313 College Algebra.

Research Question and Null Hypotheses

The research question for this study is:

Are there correlations between student grades in MA 0003 Developmental Mathematics, MA 0103 Intermediate Algebra, and MA 1313 College Algebra?

To answer this research question, three null hypotheses were addressed.

1. HO_1 : There is no statistically significant correlation between student grades in MA 0003 Developmental Mathematics and student grades in MA 0103 Intermediate Algebra.
2. HO_2 : There is no statistically significant correlation between student grades in MA 0003 Developmental Mathematics and student grades in MA 1313 College Algebra.
3. HO_3 : There is no statistically significant correlation between student grades in MA 0103 Intermediate Algebra and student grades in MA 1313 College Algebra.

Rationale of the Study

In most colleges and universities, a large majority of degree programs and majors require students to take or test out of mathematics courses (Steen, 1999). Beginning in the fall of 1984, IHL established common core curriculum requirements for Mississippi's eight public universities. One of these requirements is three semester hours of college algebra. In addition, the MSU core curriculum requires that all students graduating after January 1, 1990, must have taken six to nine semester hours of mathematics which includes MA 1313 or its equivalent and at least one additional college-level mathematics course from an approved list.

In a review of the literature, it was discovered that most developmental programs only required students to take the developmental course in the subject area for which they demonstrated academic deficiency. They were also allowed to enroll in the developmental courses along with other college-level courses during the fall

and spring semesters of the academic year. Until the summer of 1996, the developmental program at MSU followed the same policy. Because of the IHL mandate, beginning in the summer of 1996, students who do not meet admission requirements, regardless of which subject area they demonstrate academic deficiency, have to enroll in four developmental courses that are offered only during the summer.

Studies found in the review of the literature investigated the success of the developmental mathematics program in various ways. Some studies compared the success rates of students who passed developmental mathematics before enrolling in college algebra to the success rates of students who failed developmental mathematics and then enrolled in college algebra (c.f. Askt & Hirsch, 1991; Blackner ,2000; and Washington State Board for Community and Technical Colleges, 2003). Other studies compared students who enrolled in developmental mathematics before enrolling in college algebra to success of students who were recommended to take developmental mathematics but enrolled in college algebra without first taking a developmental mathematics course (Germann Community College, 2000).

The SDP at MSU differs from studies found in the literature review in the following ways.

- The SDP is offered only during the summer, whereas other programs were only offered during the fall and spring.
- Students in the SDP have to take all developmental courses, not just the subject in which they are academically deficient, whereas other programs only required students to take the subject in which they

were academically deficient, and they could also enroll in other college-level courses.

- Students must pass all the courses in the SDP before taking college-level courses, whereas other programs allowed students to take college-level course without first passing the developmental course.

Because of these differences, the SDP at MSU is unique. However, the present study focuses on the success in MA 1313 College Algebra of students who successfully completed the SDP at MSU.

Limitations

This study has several limitations. First, instructors of courses below the level of calculus at MSU range in rank from graduate student to full professor, whereas, instructors of developmental courses may be a graduate student, a middle or high school teacher, or a university instructor. Students are randomly assigned to classes by the SDP director. Also, interim assessments differ from class to class. However, starting with the summer of 2000, the SDP instructors are required to give a standardized final exam.

Likewise, interim assessments differ from class to class in MA 1313 College Algebra. During this study, MSU instructors were required to give a departmental final exam in the fall and spring semesters. The departmental final exam was constructed by the College Algebra Committee each semester. This comprehensive final was a multiple-choice exam and was given to all sections at the same time (see Appendix D for sample of MA 1313 College Algebra Final Exam). The final exam

grade counted as one-half of the final course grade if the final exam grade was higher than their prefinal average, and it counted as one-third of the final grade if the prefinal average was higher than the final exam grade. Instructors were not required to give a departmental exam in MA 1313 in the summer.

Finally, whether a student took the next mathematics course the following semester or waited more than one semester to take another mathematics course was a limitation for this study.

Definition of Terms

The following terms will be used in this study.

1. Mississippi Board of Trustees of State Institutions of Higher Learning (IHL) is the 12-member board responsible for policy and financial oversight of the eight public institutions of higher learning in Mississippi (Retrieved from <http://www.ihl.state.ms.us>).
2. MA 0003 Developmental Mathematics is a developmental course at MSU designed to prepare students for university mathematics courses at the level of MA 1313 College Algebra. This course covers real numbers, fractions, decimals, percent, algebraic expressions, factoring, algebraic fractions, linear equations, linear inequalities, integral exponents, and quadratic equations (*Bulletin of the Mississippi State University*, 2001).
3. MA 0103 Intermediate Algebra is a course at MSU designed to prepare students for MA 1313 College Algebra. This course covers real numbers, algebraic expressions, factoring, algebraic fractions, linear equations, linear

inequalities, quadratic equations, and the Pythagorean Theorem (*Bulletin of the Mississippi State University*, 2001).

4. MA 1313 College Algebra is a course required by IHL and MSU for graduation. This course covers a review of fundamentals, linear equations, quadratic equations, linear inequalities, nonlinear inequalities, functions, and topics in the theory of equations (*Bulletin of the Mississippi State University*, 2001).

Even though the topics covered in MA 0003 Developmental Mathematics and MA 0103 Intermediate overlap, the topics in MA 0103 are covered in more depth.

CHAPTER II

LITERATURE REVIEW

The purpose of this chapter is to examine what the literature says about remediation at the postsecondary level. First, the definition of students at risk is addressed, followed by a report on public schools. Next, both the postsecondary problem and the postsecondary response are addressed. Finally, a summary is addressed. The chapter concludes with relevance for this study.

Students at Risk

The definition of students “at risk” is still a major controversy among educators, policymakers, and the general public. The expression “at risk” first appeared in the education literature after the publication of *A Nation at Risk: The Imperative for Educational Reform* (National Commission on Excellence in Education [NCEE], 1983). According to Salerno (1995), the risk in that document referred to the rise in the level of mediocrity and failure threatening the future of the American society. Historically, students at risk were primarily minorities, the poor, and immigrants (Hixson & Tinzmann, 1990). Slavin and Madden (1989) described students at risk as students who are in danger of failing to complete their education with an adequate level of skills. According to Roueche and Roueche (1993), between one-third and one-half of incoming college students are as identified as at risk.

Even though incoming college students can be at risk for failure in any academic discipline, students seem to be particularly at risk in mathematics (Blackner, 2000). Students at risk for failure in mathematics learn significantly less mathematics. Kasten and Howe (1988) classified such students into two groups: “potential dropouts” and “nominal” mathematics students. Potential dropouts are students, often from poverty-level families, whose self-esteem, task performance, school achievement, and career and cultural aspirations differ from their more successful peers. These students frequently create problems in school because of their behavior and are likely to become an economic burden on society. In fact, Greene and Forster (2003) used data from the U. S. Department of Education and estimated that the national public high school graduation rate is 70%. They also estimated that Mississippi’s public high school graduation rate is 64%.

On the other hand, nominal mathematics students seldom cause problems in school because of their behavior and are not viewed as potential problems for society. Nominal mathematics students stay in school and may even go to college. These students usually do not take mathematics courses beyond the basic mathematics courses required in high school (Kasten & Howe, 1988). However, their level of understanding and competence in mathematics is significantly below the desired levels. As matter of fact, only 32% of students in all public high schools graduate ready for college (Greene & Forster, 2003). Therefore, both groups of students are at risk in mathematics.

Several factors cause students to fall into the groups at risk in mathematics. One factor is that curricula do not reflect the students’ backgrounds. Curricula are

often uninteresting and irrelevant and lack real world applications (National Council of Teachers of Mathematics, 2000). Students are turned off to mathematics. They are not only turned off by the mathematics curricula but also by the mathematics instruction. Mathematics instruction often has the wrong pace for many students, and the drill and practice do not provide enough “hands-on” experiences. Along with curricula and mathematics instruction, another factor that causes students to be at risk is math anxiety. This causes students to not perform in mathematics courses at the level at which they are capable, and they may even decide to avoid mathematics courses (Kasten & Howe, 1988). Most mathematics teachers agree that math anxiety primarily results from students’ fear of failure and feeling of inadequacy (Perry, 2004). In addition to math anxiety, students may be at risk in mathematics because they have learning and behavior problems, sensory handicaps, or physical and health impairments. Not only are curricula, math instruction, math anxiety, and behavioral and physical problems factors that cause students to be at risk in math, so is the view that mathematics is a male domain (Kasten & Howe, 1988). Unfortunately, many teachers support this view. Regardless of the reason that causes students to be at risk, it is primarily the failure of our schools to successfully educate the student population considered to be at risk (Hixson & Tinzmann, 1990).

Report on Public Schools

For nearly three decades, national leaders and educators in the U. S have been concerned about the mathematics performance of American students (National Commission on Mathematics and Science Teaching for the 21st Century, 2000). The

document, *A Nation at Risk: The Imperative for Educational Reform* (NCEE, 1983), pointed out several reasons U. S. students were at risk because of their poor mathematics performance. One indicator was that average mathematics scores on the College Board's Scholastic Aptitude Test (SAT) dropped almost 40 points from 1963 to 1980. Another indicator was that only one-third of 17-year-olds could solve a mathematics problem that involved several steps, and approximately two-fifths could not draw inferences from written material.

Along with these risk indicators, *A Nation at Risk* (NCEE, 1983) reported that a 1980 state-by-state survey showed 35 states required only 1 year of mathematics for a high school diploma. However, today there are 13 states that require two years of mathematics for graduation and 24 states and the District of Columbia that require three years for graduation. Currently, or in the coming years, five states - Alabama, Arkansas, Mississippi, South Carolina, and West Virginia - will require four years of mathematics for graduation (Education Commission of the States [ECS], 2005). ECS also reported that 13 states allowed students to choose more than 50% of the required units for graduation from electives. Furthermore, in many schools, the time spent in home economics and drivers' education courses counted as much toward graduation as time spent studying mathematics.

One important recommendation that resulted from this document was that high school graduation requirements for all students should include "Five New Basics." These Five New Basics include four years of English, four years of mathematics, three years of science, four years of social studies, and one-half year of computer science. Two years of a foreign language are strongly recommended for

students who are college-bound. These Five Basics are referred to in most states as the College Preparatory Curriculum (CPC) (see Appendix B for Mississippi's CPC). In a 2003 IHL press release, Mississippi's Commissioner of Higher Education stressed that high school students need to take a strong CPC in order for them to be successful in college (Mississippi Board of Trustees of State Institutions of Higher Learning, 2003 August). Currently, no state requires every high school student to take a CPC in order to graduate (ECS, 2005).

In addition to the findings from *A Nation at Risk* (NCEE, 1983), results from the Third International Mathematics and Science Study (TIMSS) (1995) indicated that the mathematics performance of students in the U. S. declined as they progressed through school. The TIMSS focused on the mathematics performance of students at the fourth, eighth, and twelfth grade levels from forty-one countries. The TIMSS found that the mathematics performance of U. S. students was slightly above the international average in the fourth grade, below the international average in the eighth grade, and at the very bottom of the international average in the twelfth grade. Students in the U.S. covered the topics on the TIMMS mathematics assessment of general knowledge at the twelfth grade level by the ninth grade, whereas these topics were usually covered by the seventh grade in other countries. Subsequently, the Third International Mathematics and Science Study (dubbed TIMSS-R for repeat) (1999) focused on eighth grade mathematics with 38 countries participating. The TIMSS-R confirmed the results from the 1995 study that students in the U. S. do not start out behind other countries in mathematics performance but fall behind during the middle school years. These studies indicate that fourth grade students in the U. S.

perform among the top students internationally in mathematics, and topics taught in elementary schools are very similar across the world. However, eighth grade students in the U. S. perform below average internationally in mathematics, and content in middle school covers topics that students in the rest of the world have mastered earlier in their studies (Vernille, 2002). Consequently, in the last two years of middle school, the mathematics curriculum contains more review and repetition of previous topics than challenging topics that prepare students for more advanced mathematics courses (Cogan & Schmidt, 1999). Since more advanced mathematics courses depend in turn on prerequisite skills and the cognitive preparation of previous mathematics courses, problems in mathematics compound as students try to “catch up.” Hence, there is a continuous decline in mathematics performance from elementary school through high school (Vernille, 2002). Greene and Forster (2003) compared the public school system to a pipeline. They said that students should enter preschool or kindergarten (flow from the start of the pipeline) and graduate from high school prepared for college (all the way through to the end). However, many students “leak out” in the middle of the pipeline. Greene and Forster also estimated that 32% of all students that graduate from public high schools are “college ready,” prepared to attend a four-year college. They also estimated Mississippi’s “college ready” rate is 37%.

Results from the TIMSS and TIMSS-R were reflected in *The Nation’s Report Card: Mathematics 2000* (Braswell, Lutkus, Grigg, Sanatpau, Tay-Lim, & Johnson, 2001). *The Nation’s Report Card* (Braswell, Lutkus, Grigg, Sanatpau, Tay-Lim, & Johnson, 2001) reported that 74% of fourth graders, 72% of eighth graders, and 83%

of twelfth graders scored at basic or below basic levels in mathematics.

Mississippi had 91% of its fourth graders and 92% of its eighth graders score at basic or below basic levels in mathematics. As indicated by *The Nation's Report Card* (Braswell, Lutkus, Grigg, Sanatpau, Tay-Lim, & Johnson, 2001) and the college-ready rate, there is certainly a gap between what high schools require for graduation and what four-year colleges require for admission.

Postsecondary Problem

As students try to catch up with basic skills and cognitive preparation to bridge the gap between high school and college, problems in mathematics continue into the postsecondary level (Blackner, 2000). A report by the American College Testing Program (ACT), titled *A Crisis at the Core: Preparing All Students for College and Work* (2004), found that, among the 1.2 million high school graduates who took the ACT Assessment in 2004, only 40% of these students made scores indicating that they were prepared to make a "C" or higher in college algebra. This report concluded that the CPC recommended by *A Nation at Risk* (NCEE, 1983) is not enough to prepare students for college and work. In support, Adelman (1998) stated that high school graduates who had taken a rigorous preparatory curriculum, regardless of grades, were usually better prepared for college-level work.

Even though students successfully completed college preparatory mathematics courses in high school, a large number of entering college students had high remedial placement rates (Hoyt & Sorensen, 2001). The large number of incoming freshmen with high remedial rates and the cost of remediation can be seen in reports from two-

and four- year colleges. For example, in fall 1999, 48% of the 31,187 entering freshmen in the California State University system required remedial work in mathematics (Dooley, 2001). Similarly, during 1998-1999, the University of North Carolina system spent over two million dollars on remediation for about 6,000 students, with some 74% of those students enrolled in remedial mathematics courses (Rachlin, 2000). Likewise, a report that discussed the role of developmental education for recent high school graduates attending community and technical colleges in Washington stated that almost 50% of recent high school graduates took developmental mathematics courses in college (Washington State Board for Community and Technical Colleges, 2003). These mathematics courses covered material equivalent to middle and high school Algebra I and Algebra II courses. In Mississippi, IHL reported that from the 15,856 students who did not meet regular admission requirements from fall 1996 to fall 2002, that 2,249 students enrolled in the SDP (Pennington, n.d.).

These reports raised concerns about the influence of the mathematics curriculum and instruction in schools on college mathematics. College mathematics courses are influenced by the sequence of mathematics courses taken in high school (Horn & Carroll, 1997). In addition, the level of mathematics taken in high school and the grades in the courses are significant predictors of placement in college developmental mathematics courses (Hoyt & Sorensen, 2001). Consequently, the sequence of mathematics courses and the level of mathematics taken in high school are factors that affect a student's placement in college mathematics.

There are other high school factors that influence placement in college mathematics. Instead of using the senior year to prepare for success at the postsecondary level, many students consider their senior year as time to relax and have fun, developing the “senior slump.” Additionally, some students do not take mathematics courses in their senior year because they completed their college preparatory mathematics courses in the 10th or 11th grade. Because students do not take mathematics courses during the last two years of high school, students tend to regress in their academic preparation (Kirst, 2000). As a result, students often need to take a developmental mathematics course as a refresher before attempting college-level mathematics courses.

Another factor that influences placement in college mathematics courses is math anxiety. Many students suffer from some form of math anxiety (Perry, 2004), the mildest and most common form of which is moderate test anxiety. In this case, students say that they understand the homework assignments but panic while taking a test. Another extremely common math anxiety occurs when students forget what they learn very quickly and experience chronic frustration. In this type of math anxiety, students’ mathematical understanding is limited to computational skills with little conceptual knowledge. Of course, in this case, many students blame the teachers for their poor comprehension. Unfortunately, many teachers in the K-12 levels teach computational skills instead of mathematical concepts. Often math anxiety starts at a very young age and comes from negative experiences in working with teachers, tutors, classmates, parents, or siblings (LeMoyne College, n.d.), and, as a consequence, they avoid mathematics courses. Math anxiety is extremely common

among college students. According to a survey given to college students in an introductory mathematics class during the first week of the semester, approximately 85% of the students claimed to feel at least mild math anxiety (Perry, 2004).

Regardless of the reason students are placed in remedial courses, more and more students are enrolling in remedial mathematics courses at the college- and university-level (Yocco, 1998).

Postsecondary Response

Remediation or developmental education often refers to coursework at a postsecondary institution that is below college-level. Educators have argued for years about remediation at the postsecondary level. Some say that postsecondary remediation provides a second chance for inadequately prepared students, and others argue that it is duplicative, costly, and may not even be effective (ECS, 2004). Providing remediation in mathematics has been a major role of community colleges from coast to coast. In fact, the majority of students in community colleges need remediation in mathematics (Blackner, 2000). In 1996, approximately 30% of incoming freshmen at college and universities required remediation (ECS, 2004). Most community colleges and four-year institutions require students to have math skills above the level of intermediate algebra to be adequately prepared for college level mathematics (Washington State Board for Community and Technical Colleges, 2003). State policymakers want students to pursue a postsecondary education, and they want students to be prepared for college level work when they graduate from high school (ECS, 2005). States question why so many students are inadequately prepared for postsecondary education.

There are several theories as why students need remediation at the postsecondary level. One theory is that students did not enroll in college immediately after graduating from high school, so they need refresher courses. Another theory is that students did not take a rigorous CPC. An even broader theory is the disjuncture between K-12 education and postsecondary institutions (Michelau, 2000).

Besides questioning why so many students are not prepared for postsecondary education, states also question how to determine which students need remediation and who should pay for the remediation (Michelau, 2000). States question whether remediation should be offered at two- or four- year institutions, privately by for-profit institutions, or not at all. Most four-year institutions believe that they should not have to teach content that students should have mastered in high school (ECS, 2004).

Placement methods vary significantly from college to college. Placement methods range from faculty judgment to percentile analyses. Some colleges enforce the decision of the placement method, while others allow the student to make the final decision (Akst & Hirsch, 1991). In examining states' placement methods, Michelau (2000) found that only Florida and Texas require a particular placement test to determine if a student needs remediation. Of the 28 states and Puerto Rico which administer high school exit examinations, 12 use the data from the exit exam to determine if a student needs remediation or the level of funding applied toward remediation. Seven states - Arkansas, Georgia, New York, Nevada, Oklahoma, South Dakota, and West Virginia - have statewide policies to determine how incoming freshmen in public postsecondary institutions are placed. For Mississippi's eight public universities, IHL, in response to the Ayres' lawsuit (Ayres v. Fordice, 1995),

established statewide admissions standards and placement procedure to determine which students need remediation. If students do not meet the statewide admissions standards, they must go through a screening process. This screening process collects data on students, beginning in the spring of the students' senior year, through a variety of instruments. One of the instruments used in the screening process is the College Board's ACCUPLACER. Regardless of the placement method for remedial coursework, misplacement in mathematics can have devastating consequences for a student. Consequently, placement in remedial courses is one of the pillars of a developmental program, especially in mathematics (Akst & Hirsch, 1991).

In addition to placement in remedial courses, states are concerned with the cost of remediation. As a result, states have encouraged their public universities to eliminate the remedial programs, restrict the number of remedial courses, or move the remedial programs to community colleges. State legislatures in Arizona, Texas, Florida, Virginia, New York, and California have considered adopting legislation that would limit the number of remedial courses offered at postsecondary institutions (ECS, 2005). However, Colorado, Florida, and South Carolina only offer remedial courses at two-year college institutions, and Massachusetts only allows a maximum percentage of university freshmen to be enrolled in remedial courses (Michelau, 2000). In Mississippi, the state provides funding for remediation by giving financial assistance to the Summer Developmental Program (SDP) as part of the settlement agreement in the Ayers' lawsuit (Ayers v. Fordice, 1995).

Summary

The review of the literature has shown that many incoming freshmen are inadequately prepared for college-level courses, especially in mathematics, and their inadequacies are varied. In fact, more and more students are enrolling in remedial algebra at the college- and university-level (Yocco, 1998). The increase in the number of students needing remediation at the college-level has caused colleges and universities to take a closer look at why students need remediation, whether or not remediation should be offered, and the cost of remediation. Even though colleges and universities are still trying to answer questions about remediation, several colleges and universities currently offer remedial coursework to help students who are inadequately prepared for college-level courses.

In order to establish remedial coursework to support at-risk college students, college and university administrators have to make several decisions about remedial programs. First, they have to decide how to place students in remedial courses. Placement methods range from faculty recommendations to percentile analyses. There are various instruments used for placement such as ACT/SAT scores and the College Board's ACCUPLACER. Many colleges and universities have created their own placement tests. Others have volunteer enrollment in remedial courses, while still others have mandatory enrollment based on the results from placement instruments. Next, colleges and universities decide whether students should take only remedial courses in a specific academic subject or whether students should enroll in all remedial courses offered.

Not only do remedial programs differ by placement methods and remedial courses that students are required to take, they also differ by when students can enroll in these courses. Some colleges allow students to enroll in remedial courses along with other courses during the fall and spring semesters. On the other hand, some colleges only offer remedial programs during the summer, and, in these summer programs, students only enroll in remedial courses.

In addition to college remedial programs differing by what courses students take and when students take those courses, they also differ by how decisions are made for students to enroll in other courses. Some colleges allow students to take the next mathematics course, even though students did not pass the remedial courses, while others require students pass all courses in the remedial program before they can be admitted to the university. The SDP at MSU is an example of a remedial program in which students are required to pass all of the courses before they are granted full admission to the university.

Relevance for This Study

Before the summer of 1996, students at MSU were only required to take courses in which they demonstrated academic deficiencies, and these courses were offered during the fall and spring semesters. However, beginning in the summer of 1996, students who demonstrate academic deficiencies in any area are required to enroll in the SDP. Students in the SDP enroll in four remedial courses. The remedial course in the SDP for mathematics is MA 0003 Developmental Mathematics (see Appendix E for topics covered in MA 0003). MA 0003 and MA 0103 Intermediate

Algebra are designed to prepare students for MA 1313 College Algebra. Yocco (1998) noted that students drop and/or fail college algebra more than any other course on college campuses. Because of this, courses designed to prepare students for college algebra need to be examined to determine if they are successful. The relevance for the present study is to determine the success of courses designed to prepare students for college algebra by determining if there are correlations between student grades in MA 0003 Developmental Mathematics, MA 0103 Intermediate Algebra, and MA 1313 College Algebra.

CHAPTER III

METHODS

This chapter provides a description of the methods and procedures used to conduct this study. First, the design of this study is presented, followed by descriptions of MA 0003, MA 0103, and MA 1313. Next, the population of this study is described, followed by the procedures used to collect the data for this study. Finally, the data analysis is outlined, followed by the null hypotheses.

Research Design

The research design utilized in this study was correlational. One of the main uses of the correlational method is to predict scores on one variable, referred to as the criterion variable, from participants' scores on other variables, referred to as predictor variables (Gall, Borg, & Gall, 1996). The basic strategy in correlational research is to collect data on two or more variables for each participant in the sample and compute a correlational coefficient. There are two advantages of the correlational method: (a) it allows the researcher to analyze the relationships among many variables simultaneously and (b) it gives information about the degree of the relationship between the variables. Correlations in this study were made between student grades in MA 0003 and MA 0103, between student grades in MA 0003 and MA

1313, as well as between student grades in MA 0103 and MA 1313. A description of those courses follows.

MA 0003

MA 0003 Developmental Mathematics is the mathematics course taken only by students enrolled in the Summer Developmental Program (SDP) at Mississippi State University (MSU). MA 0003 is designed to prepare students for MA 1313 College Algebra. Topics covered in MA 0003 include real numbers, fractions, decimal fractions, percent, algebraic expressions, factoring, algebraic fractions, linear equations, linear inequalities, integral exponents, and quadratic equations (*Bulletin of the Mississippi State University*, 2001) (see Appendix E for MA 0003 course outline). Credit for MA 0003 does not count toward a degree, and the grade in MA 0003 is not computed in students' GPA.

MA 0103

MA 0103 Intermediate Algebra is the mathematics course at MSU required by IHL for incoming freshmen with an ACT mathematics score of 16 or less to take during their first semester of enrollment. IHL also strongly encourages students whose ACT mathematics score is 19 or less to take MA 0103 (Office of Academic and Student Affairs of the Board of State Institutions of Higher Learning, 2004). MA 0103 is designed to prepare students for MA 1313 College Algebra. Topics covered in MA 0103 include real numbers, algebraic expressions, factoring, algebraic fractions, linear equations, linear inequalities, quadratic equations, and the Pythagorean Theorem (*Bulletin of the Mississippi State University*, 2001) (see

Appendix F for MA 0103 course outline). Credit for MA 0103 does not count toward a degree, and the grade in MA 0103 is not computed in students' GPA.

MA 1313

MA 1313 College Algebra is the college-level algebra course offered at MSU. MA 1313 covers a review of fundamentals, linear equations, quadratic equations, linear inequalities, nonlinear inequalities, functions, simultaneous equations, and topics in the theory of equations (*Bulletin of the Mississippi State University*, 2001) (see Appendix G for MA 1313 course outline). Beginning in the fall of 1984, IHL established common core curriculum requirements for Mississippi's eight public universities. One of the core curriculum requirements is three semester hours of college algebra. In addition, the university core curriculum at MSU requires all students graduating after January 1, 1990, to take six to nine semester hours of mathematics which includes MA 1313, or its equivalent, and at least one additional college-level mathematics course from an approved list of courses. MA 1313 is the entry-level college mathematics course and is usually one of the three-hour mathematics courses required in most degree programs. Some degree programs do not allow their majors to count MA 1313 as three hours of the mathematics requirement. Their majors are required to take mathematics courses above the level of MA 1313.

Population of the Study

The population in this study consisted of the incoming freshmen at MSU who successfully completed the SDP at MSU from summer 1996 through summer 2003.

Of these incoming freshmen, 644 students took the ACCUPLACER because they did not meet regular admission requirements. The breakdown of these 644 students is as follows:

- 146 students were admitted because they made passing scores on the ACCUPLACER.
- 130 students did not make passing scores on the ACCUPLACER, but later met admission requirements.
- 119 students did not make passing scores on the ACCUPLACER, but were admitted based upon a review. In such a review, a university screening committee examines a student's file to decide if their past performance in high school along with their ACT/SAT scores, if available, placement testing, special interests and skills, as well as other noncognitive factors, indicate they may be successful in college.
- 249 students did not make passing scores on the ACCUPLACER.

Out of the 249 students who did not make passing scores on the ACCUPLACER, 179 students enrolled in the Summer Developmental Program (SDP) at MSU, and 148 of these successfully completed the SDP. The population for this study then consists of the 148 students who successfully completed the SDP at MSU.

Procedures

Approval to use existing/secondary data (individual level data) was given by the MSU Institutional Review Board (IRB) for the protection of human subjects in

research (see Appendix H for IRB approval letter). After IRB approval, the MSU registrar released the data. Data were retrieved by a senior systems analyst from the Office of Information and Technology Services (ITS) at MSU, who used a data record counter that removed any identifiers so data could not be traced back to an individual. Demographic data and academic history data were retrieved for each student; each student record in the demographic data set contained ethnicity, gender, and term enrolled in SDP. Most student records contained the ACCUPLACER score in Elementary Algebra and the term the ACCUPLACER was taken. However, there were a few missing the ACCUPLACER scores. Since all of these students were supposed to have taken the ACCUPLACER, the missing the ACCUPLACER scores were probably due to university error (J. O'Bannon, personal communication, March 10, 2005). Additionally, student records contained their status with the ACCUPLACER. This status is referred to as an attribute. The attributes, along with their meanings, are as follows:

- AM – took the ACCUPLACER and failed but met admission requirements after taking the test.
- AR – took the ACCUPLACER and failed but was admitted based upon review.
- AX – took the ACCUPLACER and failed.
- AY – took the ACCUPLACER and passed.
- ASDP – attended the Summer Developmental Program and passed.
- ASDF – attended the Summer Developmental Program and failed.

Students who enrolled in the SDP, indicated by ASDP or ASDF, were also classified as AX because they did not meet the criteria on ACCUPLACER. Each student record in the academic history data set listed all mathematics courses taken along with the grade made in the course and the term in which the course was taken. MA 0003 and MA 0103 grades were recorded as A, B, C, D, and F. The L grade, representing “learning but lacking,” meant that a student was making progress but was not making a passing grade, is no longer used. Even though ASDP students should have received a grade of A, B, C, or D, there were four students with grades of L in MA 0003. For this study, the records of these four individuals were omitted before the statistical procedures were applied. However, for students who made a grade of L in MA 0103, the L grade was treated as F. Grades in MA 1313 were recorded as A, B, C, D, and F. The following scale was used to assign quality points: A = 4, B = 3, C = 2, D = 1, F = 0. Entries of AU (audit) and W (withdrawal) were also recorded as “grades” for MA 0103 and MA 1313. Records of students with AU and W were not used in this study, since they did not indicate a passing or failing grade. Some students had attempted courses more than once. This study uses the grade made on the first attempt.

Data Analysis

The researcher was interested in determining if there are statistically significant correlations between grades in MA 0003, MA 0103, and MA 1313. Furthermore, if there are statistically significant correlations between the grades in MA 0003, MA 0103, and MA 1313, the researcher was interested in being able to

predict grades in MA 0103 and MA 1313 from the grade in MA 0003, and predicting the grade in MA 1313 from the grade in MA 0103. According to Thorne and Giesen (2000), the definition of correlation is the degree of a relationship between two or more variables. Although there are several types of correlation, this study focused on linear correlation. Linear correlation is the degree for which the relationship between two variables is best described by a straight line. The Pearson product-moment correlation coefficient was used to compute the degree of the relationship between student grades in MA 0003, MA 0103, and MA 1313. Based on the definition of correlation as the degree of the linear relationship between two variables, the correlation coefficient can be used to find the equations of the straight lines that best describe the relationship between the two variables. These equations, called regression equations, can be used to predict a value of one variable from the value of another variable (Ryan, 2000). Linear regression was the statistical procedure used to find the regression equations using the MA 0003 grade (predictor variable) to predict grades in MA 0103 and MA 1313 (criterion variables) and for using the MA 0103 grade (predictor variable) to predict the grade in MA 1313 (criterion variable). The statistical package Minitab was used for the statistical analysis. An alpha level of 0.05 was used for all statistical tests.

The three null hypotheses addressed in this study and the method of data analysis for each was as follows:

H_{0_1} : There is no statistically significant correlation between student grades in MA 0003 Developmental Mathematics and student grades in MA 0103 Intermediate Algebra.

A Pearson product-moment correlation coefficient was used to examine the strength of the relationship between student grades in MA 0003 and student grades in MA 0103.

HO_2 : There is no statistically significant correlation between student grades in MA 0003 Developmental Mathematics and student grades in MA 1313 College Algebra.

A Pearson product-moment correlation coefficient was used to examine the relationship between grades in MA 0003 and grades in MA 1313.

HO_3 : There is no statistically significant correlation between student grades in MA 0103 and student grades in MA 1313.

A Pearson product-moment correlation coefficient was also used here to examine the relationship between grades in MA 0103 and grades in MA 1313.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter reports the findings of the research conducted to determine if there are correlations between student grades in MA 0003, MA 0103, and MA 1313. First, the purpose of this study is stated, followed by descriptive data collected on the population in this study. Next, the statistical analysis is described, followed by a discussion of the results of this study.

Purpose

The purpose of this study was to determine if there are statistically significant correlations between student grades in MA 0003, MA 0103, and MA 1313.

Descriptive Data

After approval by the Mississippi State University (MSU) Institutional Review Board, data on all students who successfully completed the Summer Developmental Program at MSU from 1996-2003 were retrieved from the MSU Office of Information and Technology Services. There were two sets of data, demographic data and academic history data. Each student record in the demographic data set contained ethnicity, gender, and term enrolled in SDP. Most student records also contained their ACCUPLACER score in Elementary Algebra and term that the

ACCUPLACER test was taken. According to the demographic data, 47% of the students were African American females, 36% African American males, 5% Caucasian females, 10% Caucasian males, and 2% others. Table 4.1 gives the breakdown of students who passed the SDP.

Table 4.1

Breakdown of Students Who Passed the SDP (1996-2003)

	1996	1997	1998	1999	2000	2001	2002	2003
African-American Female	5	4	14	18	7	7	9	5
Caucasian Female	1	1	0	2	1	2	1	0
Other Female	0	0	0	0	1	0	0	0
African-American Male	3	10	5	9	9	7	7	3
Caucasian Male	1	3	3	2	1	1	2	2
Other Male	0	0	0	0	0	2	0	0

Each student record in the academic history data set listed the grades made in MA 0003, MA 0103, and MA 1313 along with the term in which the courses were taken. Students who passed the SDP at MSU had to receive a grade of D or higher in MA 0003. There were four student records that had grades of L in MA 0003. These four records were eliminated from this study. However, for students who made a grade of L in MA 0103, the L grade was treated as an F because the L grade meant that a student was learning but still lacking a passing grade. The following scale was used to assign quality points: A = 4, B = 3, C = 2, D = 1, F = 0. Entries of AU (audit) and W (withdrawal) were also recorded in the academic history data set as grades for MA 0103 and MA 1313. Because AU and W do not indicate a passing or failing grade, student records with an AU or W appearing as grades for MA 0103 or MA

1313 were eliminated from this study. If a student attempted MA 0103 or MA 1313 more than once, the grade made on the first attempt was used for this study. Figure 4.1 shows the paths into MA 0103 and MA 1313 students followed after passing MA 0003.

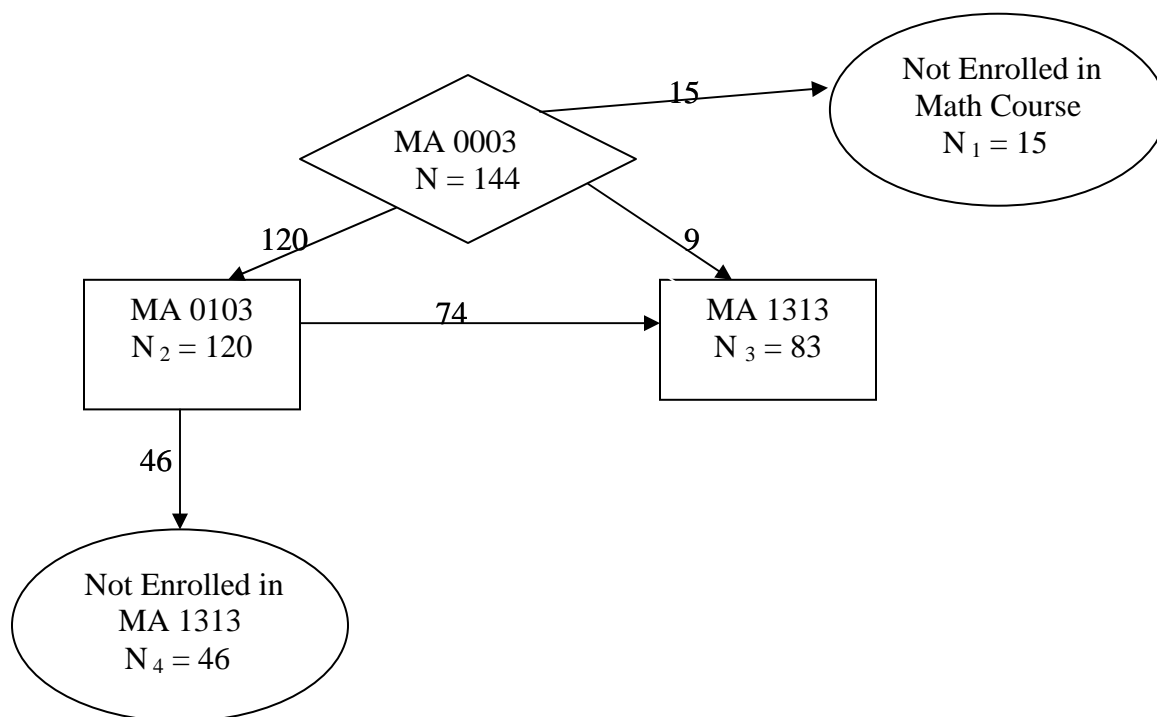


Figure 4.1: Paths into MA 0103 and MA 1313 Students Followed after Passing MA 0003 and the Number of Students Who Took Each Path

Statistical Analysis

The first null hypothesis in this study stated as follows.

H_{01} : There is no statistically significant correlation between student grades

in MA 0003 and student grades in MA 0103.

A Pearson product-moment correlation coefficient was used to examine the relationship between student grades in MA 0003 and student grades in MA 0103. The grades in MA 0003 correlated significantly with the grades in MA 0103 ($r = 0.56, p < 0.001$). Therefore, the null hypothesis was rejected. Since the correlation coefficient is positive, as the grade in MA 0003 increases, so does the grade in MA 0103. The result from the linear regression revealed that the MA 0003 grade explained 31% of the variance in the MA 0103 grade ($F(1,118) = 52.85, R^2 = 0.31, p < 0.001$) The regression equation is

$$\text{Grade}(0103) = -0.17 + 0.82 * \text{Grade}(0003). \quad (L_1)$$

Figure 4.2 shows the scatterplot and graph of the regression line for MA 0103 vs. MA 0003.

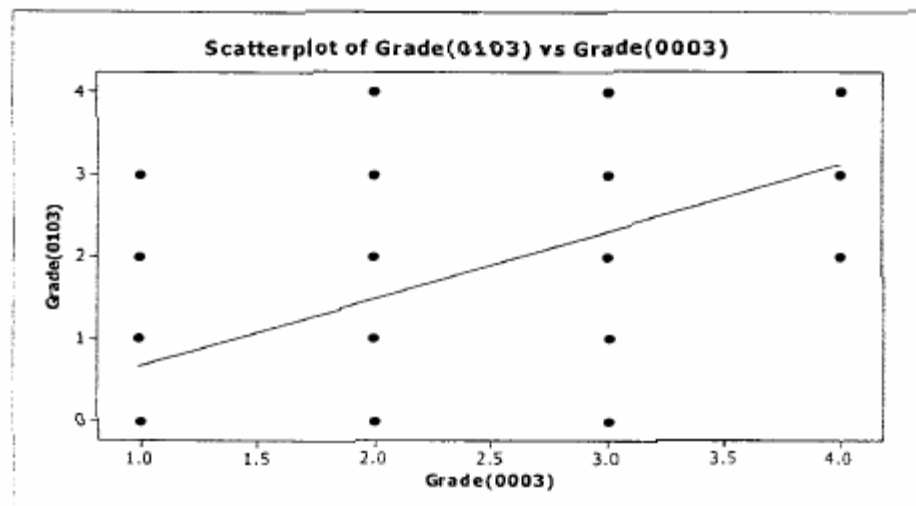


Figure 4.2: Scatterplot and regression line for MA 0103 grade vs. MA 0003 grade.

The second null hypothesis in this study is as follows.

H_{O_2} : There is no statistically significant correlation between student grades in MA 0003 and student grades in MA 1313.

A Pearson product-moment correlation coefficient was also used to examine the relationship between grades in MA 0003 and grades in MA 1313. Grades in MA 0003 correlated significantly with those in MA 1313 ($r = 0.44, p < 0.01$). Once again, the null hypothesis was rejected. Since the correlation coefficient is positive, as the grade in MA 0003 increases, so does the grade in MA 1313. The result from the linear regression revealed that the MA 0003 grade explained 19% of the variance in the MA 1313 grade, ($F(1,7) = 19.33, R^2 = 0.19, p < 0.001$). The regression equation is

$$\text{Grade}(1313) = 0.20 + 0.46 * \text{Grade}(0003). \quad (L_2)$$

The scatterplot and graph of the regression line for MA 1313 vs. MA 0003 are shown in Figure 4.3.

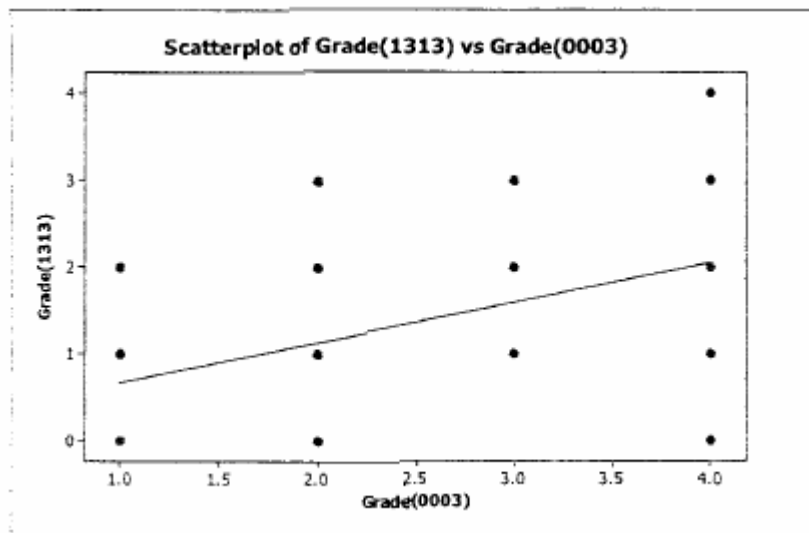


Figure 4.3: Scatterplot and regression line for MA 1313 grade vs. MA 0003 grade.

The third null hypothesis in this study is the following.

H_{O_3} There is no statistically significant correlation between student grades in MA 0103 and student grades in MA 1313.

A Pearson product-moment correlation coefficient was again used to examine the relationship between grades in MA 0103 and grades in MA 1313. Grades in MA 0103 correlated significantly with grades in MA 1313 ($r = 0.38, p < 0.01$). Hence, the null hypothesis was rejected. Since the correlation coefficient is positive, as the grade in MA 0103 increases, so does the grade in MA 1313. The linear regression revealed that the MA 0103 grade explained 15% of the variance in the MA 1313 grade, ($F(1,72) = 12.20, R^2 = 0.15, p < 0.01$). The regression equation is

$$\text{Grade}(1313) = 0.63 + 0.29 * \text{Grade}(0003). \quad (L_3)$$

Figure 4.4 shows the scatterplot and graph of the regression line for this case.

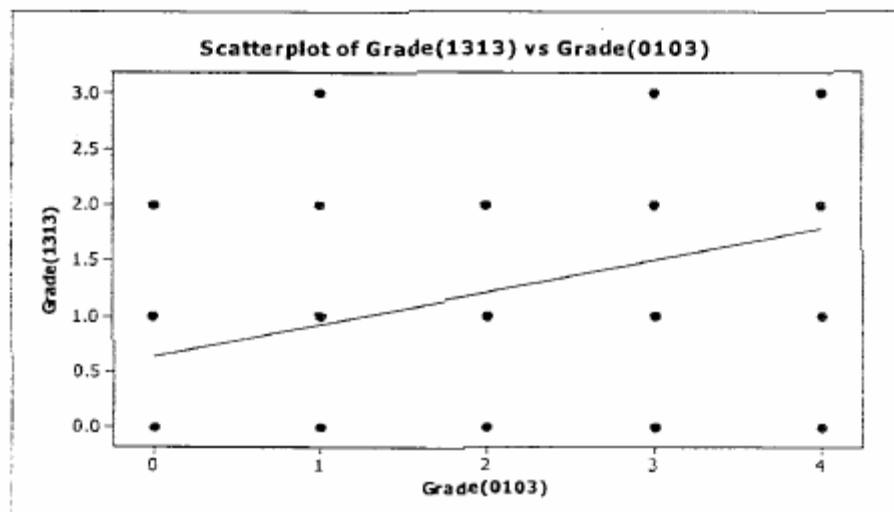


Figure 4.4: Scatterplot and regression line for MA 1313 grade vs. MA 0103 grade.

Discussion

The purpose of this study was to determine if there are statistically significant correlations between student grades in MA 0003, MA 0103, and MA 1313. The data revealed that there was a statistically significant correlation between student grades in MA 0003 and student grades in MA 0103. With the regression equation L_1 , we can predict the MA 0103 grade from the MA 0003 grades. Grades in MA 0003, MA 0103, and MA 1313 are entered as integers 4 through 0 to correspond to grades of A through F, respectively. Since the coefficients in the regression equations are not integers, the predicted grades in general will not be integers. Thus, the predicted letter grade (A, B, C, D, F) may be open to some interpretation as it is predicted from a number (A = 4, B = 3, C = 2, D = 1, F = 0). Recall that the students in this study passed the SDP which means that they made a D or higher in MA 0003. For each additional quality point earned in the MA 0003 grade, the quality point in the MA 0103 grade increases by 0.82. For example, if a grade in MA 0003 was an A, the predicted grade in MA 0103 is 3.11 or just above a B (3.0). If the grade in MA 0003 was a B, the predicted grade in MA 0103 is 2.29 or just above a C (2.0). If the grade in MA 0003 was a C, the predicted grade in MA 0103 is 1.47 or halfway between a D (1.0) and a C (2.0). If the grade in MA 0003 was a D, the predicted grade in MA 0103 is 0.65 or between an F (0.0) and a D (1.0).

This study found that there was a statistically significant correlation between student grades in MA 0003 and student grades in MA 1313. The regression equation L_2 can be used to predict the MA 1313 grades from the MA 0003 grades. For each additional quality point earned in the MA 0003 grade, the quality point in the MA

1313 grade increases by 0.46. Consequently, if a grade in MA 0003 was an A, the predicted grade in MA 1313 is 2.04 or just above a C (2.0). If the grade in MA 0003 was a B, the predicted grade in MA 1313 is 1.58 or about halfway between a D (1.0) and a C (2.0). If the grade in MA 0003 was a C, the predicted grade in MA 1313 is 1.12 or just above a D (1.0). If the grade in MA 0003 was a D, the predicted grade in MA 1313 is 0.66 or between an F (0.0) and a D (1.0).

This study found that there was also a statistically significant correlation between student grades in MA 0103 and student grades in MA 1313. Using regression equation L_3 , we can predict the MA 1313 grades from the MA 0003 grades. If the grade in MA 0103 was an F, the predicted MA 1313 grade is 0.63 or between an F (0.0) and a D (1.0). For each additional quality point earned in the MA 0103 grade, the quality point in the MA 1313 grade increases by 0.29. If the grade in MA 0103 was an A, the predicted grade in MA 1313 is 1.79 or between a D (1.0) and a C (2.0). If the grade in MA 0103 was a B, the predicted grade in MA 1313 is 1.50 or halfway between a D (1.0) and a C (2.0). If the grade in MA 0103 was a C, the predicted grade in MA 1313 is 1.21 or just above a D (1.0). If the grade in MA 0103 was a D, the predicted grade in MA 1313 is 0.92 or just below a D (1.0).

A summary of the actual grades made in MA 0003 Developmental Mathematics, MA 0103 Intermediate Algebra, and MA 1313 College Algebra by the students in this study's population broken down by gender and ethnicity is shown in Table 4.2.

Table 4.2

Summary of Grades in MA 0003, MA 0103, and MA 1313

Grade	Gender	Ethnicity	MA 0003	MA 0103	MA 1313
A	Female	African American	7	6	0
		Caucasian	1	0	0
		Other	0	0	0
	Male	African American	6	1	1
		Caucasian	1	1	0
		Other	0	0	0
B	Female	African American	15	16	3
		Caucasian	3	0	1
		Other	0	0	0
	Male	African American	10	8	3
		Caucasian	5	0	2
		Other	0	0	0
C	Female	African American	23	13	12
		Caucasian	2	1	1
		Other	1	0	0
	Male	African American	19	7	8
		Caucasian	5	5	3
		Other	0	0	0
D	Female	African American	19	13	19
		Caucasian	2	0	2
		Other	0	1	0
	Male	African American	18	4	5
		Caucasian	4	1	1
		Other	2	1	1
F	Female	African American	-	10	12
		Caucasian	-	2	1
		Other	-	0	1
	Male	African American	-	26	7
		Caucasian	-	3	0
		Other	-	1	0

In order to make a comparison between the actual grades made in MA 0103 to those predicted using the grades made in MA 0003, an average grade was computed in each grade category. For example, from the seven grades that were A's in MA 0003, the actual grades in MA 0103 were three A's, three B's, and one C. Hence, the average grade is 3.29. The same procedure was used to make comparisons between grades in MA 0003 and MA 1313, as well as grades in MA 0103 and MA 1313.

The Pearson product-moment correlation coefficient showed a statistically significant correlation between grades in MA 0003 and in MA 0103. Since the correlation was positive, this indicated that the grades in MA 0103 increase as the grades in MA 0003 increase. The comparison of the predicted grades in MA 0103 to the actual grades is shown in Table 4.3.

Table 4.3

Comparison of Grades in MA 0003 and MA 0103

Grade in MA 0003	Predicted Grade in MA 0103	Actual Grade in MA 0103	N	
A	3.11	A	3	
		B	3	
		C	1	
		D	0	
		F	0	
		Average Grade = 3.29		
		B	2.29	A
B	9			
C	9			
D	2			
F	3			
Average Grade = 2.27				
C	1.47			A
		B	7	
		C	13	
		D	10	
		F	13	
		Average Grade = 1.44		
		D	0.65	A
B	5			
C	3			
D	8			
F	26			
Average Grade = 0.69				

From the data displayed in Table 4.3, the predicted grades were on target with the average grades. In general, whatever grade was made in MA 0003, the grade in MA 0103 was one letter grade lower. In fact, 43% of the students who were predicted to make a B in MA 0103 because they made an A in MA 0003 actually made a B in MA 0103. Likewise, 35% of the students who were predicted to make a

C in MA 0103 because the MA 0003 grade was a B actually made a C in MA 0103; and 62% made an F in MA 0103 as predicted by a grade of D in MA 0003.

The Pearson product-moment correlation coefficient also showed a statistically significant correlation between grades in MA 0003 and in MA 1313. Because the correlation was positive, this indicated that the grades in MA 1313 increase as grades in MA 0003 increase. Table 4.4 shows the comparison of the predicted grades in MA 1313 to the actual grades.

Data from Table 4.4 indicates that only students who make an A in MA 0003 should consider going directly to MA 1313. The predicted grades were on target except in one case. In the case where a grade of C in MA 0003 predicted a grade of D in MA 1313, the average grade was an F.

Table 4.4

Comparison of Grades in MA 0003 and MA 1313

Grade in MA 0003	Predicted Grade in MA 1313	Actual Grade in MA 1313	N
A	2.04	A	1
		B	4
		C	3
		D	2
		F	1
		Average Grade = 2.18	
B	1.58	A	0
		B	4
		C	7
		D	13
		F	0
		Average Grade = 1.63	
C	1.12	A	0
		B	1
		C	9
		D	8
		F	13
		Average Grade = 0.94	
D	0.66	A	0
		B	0
		C	5
		D	5
		F	7
		Average Grade = 0.88	

The Pearson product-moment correlation coefficient showed a statistically significant correlation between grades in MA 0103 and in MA 1313. The correlation was positive so as grades in MA 1313 increase, so do grades in MA 0103. Table 4.5 shows the comparison of the predicted grades in MA 1313 to the actual grades. Once again the predicted grades are on target with the average grades except in one case. Data from Table 4.5 shows that a grade of C in MA 0103 predicts a D in MA 1313.

However, the average grade made in that category was an F. Results from Table 4.5 suggest that only students who make an A or a B in MA 0103 should take MA 1313.

Table 4.5

Comparison of Grades in MA 0103 and MA 1313

Grade in MA 0103	Predicted Grade in MA 1313	Actual Grade in MA 1313	N
A	1.79	A	0
		B	2
		C	2
		D	2
		F	1
		Average Grade = 1.71	
B	1.50	A	0
		B	4
		C	12
		D	2
		F	3
		Average Grade = 1.81	
C	1.21	A	0
		B	0
		C	5
		D	8
		F	16
		Average Grade = 0.95	
D	0.92	A	0
		B	1
		C	1
		D	6
		F	7
		Average Grade = 0.73	
F	0.63	A	0
		B	0
		C	3
		D	5
		F	4
		Average Grade = 0.92	

In addition, a comparison of correlation coefficients showed that there is a higher correlation between student grades in MA 0003 and in MA 1313 than between student grades in MA 0103 and in MA 1313. However, neither the grade in MA 0003 nor the grade in MA 0103 was a better predictor than the other was of the grade in MA 1313. The highest correlation was found between student grades in MA 0003 and MA 0103.

Overall, from the 74 students who took MA 0103 before taking MA 1313, 0% made an A in MA 1313, 9% made a B, 31% made a C, 31% made a D, and 28% made an F. (Percent does not add to 100 due to rounding.) Since the ACCUPLACER post-test scores and faculty recommendations were not available, there was no way to determine if students took the appropriate course after passing MA 0003. However, of the nine students who took MA 1313 without taking MA 0103, none failed MA 1313.

From the 83 students who took MA 1313, approximately 41% made a C or higher. Recall that the concern by the Department of Mathematics and Statistics in the 1970's was that only 40% of the students in MA 1313 made a grade of C or higher. Therefore, the success in MA 1313 of students who passed the SDP shows no improvement from the past, where success is defined as making a C or higher.

There are several reasons that may explain why more students did not make higher grades in MA 1313. One is that students may have taken MA 1313 without first passing MA 0103. These students may need more remediation before attempting MA 1313. Another is that math anxiety may have affected student grades in MA 1313, and, as noted in the literature review, one of the most common forms of math

anxiety is test anxiety. Students may have performed poorly in MA 1313 because they were anxious about the departmental final exam that counted at least one-third of their final grade. Furthermore, students may have performed poorly because instructors had different levels of experience, varied teaching styles, and different interim assessments.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter provides a summary of this study. This is followed by conclusions and recommendations for further research.

Summary

In the late 1970s and early 1980s, the Department of Mathematics and Statistics at Mississippi State University (MSU) introduced two algebra courses, MA 0003 Fundamentals of Algebra and MA 0103 Intermediate Algebra, to help students master the basic skills needed before taking MA 1313 College Algebra. Students were placed in these courses according to their ACT mathematics scores. In 1980, the basic algebra course changed from a three-hour course to a five-hour developmental mathematics course because of a mandate by the Mississippi Board of Trustees of State Institutions of Higher Learning (IHL). As part of the settlement of the Ayers' lawsuit, IHL also required uniform admission standards for Mississippi's eight public universities. In 1996, as another part of the settlement in the Ayers' lawsuit, IHL had each university establish a Summer Developmental Program (SDP), and all students admitted to the university with academic deficiencies were required to enroll in the SDP. In order to gain full admission to the university, students must

pass the four developmental courses in the SDP, one of which is MA 0003 Developmental Mathematics. With the establishment of the SDP, the developmental mathematics course was no longer offered as a regular course in the Department of Mathematics and Statistics, but only as a course in the SDP

The research question for this study is as follows: Are there correlations between student grades in MA 0003 Developmental Mathematics, MA 0103 Intermediate Algebra, and MA 1313 College Algebra?

Students whose education is threatened because they are academically unprepared are classified as at risk. Although students can be at risk for failure in any academic subject, they are especially at risk in mathematics. The review of the literature indicated several contributing factors that cause students to be at risk in mathematics. One such factor identified is that curricula are irrelevant, uninteresting, and lack real world applications. Another factor is that mathematics instruction has the wrong pace and does not provide enough hands-on experiences. Students are turned off to mathematics because of the curricula and instruction. Behavioral and physical problems are also factors that cause students to be at risk, as does the view that mathematics is a male domain. In addition, math anxiety causes students to avoid mathematics courses, which also puts them at risk. However, some believe that it is the failure of our K-12 schools to successfully educate the student population that causes students to be at risk for academic failure.

For over 30 years, national leaders and educators have been concerned with the decline in the mathematical preparation of American students. Results from the

Third International Mathematics and Science Study (TIMSS) (1995) and the Third International Mathematics and Science Study - Repeat (TIMSS-R) (1999) showed that there was a continuous decline in the mathematics performance of American students from elementary school through high school. As students try to catch up with the prerequisite skills and cognitive preparation needed to succeed in more advanced mathematics courses, their problems in mathematics compound. These problems continue into the postsecondary level. In fact, a report by ACT indicated that only 40% of the 1.2 million high school students who took the ACT assessment in 2004 were prepared to make a C or higher in college algebra. This report confirmed that students needed more preparation to bridge the gap between what high schools require for graduation and what colleges expect students to know than can be found in the college preparatory curriculum (CPC) recommended in *A Nation at Risk* (National Commission on Excellence in Education, 1983).

States such as California, North Carolina, and Washington reported that a large number of incoming freshmen were placed in remedial mathematics courses even though they had successfully completed a CPC in high school. However, the sequence of mathematics courses that students take in the CPC during high school may influence their placement in college mathematics courses. Another factor that may influence students' placement in college mathematics courses is that students may not have taken a mathematics course during their senior year, or they may have completed the CPC in the 10th or 11th grades. Therefore, students tend to regress in their mathematical preparation. Various forms of math anxiety also influence

placement in college mathematics, the most common form of which is moderate test anxiety, which causes students to panic while taking a test.

Regardless of the reasons that influence students' placement in remedial courses, state educators still argue about remediation at the postsecondary level. First, they want to know why so many students are academically unprepared for postsecondary education, and there are several theories concerning this. One is that students do not enroll in college immediately after high school graduation. Another is that students do not take a rigorous CPC in high school. The fact that students were not taught in K-12 what postsecondary institutions expected is another possible explanation as to why students are unprepared for postsecondary education.

Not only do states question why students are academically unprepared for postsecondary education, they also question how to determine which students need remediation. Most states do not have a common policy for placement in remedial courses. Therefore, placement methods in colleges and universities vary from faculty recommendation to placement test scores. Some colleges and universities have mandatory enrollment in remedial courses based on results from placement instruments, while others let students decide whether or not to enroll in remedial courses.

Along with questioning how to place students in remedial courses, states question who should pay for the remediation. Some think students should pay for their own remediation at private institutions rather than having the two- and four-year public institutions absorb the costs. Most four-year institutions do not want to teach

the basics that they expect students to have mastered in high school. As a result, most remediation falls on the shoulders of the two-year institutions.

This study utilized a correlational research design. The population for this study consisted of the incoming freshmen at MSU who successfully completed the SDP from 1996 through 2003. Demographic and academic history data on this population were obtained from the Office of Information and Technology Services at MSU following approval by the MSU Institutional Review Board. The statistical procedures used to analyze the data were the Pearson product-moment correlation coefficient and linear regression.

The null hypotheses for this study were as follows:

HO_1 : There is no statistically significant correlation between student grades in MA 0003 and student grades in MA 0103.

HO_2 : There is no statistically significant correlation between student grades in MA 0003 and student grades in MA 1313.

HO_3 : There is no statistically significant correlation between student grades in MA 0103 and student grades in MA 1313.

All three null hypotheses were rejected. The data reveal that there are statistically significant correlations between student grades in the lower-level mathematics courses, MA 0003 and MA 0103, and student grades in the college-level mathematics course, MA 1313. Data show that the higher grade a student receives in the lower-level mathematics courses (MA 0003 and MA 0103), the higher grade the student receives in the next college-level course (MA 1313).

Conclusions

Based on the findings of this study, one could conclude that in order for students to be successful (successful defined as making a grade of C or higher) in college-level mathematics courses, students need to achieve the highest grades possible in their remedial mathematics courses. Students who pass the remedial mathematics courses often expect to be equally successful on their first attempt in the college-level mathematics course. This belief is often supported by their advisors. It is the researcher's hope that advisors will encourage students who are not successful in the remedial courses to repeat the courses and that students will follow their advice.

Recommendations

In view of the results of this study, the following recommendations for further research are made.

1. Since each of the eight public universities in Mississippi are required to offer the Summer Developmental Program (SDP) and follow the same guidelines, further research should be conducted to compare the success of MSU students in MA 0003 to the success of students in the developmental mathematics courses at the other seven universities.
2. Further research should be conducted to compare summer remedial programs at universities in other states to the SDP at MSU and in Mississippi.

3. Further research should also be conducted to compare the placement instruments and methods at MSU to those used at universities in other states.
4. Because this study covered the period from summer 1996 through summer 2003, not all students had taken MA 1313. Further research needs to be conducted to investigate the success of the students in courses above the level of MA 1313 and their success in graduating from MSU.
5. Since the inception of this study, the Department of Mathematics and Statistics at MSU has made changes in MA 1313 College Algebra. They have taken topics out of the syllabus and have opened a math domain that uses the software *My Math Lab*. Because of these changes, further research should be conducted to investigate the performance of the SDP students in the “new” college algebra course.
6. Further research needs to be conducted to determine if the passing score on the ACCUPLACER should be raised.
7. Further research needs to be conducted to determine if students who make passing grades on all four developmental courses should also have to make a minimum score on the ACCUPLACER in order to successfully complete the SDP.
8. Further research needs to be conducted to determine whether students should make a C or higher in each of the four developmental courses in order to successfully complete the SDP.

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APPENDIX A
CATALOG DESCRIPTION AND COURSE OUTLINE FOR
MA 1103 FUNDAMENTALS OF ALGEBRA

Catalog Description

MA 1103 Fundamentals of Algebra is a developmental course designed to prepare students for college algebra. This course is not available for credit to math majors. This is a three-hour lecture course covering real numbers, algebraic expressions, factoring, algebraic fractions, linear equations, linear inequalities, systems of linear equations in two variables, integral exponents, square roots, quadratic equations, and the Pythagorean Theorem.

Course Outline for MA 1103 Fundamentals of Algebra

- I. The Set of Real Numbers
 - A. Number line
 - B. Addition, subtraction, multiplication, and division of real numbers using related properties and laws for signed numbers
- II. Algebraic Expressions
 - A. Addition, subtraction, and symbols of grouping
 - B. Laws of exponents when the exponents are positive integers
 - C. Multiplication and division of monomial expressions with positive integral exponents
 - D. Laws of exponents when the exponents are integers
 - E. Multiplication and division of monomials with positive, zero, and negative integral exponents
 - F. Multiplication and division of polynomials by monomials, polynomials by polynomials

G. Evaluation of algebraic expressions

III. Methods of Factoring

A. Greatest common divisor, least common multiple

B. Common factors

C. Difference of two squares

D. Trinomials

E. Grouping

IV. Algebraic Fractions

A. Reduction

B. Multiplication and division

C. Addition and subtraction

D. Simplification of complex fractions

V. Linear Equations in One Variable

A. Algebraic solution

B. Applications

VI. Simple Linear Inequalities in One Variable

A. Algebraic solution

B. Graphs

VII. Systems of Linear Equations in Two Variables

A. Graphs and graphical solutions

B. Algebraic solution

C. Application

VIII. Exponents and Radicals

- A. Positive exponents
- B. Negative and zero exponents
- C. General rule of exponents
- D. Simplifying square roots
- E. Adding, subtracting, multiplying, and dividing square roots
- F. The Pythagorean Theorem
- G. Radical Equations

IX. Quadratic Equations

- A. Solutions by factoring
- B. Solutions by the quadratic formula

X. Lines

- A. Slope
- B. Intercepts
- C. Point-Slope form of the equation
- D. General form of the equation

XI. Word Problems

APPENDIX B
MISSISSIPPI INSTITUTIONS OF HIGHER LEARNING REQUIREMENTS
FOR FULL ADMISSION AND MISSISSIPPI'S COLLEGE
PREPARATORY CURRICULUM

Mississippi Institutions of Higher Learning Requirements for Full Admissions

- Completion of the College Preparatory Curriculum (CPC) with a minimum 3.20 high school grade point average (GPA)
- Completion of the CPC with (a) a minimum 2.5 high school GPA on the CPC or a class rank in the top 50 percent, and (b) a composite score of 16 or higher on the ACT or a combined score of 750 or higher on the SAT.
- Completion of the CPC with (a) a minimum 2.0 high school GPA on the CPC and (b) a composite score of 18 or higher on the ACT or a combined score of 860 or higher on the SAT
- Satisfactory qualifier under National Collegiate Athletic Association standards for student-athletes who are full qualifiers under Division I guidelines.

Mississippi's College Preparatory Curriculum

- English (4 Carnegie Units): Courses must require substantial communication skills such as reading, writing, listening, and speaking.
- Mathematics (3 Carnegie Units): Algebra I, Algebra II, and Geometry. A fourth course is highly recommended. Algebra I taken in the eighth grade will be accepted provided course content is the same as the high school course.
- Science (3 Carnegie Units): Biology, Advanced Biology, Chemistry, Advanced Chemistry, Physics, Advanced Physics or any other science course with comparable content and rigor. One Carnegie Unit from a physical science course with content at a level that may serve as an introduction to physics and chemistry may be used. Two of the courses must be laboratory-based.
- Social Studies (3 Carnegie Units): United States History (1 unit), World History (1 unit with substantial geography component), Government ($\frac{1}{2}$ unit) and Economics ($\frac{1}{2}$ unit) or Geography ($\frac{1}{2}$ unit).
- Advanced Electives (2 Carnegie Units): Foreign Language, World Geography, fourth-year laboratory-based science, or fourth-year mathematics. One unit must be a foreign language or world geography. Foreign language taken in the eighth grade will be accepted provided course content is the same as the high school course.

- Computer (½ Carnegie Unit): The course should include use of application packages, such as word processing and spreadsheets. The course should also include basic computer terminology and hardware operation.

APPENDIX C

SAMPLE QUESTIONS FROM THE ACCUPLACER

Reading Comprehension

Question 1: Narrative

Read the statement or passage and then choose the best answer to the question. Answer the question on the basis of what is stated or implied in the statement or passage.

There are two types of pottery that I do. There is production pottery-mugs, tableware, the kinds of things that sell easily. These pay for my time to do the other work, which is more creative and satisfies my needs as an artist.

The author of the passage implies:

- A. artists have a tendency to waste valuable time
- B. creativity and mass-production are incompatible
- C. most people do not appreciate good art
- D. pottery is not produced by creative artists

Question 2: Sentence Relationships

Two bold sentences are followed by a question or statement about them. Read each pair of sentences and then choose the best answer to the question or the best completion of the statement.

The Midwest is experiencing its worst drought in fifteen years.

Corn and soybean prices are expected to be very high this year.

What does the second sentence do?

- A. It restates the idea found in the first.
- B. It states an effect.
- C. It gives an example.
- D. It analyzes the statement made in the first.

ANSWERS (Reading Comprehension)

- 1. B
- 2. B

Sentence Skills

Question 1: Sentence Correction

Select the best version of the bold part of the sentence. The first choice is the same as the original sentence. If you think the original sentence is best, choose the first answer.

Mr. Rose **planning** to teach a course in biology next summer.

- A. planning
- B. are planning
- C. with a plan
- D. plans

Question 2: Sentence Correction

The baby was obviously getting too **hot, then Sam did** what he could to cool her.

- A. hot, then Sam did
- B. hot, Sam did
- C. hot; Sam, therefore, did
- D. hot; Sam, trying to

Question 3: Construction Shift

Rewrite the sentence in your head, following the directions given below. Keep in mind that your new sentence should be well written and should have essentially the same meaning as the sentence given you.

Being a female jockey, she was interviewed.

Rewrite, beginning with
She was often interviewed...

The next words will be

- A. on account of she was
- B. by her being
- C. because she was
- D. being as she was

Question 4: Construction Shift

In his songs, Gordon Lightfoot makes melody and lyrics intricately intertwine.

*Rewrite, beginning with
Melody and lyrics...*

Your new sentence will include

- A. Gordon Lightfoot has
- B. make Gordon Lightfoot's
- C. in Gordon Lightfoot's
- D. does Gordon Lightfoot

ANSWERS (Sentence Skills)

- 1. D
- 2. C
- 3. C
- 4. C

Elementary Algebra

Question 1:

If a number is divided by 4 and then 3 is subtracted, the result is 0. What is the number?

- A. 12
- B. 4
- C. 3
- D. 2

Question 2:

If A represents the number of apples purchased at \$.15 each and B represents the number of bananas purchased at \$.10 each, which of the following represents the total value of the purchases?

- A. $A + B$
- B. $25(A + B)$
- C. $10A + 15B$
- D. $15A + 10B$

Question 3:

$$16x - 8 =$$

- A. $8x$
- B. $8(2x - x)$
- C. $8(2x - 1)$
- D. $8(2x - 8)$

Question 4:

If $x - x - 6 = 0$, then x is

- A. -2 or 3
- B. -1 or 6
- C. 1 or -6
- D. 2 or -3

ANSWERS (Elementary Algebra)

- 1. A
- 2. D
- 3. C
- 4. A

APPENDIX D
SAMPLE DEPARTMENTAL FINAL EXAM FOR
MA 1313 COLLEGE ALGEBRA

FINAL EXAMINATION

INSTRUCTIONS:

1. Give the following information at the top of your answer sheet: YOUR NAME, I.D. NUMBER, NAME OF INSTRUCTOR, COURSE AND SECTION NUMBER, DATE.
2. Make no marks on the exam sheets. Use the scratch paper provided.
3. Use a #2 pencil to mark your answer sheet. Keep the answer sheet neat—no stray marks, no smudges, not wrinkled.
4. Be careful to mark your answer in the proper space. If you must change an answer, erase the old answer completely.
5. Return your answer sheet, the exam questions, and all scratch paper to your instructor when you finish.
6. No calculators are allowed.

1. Assuming that x , y , and z are positive, simplify $\left[\frac{27x^{-2}y^{-1}z^0}{8x^{-5}y^6}\right]^{-2/3}$ and express the answer using only positive exponents.

(1) $\frac{2y^6}{3x^2z}$ (2) $\frac{4y^6}{9x^2}$ (3) $\frac{8y^6}{27x^2}$ (4) $\frac{9x^2}{4y^6}$ (5) $\frac{9y^6}{4x^2}$

2. Express in simplest radical form: $4\sqrt{56x^3y^2}$

(1) $2xy\sqrt{14x}$ (2) $4xy\sqrt{56x}$ (3) $8xy\sqrt{7}$ (4) $16xy\sqrt{14y}$ (5) $8xy\sqrt{14x}$

3. In the expansion of $(a - 2b)^7$, the term involving b^2 is

(1) $-7a^5b^2$ (2) $-42a^5b^2$ (3) $42a^5b^2$ (4) $-84a^5b^2$ (5) $84a^5b^2$

4. Factor completely: $3y^6 - 3y^2$

(1) $3y^2(y^2 - 1)(y + 1)^2$ (2) $y^2(3y^2 + 1)(2y + 1)(y - 1)$ (3) $3y^2(y - 1)^4$

(4) $3y^2(y + 1)^2(y - 1)^2$ (5) $3y^2(y^2 + 1)(y - 1)(y + 1)$

5. Simplify: $\frac{3x - 6}{x^2 + 4x} \cdot \frac{x^2 + 5x + 4}{x^2 - x - 2}$

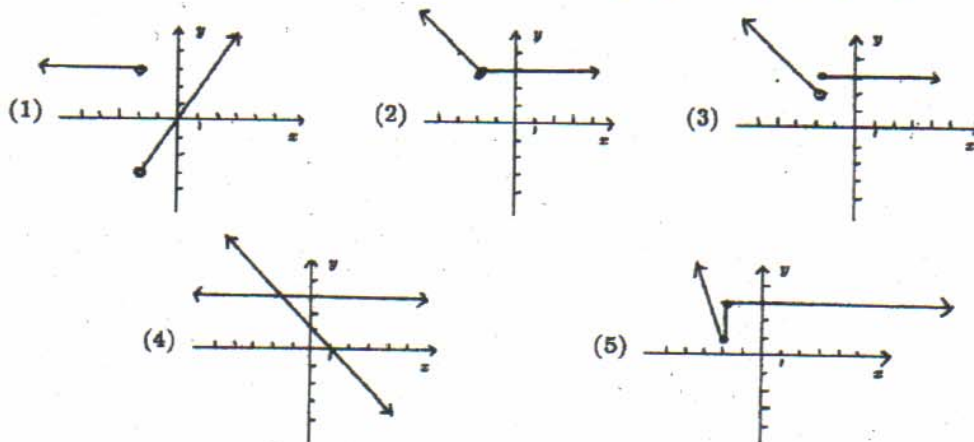
(1) $\frac{3}{x}$ (2) $\frac{2(x + 4)}{(x + 2)(x - 2)}$ (3) $\frac{3(x - 2)}{(x + 2)(x + 4)}$ (4) $\frac{3(x - 2)^2}{x(x + 4)^2}$ (5) $\frac{x^2 + 8x - 25}{2x^2 + 3x + 2}$

6. Rationalize the denominator and simplify: $\frac{\sqrt{x}}{3\sqrt{x} - \sqrt{y}}$

(1) $\frac{3xy + \sqrt{xy}}{9x + y}$ (2) $\frac{3x + \sqrt{xy}}{9x - y}$ (3) $\frac{3x + \sqrt{xy}}{3x + y}$ (4) $\frac{3x + \sqrt{xy}}{3x - y}$ (5) $\frac{3x + xy}{9x - y}$

16. Solve for x : $\sqrt{7x+11} - x = 3$
- (1) $x = -1$ (2) $x = 2$ (3) $x = 1$ or $x = 8$ (4) $x = -1$ or $x = 2$
- (5) There is no solution.
17. Find the interval on which the inequality $5(2s+1) < -3(3s+1)$ is true.
- (1) $(-\infty, -\frac{8}{19})$ (2) $(-\infty, -\frac{4}{19})$ (3) $(-\infty, 0)$ (4) $(-\infty, -\frac{2}{19})$
- (5) There is no interval on which the inequality is true.
18. Solve for x : $5x^2 + 2x \geq 4x^2 + 3$
- (1) $(-\infty, 3)$ (2) $(-1, \infty)$ (3) $(-\infty, -3] \cup [1, \infty)$ (4) $(-\infty, -3) \cup (1, \infty)$
- (5) $\{-1, 3\}$
19. Find all values of x for which the inequality $2|2-3x| < 1$ is true.
- (1) $\left\{x : \frac{1}{2} < x < \frac{5}{6}\right\}$ (2) $\left\{x : x > \frac{5}{6}\right\}$ (3) $\left\{x : x < \frac{1}{2}\right\}$
- (4) $\left\{x : x < \frac{1}{2} \text{ or } x > \frac{5}{6}\right\}$ (5) $\left\{-\frac{1}{2} < x < \frac{2}{3}\right\}$
20. Find the distance between the midpoint of the points $(-1, 3)$ and $(5, 8)$ and the point $(3, 2)$.
- (1) $\frac{\sqrt{53}}{4}$ (2) $\frac{\sqrt{53}}{2}$ (3) $\sqrt{\frac{11}{2}}$ (4) $\frac{7}{2}$ (5) $\frac{53}{4}$
21. Determine which of the points $(1, 2)$, $(3, 6)$, and $(4, 9)$ is(are) on the graph of the equation $y = \frac{1}{2}x^2 + \frac{3}{2}$.
- (1) $(1, 2)$ (2) $(1, 2)$ and $(3, 6)$ (3) $(3, 6)$ (4) $(3, 6)$ and $(4, 9)$
- (5) $(1, 2)$, $(3, 6)$, and $(4, 9)$
22. Which of the following is an equation of the circle having the points $P(-2, 5)$ and $Q(4, 5)$ as endpoints of a diameter?
- (1) $(x-1)^2 + (y-5)^2 = 9$ (2) $(x-1)^2 + y^2 = 34$ (3) $(x+1)^2 + y^2 = 9$
- (4) $x^2 + y^2 = 18$ (5) $(x-2)^2 + (y-1)^2 = 9$

23. The slope of the line passing through the points $P(-2, 4)$ and $Q(4, -2)$ is
 (1) 1 (2) 2 (3) 0 (4) -1 (5) -2
24. Find an equation of the line with y -intercept 3 that is parallel to the line $x + 2y + 5 = 0$.
 (1) $x + 2y - 6 = 0$ (2) $2x + 2y - 3 = 0$ (3) $3x - y - 2 = 0$ (4) $3x + 4y - 1 = 0$.
 (5) $x + y - 2 = 0$.
25. The domain of the function $f(x) = \sqrt{x^2 - 9}$ is.
 (1) $x \neq -3$ or $x \neq 3$ (2) $[-3, 3]$ (3) $(-\infty, -3] \cup [3, \infty)$ (4) $[3, \infty)$ (5) $(-\infty, -3]$
26. If $f(x) = 3x + 2$, then $\frac{f(a+h) - f(a)}{h} =$
 (1) 1 (2) $\frac{3h+4}{h}$ (3) 3 (4) $3a+h$ (5) $3(a+h)+2$
27. The maximum value of the function $f(x) = 1 + 3x - x^2$ is
 (1) 1 (2) 2 (3) $3/2$ (4) $13/4$ (5) The function has no maximum value.
28. If the functions f and g are inverses of each other, then $(g \circ f)(x) =$
 (1) 1 (2) $\frac{g(x)}{f(x)}$ (3) $g(x) \cdot f(x)$ (4) x (5) $(g \circ f)(x)$ does not exist.
29. The graph that best represents the function $f(x) = \begin{cases} 1 - x, & \text{if } x < -2 \\ 3, & \text{if } x \geq -2 \end{cases}$ is



30. If $f(x) = \frac{2}{x}$ and $g(x) = \frac{x}{x+2}$, then $(f \circ g)(x) =$

- (1) $\frac{2(x+2)}{x}$ (2) $\frac{1}{1+x}$ (3) $\frac{2}{x+2}$ (4) $\frac{2x+2}{x^2}$ (5) $\frac{x^2}{x+2}$

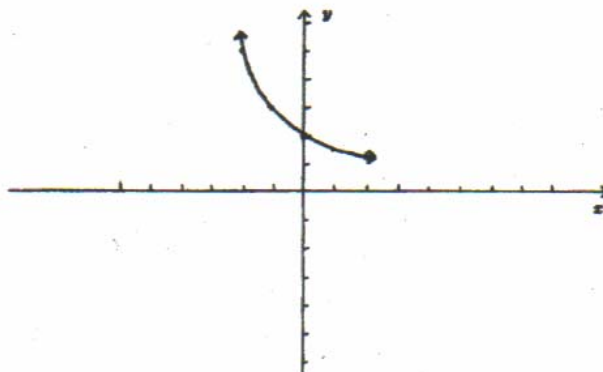
31. According to the Remainder Theorem, when $x^3 + 3x^2 - 1$ is divided by $x - 1$ the remainder is

- (1) 1 (2) -1 (3) 3 (4) 4 (5) 0

32. Find all of the solutions of the equation $x^4 + x^3 + 7x^2 + 9x - 18 = 0$.

- (1) $x = 1, x = 2, x = \pm 2i$ (2) $x = -2, x = 1, x = \pm 3i$ (3) $x = -2, x = 1, x = \pm 3$
 (4) $x = 1, x = 2, x = 1 \pm i$ (5) This equation has no solution.

33. Which of the following functions does the graph given below represent best?



- (1) $f(x) = 2^x$ (2) $f(x) = 2^{-x}$ (3) $f(x) = \log_2 x$ (4) $f(x) = 1 + 2^{-x}$
 (5) $f(x) = -1 + \log_2 x$

34. The number of bacteria in a culture is given by the function $n(t) = 50(2^{3t})$, where t is measured in hours. How many hours would it take for the number of bacteria to double?

- (1) 1 hour (2) 2 hours (3) $\frac{1}{3}$ hour (4) $\frac{1}{2}$ hour (5) $\frac{1}{4}$ hour

35. $\log \frac{3x^2}{(x+1)^{10}} =$

- (1) $2\log 3 + 2\log(x+1)$ (2) $\log(3x^2 - (x+1)^{10})$ (3) $\frac{\log 3x^2}{\log(x+1)^{10}}$
 (4) $(\log(3x))^2 - (\log(x+1))^{10}$ (5) $\log 3 + 2\log x - 10\log(x+1)$

36. The greens fee for one round of golf at the local golf course is \$15 for MSU students, \$18 for MSU faculty and staff, and \$20 for others. On a certain day, 82 rounds of golf were played and the receipts were \$1496. If twice as many non-MSU affiliated people played as students, find the number of students who played that day.

- (1) 10 (2) 12 (3) 20 (4) 24 (5) 30

37. Solve for x : $5^x = 4^{x+1}$

- (1) 0 (2) $\log 4 - \log \frac{5}{4}$ (3) $\frac{\log 4}{\log 1.25}$ (4) $\log 6$ (5) 6

38. Solve for x : $\log_4(x-2) + 2\log_4 x = 1 + \log_4 2x$

- (1) $x = -2$ or $x = 4$ (2) $x = -1$ (3) $x = -2$ or $x = 3$ (4) $x = 4$ (5) $x = 6$

39. Find the complete solution of the system $\begin{cases} x + y - 2z = 7 \\ 2x - y + 3z = 17 \end{cases}$

- (1) $x = 2, y = -1, z = -3$ (2) $x = 7, y = 2, z = 3$
 (3) $x = 4z - 3, y = 3z - 3, z = \text{any number}$
 (4) $x = -\frac{1}{3}z + 8, y = \frac{7}{3}z - 1, z = \text{any number}$
 (5) The system has no solution.

40. One solution of the system $\begin{cases} x^2 - 2x + y^2 = 3 \\ x - y = 3 \end{cases}$ is

- (1) $x = 0, y = 3$ (2) $x = 1, y = -2$ (3) $x = 0, y = \sqrt{3}$ (4) $x = -1, y = 0$
 (5) $x = 5, y = 2$

APPENDIX E

COURSE OUTLINE FOR MA 0003 DEVELOPMENTAL MATHEMATICS

**MA 0003 Developmental Mathematics Course Outline from the Textbook,
Introductory Algebra, 7th ed., by Bittinger & Keedy**

- Set R.5-----Exponential Notation and Order of Operations
- Set 1.4-----Subtraction of Real Numbers
- Set 1.5-----Multiplication of Real Numbers
- Set 1.7-----Properties of Real Numbers
- Set 1.8-----Simplifying Expressions; Order of Operations
- Set 2.1-----Solving Equations: The Addition Principle
- Set 2.2-----Solving Equations: The Multiplication Principle
- Set 2.3-----Using the Principles Together
- Set 2.7-----Solving Inequalities
- Set 3.1-----Integers as Exponents
- Set 3.2-----Exponents and Scientific Notation
- Set 3.3-----Introduction to Polynomials
- Set 4.1-----Introduction to Factoring
- Set 4.2-----Factoring Trinomials of the type x^2+bx+c
- Set 4.3-----Factoring Trinomials of the type ax^2+bx+c , a not equal to 1
- Set 4.4-----Factoring ax^2+bx+c , a not equal to 1, using Grouping
- Set 4.5-----Factoring Trinomial Squares and Difference of Squares
- Set 4.6-----Factoring: A General Strategy
- Set 4.7-----Solving Quadratic Equations by Factoring
- Set 4.8-----Solving Problems
- Set 5.1-----Multiplying and Simplifying Rational Expressions
- Set 5.2-----Division and Reciprocals
- Set 5.3-----Least Common Multiples and Denominators
- Set 5.4-----Adding Rational Expressions
- Set 5.5-----Subtracting Rational Expressions
- Set 5.6-----Solving Rational Equations
- Set 5.7-----Solving Problems and Proportions
- Set 6.1-----Graphs
- Set 6.2-----Graphing Linear Equations
- Set 6.3-----More on Graphing Linear Equations
- Set 6.4-----Slope and Equations of Lines
- Set 6.5-----Parallel and Perpendicular Lines
- Set 7.1-----Systems of Equations in Two Variables
- Set 7.2-----The Substitution Method
- Set 7.3-----The Elimination Method
- Set 8.1-----Introduction to Square Roots and Radical Expressions
- Set 8.2-----Multiplying and Simplifying with Radical Expressions
- Set 8.3-----Quotients Involving Square Roots
- Set 9.1-----Introduction to Quadratic Equations
- Set 9.3-----Quadratic Formula

APPENDIX F

COURSE OUTLINE FOR MA 0103 INTERMEDIATE ALGEBRA

Course Outline and Objectives**MA 0103 Intermediate Algebra**

TEXT: Intermediate Algebra, 3rd Edition, by K. Elayn Martin-Gay

MA 0103 is designed to prepare a student for MA 1313 College Algebra. This course does not count toward any degree nor does it reflect in a student=s grade point average. It does count in a student=s course load. Calculators are not allowed in this course.

Chapter 1, Sections 1.3 - 1.4: After completing Chapter 1, a student should:

- be able to write phrases as algebraic expressions and write sentences as equations.
- be able to identify like terms and simplify algebraic expressions.
- be able to write products in exponential form and to find n th roots of positive integers.
- be able to evaluate algebraic expressions.
- know and be able to apply the Order of Operations.

Chapter 2, Sections 2.1 - 2.7: After completing Chapter 2, a student should:

- be able to solve linear equations and inequalities in one variable and to recognize equations with no solution.
- be able to solve word problems which can be solved using a linear equation in one variable.
- be able to use interval notation.
- be able to solve compound inequalities.
- know the definition of absolute value and be able to solve linear equations and inequalities involving absolute value.

Chapter 3, Sections 3.3 - 3.5: After completing Chapter 3, a student should:

- be able to graph linear equations in two variables.
- be able to find the intercepts of linear equations in two variables.

- find the slope of a line given two points or given the equation of the line.
- be able to write the equation of a line in slope-intercept form and to use the slope-intercept form in real-world applications.
- know the slopes of horizontal and vertical lines.
- understand the relationship between the slopes of parallel and perpendicular lines.

Chapter 4, Sections 4.1 - 4.3: After completing Chapter 4, a student should:

- be able to solve a linear system of equations in two variables by graphing, substitution and elimination.
- be able to solve a linear system of equations in three variables by elimination.
- be able to solve problems that can be modeled by a system of linear equations in two variables.

Chapter 5, Sections 5.1 - 5.8: After completing Chapter 5, a student should:

- know the meaning of the words term, constant, polynomial, monomial, binomial, trinomial, and degree (of a polynomial).
- know the exponent laws for integral exponents.
- be able to compute using scientific notation and to convert from scientific to decimal and from decimal to scientific notation.
- be able to simplify, evaluate, add, subtract, multiply and divide polynomials.
- be able to factor by finding the greatest common factor and by grouping.
- be able to factor trinomials, the difference of two squares, binomial squares and the sum and difference of two cubes.
- be able to solve quadratic equations by factoring.

Chapter 6, Sections 6.1 - 6.4, 6.6, 6.7: After completing Chapter 6, a student should:

- be able to find values for which a rational expression is undefined.

- be able to simplify rational expressions by reducing to lowest terms.
- be able to add, subtract, multiply and divide rational expressions.
- be able to simplify complex fractions.
- be able to solve applications involving rational expressions.
- be able to solve literal equations.

Chapter 7, Sections 7.1 - 7.5: After completing Chapter 7, a student should:

- be able to find square, cube and nth root and convert from exponential to radical and from radical to exponential form.
- know the meaning algebraic expressions involving rational exponents.
- know the exponent laws for rational exponents and use rational exponents to simplify radical expressions.
- understand the concept of principal nth root.
- be able to use the product and quotient rules for radicals and be able write radicals in simplest radical form.
- be able to add and subtract radicals.
- be able to rationalize numerators and denominators of radical expressions.

Chapter 8, Sections 8.1 and 8.2: After completing Chapter 8, a student should:

- be able to solve quadratic equations by completing the square.
- be able to solve quadratic equations by using the Quadratic Formula.

APPENDIX G

COURSE OUTLINE FOR MA 1313 COLLEGE ALGEBRA

Course Outline and Objectives

MA 1313 College Algebra

TEXT: College Algebra, 3rd Edition, by Stewart, Redlin and Watson

NOTE: Effective with the Fall 2000 Semester, students taking the departmental final examination will be allowed but not be required to use a calculator. Your instructor is not expected to provide instruction on the use of your calculator.

Chapter 1, Sections 3, 4, 5 and 6: The material in Chapter 1 should have been mastered in a previous course, with the possible exception of factoring expressions like Example 13 on page 40, simplifying expressions like Example 7 on page 48, and/or solving equations using nth roots and fractional exponents like Examples 6 and 7 on page 58.

After completing Chapter 1, a student should:

- be able to combine and simplify algebraic expressions involving radicals, fractional exponents, fractional expressions and complex fractions.
- know the factoring formulas found on page 38 and be able to factor quadratic trinomials, factor by grouping, and factor expressions in which the variables have negative or fractional exponents.
- be able to solve equations involving fractions, fractional exponents, and literal constants.
- be able to solve equations containing nth roots.

<u>Section</u>	<u>Suggested Minimum Course Assignment</u>
3	p. 30: 1, 3, 4a, 4b, 5c, 6a, 6b, 7a, 7c, 9a, 9b, 10b, 10c, 11, 12, 15, 17, 20, 23, 28, 29, 31, 33, 35, 40, 41, 43, 46, 48, 49, 50, 52, 53, 54, 55, 56, 57, 58a, 58c, 59a, 59b, 60c
4	p. 41: 24, 26, 29, 30, 33, 35, 39, 43, 48, 49, 51, 52, 53, 54, 55, 57, 59, 60, 61, 62, 65, 71, 73, 75, 77, 78, 81, 85, 87
5	P. 50: 5, 8, 9, 11, 13, 15, 21, 23, 25, 31, 34, 35, 37, 39, 41, 43, 47, 53, 55, 60, 61, 64, 68
<u>6</u> 6 hours	p. 60: 1, 3, 9, 11, 13, 17, 18, 21, 23, 25, 29, 35, 39, 41, 43, 45, 47, 49, 53, 63, 65, 71, 73, 74, 75, 81

Chapter 2, Sections 1, 2 and 4: After completing Chapter 2, a student should be able to:

- find the midpoint of a line segment given the endpoints.
- find the distance between two points.
- determine if a given point lies on the graph of an equation by checking to see if the coordinates of the point satisfy the

equation.

- find the x and y intercepts of a graph.
- find the equation of a circle satisfying given conditions.
- show that a given equation represents a circle (by completing the square).
- find the radius and center of a circle given its equation.
- find the slope of a line given two distinct points.
- find the slope of a line given its graph.
- write an equation of a line given (i) a point and a slope, (ii) two points, (iii) a point and a line parallel to the required line, or (iv) a point and a line perpendicular to the required line.

<u>Section</u>	<u>Suggested Minimum Course Assignment</u>
1	P.80:3,5,25,32,35,37,39,40,45
2	P.92:1,3,5,7,9,11,13,51,53,55,57,59,61,63,65,67,69,70
4	P.111:3,5,9,11,17,19,23,27,31,33,39,41,43
4 hours	

Chapter 3, Sections 2-8: After completing Chapter 3, a student should:

- be able to solve word problems involving age, consecutive integers, area, perimeter, simple interest, uniform motion, mixture, averaging, the Pythagorean Theorem and work.
- know how to solve a quadratic equation by factoring, completing the square, and using the quadratic formula.
- know the definition of a complex number and be able to perform the basic arithmetic operations with complex numbers.
- know how to solve an equation by grouping and factoring.
- know how to solve an equation by converting it to quadratic form.
- know how to solve an irrational equation and check for extraneous solutions.
- be able to solve linear and nonlinear inequalities and represent the solution using both interval and set notation.
- be able to graph the solution of an inequality on the real line.
- know the definition of absolute value and be able to solve equations and inequalities involving absolute values.

<u>Section</u>	<u>Suggested Minimum Course Assignment</u>
2	p.146:13,17,19,23,25,29,30,34,45,51,52,55,57,63
3	p.161:3,5,7,11,13,17,19,21,25,35,37,41,45,62,63,68,71
4	p.170:1,3,5,6,7,9,11,13,15,17,21,23,25,31,33,35,39,41,47,49,53,55,59
5	p.178:1,3,5,7,9,10,11,13-55(odd)

6	p.185:3,5,7,8,11,15-29(odd),33-39(odd)
7	p.194:1,3,5,7,9,11,12,14,21,23,25,27,31,33,35,37,39
8	p.199: 1,3,7,9,11,15,17,19,21,25,27,31,33,37,39
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9 hours	

Chapter 4, Sections 1,2,6 7 and 8: After completing Chapter 4, a student should:

- know the definition of function and understand what a function is (and is not).
- understand the Vertical Line Test and be able to apply it.
- be able to determine the implicit domain and range of a function defined by an algebraic expression and be able to evaluate the function.
- be able to determine the intercepts, domain and range of a function given graphically and be able to evaluate the function by using its graph.
- be able to graph functions defined by linear, quadratic, square root, absolute value, greatest integer and piecewise expressions.
- be able to find the vertex and axis of a quadratic function (parabola) and sketch its graph.
- be able to determine the extreme value of a quadratic function and know the significance of the sign of the coefficient of the square term.
- be able to combine functions in various ways, including composition, and find the domain of the resulting function.
- know what is meant by a one-to-one function and be able to apply the Horizontal Line Test.
- be able to find the inverse of a function and know the relationship between the domain and range of a function and the domain and range of its inverse.

<u>Section</u>	<u>Suggested Minimum Course Assignment</u>
1	p.217:1,3,7,9,11,15,20,21,23,25,27,31,32,35-53(odd),61,63
2	p.228:1,3,5-11,13,15,17,19,23,25,35,38,41,45,59,63,66,69
6	p.266:3,11,13,15,19,21,23,25,27,31,34,35,37,41
7	p.275:1,3,5,8,11,17,19,20,21,22,23,25,27,29,31,33,36,37,40,43,45,47,50
8	p.287:1,3,5,7,11,13,15,17,20,21,25,27,31,37,41,43,47,51,63,65
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7 hours	

Chapter 5, Sections 2,3,and 4: After completing Chapter 5, a student should:

- understand and be able to apply the following to solving problems involving polynomials: the division algorithm, synthetic division, Fundamental Theorem of Algebra, Remainder Theorem, Factor Theorem, Rational Roots Theorem, Conjugate Roots Theorem.
- know the relationship between the zeros of a polynomial $Q(x)=P(x)/(x-r)$, where $P(x)$ is a polynomial of degree $n \geq 1$ and r is a Zero of $P(x)$, and the zeros of $P(x)$.

<u>Section</u>	<u>Suggested Minimum Course Assignment</u>
2	p.332:3,7,13,15,19,27,32,35,37,39,41,43,45,46,49
3	p.341:2,3,7,11,15,20,26,35,39,41,42,71,73
4	P.353:3,7,15,19,21,23,25,26,29,34,37,42,45,50,52b
4 hours	

Chapter 6, Sections 1,2,3,4 and 5: After completing Chapter 6, a student should:

- know the definitions of exponential and logarithmic function and their properties (domain, range, intercept, asymptote).
- be able to sketch the graph of exponential and logarithmic functions without using a calculator.
- know what the number e is.
- know both the analytical and graphical relationships between exponential and logarithmic functions.
- know the Laws of Logarithms and be able to simplify logarithmic expressions.
- be able to solve logarithmic equations and know to check for extraneous solutions.

<u>Section</u>	<u>Suggested Minimum Course Assignment</u>
1	p.384: 1,5,9,11,15-21,23,29,33
2	p.394: 3,5,9a,11a,11c,11d
3	p.405: 1,3,5,9,13a,13c,15a,15c,17,23,27,28,37-42
4	p.411: 5,11,13,19,21,25,29,35,39,41
5	p.418: 1,3,17,29,35,37,41,43,45,47
5 hours	

Chapter 7, Sections 1 and 2: After completing Chapter 7, a student should:

- be able to solve systems of linear or non-linear equations in two variables by elimination and/or substitution.
- be able to determine when a system has no solution.
- be able to determine when a system has infinitely many solutions.

<u>Section</u>	<u>Suggested Minimum Course Assignment</u>
1	p.454: 1,3,5,9,11,15,19,21,25,26,37,39
<u>2</u>	p.461: 1,5,9,13,15,23,33,35,37
2 hours	

Chapter 9, Section 6: A student should know about Pascal's triangle, be able to write a binomial in expanded form, and be able to use binomial coefficients to find particular terms in an expanded binomial.

<u>Section</u>	<u>Suggested Minimum Course Assignment</u>
<u>6</u>	p.630: 1,2,7,9,11,15,17,21,22,23,25,27,29,30,31,35,37,39,41,42
1 hour	
Total	38 hours

APPENDIX H
MISSISSIPPI STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD
LETTER OF APPROVAL



October 30, 2003

Martha Pratt
111 Apache Drive
Starkville, MS 39759

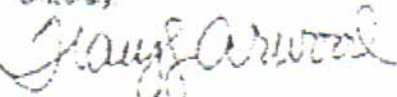
Re: IRB Docket #03-236: Investigation of Success in Satisfying University Core Mathematics Requirements and Graduation of Students in the Summer Developmental Program at Mississippi State University

Dear Ms. Pratt:

The above referenced project was reviewed and approved via administrative review on October 31, 2003 in accordance with 45 CFR 46.101 b(4). Continuing review is not necessary for this project; however, any modification to the project must be reviewed and approved by the IRB prior to implementation. Any failure to adhere to the approved protocol could result in suspension or termination of your project. The IRB reserves the right, at anytime during the project period, to observe you and the additional researchers on this project.

Please refer to your IRB number (#03-236) when contacting our office regarding this application.

Thank you for your cooperation and good luck to you in conducting this research project. If you have questions or concerns, please contact me at ta.wood@research.msstate.edu or 325-3294.

Sincerely,

 Tracy S. Arwood
 Regulatory Compliance Officer

cc: Dwight Hare

Office for Regulatory Compliance

1000 Old Main • Starkville, MS 39762 • Phone: 325-3294 • Fax: 325-3294