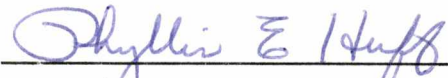


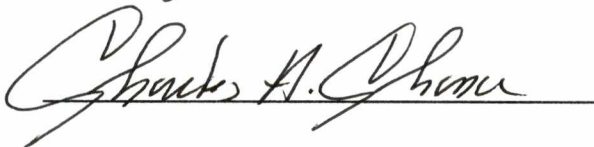
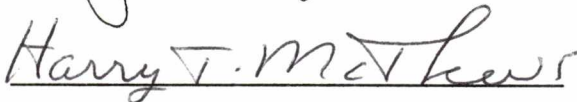
To the Graduate Council:

I am submitting herewith a dissertation written by Debra Deon Bryant entitled "A Comparison of Success Rates in Grade Maintenance in R/D Mathematics through Level 1 Mathematics of TTU Students and Transfer Students to TTU from Other State Post-Secondary Institutions from Fall 1994 through Spring 1996." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Education.

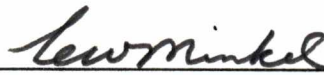


Phyllis Huff, Major Professor

We have read this dissertation
and recommend its acceptance:



Accepted for the Council:



Associate Vice Chancellor and
Dean of The Graduate School

A COMPARISON OF SUCCESS RATES IN
GRADE MAINTENANCE IN R/D MATHEMATICS
THROUGH LEVEL 1
MATHEMATICS OF TTU STUDENTS
AND TRANSFER STUDENTS TO TTU FROM
OTHER STATE POSTSECONDARY INSTITUTIONS
FROM FALL 1994 THROUGH SPRING 1996

A Dissertation
Presented for the
Doctor of Education
Degree
The University of Tennessee, Knoxville

Debra Deon Bryant

May 1998

DEDICATION

To my husband, Bruce, and my daughter, Rachel.

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ABSTRACT

The purpose of this study was to investigate the differences in the remedial/developmental math curricula that impact transfer students who enroll in Tennessee Technological University (TTU) prior to completion of their level 1 mathematics course work.

This study was conducted with 419 students who first enrolled at TTU and 70 students who transferred to TTU from another Tennessee Board of Regents college or university from Fall 1994 through Spring 1996. Only students who had received a passing grade in a remedial or developmental mathematics course and continued through the level 1 mathematics course were included in the study. The student's grades in mathematics provided the basis of comparison of grade maintenance (defined as success) in these ways: 1) Group One had completed three remedial/developmental courses and level 1 mathematics; 2) Group Two had completed two developmental courses and level 1 mathematics; and 3) Group Three had completed one developmental course and level 1 mathematics. An additional component of the study compared grade maintenance for students who had completed one or more remedial or developmental courses at a TBR school which has implemented

algebra reforms with grade maintenance for students who completed their remedial/developmental courses at a TBR school which has a traditional algebra course.

The null hypotheses tested were that there were no significant differences among the means of each of the three groups with reference to grade maintenance.

Final grades for each course in the remedial and/or developmental and level 1 mathematics were analyzed to determine success. Only the final grade was recorded, regardless of the number of attempts made. The letter grades were translated into the familiar 4.00 scale and used to test the hypotheses.

Since the groups were found to be homogeneous, the means were analyzed by a t-test. The results indicated that non-transfer students have a higher grade point average in remedial mathematics and that transfer students have a higher grade point average in developmental mathematics. At level 1 mathematics, the grade point averages differ by only .08. For each comparison no significant differences were found at the .05 level.

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Chapter I

Introduction

Nationally, there are 3.5 million students enrolled in developmental education courses. This results in about forty-five (45) percent of all college students in this country having one or more developmental course requirements (Coble and Bryant, 1995). Mathematics is the curriculum area in which developmental assistance is most often needed. More than three-quarters of all college and universities in the United States now offer some type of pre-freshmen course work in mathematics, but these colleges have been struggling with varying degrees of success to cope with the inadequacy of mathematical skills brought to postsecondary institutions by entering first-year and returning adult students (Coble and Bryant, 1995).

In Tennessee, roughly 13,000 first-time freshmen attending a public college are required to complete one or more developmental courses. Eighty (80) percent of these students enroll in mathematics only ("Enrollment in remedial classes," 1995). The focus of postsecondary mathematics remediation is to sufficiently improve the mathematical skills of targeted students thus enabling them to

successfully complete college-level mathematics or mathematics-dependent courses. The expectation is that successful remediation will allow the same opportunity of success in college-level mathematics courses to these students as is available to students not requiring remedial mathematics courses (Wepner, 1985).

Remedial/Developmental studies (R/D) courses have been offered, by mandate, at all Tennessee State Board of Regents (TBR) institutions since 1985. The program was designed to address the 1983 Educational Equality Project's study *Academic preparation for college: What students need to know and be able to do*. Tennessee's plan for R/D Programs was developed in July 1984, with the guidelines and mandatory placement criteria outlined in a paper, commonly called *The White Paper*, in place by the end of the year (Tennessee Board of Regents [TBR], 1984). The mathematics component of R/D studies encompasses one remedial and two developmental courses. The curriculum guidelines for the remedial mathematics course were initially taken from the Basic Skills Competencies defined by the Tennessee State Department of Education as its "Objectives for the Tennessee Proficiency Test," of which 21 of the 50 basic skills competencies focus on mathematics (Appendix A, pages 68-71). The developmental mathematics component comprises two

semesters and is a program of instruction that leads to the proficiency in the "Basic Academic Competencies" and in the "Basic Academic Subjects" as defined by the Educational Equality Project (Appendix A, pages 77-78 and 83-85). Since the majority of the skills are algebra related, the initial postsecondary curriculum simulated the high school Algebra I and Algebra II courses. With the successful National Council for Teachers of Mathematics (NCTM) efforts at reform in mathematics education for K-12 which began in the late 1980s and the recent efforts at reform in introductory college mathematics, there is a shift away from traditional algebraic topics in several of Tennessee's public colleges.

All first-year students requesting regular admission to Tennessee Technological University (TTU) must complete the Academic Assessment and Placement Program (AAPP) math portion if any of the following conditions apply:

1. Students under 21 years of age - assessment based on ACT scores: ACT mathematics score ≤ 18 must take the Elementary Algebra and Intermediate Algebra pretests if they have completed two years of algebra or Elementary Algebra and Arithmetic pretests if they have less than two years of high school algebra.
2. Students 21 years of age or older - assessment based on ACT scores no older than three years, or student is required to take the appropriate pretests as described in one.
3. Transfer students - assessment based on hours earned. If hours earned are fewer than 60 and a

passing grade in college-level math has not been earned (Willis & others, 1992).

Whether one believes that remediating mathematics at the postsecondary level is necessary or not, there is a need for a comprehensive evaluation of the mathematics component of the Academic Development Program (ADP) at Tennessee Technological University. In a 1991 statewide persistence study it was reported that R/D students perform within 2% of non R/D students in subsequent college level math courses (Coble, 1991). An indicator of the need for this study is that student pass rates in the college level 1 mathematics courses have not consistently met this statewide trend (Coble & others, 1993; Coble, 1994; Mannle, 1997). Findings from this study should address factors that enhance student success and lead to recommendations for program improvement at TTU.

Background of the Problem

In the fall of 1995, the ADP mathematics faculty at TTU began to question the R/D mathematics curricula of other TBR institutions. The mathematics component at TTU consists of a traditional beginning and intermediate algebra course, similar to Algebra I and Algebra II in high school. It was a stated concern that the TBR schools where adjustments were

being made in the mathematics curricula are influencing student success rates, particularly for transferring students. As an example, one TBR school had dropped the content on factoring polynomials in the Developmental Mathematics I course. Two of their students, who transferred to TTU prior to finishing the R/D mathematics sequence, elected to informally audit the TTU ADP083 course rather than earn an "F" in Developmental Mathematics II. Their decision was made when the content on complex factoring methods was introduced (with the assumption that the student already has a background in factoring techniques). It was evident that an assessment of transferring students' success rates was necessary in order to suspend speculation that curriculum revisions being made at other TBR schools were harmful to student success until data provided such conclusions.

The concern of this study is to compare grade maintenance in R/D and level 1 mathematics for entering and transfer students with R/D requirements. Research, rather than continued debate that the traditional approach to teaching algebra is best for TTU students, is needed in order to provide an inducement for change. If adjustments in curriculum at other TBR schools are enhancing student

success, then the TTU faculty must consider adopting such changes.

The Problem

The mathematics component of the Academic Development Program at Tennessee Technological University serves approximately thirty-five (35) percent of all incoming students. Of these students, some ten (10) percent transfer to TTU from other state two- or four-year institutions. With the release of both the National Council of Teachers of Mathematics (NCTM) *Curriculum and Evaluation Standards for School Mathematics* and the American Mathematical Association of Two-Year Colleges (AMATYC) *Crossroads in Mathematics: Standards for Introductory College Mathematics Before Calculus*, there is a push to de-emphasize traditional arithmetic and algebra topics such as arithmetic drill exercises, routine operations with real numbers, rote uses of formulas, paper and pencil graphing of linear and quadratic functions, the use of factoring to solve equations, the simplification of rational and radical expressions, the solution of rational and radical equations, solving systems of equations using determinants, conic sections, and word problems by type (National Council of

Teachers of Mathematics [NCTM], 1989; American Mathematical Association of Two-Year Colleges [AMATYC], 1995). Many two-year community colleges are making sweeping reforms in their R/D mathematics curricula to actually de-emphasize many traditional algebra topics. At TTU, the R/D mathematics curriculum continues to provide a traditional approach to the study of algebra. TTU is the feeder school for students from several two-year community colleges. There existed a need to investigate success rates for R/D and level 1 mathematics in order to determine if students are being adequately prepared for further math or math dependent courses.

The Purpose

The purpose of this study was to assess grade maintenance of entering and transfer students who have R/D mathematics requirements to Tennessee Technological University in both R/D and level 1 mathematics. Three population groups were compared with reference to grade maintenance.

Additionally, the study established the similarities and differences in the R/D math curricula at all TBR colleges/universities. A comparison was made between the

success rate of students who transferred from institutions that have made reforms in their R/D mathematics curriculum from those who transfer from institutions that use traditional algebra curriculum content.

Need for the Study

Research which supports success of the R/D mathematics program should enhance the University's support of the program. There is increasing attention by the public and lawmakers to higher education expenditures and R/D comes under scrutiny during each budget meeting. In 1994, specific allocations for R/D were taken out of the four-year university's line item expenses, thus giving each university much leeway in the budget allocated for the program. Most research performed at the State level and by community colleges deals with student retention, of which grade maintenance is only one component. There was no available research relating the effects of different mathematics curricula in R/D programs on the student who transfers from a two-year community college to a four-year college or university.

This study sought to answer these questions "What are the indicators that there is a lack of mathematics

curriculum continuity for those students who transfer to TTU before completing the R/D requirements and/or level 1 mathematics?" and "Do students who transfer to Tennessee Technological University from another state institution before completing their level 1 mathematics requirement succeed at the same rate as students who complete their R/D requirement at TTU?"

Assumptions

There is a trend in R/D mathematics for some institutions to use one textbook for all three R/D classes, or one textbook for the remedial course and one textbook for both developmental courses. The underlying reason for this is to incorporate algebra reform concepts of allowing time for emphasis of real problem solving, group projects, etc., with algebra techniques being introduced as needed. The result is that isolated topics are covered in each course. There is a stated assumption by R/D mathematics faculty members at TTU that students need review and repetition in order to learn algebraic concepts.

This study also assumes that assigned grades for a course are a measure of the student's ability to perform.

This assumption must be made as grade maintenance is being used as a measure of success.

Delimitations

This study is delimited to entering and incoming transfer students (from other TBR institutions) to TTU during the six semesters, Fall 1994 through Spring 1996. Summer semesters were included. Only data for students who completed one or more remedial/developmental courses and level 1 mathematics were used.

Definition of Terms

The following definitions of terms will be used in this study:

1. Academic Developmental Program (ADP).

An independent program at Tennessee Technological University that works to provide students with instruction in basic skills (reading, mathematics, writing) and study skills at both the remedial and developmental levels.

2. R/D Mathematics Program (TTU).

A series of three, four credit hour courses that satisfy the pre-freshman entry level for mathematics at Tennessee Technological University.

3. Success.

Success is measured by TBR-mandate as retention in the University. For purposes of this study success will further be defined as grade maintenance from R/D mathematics through level 1 mathematics.

4. ADP073 (Remedial Mathematics).

Fundamental operations and concepts involving basic arithmetic; area, perimeter and volume; operations with signed numbers; and simple linear equations.

5. ADP083 (Developmental Mathematics I).

Prerequisites: ADP 073 or satisfactory placement test score. Review of operations with signed numbers and linear equations, introduction to the fundamental concepts of algebra, and applications.

6. ADP084 (Developmental Mathematics II).

Prerequisites: ADP 083 or satisfactory placement test score and two high school algebra credits. Algebraic fractions, absolute value, advanced

factoring skills, quadratic equations, systems of equations, and conic sections and functions.

7. Level 1 mathematics.

Prerequisites: Minimum of two years of high school algebra and one year of high school geometry, or satisfactory completion of R/D course requirements. There are a variety of level 1 mathematics courses, with the choice based on the student's major.

Currently, any student enrolled in a degree granting program of study must elect at least one level 1 mathematics course.

Hypotheses

In this study, these specific null hypotheses will be tested at the five percent level of significance:

H₀1: No significant differences exist between the success rate of students that transfer with a requirement to enroll in developmental mathematics I (having had remedial mathematics at the previous institution) from the students who complete the remedial mathematics requirement at TTU.

H₀2: No significant differences exist between the success rate of students that transfer with a requirement to enroll in developmental mathematics II (having had developmental

mathematics I at the previous institution) from the students who complete the developmental mathematics I requirement at TTU.

H₀3: No significant differences exist between the success rate of students that transfer with a requirement to enroll in level 1 mathematics (having had developmental mathematics II at the previous institution) from the students who complete the developmental mathematics II requirement at TTU.

H₀4: No significant differences exist between the success rate of students who transfer from institutions that have made reforms in their R/D mathematics curriculum from those who transfer from institutions that use traditional algebra curriculum content.

The following question is also being considered. The analysis on this question will be of a comparative nature.

Question: Are there differences between the R/D math curricula at the various TBR colleges/universities and the R/D math curricula at TTU?

Organization of the Study

This study is organized into five chapters.

Chapter I introduces the study and contains the following components: background of the problem, statement of the problem, purpose of the study, need of the study,

assumptions, delimitations, definitions used, hypotheses, and organization.

Chapter II contains a review of literature relevant to the study. Subheadings in the review of literature include: research on effectiveness of the remedial programs at the college level, research on transfer students at the college level, and NCTM Standards use in mathematics instruction in R/D programs.

Chapter III presents the methods and procedures for evaluation used in the study.

Chapter IV includes an analysis of data organized by hypotheses being tested. There will also be a discussion of the opinions generated by the research question.

Chapter V provides a summary of the study, conclusions, implications, limitations, and recommendations for future research.

Chapter II

Review of Literature

The review of the literature related to this study includes studies in:

- 1) research on effectiveness of the remedial programs at the college level,
- 2) research on transfer students at the college level; specifically in success and retention,
- 3) NCTM Standards use in mathematics instruction in R/D programs.

A survey of related literature was developed using an ERIC search both in the library (on-line services) and the internet. A manual search of Dissertation Abstracts International was completed.

Effectiveness of Remedial Programs

Currently, success of the R/D mathematics program is measured by TBR-mandated retention reports. This report is a statistical tool that measures numbers of students who have entered through R/D and their retention until graduation. Success of the program is synonymous with

continued enrollment at Tennessee Technological University. There is no separate report to measure success for transfer students.

A study at Dalton Junior College in Georgia by June Sparks and Cynthia Davis in 1977 evaluated the developmental education program by comparing the performance of the students admitted under the category "Special Studies" with that of regular college students using grades as the success indicator. The study's summary suggested that when the Special Studies students moved into regular credit courses, they maintained grades that were equal to those earned by the regular students in those classes.

An investigation was done to determine if students who have completed a basic skills course display higher levels of academic performance when compared to regularly admitted students. Researchers concluded that remedial programs have both positive short-term and long-term effects on academic performance (Behrman and Paul, 1984).

An Alabama study reported that students who were successful in a remedial algebra course had significantly higher grades in college algebra when compared with students who either had failed remedial algebra or had not attempted remedial algebra prior to attempting college algebra (Head and Lindsey, 1984).

The focus of a 1992 study by Monroe-Ellis was the remedial mathematics course content. Students' completion and success rates were compared for students who received basic mathematics skills instruction with those for students who received prealgebra instruction. The researcher found that there was no significant difference in either completion or success rates.

In 1985-86, research was done which measured the effectiveness of the remedial programs at William Rainey Harper College. Student progress was monitored following completion of any remedial mathematics course. The results of the study revealed that the student who did well in remedial courses was more likely to not only achieve a higher overall grade point average but also to continue longer at the college than the student who either did not do well in the remedial program or did not participate in the program (Kolzow, 1986).

In a study performed at Ramapo College in New Jersey, comparisons were made between R/D students and non-R/D students who had subsequent success in completing a college algebra course. It was found that the R/D students performed significantly higher on an algebra post-test at the .01 level. An analysis of the final grade in the college algebra course showed eighty-one (81) percent of the

R/D students successfully complete college level mathematics as compared to eighty percent of the non-R/D students (Wepner, 1985).

A comparison of the grade point averages (GPA) in mathematics of community college freshmen who completed developmental courses with those of students who took no remedial courses was completed by Kraska in 1990. She reported that developmental students had significantly higher GPA's in college-level math than non-developmental students.

The results of a similar study done at TTU of a comparison of students who completed ADP 084 with students who had no R/D requirement found that there was no significant difference in the final level 1 mathematics grade. The researcher considered the results successful as the primary goal of the R/D program is to provide an equal opportunity for R/D students to compete with non-R/D students (Wynn, 1987).

Higher posttest scores and improved mathematics skills for students who successfully completed R/D mathematics requirements were found in a study conducted at City College of New York. The researcher concluded that the average student had sufficiently improved his mathematical skills to

ensure success in the college level mathematics course (Berger, 1971).

In 1993, a meta-analysis of R/D programs was performed at Texas A&M. The researcher used the meta-analysis techniques of Glass and Hedges to classify the kinds of college developmental programs and to detect the relative success of such programs. One hundred eighty-five studies conducted from 1970 through 1990 met the criteria and were evaluated. It was found that in most of the studies there was a positive impact on student achievement for those students who had enrolled in R/D mathematics (Burley, 1993).

A historical comparison conducted at Memphis State University between students enrolled in 1984 (prior to implementation of R/D program) with students enrolled in 1988 established that students who were enrolled in 1988 and completed R/D mathematics requirements were not only more successful in college level mathematics courses, but were more apt to continue their studies to graduation (Cantler, 1993).

Two longitudinal evaluations of R/D mathematics programs were performed in the early 1990s. In the Texas study, which included student data from 1991 to 1994, the researcher at McLennan Community College found that students who successfully passed any R/D mathematics course had

significantly higher scores on the required Texas Academic Skills Program test (England, 1995). In the Ohio study at Sinclair Community College it was found that for students who first enrolled in the fall of 1990, students who were successful in R/D mathematics performed at a satisfactory level in their subsequent coursework. In this study there was no significant difference in the scores when compared with non-R/D students (Sinclair Community College, 1995).

Not all studies comparing remedial and non-remedial students have resulted in positive correlations. In 1968, Roueche reported that college developmental studies programs failed the students they served. The 1974 research conducted by Cross supported Roueche's analysis. In a later study, the academic success of students enrolled in remedial mathematics programs was compared at two large state universities, California State University (Northridge) and San Diego State University. Longitudinal success measures were defined as annual pass-fail rates and persistence rates. Though mathematics remedial and non-remedial students were grouped into three SAT-Math score categories there were no significant differences found at either campus for persistence rates. It was determined that there was a significant difference found in the pass-fail rates of the remedial and the non-remedial students at each of the three

levels with the non-remedial students having higher success rates (McCornak & others, 1985).

Three Mississippi universities were the sites of a 1987 study on students' GPA. Comparisons were made among three groups. The first group comprised students who received remedial instruction. The second group consisted of students who did not require remediation. Group three was made up of students who needed remediation but chose to bypass remedial courses. The researcher found that the GPA for the students who did not need remediation were significantly higher than the GPA's of the other two groups. Additionally, students who accepted the remediation had significantly higher GPA's than those who refused remediation (Porter, 1987).

A study of posttest scores for students who completed remedial mathematics courses in the California Community College System over a three year period was encouraging in that there was a twenty-seven (27) to ninety-eight (98) percent gain over pretest scores. However, the researchers found that although these gains were significant, the increase in skills was not sufficient to ensure success in college mathematics (Barr and Parker, 1989).

Another study, completed at a rural northern California community college was undertaken to assess the effectiveness

of remedial mathematics classes. Data related to remedial class completion, following semester persistence rates, hours completed, grade point average, and declared major were collected for all remedial students taking mathematics courses in the school year 1981-82. The study's results, based on an overview of Fall 1981, Spring 1982, and Fall 1982, suggested that remedial students had a retention rate at slightly less than the comparable student population. The researchers also concluded that, based on their GPA's alone, remedial students were performing about "average" (Gash, 1983).

A national survey was completed in 1983 at Augusta College in Georgia to determine numerous aspects of remedial programs across the country. Data collected from the completed surveys showed that fifty-one (51) to seventy-five (75) percent of the R/D students successfully completed at least one college level math-dependent course. There were no data in this study that compared the percentage of non-R/D students who were also successful in completing college level math courses (Chang, 1983).

From Fall 1986 through Fall 1990, 1126 students enrolled in developmental mathematics courses were tracked in order to study the effectiveness of the Johnson County Community College's developmental studies program. It was

found that students who had been successful in R/D mathematics generally achieved passing grades in college-level courses, though both their grades and course completion rates were lower than the college-wide averages in those same courses (Seybert and Soltz, 1993).

Transfer Students: Success and Retention

The review of literature on transfer students from community colleges to four-year institutions found only a few completed studies on the effect of transfer on the R/D student. With this in mind, this review of literature will also include research found on non-R/D students who transfer to four-year institutions.

As part of a review of policies and procedures regarding postsecondary remedial education, the Illinois Community College Board administered a survey to students who had transferred to the state's public universities from a community college in Fall 1979 to determine why transfer students from community colleges might be required to take remedial coursework at the universities. It was found that students who earned associate degrees prior to transfer did not require remedial education, but those who transferred

before completing a degree often needed remediation (Illinois Community College Board, 1983).

Success, defined in the study as having a "C" or higher grade in the first semester after transferring to a degree-granting school, was the focus of a 1987 study in Indiana. Data analysis for 245 students who completed twenty-four hours in a developmental studies program revealed that sixty-two (62) percent of the students were successful in the degree-granting school. The data also showed a strong positive correlation between performance in developmental studies with performance at the degree-granting school (Ray, 1987).

Coleman reported in a 1984 study in Texas that academic performance in math-dependent courses for students who complete all their mathematics prerequisites (namely, calculus) at a community college is equal to that of students who complete their mathematics coursework at the degree-granting institution. The study population involved 175 transfer students from three community colleges and 188 students from the degree-granting institution. He also found that a substantially greater percentage of the students who completed the calculus sequence at the community college received grades of "C" or higher.

In 1995, a study was conducted in which the relationship between several variables that affect retention rates in community college developmental education mathematics programs was completed by Umoh, Eddy, and Spaulding. Their findings indicated that retention is most affected by the student's commitment to continue his or her studies, and not a factor of getting passing grades. Thus, students who are allowed an unlimited number of attempts in the remedial/developmental component of their mathematics career at any college, are retained at this level if they have high intent to persist. This intent does not carry over to the college-level mathematics because the "unlimited attempt" is removed.

At St. Augustine College (SAC) in North Carolina, a longitudinal study of graduating seniors was undertaken. The study began in 1990 and is continuing. Findings from phase one of the study revealed that students transfer to SAC with high levels of mathematics ability, an indication that the community college is ensuring that transferring students have adequate mathematics preparation (Kraemer, 1996).

Another researcher, when comparing dropouts from colleges across the nation, stated that the relationship between any form of grade performance and retention is not

clearly understood (Spady, 1971). Other factors, including age, gender, and parents' education influenced retention decisions in an indirect manner in that the student expressed an intent to complete the mathematics component of his or her college education in order to open other doors.

Use of NCTM/AMATYC Standards in R/D mathematics

The review of literature on the use of the Standards revealed numerous classroom activities using the *Standards* along with one study in progress and one completed study. There were no completed studies that address a comprehensive curriculum reform requiring fundamental changes, not just a revamping of traditional methods and courses. The rationale for reform is strongly connected to a constructivistic view of learning in which students will be immersed in problem-solving experiences that provide the following:

1. exploration of real-life problems using computers and graphing calculators.
2. use of inductive and deductive reasoning in the discovery of mathematical relationships.
3. development of communication skills to effectively convey mathematical findings, and
4. opportunities to formulate connections between mathematical representations and topics. (NCTM, 1989; NCTM, 1991).

Community colleges have been further challenged by AMATYC to reform traditional community college mathematics curricula to enhance workforce preparation, as only ten (10) to fifteen (15) percent of community college students complete four-year degrees (Pincus & Decamp, 1989).

This call to reform has formidable challenges. Included are instructional issues, time allocations, accessibility of instructional materials and assessment tools, student issues (under-preparedness, mathematics anxiety, and attitude), and support by administration and faculty (Prichard, 1996). Diana Gregg of Purdue University has summed up these obstacles in this manner:

Unfortunately with the notable exception of DeMarois, McGowen, and Whitkanack developmental algebra texts, what is currently being done in the name of reform of developmental mathematics focuses on figuring out better delivery systems for traditional content. If we continue with this approach, then we will fail to make any qualitative change in mathematics teaching and learning.

A study performed at Roane State Community College using an instructor designed constructivist model for teaching developmental mathematics II found that there was no significant difference in either achievement or attitude between the treatment and control groups (Bailey, 1996).

Preliminary results from a longitudinal project at William Rainey Harper College, begun in Spring 1992 to restructure developmental and college algebra courses indicate that there is a significant difference in achievement for students who use reform curriculum materials, the graphing calculator and a computer algebra system. The study reports that students who are enrolled in the program succeed at a higher rate in both the pilot course and in subsequent math-dependent courses. This significance also held for students who returned to a traditional type class following successful completion of the pilot course (McGowen, DeMarois, and Whitkanack, 1995).

Summary

The review of literature for this study researched the effects of both the traditional mathematics remedial program and remedial mathematics programs that have instituted some curriculum reforms on student success. The results for the traditional mathematics R/D program are mixed with regard to student success. For the programs that are instituting curriculum reform there was only one completed study conducted using reform materials. Therefore, additional research is needed to determine the effects of curriculum reform materials on success rates of R/D students.

Chapter III

Methods and Procedures

The purpose of this study was twofold. The two goals of the study were:

1. to compare success of transfer students with regularly admitted students to TTU.
2. to compare R/D mathematics curricula for all TBR postsecondary institutions.

This chapter describes the procedures used to obtain the data necessary to test the hypotheses.

Setting

Tennessee Technological University (TTU) located in Cookeville, Tennessee, has a restricted admission policy.

To become a student at TTU, the applicant must:

1. be a graduate of a state approved or accredited high school, and
2. have taken the American College Test (ACT), and
3. have completed a high school curriculum that includes as a minimum 14 academic credits (two of which are Algebra I and Algebra II), and

4. have a high school academic average of at least 2.35 on a 4.00 scale, or have an ACT composite score of 19, or
5. be classified as a transfer student, having earned at least twelve semester hours of degree credit in another college or colleges, with at least a cumulative grade point average necessary for retention at TTU (Willis & others, 1992).

Many prospective students are lacking one or more of the admissions policy requirements and are required to take the Academic Assessment and Placement Program (AAPP) pre-test. Developmental mathematics was designed for students who are unsuccessful on the AAPP exam.

Remedial/developmental mathematics is a skills-based course of study comprising three semesters of study, Prealgebra (ADP073), Beginning Algebra (ADP083), and Intermediate Algebra (ADP084). The primary goal of the program is that students completing the sequence of courses determined by the AAPP exam should perform as well as or better than non-R/D students in level 1 mathematics courses. According to departmental studies on student achievement for Spring 1996, pass rates for former R/D students exceed those of non-former R/D students in three of the six level 1 mathematics courses. For the remaining three courses, there were no former R/D students enrolled in two of the courses.

The remaining course, Elementary Probability and Statistics (Math 107) historically has had a higher pass rate for non-R/D students at TTU. The course has fewer applications of algebraic concepts than any of the six level 1 mathematics courses.

Subjects

Data for this study were collected from student records of all students entering TTU through either the ADP Program or as transfer students from Fall 1994 through Spring 1996. This approximates 600 students per year who enroll in R/D mathematics and 125 students per year who transfers. The population for this study, which encompassed six semesters, was composed of 419 first time students at TTU and 70 transfer students to TTU from other TBR institutions. All students who met the study criteria were selected. The grade information for the two populations was compared for mathematics grade maintenance only. Permission to access grade information was obtained through the Departmental Director at TTU, with the method of access being approved by the University of Tennessee through the use of Form A, "Certification of Exemption from Review by Full Committee for Research Involving Human Subjects".

Design for Choosing Subjects

A special computer program (called a FOCUS program) which runs within the permanent records program (TTUMIS system) was used to extract both the subjects of the study and the grades earned by the subjects for any of the courses included in the study. No student who had received a grade of A, B, C, D, F, or WF in the level 1 mathematics course was excluded. A grade of "WF" was translated as an "F" as it carries the same number of quality points.

Procedures

The comparison of grades had to be performed on three different groups as students may be required to enter the program at either ADP073, ADP083, or ADP084. The three groups being compared were:

1. Students who transferred with an ADP083 requirement (having had remedial mathematics at the previous institution) were compared with the students who completed the remedial mathematics requirement at TTU.

2. Students who transferred with an ADP084 requirement (having had developmental mathematics I or both remedial mathematics and developmental

mathematics I at the previous institution) were compared with the students who completed the developmental I mathematics requirement at TTU.

3. Students who transferred with a level 1 mathematics requirement (having had developmental mathematics II or any viable combination of remedial and developmental mathematics I at the previous institution) were compared with the students who completed the developmental II mathematics requirement at TTU.

The level 1 mathematics courses included Introduction to Contemporary Mathematical Ideas (Math 101), Elementary Probability and Statistics (Math 107), Survey of Elementary Mathematics I (Math 131), Finite Mathematics (Math 141), College Algebra and Analytic Geometry (Math 145), and Pre-Calculus Mathematics (Math 171).

Instruments of the Study

A survey was made of all Tennessee public postsecondary institutions to determine the curriculum in each of the three R/D mathematics course levels. The survey instrument was developed by the investigator to determine the learning objectives for each of the R/D mathematics courses and to identify concepts from algebra reform (if any) being

incorporated into the R/D program for each TBR college/university. Several colleagues at TTU reviewed the instrument and made suggestions for its improvement. These suggestions were incorporated in the finished survey. A copy of the survey and its accompanying letter and informed consent form are included in Appendix C, pages 94-99. Permission to access faculty at each TBR institution was obtained from Dr. Ken McCullough, Assistant Vice Chancellor for Academic Affairs at the Tennessee Board of Regents. The method of accessing faculty at other campuses was approved by the University of Tennessee through the use of Form A, "Certification of Exemption from Review by Full Committee for Research Involving Human Subjects". There were follow-up personal interviews with individual college/university R/D mathematics faculty as comparative curriculum information could not be completely determined by the survey instrument.

Summary

This chapter dealt with the procedures used in the study, the design of the study, and the methodology used in the study. Included were discussions on subject selection for the grade comparison component of the study, instruments

used in the curricula comparison component of the study, and the organization of the study.

Chapter IV

Results of the Investigation

This chapter presents the analysis of data needed to test the hypotheses stated. Results are given of data analysis for each hypothesis individually. Finally, a summary of results will be presented.

Results of hypotheses one through four were tested at the 0.05 level of significance using a two-sample t-test for independent samples. This parametric test for the difference between means with unequal population samples is being chosen because the range of sample population sizes being compared is 18 through 419. The grade data have been converted to the 4.00 scale, it is interval data; thus, a parametric test is appropriate. The results for the research question are comparative in nature and will be summarized using percentages.

Meeting ADP073 Objectives

The Tennessee Board of Regents (TBR) postsecondary schools are meeting from five(5) percent to one hundred (100) percent of the twenty-one objectives mandated for ADP073. Each school is meeting from eleven to nineteen of

the mandated objectives. Only one TBR institution is meeting objectives twenty and/or twenty-one (Table A-1, Appendix A, page 72).

H₀1: No significant differences exist at the 0.05 level of significance between the success rate of students that transfer with a requirement to enroll in developmental mathematics I (having had remedial mathematics at the previous institution) from the students who complete the remedial mathematics requirement at TTU.

For purposes of the analysis, Campus 1 is TTU and Campus 2 is all other TBR institutions. Group one, previously described as students who transferred to TTU with an ADP083 requirement was composed of eighteen students. These transfer students were compared with fifty-four students who completed an ADP073 requirement at TTU. Table 4.1 reports the mean grade distributions for these groups.

Table 4.1

Mean grades for ADP073 at the two campuses

COURSE	CAMPUS	SUBJECTS n = 72	MEAN	T*
ADP073	1	54	3.167	
	2	18	2.944	1.074

*Probability of occurrence at 5% significance level is .2864

In order to make comparison between courses, the ADP083 mean grades are shown in Table 4.2, although the discussion of ADP083 is with the next hypothesis. Relevant to this hypothesis are the seventy-two subjects whose mean grades are included in Table 4.2.

Table 4.2

Mean grades for ADP083 at the two campuses

COURSE	CAMPUS	SUBJECTS n = 326	MEAN	T*
ADP 083	1	276	2.815	
	2	50	3.020	-1.694

*Probability of occurrence at 5%significance level is .0913

The grades distributions were analyzed for significant differences in means between the campuses using t-test. The t-test was performed after the data were subjected to a test for homogeneity of variances with $F=1.13$, $p > 0.05$. No significant difference was found ($p > 0.05$) between the mean grades of TTU versus transfer students.

Using both the ADP073 and ADP083 grades for each subject included in both Tables 4.1 and 4.2, an analysis of change in the mean grade between the two courses was performed. Table 4.3 reports the decrease in grade point average, designated as "mean grade loss" for each campus.

Table 4.3

Mean grade loss from ADP073 to ADP083 (Subjects shown at campus 2 fulfilled ADP073 requirement at campus 2, then transferred to campus 1)

COURSES	CAMPUS	SUBJECTS n = 72	MEAN LOSS	T*
ADP073/083	1	54	-0.519	
	2	18	-0.056	-2.134

*Probability of occurrence at 5% significance level is 0.0362.

The results of this comparison are significant ($p < 0.05$) for the students who transferred to TTU with an ADP 083 requirement. No significant difference was found for students who completed both ADP073 and ADP083 at TTU.

Meeting ADP083 Objectives

Because the ADP083 objectives are broadly stated in goal language, it was difficult to accurately identify a specific number of TBR mandated objectives. Rather than prepare an extensive list of instructional objectives to match to the goals, a comprehensive list of topics which might be taught in a beginning algebra course was developed (Table A-3, Appendix A, pages 79-82).

H_0 : No significant differences exist at the 0.05 level of significance between the success rate of students that transfer with a requirement to enroll in developmental mathematics II (having had developmental mathematics I at the previous institution) from the students who complete the developmental mathematics I requirement at TTU.

Group two, composed of fifty students transferring with an ADP084 requirement were compared with 276 students who completed ADP083 at TTU. Table 4.4 reports the mean grade distributions for these groups.

Table 4.4

Mean grades for ADP083 at the two campuses

COURSE	CAMPUS	SUBJECTS n = 326	MEAN	T*
ADP 083	1	276	2.815	
	2	50	3.020	-1.694

*Probability of occurrence at 5% level of significance is 0.0913.

The ADP083 grades distributions were analyzed for significant differences in means between the campuses using t-test. The t-test was performed after the homogeneity of variance test concluded that the variances were equal, $F = 1.15$, $p > 0.05$. No significant difference was found

($p > 0.05$) between the mean grades of TTU versus transfer students.

In order to make comparison between courses, the ADP084 mean grades are shown in Table 4.5, although the discussion of ADP084 grades is with the next hypothesis. Relevant to this hypothesis are the 326 subjects whose mean grades are included in Table 4.4.

Table 4.5

Mean grades for ADP084 at the two campuses

COURSE	CAMPUS	SUBJECTS $n = 589$	MEAN	T*
ADP084	1	419	2.785	
	2	70	2.929	-1.412

*Probability of occurrence at 5% level of significance is 0.1587.

Using both the ADP083 and ADP084 grades, an analysis of change in the mean grade between the two courses was performed. Table 4.6 reports the mean grade loss for each campus. The results of this comparison are not significant for either campus ($p > 0.05$).

Table 4.6

Mean grade loss from ADP083 to ADP 084 (Subjects shown at campus 2 fulfilled ADP083 requirement at campus 2, then transferred to campus 1)

COURSES	CAMPUS	SUBJECTS n = 326	MEAN LOSS	T*
ADP083/084	1	276	-0.025	
	2	50	-0.18	1.280

*Probability of occurrence at 5% level of significance is 0.2015.

Meeting ADP084 Objectives

Because the ADP084 objectives are broadly stated in goal language, it was difficult to accurately identify a specific number of TBR mandated objectives. Rather than prepare an extensive list of instructional objectives to match to the goals, a comprehensive list of topics which might be taught in an intermediate algebra course was developed (Table A-4, Appendix A, pages 86-89).

H₀3: No significant differences exist between the success rate of students that transfer with a requirement to enroll in level 1 mathematics (having had developmental mathematics II at the previous institution) from the students who complete

the developmental mathematics II requirement at TTU.

Group three, the largest group, had a total of 586 subjects, 419 TTU students who completed ADP084 prior to taking level 1 mathematics and seventy transfer students who met all of the R/D mathematics requirements prior to entering TTU. Table 4.7 reports the mean grade distributions for these groups.

Table 4.7

Mean grades for ADP084 and level 1 mathematics at the two campuses

COURSE	CAMPUS	SUBJECTS n = 589	MEAN	T
ADP084	1	419	2.785	
	2	70	2.929	-1.412*
Level 1	1	419	1.811	
	2	70	1.886	-0.450**

*Probability of occurrence at 5% level of significance is 0.1587.

**Probability of occurrence at 5% level of significance is 0.6529.

A test for homogeneity of variances ensured that the variances were equal, $F=1.27$, $p > 0.05$. The grades distributions were then analyzed for significant differences in means between the campuses using a t-test. No

significant difference was found ($p > 0.05$) between the mean grades of TTU students as compared with transfer students.

Using both the ADP084 and level 1 mathematics grades, an analysis of change in the mean grade between the two courses was performed. Table 4.8 reports the mean grade loss for students at each campus.

Table 4.8

Mean grade loss from ADP084 to level 1 mathematics (Subjects shown at campus 2 fulfilled ADP084 requirement at campus 2, then transferred to campus 1)

COURSES	CAMPUS	SUBJECTS n = 589	MEAN LOSS	T*
ADP084/level I	1	419	-0.974	
	2	70	-1.043	0.445

*Probability of occurrence at 5% significance level is .6568

No significant difference in mean grade loss from the last R/D mathematics course to level I mathematics was found.

Differences Between TBR Campuses Using
Algebra Reform Curriculum versus TBR Campuses
Using Traditional Algebra Curriculum

H₀4: No significant differences exist between the success rate of students who

transfer from institutions that have made reforms in their R/D mathematics curriculum from those who transfer from institutions that use traditional algebra curriculum content.

For purposes of the analyses, TBR institutions engaged in algebra reform for developmental mathematics will be denoted as Algebra Reform Curriculum (ARC); and TBR institutions using traditional algebra curriculum will be denoted as Traditional Algebra Curriculum (TAC). Using information from surveys and syllabi, it was determined that nine (9) of the nineteen (19) TBR colleges and universities from which students might transfer to TTU are engaged in some type of algebra reform at the developmental level. Designators used to make the determination included the following:

1. decreased attention to word problems by type.
2. decreased attention to simplification of radical expressions and operations with rational expressions.
3. decreased attention of the use of factoring to solve equations.
4. decreased attention to paper-and-pencil graphing of equations, solutions of systems of equations, and graphing of conic sections.
5. increased use of technology use in graphing equations and conic sections, and in solving systems of equations.

6. increased use of real-world problems to motivate and to apply theory (NCTM, 1989 and AMATYC, 1995).

7. stated goal in syllabus/survey that NCTM and/or AMATYC Standards were a priority vehicle of the curriculum.

Grade data for the seventy transfer students was assigned to either the ARC group or the TAC group. Table 4.9 relates the results of the analysis.

Table 4.9

Mean grades for ADP073, ADP083, ADP084 and level 1 mathematics at the ARC and TAC campuses

COURSES	CAMPUS	SUBJECTS	MEAN GRADE	T*
ADP 073	TAC	n = 9	2.67	
	ARC	n = 9	3.22	1.715
ADP 083	TAC	n = 30	2.87	
	ARC	n = 20	3.20	1.611
ADP 084	TAC	n = 40	2.90	
	ARC	n = 30	3.07	0.984
level 1	from TAC	n = 40	1.70	
	from ARC	n = 30	2.00	0.926

*Probabilities of occurrence at 5% level of significance are 0.1056, 0.1138, 0.3288, and 0.3578, respectively.

For the students who began at either the ADP073 or ADP084 level, there were an equal number of subjects in each group.

For the students who began their coursework at the ADP084 level, the TAC group was larger than the ARC group. For this reason, the two sample t-test for independent samples of different sizes was run.

A test for homogeneity of variances ensured that the variances were equal, $1.08 < F < 1.59$ for the four t-tests, $p > 0.05$. The grades distributions were then analyzed for significant differences in means between the TAC and ARC. No significant difference was found ($p > 0.05$) between the mean grades for transfer students who have experienced a traditional algebra curriculum and transfer students who have experienced an algebra reform curriculum.

Differences Between TTU Campus
versus other TBR Campuses

Question: Are there differences between the R/D math curricula at the various TBR colleges/universities and the R/D math curricula at TTU?

Information taken from either a survey, the internet, or a departmental syllabus containing course content information was obtained for all TBR colleges/universities. Table A-2, Appendix A, pages 73-76 provides a comparison of learning objectives (instructional goals), mandated by the

TBR, being met by each responding institution for ADP073. The broad curriculum goals mandated by TBR for ADP083 and ADP084 preclude a one-to-one comparison of learning objectives as each broad goal may have several expected learning outcomes. Tables A-2 through A-4 (Appendix A, pages 73-76, 79-82, and 86-89), provide a listing of topics being taught at the various TBR institutions for each remedial and/or developmental mathematics course.

There were differences found in the comparison of learning objectives and/or curricular goals among the institutions. At the ADP073 level, eight of the twenty TBR schools responding to the remedial curriculum questions are teaching basic mathematics skills (no prealgebra topics included), six of the schools are teaching a few algebraic topics along with basic mathematics skills, and six are teaching basic mathematics skills supplemented with algebraic skills. At the ADP083 and ADP084 level, the variety of algebraic, geometric, and statistical topics being taught covered a wide range of instructional objectives. There were no two schools that were teaching the same instructional objectives for either ADP083 or ADP084. This diversity was evident even when two or more schools were using the same edition of the same textbook.

Summary of the Results

In summarizing the hypotheses testing, the following results were found:

H₀1 (not rejected): No significant differences exist between the success rate of students that transfer with a requirement to enroll in developmental mathematics I (having had remedial mathematics at the previous institution) from the students who complete the remedial mathematics requirement at TTU.

H₀2 (not rejected): No significant differences exist between the success rate of students that transfer with a requirement to enroll in developmental mathematics II (having had developmental mathematics I at the previous institution) from the students who complete the developmental mathematics I requirement at TTU.

H₀3 (not rejected): No significant differences exist between the success rate of students that transfer with a requirement to enroll in level 1 mathematics (having had developmental mathematics II at the previous institution) from the students who complete the developmental mathematics II requirement at TTU.

H₀4 (not rejected): No significant differences exist between the success rate of students who transfer from institutions that have made reforms in their R/D mathematics

curriculum from those who transfer from institutions that use traditional algebra curriculum content.

Question answer: Differences do exist between the R/D math curricula at the various TBR colleges/universities and the R/D math curricula at TTU at all three levels of remedial and developmental mathematics courses.

Chapter V

Summary, Conclusions, and Recommendations

This chapter presents a summary, conclusions, and recommendations of the study.

Summary of the Study

This study investigated the effects that transferring from one Tennessee Board of Regents (TBR) postsecondary institution to Tennessee Technological University (TTU) prior to completion of level 1 mathematics has on student success in the subsequent mathematics course (through level 1 mathematics). Another aspect of the study investigated the effects of having experienced a traditional algebra curriculum versus a reform algebra curriculum at the transferring institution during the remedial/developmental (R/D) mathematics sequence on success rates. Finally, from survey instruments sent to all TBR colleges/universities, comparisons of curricula for each R/D mathematics course at the twenty (20) TBR colleges/universities were made.

In the first part of the study, grade information was collected for all entering and incoming transfer students at

TTU during the semesters Fall 1994 through Spring 1996. Only data for students who completed one or more R/D courses and level 1 mathematics were used. The final grades were analyzed using a two-sample t-test for independent samples. There were three separate analyses made as students may enter the R/D mathematics program at one of three levels. The three groups of subjects were composed as:

1. Group One: ADP073, ADP083, ADP084, level 1 mathematics
2. Group Two: ADP083, ADP084, level 1 mathematics
3. Group Three: ADP084, level 1 mathematics

The first three null hypotheses tested were that there were no significant differences among the means of groups between the success rate of students that transfer with a requirement to enroll in:

H_01 : developmental mathematics I (having had remedial mathematics at the previous institution) from the students who complete the remedial mathematics requirement at TTU.

H_02 : developmental mathematics II (having had developmental mathematics I at the previous institution) from the students who complete the developmental mathematics I requirement at TTU.

H_03 : level 1 mathematics (having had developmental mathematics II at the previous institution) from the

students who complete the developmental mathematics II requirement at TTU.

The fourth null hypothesis tested was that there were no significant differences among the means of the groups based on the type of curriculum experienced in R/D mathematics. It is more formally stated as:

H₀₄: No significant differences exist between the success rate of students who transfer from institutions that have made reforms in their R/D mathematics curriculum from those who transfer from institutions that use traditional algebra curriculum content.

The research question provided a comparison of course content for each R/D mathematics course at all TBR colleges and/or universities to determine similarities to the course content at TTU. The formal statement of the research question was:

Question: Are there differences between the R/D math curricula at each of the TBR colleges/universities and the R/D math curricula at TTU? Yes, a comparison of course syllabi, textbooks, and survey answers revealed that there are numerous differences in the course content for each of the three remedial/developmental mathematics courses.

Conclusions

On the basis of the analyses of the data the following evaluations were made of the hypotheses.

In answer to the questions:

1) Do students who transfer to TTU from another state institution before completing their level 1 mathematics requirement succeed at the same rate as students who complete their R/D requirement at TTU? **Yes.** In each group, it was found that there was no evidence that transferring to TTU from another TBR institution unfavorably influenced student success.

2) What are the indicators that there is a lack of mathematics curriculum continuity for those students who transfer to TTU before completing the R/D requirements and/or level 1 mathematics? Even though differences exist in the mathematics curriculum among the TBR colleges and universities, student success rates are not being adversely affected. There are isolated cases where students do exhibit detrimental effects of transferring to TTU prior to completion of their R/D requirement (hence the unofficial auditing of a course in which the student has already earned a passing grade), but there are no significant differences when the aggregate group of transfer students is examined.

Recommendations

The results of this study have led the investigator to offer the following recommendations. There is a need for the following studies to be conducted:

1. This study should be repeated at TTU for subsequent semesters to determine if the long term results are the same.
2. Additional components of the study should contain research on:
 - a. other factors that affect success for the R/D and transferring student.
 - b. factors that predict grade maintenance in mathematics for the R/D and transferring student (such as high school grade point average, age, race, gender, and grade in prerequisite mathematics courses).
 - c. extent of impact that algebra reform has had on each R/D mathematics course at each TBR institution.
 - d. homogeneity of R/D mathematics curriculum content coverage within each TBR institution.
3. This study should be replicated (for the first three hypotheses) with a similar design but with a different R/D course sequence. This would allow

greater generalization of the results in the R/D program.

4. This study should be replicated at each of the four-year TBR postsecondary institutions to determine if results obtained at TTU can be generalized to the TBR university system.

Concluding Remarks

This study was initiated to explore some issues raised by TTU R/D mathematics faculty regarding transfer students. There was a stated concern that students who transferred to TTU from another TBR institution were not being successful in their mathematics sequence from ADP073 through level 1 mathematics. The results of this study indicate that having experienced a different mathematics curriculum at another institution did not adversely affect the transferring student.

There is much work to be done before curriculum revision recommendations are made. Data on transfer students and first time TTU students should continue to be analyzed. Also, a review of similar research studies being conducted by other TBR institutions should be conducted.

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Appendices

Appendix A

EQ Project Competencies and Compliance in the R/D

Mathematics Curriculum

Basic Skills Competencies

Objectives for the Tennessee Proficiency Test

Basis for Remedial Mathematics

1. WRITING A NUMERAL FOR A WORD NAME. Given a word name for a number less than one billion, the student will determine the equivalent numeral.
2. ROUNDING OFF NUMBERS. Given a whole number with fewer than seven digits, the student will determine the answer which represents the nearest multiple of ten, hundred, thousand, or ten thousand.
3. PLACE VALUE. Given a whole number or a decimal number, the student will identify the digit that is in a given place.
4. ADDING WHOLE NUMBERS AND DECIMAL NUMBERS. Given a problem to add either two or more whole numbers or two decimal numbers, the student will solve the problem with regrouping.

5. SUBTRACTING WHOLE NUMBERS OR DECIMAL NUMBERS. Given a problem to subtract either two whole numbers or two decimal numbers, the student will solve the problem with regrouping.

6. MULTIPLYING WHOLE NUMBERS. Given a problem to multiply a three-digit number by a two-digit number, the student will solve the problem with regrouping.

7. MULTIPLYING DECIMAL NUMBERS. Given a problem to multiply two decimal numbers, each having no more than three decimal places, the student will solve the problem.

8. DIVIDING WHOLE NUMBERS. Given a problem to divide a four-digit number by a one-digit number or a two-digit number, the student will solve the problem for which the answer may have a remainder.

9. DIVIDING A DECIMAL NUMBER BY A WHOLE NUMBER. Given a problem to divide a decimal number by a whole number, the student will solve the problem.

10. ADDING FRACTIONS. Given a problem to add three fractions with unlike denominators, including mixed numbers, the student will solve the problem and express the answer in simplest form.

11. SUBTRACTING FRACTIONS. Given a problem to subtract two fractions with unlike denominators, one of which may be a mixed number, the student will solve the problem and express the answer in simplest form.

12. MULTIPLYING OR DIVIDING FRACTIONS. Given a problem to multiply or divide two fractions, including mixed numbers, the student will solve the problem and express the answer in simplest form.

13. FRACTION, DECIMAL NUMBER, AND PERCENT EQUIVALENCY. Given a simple fraction, a decimal number, or a percent, the student will determine either of the other equivalent forms of the number.

14. PERCENT OF A NUMBER. Given a problem that involves finding the percent of a number, the student will solve the problem.

15. FINDING PERIMETER AND AREA. Given the lengths of the adjacent sides of a rectangular figure, the student will determine the perimeter or the area.

16. DETERMINING THE ARITHMETIC MEAN. Given a problem involving five two-digit whole numbers, the student will determine the arithmetic mean.
17. OPERATIONS FOR SOLVING SIMPLE WORD PROBLEMS. Given a simple one-step word problem, the student will identify the operation required for the solution of the problem.
18. INTERPRETING GRAPHS. Given illustrations of bar, circle, picture, or broken-line graphs, the student will interpret their meanings.
19. EQUIVALENT MEASURES. Given either customary or metric units of measurement of (1) length, (2) weight (customary or mass (metric), (3) volume or (4) time, the student will determine an equivalent measure within the same system.
20. LINEAR MEASUREMENT. Given a drawing of a ruler and an object, the student will determine the length of the object to the nearest one-fourth of an inch or to the nearest centimeter.
21. MEASURING TEMPERATURE. Given an illustration of a thermometer with either the Celsius or Fahrenheit scale, the student will determine the pictured temperature.

Table A-1. Compliance with TBR-mandated competencies in remedial mathematics

Objectives	Percent of schools in compliance
Writing a numeral for a word name	95
Rounding off numbers	95
Place value	95
Adding whole numbers and decimal numbers	100
Subtracting whole numbers or decimal numbers	100
Multiplying whole numbers	100
Multiplying decimal numbers	100
Dividing whole numbers	95
Dividing a decimal number by a whole number	100
Adding fractions	100
Subtracting fractions	100
Multiplying or dividing fractions	100
Fraction, decimal number, and percent equivalency	100
Percent of a number	100
finding perimeter and area	85
Determining the arithmetic mean	75
Operations for solving simple word problems	95
Interpreting graphs	75
Equivalent measures	60
Linear measurement	5
Measuring temperature	5

Percentages are based on all twenty (20) TBR community colleges and universities responses

Table A-2. Percentages of TBR institutions providing instruction for the given objective in remedial mathematics (Page one of four).

Objectives	Percent of schools teaching the objective
WHOLE NUMBERS	
Reading and writing whole numbers	95
Inequalities	80
Addition of whole numbers	100
Subtraction of whole numbers	95
Multiplication of whole numbers	100
Division of whole numbers	95
Long division	95
Whole number exponents and powers of ten	40
Scientific notation	25
Rounding whole numbers	95
Estimation	75
Four laws of exponents	35
Exponents and order of operations	100
Solving equations	70
Solving word problems with whole numbers	90
Rules of divisibility	65
FRACTIONS	
Basics of fractions	100
Mixed numbers	95
Factors	100
Multiples	50
Writing a fraction in lowest terms	100
Multiplication of fractions	100
Applications of multiplication	90
Dividing fractions	100
Multiplication and division of mixed numbers	95
Adding and subtracting like fractions	100
Least common multiples	90
Adding and subtracting unlike fractions	100
Adding and subtracting mixed numbers	95
Order relations and the order of operations	100
Complex fractions	30

Table A-2 (Continued). Percentages of TBR institutions providing instruction for the given objective in remedial mathematics (Page two of four).

Objectives	Percent of schools teaching the objective
DECIMALS	
Reading and writing decimals	100
Rounding decimals	100
Order (Inequalities)	90
Adding decimals	100
Subtracting decimals	100
Multiplying decimals	100
Dividing decimals	100
Writing fractions as decimals	100
Estimation	70
Solving problems with decimals	90
Order of operations	55
RATIO AND PROPORTION	
Ratios	100
Rates	80
Proportions	100
Solving proportions	95
Applications of proportions	100
PERCENT	
Basics of percent (notation)	100
Percent and fractions	100
The percent proportion	70
Identifying the parts in a percent problem	85
Using proportions to solve percent problems	90
The percent equation	45
Applications of percent	100
Sales tax	75
Commission	75
Discount	80
Simple interest	85
Compound interest	50
Real estate expenses/Car expenses	15
Bank statements	15

Table A-2 (Continued). Percentages of TBR institutions providing instruction for the given objective in remedial mathematics (Page three of four).

Objectives	Percent of schools teaching the objective
DIRECT MEASUREMENT/MEASUREMENTS	
Measuring length	5
Measuring temperature	5
The English System	70
The metric system: length	70
The metric system: capacity and weight	65
Applications of English/metric measurement	55
Conversion between English/metric systems	40
GEOMETRY	
Basic geometric terms	45
Angles and their relationships	40
Perimeter: rectangles and squares	80
Area: rectangles and squares	85
Perimeter: Parallelograms and trapezoids	80
Area: Parallelograms and trapezoids	80
Triangles	85
Circles	85
Volume	55
Square roots and the Pythagorean theorem	40
Simplifying square roots	20
Similar triangles	20
Similar geometric figures	25
Applications of geometry	55
STATISTICS	
Circle graphs	75
Bar graphs and line graphs	80
Tables	45
Pictographs	50
Histograms and frequency polygons	35
Mean	85
Median	70
Mode	65

Table A-2 (Continued). Percentages of TBR institutions providing instruction for the given objective in remedial mathematics (Page four of four).

Objectives	Percent of schools teaching the objective
THE RECTANGULAR COORDINATE SYSTEM	
Graphing ordered pairs	45
Plotting points	50
Solving equations in two variables (graphing)	45
The rectangular coordinate system	45
Variation	20
BASIC ALGEBRA	
The language of algebra	45
Equations and formulas	35
Adding and subtracting polynomials	40
Multiplying and dividing polynomials	30
Signed numbers	70
Opposites, absolute value, and inequalities	45
Addition/subtraction of signed numbers	70
Multiplication/division of signed numbers	70
Order of operations	70
Evaluating expressions and formulas	50
Solving equations with addition principle	60
... with multiplication principle	60
Solving equations of the form $ax + b = c$	55
Solving equations with several steps	30
Applications	35
CALCULATORS	
Scientific	10
Fraction key required	20
Graphing	20
Any type	5
Conditional (such as after a specific test)	10
None	35

Data taken from completed surveys and/or course syllabi of all TBR institutions

Objectives for Basic Academic Competencies
Educational Equality Project

Basis for Developmental Mathematics I

MATHEMATICS

1. The ability to perform , with reasonable accuracy, the computations of addition, subtraction, multiplication, and division using natural numbers, fractions, decimals, and integers.
2. The ability to make and use measurements in both traditional and metric units.
3. The ability to use effectively the mathematics of:
 - a. integers, fractions, and decimals;
 - b. ratios, proportions, and percentages;
 - c. roots and powers;
 - d. algebra;
 - e. geometry.
4. The ability to make estimates and approximations, and to judge the reasonableness of a result.
5. The ability to formulate and solve a problem in mathematical terms.
6. The ability to select and use appropriate approaches and tools in solving problems (mental computation, trial and error, paper-and-pencil techniques, calculator, and computer).
7. The ability to use elementary concepts of probability and statistics.

REASONING

8. The ability to identify and formulate problems, as well as the ability to propose and evaluate ways to solve them.
9. The ability to recognize and use inductive and deductive reasoning, and to recognize fallacies in reasoning.
10. The ability to draw reasonable conclusions from information found in various sources, whether written, spoken or displayed in tables and graphs, and to defend one's conclusions rationally.

11. The ability to comprehend, develop, and use concepts and generalizations.
12. The ability to distinguish between fact and opinion.

Table A-3. Percentages of TBR institutions providing instruction for the given objective in developmental mathematics I (Page one of four).

Objectives	Percent of schools teaching the objective
GEOMETRY	
Basic geometric figures	20
Perimeter	20
Area: Rectangles and squares	
Area: Parallelograms, triangles, and trapezoids	20
Circles	20
Volume and surface area	20
Relationships between angle measures	20
Congruent triangles/properties of parallelograms	20
Similar triangles	20
REAL NUMBERS	
Review arithmetic/prealgebra	100
Sets and the real number system	35
Real numbers and their graphs	85
Fractions	80
Exponents and order of operations	100
Adding and subtracting real numbers	100
Multiplying and dividing real numbers	100
Algebraic expressions	100
Properties of real numbers	95
EQUATIONS AND INEQUALITIES	
Introduction to equations	100
Solving more equations	100
Simplifying expressions to solve equations	100
Literal equations	100
Applications of equations	100
Number problems	100
Age problems	25
Geometry problems	90
Coin problems	30
Mixture/Distance/Interest problems	75
Break-even point	15
Break point	20
Solving inequalities	95

Table A-3 (Continued). Percentages of TBR institutions providing instruction for the given objective in developmental mathematics I (Page one of four).

Objectives	Percent of schools teaching the objective
POLYNOMIALS	
Natural number exponents	95
Zero as an exponent	95
Negative integer exponents	95
Scientific notation	85
Polynomials	95
Adding and subtracting polynomials	90
Multiplying polynomials	90
Dividing polynomials by monomials	90
Dividing polynomials by polynomials	90
Synthetic division	85
FACTORING POLYNOMIALS	
Greatest common factor	85
Grouping	80
Difference of two squares	85
Trinomials with leading coefficients of 1	85
General trinomials	85
Sum/difference of two cubes	50
Compound factoring	15
Problem solving	75
RATIONAL EXPRESSIONS	
Basic properties of algebraic fractions	50
Multiplying fractions	45
Dividing fractions	45
Add/Subtract with like denominators	45
Add/Subtract with unlike denominators	45
Complex fractions	25
Solving equations	30
Applications	25
Ratio	35
Proportion	35

Table A-3 (Continued). Percentages of TBR institutions providing instruction for the given objective in developmental mathematics I (Page three of four).

Objectives	Percent of schools teaching the objective
GRAPHING LINEAR EQUATIONS AND INEQUALITIES	
Pie, bar, and line graphs	10
Graphing linear equations	70
Slope of a line	60
Writing equations of lines: $y = mx + b$	60
Writing equations of lines: $Ax + By = C$	30
Writing equations of lines (point-slope)	45
Parallel and perpendicular lines	40
Graphs of $y = (x - h)^2$ and $y = x^2 + k$	5
Graphs of $y = x + h $ and $y = x + k$	5
Graphing inequalities	45
Relations	25
Functions	35
Direct variation	30
Inverse variation	30
Joint/Combined variation	15
SOLVING SYSTEMS OF EQUATIONS AND INEQUALITIES	
by Graphing	55
by Substitution	55
by Elimination	55
Applications	55
Systems of 3 equations in 3 variables	50
ROOTS/RADICAL EXPRESSIONS	
Radicals	45
Simplifying radical expressions	40
Adding/subtracting radical expressions	40
Multiplying/dividing radical expressions	40
Solving equations containing radicals	30
The Pythagorean theorem	20
The distance formula	10

Table A-3 (Continued). Percentages of TBR institutions providing instruction for the given objective in developmental mathematics I (Page four of four).

Objectives	Percent of schools teaching the objective
QUADRATIC EQUATIONS	
Solving equations of the form $x^2 = c$ optional	25/5
Completing the square optional	25/5
The quadratic formula optional	25/5
Application of quadratic equations optional	25/5
Complex numbers optional	10/5
Graphing quadratic functions 15/5/optional	
PROBABILITY	
Handouts; unspecified topics	30
Probability	5
Permutations	5
Combinations	5
Binomial theorem	5
CALCULATORS	
Scientific	15
Fraction key required	0
Graphing	25
Any type	20
None	30
Conditional (such as after a specific test)	10
Calculator instruction	15

Data taken from completed surveys and/or course syllabi of all TBR institutions

Objectives for Basic Academic Subjects
Educational Equality Project

Basis for Developmental Mathematics II

GENERAL MATHEMATICAL SKILLS

1. The ability to apply mathematical techniques in the solution of real-life problems and to recognize when to apply those techniques.
2. Familiarity with the language, notation, and deductive nature of mathematics and the ability to express quantitative ideas with precision.
3. The ability to use computers and calculators.
4. Familiarity with the basic concepts of statistics and statistical reasoning.
5. Knowledge in considerable depth and detail of algebra, geometry, and functions.

SPECIFIC MATHEMATICS SKILLS

Computing

6. Familiarity with computer programming and the use of prepared computer programs in mathematics.
7. The ability to use mental computation and estimation to evaluate calculator and computer results.
8. Familiarity with the methods used to solve mathematical problems when calculators or computers are the tools.

Statistics

9. The ability to gather and interpret data and to represent them graphically.
10. The ability to apply techniques for summarizing data using such statistical concepts as average, median, and mode.

11. Familiarity with techniques of statistical reasoning and common misuses of statistics.

Algebra

12. Skill in solving equations and inequalities.
13. Skill in operations with real numbers.
14. Skill in simplifying algebraic expressions, including simple rational and radical expressions.
15. Familiarity with permutations, combinations, simple counting problems, and the binomial theorem.

Geometry

16. Knowledge of two- and three-dimensional figures and their properties.
17. The ability to think of two- and three-dimensional figures in terms of symmetry, congruence, and similarity.
18. The ability to use the Pythagorean theorem and special right triangle relationships.
19. The ability to draw geometrical figures and use geometrical modes of thinking in the solving of problems.

Functions

20. Knowledge of relations, functions, and inverses.
21. The ability to graph linear and quadratic functions and use them in the interpretation and solution of problems.

MATHEMATICS SKILLS FOR STUDENTS EXPECTING TO MAJOR IN
SCIENCE OR ENGINEERING OR TO TAKE ADVANCED COURSES IN
MATHEMATICS OR COMPUTER SCIENCE

Computing

22. The ability to write computer programs to solve a variety of mathematical problems.

23. Familiarity with the methodology of developing computer programs and with the considerations of design, structure, and style that are an important part of this methodology.

Statistics

24. Understanding of simulation techniques used to model experimental situations.

25. Knowledge of elementary concepts of probability needed in the study and understanding of statistics.

Algebra

26. Skill in solving trigonometric, exponential, and logarithmic equations.

27. Skill in operations with complex numbers.

28. Familiarity with arithmetic and geometric series and with proofs by mathematical induction.

29. Familiarity with simple matrix operations and their relation to systems of linear equations.

Geometry

30. Appreciation of the role of proofs and axiomatic structure in mathematics and the ability to write proofs.

31. Knowledge of analytic geometry in the plane.

32. Knowledge of the conic sections.

33. Familiarity with vectors and with the use of polar coordinates.

Functions

34. Knowledge of various types of functions including polynomial, exponential, logarithmic, and circular functions.

35. The ability to graph such functions and to use them in the solution of problems.

Table A-4 . Percentages of TBR institutions providing instruction for the given objective in developmental mathematics II (Page one of four).

Objectives	Percent of schools teaching the objective
REAL NUMBERS	
Study skills for success in mathematics	5
Using a calculator	15
Sets and the real number system	70
Properties of real numbers	70
Inequalities and graphs of sets of real numbers	70
Arithmetic of real numbers	45
Conditional statements	20
Number sequences and inductive reasoning	10
Paired data: Tables, histograms and line graphs	5
EXPONENTS AND POLYNOMIALS	
Exponents	60
Scientific notation	50
Adding and subtracting polynomials	55
Multiplying polynomials	60
Dividing polynomials	50
Synthetic division	20
EQUATIONS AND INEQUALITIES	
Linear equations and their solutions	60
Applications	60
Formulas and literal equations	60
Absolute value equations	55
Linear inequalities	60
Inequalities with absolute values	55

Table A-4 (Continued). Percentages of TBR institutions providing instruction for the given objective in developmental mathematics II (Page two of four).

Objectives	Percent of schools teaching the objective
FACTORING POLYNOMIALS	
Greatest common factor	70
Difference of two squares	70
Sum/difference of two cubes	50
Factoring trinomials	70
Compound factoring	60
Solving equations by factoring	65
Applications	65
RATIONAL EXPRESSIONS	
Simplifying fractional expressions	90
Multiplying and dividing rational expressions	90
Add/Subtract with rational expressions	90
Complex fractions	70
Equations containing rational expressions	90
Applications of rational expressions	75
GRAPHS, EQUATIONS OF LINES, AND VARIATION	
Rectangular coordinate system	100
Slope of a nonvertical lines	100
Equations of lines	100
Graphs of other equations	75
Graphs of linear inequalities in two variables	95
Introduction to functions	85
Proportion and variation	70

Table A-4 (Continued). Percentages of TBR institutions providing instruction for the given objective in developmental mathematics II (Page three of four).

Objectives	Percent of schools teaching the objective
RATIONAL EXPONENTS AND RADICAL EXPRESSIONS	
Rational exponents	95
Radical expressions	95
Adding/subtracting radical expressions	90
Multiplying/dividing radical expressions	90
Radical equations	90
Application of radicals	95
Radicals with different orders	25
QUADRATIC EQUATIONS	
Completing the square	75
The quadratic formula	100
Complex numbers	95
Application of quadratic equations	80
Graphs of quadratic functions	70
Quadratic and other nonlinear inequalities	55
SOLVING SYSTEMS OF EQUATIONS AND INEQUALITIES	
Solution by Graphing	95
Solution by Substitution and Elimination	95
Systems of 3 equations in 3 variables	45
Determinants	25
Matrices	20
Systems of inequalities	45

Table A-4 (Continued). Percentages of TBR institutions providing instruction for the given objective in developmental mathematics I (Page four of four).

Objectives	Percent of schools teaching the objective
FUNCTIONS AND CONIC SECTIONS	
Polynomials and other functions	40
Algebra of and composition of functions	20
Inverses of functions	20
Parabolas that open up/down	55
Circle and parabola	20
Ellipse and hyperbola	15
Solving simultaneous second-degree equations	15
EXPONENTIAL AND LOGARITHMIC FUNCTIONS	
Exponential functions	10
Exponential equations	10
MISCELLANEOUS TOPICS	
The binomial theorem	5
Permutations/Combinations	10
CALCULATORS	
Scientific	25
Graphing	30
Any type	25
None	5
Conditional, such as instructor choice	15
Calculator instruction	15

Data taken from completed surveys and/or course syllabi of all TBR institutions

Appendix B

TBR Colleges/Universities

ADP Mathematics Course Credit Hours

Colleges/Universities in the
Tennessee Board of Regents System

Number of Credit Hours in each ADP Mathematics Course

Table B-1. Comparison of credit hours allocated to each of the remedial/developmental mathematics courses

Institution's Name	Hours of credit		
	073	083	084
<u>Community Colleges</u>			
Chattanooga State Technical Community College	3	5	5
Cleveland State Community College	3	5	5
Columbia State Community College	3/2*	3/2*	3/2*
*laboratory 2 hours; student receives 4 hours credit			
Dyersburg State Community College	3	3	3
Jackson State Community College	3	4	4
Motlow State Community College	3	3	3
Nashville State Technical Institute	3	4	4
Northeast State Technical Community College	3	5	5
Pellissippi State Technical Community College	3	4	5
Roane State Community College	2	5	5
Shelby State Community College	3	4	4
Volunteer State Community College	3	5	5
Walters State Community College	3	3	5
State Technical Institute at Memphis	3	4.7	4.8

Table B-1 (Continued). Comparison of credit hours allocated to each of the remedial/developmental mathematics courses

Institution's Name	Hours of credit		
	073	083	084
<u>Universities</u>			
Austin Peay State University	3	3	3
East Tennessee State University	3	3	3
Memphis State University	3	3	3
Middle Tennessee State University	3	3	3
Tennessee State University	3/1*	3/1*	3/1*
*laboratory 1 hour; student earns 3 hours credit			
Tennessee Technological University	4	4	4

Data taken from TTU Office of Admissions *Transfer Course Equivalency Conversion Table*, 1996.

Appendix C
Materials Used

July 8, 1997

Dear Colleague:

As part of a study for my dissertation, I am studying how R/D mathematics classes are being conducted at other TBR institutions. I would also like to share this information between schools.

Enclosed are four sets of questionnaires --one to be completed by the math coordinator and one for a representative from each level of instruction: remedial math, developmental math I, and developmental math II. Please have the math coordinator distribute these to a full-time faculty member (if possible) at each level of instruction. There are also four consent forms enclosed, separate from the surveys, that outline the faculty member's participation in completing the survey.

In order to encourage your participation in this survey, I have enclosed self-addressed stamped envelopes, marked "surveys" and "consent forms". Please mail all the completed forms from your school in the same mailing.

I appreciate your comments. If I keep on my "time-line", the results of this survey will be shared at the 1998 TNADE Conference.

Sincerely yours,

Mrs. Debra D. Bryant
Mathematics Coordinator
Academic Development Program

INFORMED CONSENT FORM

95

"A comparison of success rates in grade maintenance in R/D mathematics through Level 1 mathematics of TTU students and transfer students to TTU from other State postsecondary institutions from Fall, 1994 through Spring, 1996"

**Debra Bryant
Tennessee Technological University**

I, _____, consent to participate in a study to help the researcher evaluate grade maintenance using a comparison between transfer students and TTU students who have an R/D requirement with their Level 1 math requirement. Curriculum information will be assessed to determine which TBR schools are using algebra reform materials. I understand that as a participant, I am to complete a written questionnaire regarding the curriculum for a R/D course which I teach, and that this is the fullest extent of my participation in the study.

I understand that participation is strictly voluntary. I may cease participation at any time I so choose and/or may leave blank any item I find offensive or overly personal. It is my understanding that no special benefit is attached to my participation in this research project and no penalty may be viewed by my election not to participate.

I understand that I am not putting myself at any more risk of harm or personal discomfort by participating in the study than I would encounter during daily life.

I understand that the questionnaire is identifiable by school and course description, but not by the faculty member who is completing the survey. The consent forms will be mailed, opened, and stored by the Director of the Academic Development Program at TTU, while the surveys will be mailed, opened, and kept in a locked file by the researcher until the study is complete and will then be shredded.

I understand that general conclusions regarding group data will be reported in the researcher's dissertation and as the basis for a presentation to TNADE. I understand that a possible benefit of the study might be an affirmation that algebra curriculum reform enhances mathematics grade maintenance for developmental students. Additionally, the information gained may be used by the TTU Academic Development Program in curriculum revision.

I understand that I may contact the researcher, Debra Bryant (615)372-3668 or DDW9000@tntech.edu, or faculty advisor, Dr. Phyllis Huff (423)974-3435, if I have questions or concerns about the study.

I have read the material above, understand it clearly, and agree to complete the survey in a truthful manner.

Signature _____

Date _____

School _____

Directions: Please respond to each question, with either a multiple choice answer or a free response.

1. Our remedial/developmental mathematics classes are taught using:
 - a. textbook series Basic Mathematics, Beginning Algebra, Intermediate Algebra
 - b. textbook series Prealgebra, Beginning Algebra, Intermediate Algebra
 - c. One textbook for all three courses
 - d. Basic math text for remedial math, and one text for developmental math
 - e. Prealgebra text for remedial math, and one text for developmental math
 - f. Other (Please describe):

2. CIRCLE ALL THAT APPLY. If you have recently changed from a series to using one textbook (or if you are considering such a change), explain the major rationale for the change.
 - a. Book cost to student
 - b. Continuity of material from course to course
 - c. Time constraints
 - d. This question does not apply to this school
 - e. Other (Please explain):

3. CIRCLE ALL THAT APPLY. Conversely, if you have been using one textbook and are considering changing to two or three, explain the major rationale for the change.
 - a. Need for repetition of topics, going into greater depth as the student progresses
 - b. Insufficient detail to topics
 - c. Book was not what was expected
 - d. Students entering at developmental I or developmental II level did not have prerequisite skills
 - e. this question does not apply to this school
 - f. Other (Please explain):

4. CIRCLE ALL THAT APPLY. Students enrolled in any R/D math course are tested in the following manner:
 - a. Chapter tests/Final exam (open response), departmental versions
 - b. Chapter tests/Final exam (open response), instructor made
 - c. Chapter tests/Final exam (multiple choice), departmental versions
 - d. Chapter tests/Final exam (multiple choice), instructor made
 - e. Other (Please describe):

5. CIRCLE ALL THAT APPLY. The environment provided for student testing is: 97

- a. Classroom setting, 1 hour or less time limit
- b. Tutoring lab, 1 hour or less time limit
- c. Tutoring lab, no time limit
- d. Take home tests
- e. Other (describe):

6. CIRCLE ALL THAT APPLY. For students who score less than a minimum score on any chapter test, retesting of the material is:

- a. Not allowed
- b. Allowed after reteaching
- c. Allowed after student performs some type of review
- d. Allowed at student's request
- e. Other (describe):

7. If there are skills being taught at any level that must be supplemented by materials other than the textbook, describe those supplements.

8. Explain when calculator usage became a part of your program (if it is) and the process used to encourage instructors to allow students to use calculators as part of the curriculum.

9. Please provide a copy of your course syllabus that describes your grading scale and components that are graded (such as tests, final, quizzes, journals, etc.) for each level.

School _____

Respondent is completing the survey as an instructor of (circle one):

Remedial mathematics Developmental I math Developmental II math.

Textbook/edition/author used Fall, 1995: _____

(Please circle all chapter numbers covered): 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Adoption date _____

Directions: Please respond to each question, with either a multiple choice answer or a free response.

1. CIRCLE ALL THAT APPLY. Why did your department choose this particular text?

- a. New edition of book already in use.
- b. Expanded edition for use in two or more courses.
- c. Return to traditional texts for use in only one course.
- d. Topics covered that were not covered in other texts offered.

Please specify _____

- e. Other (please specify)

2. What skills are being taught in this class? (In lieu of listing the skills, you may wish to send a copy of your course syllabus)

3. Do you supplement the textbook with additional materials?

- a. No, go to next question.
- b. Yes (Briefly describe supplements)

4. Are students required to use the math lab?

- a. No, go to next question
- b. Yes

1. Number of hours per week: 1 2 3 4 5 6+

2. Specific assignments made for the lab? If so, describe a sample assignment.

- a. No, go to next question
- b. Yes (Briefly describe sample assignment)

5. Are calculators used to enhance math instruction?

a. No, go to next question.

b. Yes

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1. CIRCLE ALL THAT APPLY. When allowed?

a. homework

b. class room assignments

c. tests

d. all of the above

2. CIRCLE ALL THAT APPLY. What type?

a. four function

b. scientific

c. graphing

d. whatever student brings

e. specific type _____.

3. CIRCLE ALL THAT APPLY. When is instruction given on "how to use" the calculator?

a. as needed by the student informally

b. structured as part of the class

c. in the math lab as assignments

d. no instruction is given

6. Additional comments (optional).

Debra Deon Bryant was born in Cookeville, Tennessee, on March 27, 1953. She is married to Bruce Bryant and they have three children, Heather, Dusty, and Rachel.

Mrs. Bryant holds a Bachelor of Science Degree in Secondary Education with a major in Sociology and a minor in Mathematics and a Master of Arts in Curriculum and Instruction, both from Tennessee Technological University. This dissertation completes requirements for an Ed.D. in Education with an emphasis in mathematics Education at the University of Tennessee in Knoxville, Tennessee.

Mrs. Bryant has taught courses in mathematics and science on the secondary level, grades 9 through 12, in the Putnam County School System, and mathematics in the Academic Development Program at Tennessee Technological University, TTU. She has also had experience as an adjunct faculty with the Mathematics Department at TTU.

At the present time, Mrs. Bryant is an instructor and serves as the mathematics coordinator for the Academic Development Program at Tennessee Technological University in Cookeville, Tennessee.