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Redesigning Mathematics Curriculum for Underprepared College Students

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Abstract

While developing strategies to meet the needs of underprepared students, public colleges and universities across the nation are being faced with directives, often stemming from public viewpoint, state legislatures, and/or state governing bodies of higher education systems, to modify existing university programs in an effort to decrease the cost of serving incoming or first-year students, particularly those programs addressing developmental education. Middle Tennessee State University began a redesign of all its developmental courses in an effort to satisfy recommendations and to meet strategic planning objectives of its state governing board. The purpose of this report is to examine the results of the pilot year of the redesign initiative for two prescribed mathematics general education courses MATH 1010K, Mathematics for General Studies, and MATH 1710K, College Algebra. The newly developed plan provides a more comprehensive approach that results in enhanced academic quality, flexible delivery options, greater uses of technology, and a reduction in the number of required courses.

Keywords: General Education Mathematics; Course Redesign; Developmental Education; Underprepared Students; Academic Deficiencies

In an effort to effectively address the needs of underprepared students admitted to higher education institutions across the nation, many programs and initiatives have been implemented. Over the years, the discipline addressing this concern has been termed "developmental education." According to Boylan and Bonham (2007),

> developmental education refers to a broad range of courses and services organized and delivered in an effort to help retain students and ensure the successful completion of their postsecondary education goals. These courses and services are generally delivered according to the principles and theories of adult development and learning, hence the term "developmental" education. (p. 2)

In the 1970s, higher education institutions began to open their doors to students regardless of the students' levels of preparation (Perin, 2005). More recently, a report issued by the National Center for Education Statistics (2003) indicated that 28 percent of entering freshmen enrolled in at least one developmental education course in fall 2000.

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What has been the impetus or driving force behind this increase in the number of underprepared students seeking enrollment in higher education institutions? With the emergence of a global economy, the requirements of the labor force have changed considerably. The labor force continues to experience a decrease in the number of positions for unskilled workers and an increase in the need for workers who are skilled in the innovation and use of technology and who are able to think critically in the workplace. Postsecondary education has become a necessity for the populace as demands for higher-level skills continue to increase. It has become a national imperative to increase access to higher education and to address achievement gaps that exist between preparation levels and academic expectations of the institutions of higher learning (American Council on Education, 2004). According to the American Mathematical Association of Two-Year Colleges (AMATYC), as stated in *Crossroads in Mathematics* (1995),

> Higher education is situated at the intersection of two major crossroads: A growing societal need exists for a well-educated citizenry and for a workforce adequately prepared in the areas of mathematics, science, engineering, and technology while, at the same time, increasing numbers of academically underprepared students are seeking entrance to postsecondary education. (p. 3)

Moreover, the student populations in postsecondary education have become more diversified, with increasing numbers of women, ethnic minorities, and non-traditional students entering the ranks (AMATYC, 1995). With a greater emphasis on access, with changing demographics in the nation's population, and with the demand for higher-skilled workers in a global economy, colleges and universities across the nation are being compelled to meet the needs of all incoming students having varying levels of preparation (McCabe, 2000; Potts, Chatis, & Lyttle, 2005).

Rationale for Redesign

While developing strategies to meet the needs of underprepared students, public colleges and universities across the nation are being faced with directives, often stemming from public viewpoint, state legislatures, and/or state governing bodies of higher education systems, to modify existing university programs in an effort to decrease the cost of serving incoming or first-year students, particularly those programs addressing developmental education. The American Council on Education (2004) has concluded that the rising cost of higher education has served to stimulate and generate extensive discussion about accountability in higher education among these public forums. In an effort to appease the public's concerns, elected officials have looked at ways to lower costs and to assure that appropriated funds are well-spent in preparing its citizens to be productive members in the higher-skilled workforce required of today's graduates. Organizations and institutions of higher education are looking at ways to hasten students' progression through freshman or general education courses, while still providing resources and support for a successful first year experience. It has been shown in numerous studies that a successful first year experience is instrumental in improving graduation and retention rates (Kelly, 2006). Across the nation, course redesigns are

being implemented and assessed as a possible means for meeting the objective of improving student outcomes while reducing costs (Twigg, 2003).

Tennessee Board of Regents Redesign Initiative

The Tennessee Board of Regents (TBR) is a state governing body for 6 public four-year institutions, 13 public community colleges, and 27 technology centers. Among TBR institutions, a 2005 report indicated that 74 percent of entering freshmen at two-year institutions and 40 percent at four-year institutions required a developmental education course. For non-traditional students, 21 years of age or older, 50 percent required a developmental course. The annual cost for developmental education for the system is approximately $25 million, which is shared equally between state appropriations and student tuition ("Call to Participate," n.d.). Because access remains a primary goal for higher education in Tennessee, TBR reports and planning documents outline goals, objectives, and strategies for making a significant difference in success rates for all students in postsecondary education. Additional goals include reducing the cost and time for completion of developmental education requirements.

A document entitled *Defining Our Future* was generated by the Tennessee Board of Regents (2001) as a report to the Tennessee General Assembly pursuant to Tennessee House Bill No. 2038/Senate Bill No. 2000. In this report, the TBR assessed the impact of current and future budget reductions for higher education institutions in the state of Tennessee and reports new self-efficiency measures of the TBR system. In *Defining Our Future*, six key recommendations were proposed to maintain access and quality in higher education while working within the constraints of reduced state funding and resources. These six recommendations included:

- Reduce the cost of remedial and developmental education,
- Reduce the cost of earning a degree,
- Reduce the time to a degree for transfer students,
- Reduce the cost of (or eliminate) off-campus locations that are not cost-effective,
- Eliminate under-performing academic programs, and
- Share and pool resources.

The first of the six recommendations called for the reduction of cost for remedial and developmental education throughout the system. Remedial courses are the lowest level of developmental education, addressing basic skill deficiencies in reading, writing, and mathematics. As an initial response to *Defining Our Future*, remedial education was eliminated at all four-year institutions in the TBR system. The community colleges were utilized to provide any remediation in language arts and mathematics because of the lower tuition costs. In the more recent TBR (2005) plan, *Setting New Directions*, one outlined objective is to increase speed and success of remedial/developmental work for students requiring such coursework to become college-ready. The strategy associated with this objective consists of establishing a remedial/developmental program based at the community colleges that is substantially technology driven. In conjunction with this strategic plan, the Tennessee Board of Regents has joined the Redesign Alliance of the

National Center for Academic Transformation (NCAT). A statewide effort is currently underway in which all TBR institutions are being asked to develop plans for redesigns of all remedial and developmental courses.

Middle Tennessee State University

Middle Tennessee State University (MTSU) is a public four-year institution located in the geographical center of the state. MTSU is accredited by the Commission on Colleges of the Southern Association of College and Schools (SACS) and awards associate's, bachelor's, master's, specialist's and doctoral degrees. The University is a member of the State University and Community College System of Tennessee that is governed by the Tennessee Board of Regents. With a total student population of approximately 23,000, MTSU boasts the largest undergraduate student population in the State and attracts more valedictorians and salutatorians from its Tennessee high schools than does any other postsecondary educational institution in the State. However, a significant portion of the MTSU student population, approximately 35 percent of first-time freshmen, requires additional preparation in one or more academic areas. Of all students enrolled in courses designed to address academic deficiencies, 31 percent are classified as non-traditional students. Approximately 45 percent of all students receiving a bachelor's degree have successfully completed a course that addressed a deficiency in at least one academic area.

In an effort to satisfy TBR recommendations, to meet strategic planning objectives, and to transition students from high school to college-level work, MTSU began a redesign of all its developmental courses. Formerly, developmental education was a centralized program encompassing the areas of writing, reading, mathematics, and learning strategies. All courses and student services were housed in one department. In following the aforementioned TBR directives, the administration examined several models for the restructuring and redesign of developmental education. The model adopted is considered to be "partial mainstreaming," in which all redesigned courses are housed in regular academic departments but are coordinated separately (Perin, 2005). For the area of mathematics, the redesign involved the elimination of the elementary algebra (DSPM 0800) and intermediate algebra (DSPM 0850) courses. These courses, like most developmental courses, were assigned institutional credit only and did not count toward a student's degree requirements (Perin, 2005). In the redesign, selected general education mathematics courses at MTSU were modified and the University curriculum committee approved a new mathematics course, MATH 1000K, Essentials of Mathematics. Two mathematics courses that satisfy the general education requirement for a vast number of major degree programs at MTSU, Mathematics for General Studies (MATH 1010) and College Algebra (MATH 1710), were chosen to be used for the pilot year. In the redesign, MATH 1000K and special sections of MATH 1010 and MATH 1710 are used to meet the needs of underprepared students. No longer classified as developmental courses, they are now designated as prescribed courses. These redesigned mathematics courses provide prescriptive measures to address the needs for students whose ACT, SAT, or COMPASS (Computer-Adaptive Placement Assessment and Support System) scores would indicate an academic deficiency. COMPASS is a comprehensive testing system developed by ACT to help postsecondary institutions place students into

appropriate level courses. The prescribed courses incorporate the use of technology and lab components in an effort to reinforce instructional activities and to improve student learning outcomes. Similar to most developmental courses, the class enrollments are capped (McCusker, 1999). In the redesign, a decision was made to award credit for the prescribed courses. According to Crawford (1993) and Maxwell (1997), courses that are awarded college credit encourage students to devote more time and effort to the course and result in more positive attitudes about their enrollment at the university. These prescribed courses are denoted by the letter K in the rubric to differentiate between prescribed courses and regular sections of MATH 1010 and MATH 1710. Tables 1 and 2 delineate the structures of the former developmental mathematics courses and the newly designed prescribed mathematics courses.

Table 1. Former Developmental Mathematics Course Structure

Former Courses	Credit Hours	Contact Hours	Successive Course
DSPM 0800	3 (Institutional Credit)	3	DSPM 0850
DSPM 0850	3 (Institutional Credit)	3	MATH 1010 or MATH 1710

Table 2. Redesigned Prescribed Mathematics Course Structure

Redesigned Courses	Credit Hours	Contact Hours	Successive Course
MATH 1000K	3 (Elective Credit)	5 (3 Classroom/ 2 Lab)	MATH 1010K or MATH 1710K
MATH 1010K or MATH 710K	3 (General Education Credit)	5	NA

As illustrated in Tables 1 and 2, the redesigned course structure allows students to address academic deficiencies and to complete a general education mathematics course in a shorter time period. In the former developmental course structure, two or three semesters, depending on initial placement, were required for students to receive general education mathematics credit. The redesigned structure eliminates one full semester in meeting that requirement. The redesigned structure follows traditional practices for developmental mathematics courses by capping enrollment sizes to 25 for sections of MATH 1000K, MATH 1010K, and MATH 1710K. This generates a smaller student-to-instructor ratio and allows instructors to give more individual assistance to students enrolled in the prescribed mathematics courses. The element of smaller class size may be a contributing factor in promoting students' successful completion of the courses.

Purpose

As redesign initiatives are developed and implemented, it is imperative that such measures are evaluated for effectiveness. The purpose of this report is to examine the results of the pilot year of the redesign initiative for the two prescribed general education mathematics courses, MATH 1010K and MATH 1710K. This report will assess the redesign by examining the following comparisons:

- Combined success rates of students in K sections of MATH 1010 and MATH 1710 to success rates of students in the former developmental mathematics course, intermediate algebra (DSPM 0850).
- Success rates of students in K sections to success rates of students in non-K sections of MATH 1010.
- Success rates of students in K sections to success rates of students in non-K sections of MATH 1710.
- Combined success rates of students in K sections of MATH 1010 and MATH 1710 to combined success rates of students in non-K sections of these courses.
- Success rates of students in non-K sections of MATH 1010 and MATH 1710 who have taken prior developmental mathematics courses at MTSU or other transferring institutions to success rates of students in K sections of these courses.

Planning and Implementation of K Courses

Over the course of several semesters, University personnel worked in the planning of the new course design. To develop a plan that addressed the needs of underprepared students, the administration worked with the following groups: DSP faculty and staff; college deans; select faculty from the colleges of Basic and Applied Sciences, Liberal Arts, and Education and Behavioral Sciences; the Instructional Technology Division; the Scheduling Center; and the Records Office. Implementation of the course redesign took place in fall 2006.

Mathematics Curriculum

Teams were formed to address curricular issues for each mathematics course in the redesign plan. One course (MATH 1000K, Essentials of Mathematics) was newly designed and two general education mathematics courses (MATH 1010, Mathematics for General Studies, and MATH 1710, College Algebra) were modified to meet the needs of students whose ACT, SAT or COMPASS scores indicated placement in a developmental or prescribed mathematics course. As stated in the purpose of the study, this report focuses on the newly modified general education mathematics courses MATH 1010K and MATH 1710K. However, MATH 1000K will play an increasingly significant role in the overall success of the redesign structure because students in this course feed into the two prescribed courses for which students receive general education mathematics credit. Therefore, course descriptions for all three courses in the redesign project are provided as follows:

1. MATH 1000K (Essentials of Mathematics)
   This newly designed course provides students with an introduction to learning mathematics. In addition to the acquisition of mathematics skills, the course incorporates strategies for learning mathematics, for problem solving, and for improving critical thinking and technology skills. Another objective of the course is to expand students' abilities to learn independently. The major goal of the course is to provide a strong foundation for success in higher-level mathematics courses.

2. MATH 1010K (Mathematics for General Studies)
   This is a special section of an existing liberal arts mathematics course. As a liberal arts mathematics course, the course covers a variety of topics. Content features the topics of logic, set theory, financial management, numeration systems, trigonometry, probability, and statistics. In addition to these topics, the K sections cover linear and quadratic equations, factoring, graphs, functions, and systems of equations and inequalities.

3. MATH 1710K (College Algebra)
   This is a special section of the existing college algebra course. K sections of the course include additional algebra topics of factoring, rational exponents, and radical expressions. The supplementary topics provide a review and enhancement of foundational algebra skills.

Special attention was given to assure that the curricula of the K courses met all objectives and learning outcomes for the non-K sections of MATH 1010 and MATH 1710. Each of the prescribed courses offers students three hours of college credit. Credits for MATH 1000K are general elective credits and credits for MATH 1010K and MATH 1710K satisfy general education requirements for mathematics. Prescribed mathematics courses must be taken in the initial semester of a student's enrollment at MTSU. Students are not allowed to drop these courses unless there are extenuating circumstances approved by the director.

Placement

Scores used for placement in mathematics are the ACT, SAT, or COMPASS mathematics sub-scores. COMPASS was chosen by the Tennessee Board of Regents as an assessment to determine a student's readiness for college-level courses. Students 21 years of age or older having invalid ACT/SAT scores or no scores are required to take the COMPASS. Invalid scores are from tests taken three or more years prior to admission. Table 3 shows how the students are placed based on ACT, SAT, or COMPASS scores.

Students who place into and successfully complete MATH 1000K are required to take either MATH 1010K or MATH 1710K in the consecutive semester, excluding summer sessions. Students are advised to enroll in MATH 1010K or MATH 1710K based on requirements with respect to their declared or intended majors.

Table 3. Prescribed Mathematics Course Placement

Course Placement	Test Scores		
	ACT	**SAT**	**COMPASS**
MATH 1000K	15-16	350-390	30-99 in pre-algebra or 20-27 in algebra
MATH 1010K or MATH 1710K	17-18	400-450	28-49 in algebra

It should be noted that a student with an ACT mathematics sub-score of 14 or less, an SAT mathematics sub-score less than or equal to 340, or a COMPASS pre-algebra score of 1-29 places into DSPM 0700. This is a basic mathematics course that is taught by the community colleges in the TBR system. Previous to the redesign of developmental courses, MTSU partnered with Motlow State Community College in 2003 in an agreement whereby Motlow faculty members teach the DSPM 0700 course at MTSU facilities. Historically, very few students entering MTSU place in the remedial mathematics course.

Course Redesign Features

Credit/Contact Hours

Each prescribed mathematics course carries three credit hours. Students successfully completing MATH 1000K receive three hours of elective credit, while MATH 1010K and MATH 1710K fulfill three hours of general education mathematics requirements. Furthermore, each prescribed mathematics course requires five contact hours. These contact hours are comprised of classroom hours and/or a lab component. MATH 1000K requires three hours of classroom instruction per week coupled with two hours of structured lab activities. MATH 1010K and MATH 1710K courses require a full five hours of classroom instruction, meeting for five 55-minute class meetings per week, or the equivalent thereof for two- or four-day per week sections.

Faculty

For the academic year 2006-07, 18 full-time faculty members and 4 adjunct faculty members taught the redesigned mathematics courses. To determine faculty workload, the credit hours and contact hours were averaged. The average of credit hours and contact hours resulted in four workload hours for each K-section taught. The student-to-instructor ratio for each K section is 25 or less. Non-K sections of MATH 1010 and MATH 1710 each carry three credit hours and three contact hours, with an average class size of 34. Faculty members with no reassignments and/or who teach no graduate courses are

required to have a 12-hour workload per semester, or a total of a 24-hour workload for fall and spring semesters of each academic year. Due to a larger student population for prescribed courses in fall semesters as compared to spring semesters, faculty members teaching prescribed mathematics courses are usually assigned four K sections in the fall and two in the spring. Based on a faculty member's teaching load, the balance of the required 30 hours per week on campus is dedicated to office hours. During this time students are afforded the opportunity to receive individual assistance from the instructor.

Technology Component

Each course requires a technology component offering online homework activities, practice exercises, test reviews, video instruction, an e-textbook, and a discussion board. Each course requires a graphing calculator. Instructors develop online activities to supplement and enhance in-class instruction. The online component allows students to receive immediate feedback. Students can email questions to the instructor immediately when working within the online component. The instructor can then view the actual problem about which the student is questioning. The instructor can also view a student's entire assignment to see which problems are correct or incorrect. This enables instructors to identify and address specific needs individually or collectively in the classroom. The online activities also permit students to receive assistance when they are off-campus and at hours when the mathematics lab is closed. Assignments are posted and videos are available online for students to view when absent from a class meeting. The use of technology in the classroom and the online technology components allow instructors to introduce student exercises in the classroom that are more relevant to real-world applications.

Grading

The textbook committee for the mathematics area selected a textbook for each course. The curriculum committee defined the course content for all sections and generated a common course syllabus. The syllabus specifies learning objectives, an attendance policy, and required course materials. All sections require that the course final exam be weighted at 20 percent and that assisted work (homework, group projects, etc.) count no more than 10 percent of the course grade. Each course requires a student to have an overall grade of 70 percent or better to successfully complete the course. A student's grade is based on quizzes, homework grades (online and hand-scored), unit tests, and a final exam. The final exam for both K sections and non-K sections of MATH 1710 is a common departmental exam.

Academic Support

All students taking prescribed courses have access to the following academic support services.

- ***Academic Support Center*** – Each student is assigned an academic advisor at the center who works with faculty members in addressing concerns about student progress or classroom attendance.
- ***Academic Enrichment*** – This office is responsible for testing and placement of incoming students into appropriate classes based on University and TBR guidelines.
- ***Lab*** – The Academic Enrichment Mathematics Lab is open 58 hours per week and is staffed by graduate assistants and student peer tutors to provide assistance with prescribed mathematics courses.
- ***Student Athlete Enhancement Center*** – This center provides extra assistance to student athletes enrolled in prescribed courses. The facility houses a study hall, computer lab, and tutoring rooms.
- ***Disabled Student Services*** – This office provides readers and tutors, special testing accommodations, and adaptive computer technologies for registered students.

Results of Pilot Year

For fall 2006, 31 sections of MATH 1710K and 12 sections of MATH 1010K were offered. For spring 2007, 21 sections of MATH 1710K and 10 sections of MATH 1010K were offered. Since success in the prescribed mathematics courses requires at least 70 percent mastery, which equates to a grade of C or better, the grade distributions for both K and non-K sections were separated into two groups. The first group consisted of grades A to C, representing the group of students who successfully completed the course, and the second group consisted of grades D, F, I, or W, representing the group of students who were unsuccessful at completing the course. The same groupings were used to categorize the former intermediate algebra course (DSPM 0850) for the three prior academic years of 2003-2004, 2004-2005, and 2005-2006.

Five major hypotheses were tested in this study.

- H_1 – There is no statistically significant difference in the success rates comparing the average of the previous three academic years of DSPM 0850 to the combined MATH 1010K/1710K for AY 2006-2007.
- H_2 – There is no statistically significant difference in the success rates comparing students in K sections to students in non-K sections of MATH 1010.
- H_3 – There is no statistically significant difference in the success rates comparing students in K sections to students in non-K sections of MATH 1710.
- H_4 – There is no statistically significant difference in the combined success rates comparing K sections of MATH 1010 and MATH 1710 to combined success rates of non-K sections of MATH 1010 and MATH 1710.
- H_5 – There is no statistically significant difference in the success rates comparing students in non-K sections of MATH 1010 and MATH 1710 who have taken prior developmental mathematics courses at MTSU or transferring institutions to students in K sections of these courses.

At a .05 significance level, a 2-Proportion *z* test was used to test each of the five hypotheses. In each test, the null hypothesis was that there was no statistically significant

difference. Table 4 summarizes the results and conclusions for the testing of all five hypotheses. Tables 5-7 provide the specific data relative to these findings.

Table 4. Results and Conclusions of Hypotheses Tests

Hypothesis	p-value	Conclusion
H_1	0.136	Cannot reject the null hypothesis
H_2	0.225	Cannot reject the null hypothesis
H_3	0.947	Cannot reject the null hypothesis
H_4	0.602	Cannot reject the null hypothesis
H_5	0.000	Reject the null hypothesis

Table 5 illustrates the comparison of the success rate of students in newly designed K courses to the success rate of students in the former intermediate algebra course (DSPM 0850). The first hypothesis investigated the difference in the success rates comparing the average of the previous three academic years of DSPM 0850 to the combined MATH 1010K/1710K for AY 2006-2007. From Table 5, the success rate for the 3-year average of DSPM 0850 was 65.1% and the success rate for combined MATH 1010K/1710K was 67.1%. There was not a statistically significant difference in the pass rates of the two groups. These findings were particularly encouraging because they indicated that the students placed in the prescribed sections of these higher-level courses were able to master essentially two semesters of material in one at the same rate that they had mastered the former developmental mathematics course. Furthermore, as opposed to receiving only institutional credit for successful completion, these students had satisfied their general education mathematics requirement. Previously, students enrolled in DSPM 0850 for one semester were required to take an additional semester of MATH 1010 or MATH 1710.

Table 6 shows the success rate of students in newly designed K sections to the success rate of students in non-K sections of MATH 1010, Mathematics for General Studies, and MATH 1710, College Algebra, for AY 2006-2007.

Both K sections and non-K sections of MATH 1010 and MATH 1710 satisfy the general education mathematics requirement. Therefore, it is vital that these courses are examined individually and collectively to assess the effectiveness of the redesign initiatives. The second hypothesis investigated the difference between the success rate of students in K sections and the success rate of students in non-K sections of MATH 1010.

From Table 6, the success rate for students enrolled in MATH 1010K sections was 70.5% for AY 2006-2007. Information from the same table shows that the success rate for students enrolled in MATH 1010 (Non-K) sections was 67.4%. A statistical test indicates that there is no significant difference in the pass rates for students in the special sections for prescribed students and in the regular sections of this course. The third hypothesis considered the difference in success rates between students in K sections and non-K

Table 5. Student Success Rates: Former DSPM 0850 Course vs. K Courses

COURSE	GRADES	
DSPM 0850	**A to C**	**D, W, I, or F**
AY 2003-2004	67.8%	32.2%
AY 2004-2005	63.3%	36.7%
AY 2005-2006	64.2%	35.8%
3-year average	65.1%	34.9%
MATH 1010K		
AY 2006-2007	70.5%	29.5%
MATH 1710K		
AY 2006-2007	65.8%	34.2%
MATH 1010K/1710K combined	67.1%	32.9%

Table 6. Student Success Rates: K sections vs. Non-K sections

COURSE	GRADES	
MATH 1010K	**A to C**	**D, W, I, or F**
AY 2006-2007	70.5%	29.5%
MATH 1010 (Non-K)		
AY 2006-2007	67.4%	32.6%
MATH 1710K		
AY 2006-2007	65.8%	34.2%
MATH 1710 (Non-K)		
AY 2006-2007	65.9%	34.1%
MATH 1010K/1710K combined		
AY 2006-2007	67.1%	32.9%
MATH 1010/1710 (Non-K) combined		
AY 2006-2007	66.4%	33.6%

sections of MATH 1710. Using the same test and data from Table 6, results were examined. The success rate for students in MATH 1710K sections was 65.8% and the success rate for students in non-K sections of MATH 1710 was 65.9%. Again, there was no statistically significant difference in the pass rates. As stated in the fourth hypothesis, combined success rates of students in K sections of both MATH 1010 and MATH 1710 and combined success rates of students in non-K sections of these courses were investigated to determine if there was a significant difference between the two. The combined success rate for students in K sections of MATH 1010 and MATH 1710 was 67.1% and the combined success rate for students in non-K sections of these courses was

66.4%. Once more there was no statistically significant difference in the pass rates. These findings were very promising because students in the prescribed courses, K sections, were, in general, academically weaker based on placement criteria. It should be noted that non-K sections usually have larger enrollments. The average class size is 34 with some sections having as many as 40 students. K sections are typically limited to 25 students. Additionally, online lab components are not required in non-K sections. Students in K sections may receive extra benefit from online components that are essentially available around the clock. K sections also feature five contact hours providing extended classroom time and increased instructor-student contact during the semester.

Some students in non-K sections of MATH 1010 or MATH 1710 have taken DSPM 0850 or a comparable course at another institution or have successfully completed DSPM 0850 at MTSU prior to fall 2006 when the redesign courses were piloted. Table 7 presents the success rate of students in non-K sections who have taken a prior developmental mathematics course(s) to the success rate of students in K sections of MATH 1010 and MATH 1710 for AY 2006-2007.

Table 7. Student Success Rates: DSP Background in Non-K sections vs. K sections

COURSE	**GRADES**	
MATH 1010 (Non-K) with DSP	**A to C**	**D, W, I, or F**
AY 2006-2007	57%	43%
MATH 1010K		
AY 2006-2007	70.5%	29.5%
MATH 1710 (Non-K) with DSP		
AY 2006-2007	56.6%	43.4%
MATH 1710K		
AY 2006-2007	65.8%	34.2%

The fifth and final hypothesis was investigated to determine if data showed a statistically significant difference between the success rate of students in non-K sections who have taken developmental mathematics courses to the success rate of students in K sections of MATH 1010 or MATH 1710. From Table 7, the success rate for students in MATH 1010 (Non-K) with DSP background was 57% and the success rate for students in MATH 1010K was 70.5%. Also from Table 7, the success rate for students in MATH 1710 (Non-K) with DSP background was 57% and the success rate for students in MATH 1710K was 70.5%. Success rates for students in K sections of MATH 1010 and MATH 1710 were found to be significantly higher than the success rates of students with prior DSP backgrounds in non-K sections of these courses. This result shows that the new course design generated better student learning outcomes than the traditional two-semester sequence that included DSPM 0850 followed by the general education mathematics course. This new design was more effective in helping students with academic deficiencies to be successful in fulfilling their general education mathematics

requirement. Factors that may have contributed to lower student outcomes for students with prior DSP backgrounds in non-K sections include:

- The ability of students in non-K sections to drop the course at will.
- Varying levels of preparation for transfer students with a DSP background.
- Only one year of data is available at this time with which to compare results.

Conclusions

The pilot year of the course redesign has provided promising results. Data for AY 2006-2007 is encouraging for measured student learning outcomes in the newly designed courses. The data may also provide rationale for placement of transfer students with a background in DSP mathematics into K sections of MATH 1010 or MATH 1710. If additional years of the course redesign prove as successful, then there will be a continual decline in the numbers of MTSU students with backgrounds in DSP who are in the non-K sections of these courses. Further study with additional years of the redesign may indicate its impact on retention and graduation rates.

The course redesign at MTSU has addressed several of the recommendations in both the *Defining Our Future* and the *Setting New Directions* documents generated by the Tennessee Board of Regents. Students are obviously progressing at a faster pace through prescribed measures to address academic deficiencies and through general education requirements. Because students have the opportunity to overcome an academic deficiency and to satisfy general education mathematics requirements within one semester, the cost to the student, to the University, and to the State is reduced. Additional studies could provide specific information relative to cost effectiveness.

The newly developed plan provided a more comprehensive approach that resulted in enhanced academic quality, flexible delivery options, greater uses of technology, and a reduction in the number of required courses. These results have strong implications for not only higher education institutions in the Tennessee Board of Regents system, but to others across the nation faced with meeting the needs of underprepared students in the area of mathematics.

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