



Experts in improving learning and
reducing cost in higher education.

[View Site Map](#)
 Search

[Who We Are](#)
[What We Do](#)
[How To Do It](#)
[Contact Us](#)
[Subscribe to The Learning MarketSpace](#)

Institution D: Developmental Mathematics

Abstract

INSTITUTION D plans to redesign all three developmental studies mathematics courses into one course. We currently offer three courses, which over five years have had an average annual enrollment of 2212 with 283 in Basic Math, 909 in Elementary Algebra, and 1020 in Intermediate Algebra. Our goal has been to remediate high school algebra deficiencies. Each professor has been developing his/her own instruction strategies and agenda to cover common course objectives and outcomes. Most have used the traditional classroom approach. Some faculty have incorporated *MyMathLab* in the homework assignments and/or tests. This past year we piloted an individualized study approach using *MyMathLab*.

Often, developmental math is a stop gate to our students' educational goals. With a failure rate at approximately 44%, many students are delayed in taking college level courses or applying for admission to health science programs. Others give up and drop out completely. Our current developmental program is not meeting the diverse needs of students in levels of preparation, learning styles, and specific educational goals. Students are required to study topics that are not relevant to their majors, to take an entire course even though they are deficient in a portion of the topics, and to learn at the same pace and instructional strategies as the entire class. Varying instructional techniques and course agendas make changing classes difficult even though the student's needs may be different.

This course redesign will modularize the content of the three developmental courses. Modeled in part after the University of Alabama's Math Technology Learning Center, we plan to create a learning center to house course content modules delivering instruction, video lectures, homework, and testing online with immediate assistance by instructors and tutors. Students will be required to master only concept deficiencies needed for their career goals. Student learning will be accommodated by online tutorials, video lectures, instructor lead lecture/discussion groups, organized group study, one-on-one tutoring, and others. All students in a particular module will have common homework assignments and tests generated by *MyMathLab*. Through its diagnostic and record keeping functions, the software will provide quick feedback to students. The teachers and tutors will have ready access to the student's progress. The Learning Center would provide remediation for the student who falls behind in his/her scheduled work and acceleration for the student who is capable of moving through objectives more quickly.

Our redesign will create a program that will prepare our student for his educational goal whether it involves beginning a program of study in a field that requires advanced mathematics, completing a general education mathematics course, or applying for admission to INSTITUTION D nursing or allied health programs. This redesign will accommodate students' varying levels of preparation, math anxieties, and diverse learning styles. Student learning will be active and learner centered. On demand individualized assistance will increase student persistence, as well as help instructors continuously improve the learning activities in the course. Providing immediate feedback on homework and tests will motivate students to keep on until *they get it right* and allow them to get needed diagnostic feedback and revised study plans. Instructors will be able to monitor each student's progress and time on task and take suitable action.

During the pilot phase we will use the Parallel Sections Method to compare student learning outcomes. Upon full implementation, we will use baseline data from the parallel sections offered in the traditional format during pilot phase. We will compare student success rates in the former traditional and the newly redesigned settings, their gain in knowledge as measured by pre- and post-tests, and their performance in subsequent mathematics courses. There will be qualitative evaluation of student attitude changes towards math and student/faculty perceptions of the new learning environment.

The Course Redesign will involve changes in faculty and tutoring responsibilities. Duplication of efforts on the part of faculty will be eliminated creating opportunities for using alternate staffing patterns. We will reduce the number of sections and increase section size. Instead of spending time preparing and grading, the instructor can engage the student in more personal assistance and can meet each student's specific immediate needs. The ongoing feedback will allow faculty to spend class time on concepts the students do not know. Further, faculty time can be reallocated for other tasks. INSTITUTION D anticipates additional savings as students move seamlessly through needed course modules and enroll in credit-bearing courses. We anticipate a cost savings of approximately 27%. The savings from this project will go into the college's general fund. We can then request financing for other redesign projects in the Mathematics Department.

Application Narrative

Selected Model: Emporium

In order to accommodate our students varying learning styles, levels of preparation, and career goals, the INSTITUTION D Mathematics Department has chosen the following components of the Emporium Model.

- Customize the learning environment for each student based on background, learning preference, and academic/professional goals
- Offer students individualized paths to reach the same learning outcomes
- Provide structure for students through an individualized learning contract
- Include an array of learning opportunities: instructional software, lectures, team/group collaboration, small group study sessions, focus groups for students with same educational goals, videos, and skills building assignments with immediate feedback from *MyMathLab*
- Modularize course content
- Allow earning of variable credit based on how many modules the student successfully completes during a term
- Eliminate duplication of efforts by faculty
- Use a staffing model that utilizes a combination of faculty, peer tutors, and retired high school teachers
- Teach more than one course in the Learning Center
- Set mandatory attendance in the Learning Center
- Establish mandatory weekly group meetings

For many years we have reviewed and tried many course delivery systems. We have determined that *MyMathLab* best fits our students' needs and our institution's capabilities. We have been using *MyMathLab* in some of our developmental classes but have not experienced a significant increase in student success. We believe what has been lacking is the Learning Center. We need a place for students to go to learn mathematics at a time convenient to them and with on-demand help as needed. Actually, the Math Department has requested a learning center annually over the past fifteen years and has not had the administrative support until now. The Learning Center will not only provide a place for students to access their course materials, but our redesign will change the concept of learning mathematics. The current redesign efforts have helped us realize that coordinating faculty efforts and changing the goal of the developmental math program will also increase student success.

A common syllabus for the entire course will be used. Even so, students will be required to master only the modules that are relevant to their career goals and that a pretest has determined as deficiencies. Our redesign will require learning to be more active and student centered. Students will be guided in choosing what types of learning materials to use depending on their needs and in determining a timeline to work through their prescribed modules. Our redesign will free faculty and staff to be available for immediate one-on-one assistance. Frequent practice, immediate feedback, and reinforcement of concepts will be provided by *MyMathLab*.

What have been three courses will be redesigned into one course organized with nine modules. In the fall 2007, we will begin using *Developmental Mathematics, Custom Edition for INSTITUTION D* published by Pearson/Addison Wesley with *MyMathLab* correlated to this text. In our redesign, we will continue to use this textbook and software, as well as a common syllabus, assignments, and tests. A team of faculty will be responsible for course development and determining course delivery strategies, saving time and achieving more course consistency. The team will also determine appropriate assessments for placing students in needed modules, as well as appraisal of learning in each module. Training and ongoing monitoring of all instructors and tutors will be needed to insure consistent learning experiences and outcomes. We expect to utilize fulltime faculty, adjunct instructors, professional tutors (We have retired high school mathematics teachers available), and peer tutors. Each faculty member will be assigned a group of students to counsel, monitor and guide through the entire course learning process. All students will be required to record a minimum amount of time per week in the Learning Center and attend a weekly session with their assigned faculty mentor and focus group.

Student learning will be active and learner-centered. Each student will have an individualized learning contract based on background, learning preference, and academic/professional goals detailing which module needs to be studied and when each part needs to be accomplished. *MyMathLab* provides instructional software that supports auditory, visual, and discovery-based learning styles including interactive tutorials, computational exercises, videos, practice exercises and online quizzes. The required attendance policy will insure time on task and student involvement. We plan to organize focus groups of students with common educational goals to encourage and support each other. This will provide opportunities for connectivity of student learning to the student's career goals. Sharing and explaining their learning with other students will deepen their understanding and increase their persistence.

The Learning Center will provide students with more individualized assistance. First, tutorials are built into the software in *MyMathLab*. When a student gets stuck, he can ask for an example or a step by step explanation. A study plan, which highlights which areas need practice, will be generated for each student. At its best, however, technology does not replace the need for human contact. A tutor or instructor can look at the student's work and determine the misunderstanding or simply find the careless mistake. Or the tutor can suggest a study group or refer the student to a faculty member to arrange alternative learning strategies. Students need encouragement and praise to keep them on task. We plan to provide a staff of peer tutors, retired high school teachers, adjunct faculty, and fulltime faculty that will aid in student persistence, learning, and satisfaction. Also, the faculty member can learn what is difficult for students and improve course learning activities.

MyMathLab provides immediate feedback to students. In the practice exercises (MML designates as homework), the student is told immediately if the answer is correct or not. If incorrect, the student can select

“Show Me How” on the tutorial or simply “Work a Similar Exercise.” As an incentive to do the practice exercises, we will have a homework component in determining the student’s grade, as well as require mastery before moving forward. The quiz component of *MyMathLab* requires the student to complete the entire set of exercises before permitting the student to know which problems are correct or incorrect. This will take the student to the next learning level of not depending upon step by step assistance. We expect the quizzes be used as practice tests. Finally, the tests are graded immediately by *MyMathLab* upon submission. Hard copies of all student work are available for the student to review. Students will be required to show mastery of each unit in a module. If a student needs to retest, an instructor will review his test and recommend appropriate remediation. Because learning mathematics is not just getting the answer correct, we plan to determine the best way to review student’s work. *MyMathLab* has open response exercises – not just multiple choice. We will either require students to keep a notebook demonstrating their work on their homework and practice tests and/or turn-in work on tests. Such work can be graded holistically using common rubrics. This is still a decision to be made by the faculty redesign team who will decide upon methods of observing student work while at the same time not taking away from the efficiency afforded by *MyMathLab*.

MyMathLab has an excellent tracking feature. Faculty can monitor student progress, as well as time on task. Our redesign will require a minimum amount of time per week in the Learning Center. Students will be able to access practice exercises and sample tests from home but this will not replace required lab time. Our redesign team will determine the specifics, but probably a minimal amount of points will be given for meeting required lab time. Faculty can email students through *MyMathLab* to encourage students or suggest additional activities.

Course modularization will provide our students options

- To select those topics relevant to his/her career goals
- To study only topics in which he/she is unprepared
- To proceed at a faster pace if possible or slower pace if necessary
- To earn variable credit based on number of modules successfully completed

We plan to create nine modules. The student will be assessed as to his/her academic/professional goals and course competency deficiencies. Then, an individualized learning contract will be designed which will give the student a detailed list of all modules that need to be mastered and when each should be targeted for completion.

It will be necessary to survey all career programs on campus to determine which modules their students will be required to complete prior to admission. Pre-requisite competencies of general education mathematics courses are currently being reviewed to determine pre-requisite modules.

We have concerns about the logistics of student record keeping, especially in regard to financial aide. None-the-less, our Vice President of Student Services has committed to making our redesign work including modularization. In the fall of 2007, we plan to establish the mechanics.

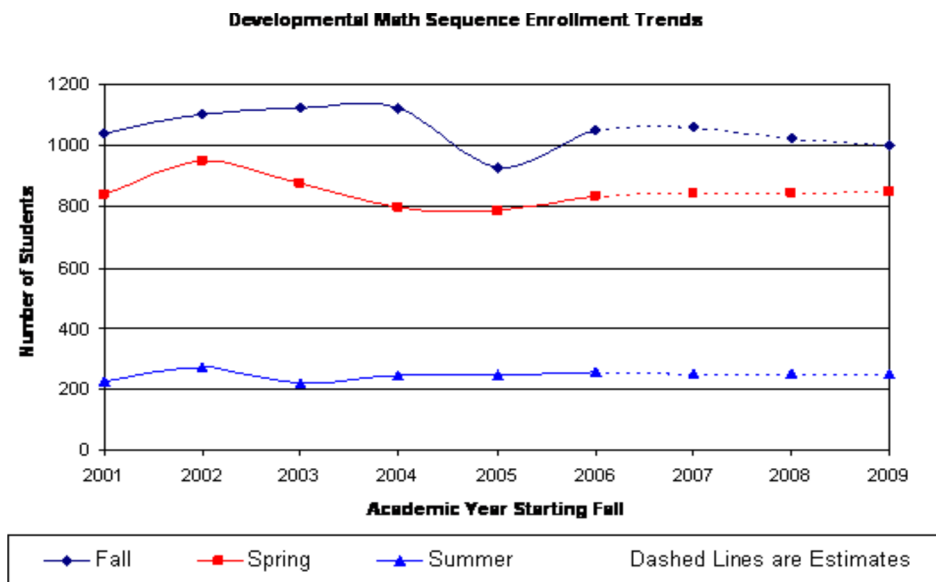
In the fall 2007, we will begin using *Developmental Mathematics, Custom Edition for INSTITUTION D* with *MyMathLab* published by Pearson/Addison Wesley. This text will be packaged with the student’s *MyMathLab* access code, which will be active until the course contract is completed. *MyMathLab* will be customized with the textbook and will include an online course manual with an orientation to the course, information about the course structure, the course content, the learning contract, the purpose of the learning styles and study skills assessment, and the various ways the students might choose to learn the material. The course manual will also comprise mathematics study skills material, particularly math anxiety, and an online assessment of students’ learning styles. The customized online material will include the syllabus, the required *MyMathLab* homework, timed basic skills quizzes on adding, subtracting, multiplying and dividing whole numbers, extra practice worksheets on perfect squares, square roots, exponents, fractions, simple equations and skills involving integers.

In summary key components of our redesign include

- Individualized mastery-based learning contracts providing individualized paths to reach the same learning outcomes based on the student’s background, learning preference and academic/career goals
- Modularized course content allowing the student the options to select those topics relevant to his/her career goals, to study only those topics in which he/she is unprepared, to proceed at a pace appropriate to his/her needs, and to earn variable credit for modules completed
- Mandatory attendance in the Learning Center and group meetings
- An assortment of learning opportunities to include instructional software, lectures, team/group collaboration, small group study sessions, focus groups for students with same educational goals, videos, skills building assignments with immediate feedback from *MyMathLab*
- A team approach by faculty in course design, assessment, and student assistance
- A staffing model that combines faculty, professional tutors, and peer tutors

Cost Reduction Strategy: Reduce the number of sections and increase the section size

The enrollment trends in the Developmental Mathematics Sequence have had some flux over the last six academic years; however, when compared to the college’s overall enrollment, the percentages have been fairly consistent. Using the data for these years, we have projected that the enrollment in the developmental math sequence will be steady out in the next few years. This data is present in the chart below.



Since the enrollment in the course sequence has been mostly consistent, the major cost saving mechanism will be to reduce the number of sections. The section sizes will be increased from an average of 20 students per section to 30 students per section. This will decrease the number of sections from 97 in the 2006-2007 academic year to an estimated 69 sections in the 2009-2010 academic year. This is a reduction of 28 instructor assignments which will allow for faculty – both full-time and adjunct – to be reassigned to either college-level courses or the Math Learning Center .

Further cost savings will be realized by reducing the amount of time each faculty member spends on instructional tasks. The curriculum will become fully departmentalized with responsibilities shared among the faculty, reducing the amount of overlapping work. One such example would be incorporating faculty notes into the customized *MyMathLab* environment. Faculty time will be reduced further since all homework, quizzes, and tests will be completed and automatically graded within the *MyMathLab* course management system.

Another form of cost savings will be modularizing the developmental mathematics sequence. While we do not anticipate this being a direct cost savings to the college, it will be a direct cost savings to the student. By modularizing the course, students will be billed according to the number of modules that they need and expect to complete. For example, a student might complete only two modules in one semester. He/she would get credit for those two modules and would not have to pay to take them again the next semester. Under the current course structure, the student would have to pay to repeat an entire course when he only needed the last unit. For a student on a tight budget, this would allow for his/her funds to stretch further. Another advantage to the modularization would be the student that needs just a refresher of the material. For example, a student that tests into the current Elementary Algebra class may only need the second half of that course's material. Currently, that student would have to take both Elementary and Intermediate Algebras. Under a modular course structure, this student could potentially complete all of his/her modules in one semester instead of having to take two. This would save the student time and money that could then be spent on college level courses.

The Math Learning Center is a major component of the redesign and staffing it efficiently is necessary. Some staffing will come from incorporating all or parts of the existing Math Lab with the Learning Center ; however, this alone will not sufficiently staff the Learning Center . All math faculty members teaching a developmental course, including adjuncts, will be required to spend time in the Center as part of his/her course load. This is possible due to the reduction in the amount of time each faculty spends in preparation outside of class. Furthermore, this will allow the faculty to interact one-on-one with all developmental math students instead of just his/her assigned students. This increase in interaction between faculty and students will become one of the math department's retention efforts. The Math Learning Center will also utilize some of the displaced adjuncts as professional tutors in addition to the professional tutors that are already working in the current Math Lab.

With the current course design, a total of \$364,350 or \$184 per student was spent on developmental mathematics in the 2006-2007 Academic Year. If the redesign course were used during this time frame, \$267,930 or \$135 per student would have been spent. This would be a reduction of approximately 27% in the costs. In keeping with TBR policy, this cost savings would go back into the college's general fund. In the future, the math department could request this money for additional redesign of college-level courses.

Timeline

SPRING AND SUMMER 2007

- Worked with book publisher Pearson/Addison Wesley to develop custom book for all modules with *MyMathLab* correlated to this book

- Presented request to TAF (Technology Access Fee) Committee for computers for emporium style lab
- Presented need for space to Space Utilization Committee
- Attended Redesign Workshop #1
- Established Redesign Team
- Completed and Submitted Readiness Criteria to redesign all three developmental math course into one
- Attended Redesign Workshop #2
- Developed and submitted Final Project Plan

FALL 2007

- Begin using *Developmental Mathematics, Custom Edition for INSTITUTION D* published by Pearson/Addison Wesley with online *MyMathLab* correlated to textbook
- Develop online course manual
- Develop common syllabus
- Determine delivery strategies with an assortment of learning opportunities
- Settle on number of hours student will be required to participate in the Learning Center and group discussions
- Modularize course content
- Survey directors of career programs to determine which modules their students will need to complete
- Review college level math course prerequisite competencies to determine prerequisite modules
- Determine appropriate assessment criteria for placing students in needed modules
- Agree upon pre- and post-tests for assessing student learning
- Identify a survey for evaluation of students' attitude changes towards math
- Identify a survey for evaluation of student/faculty perceptions of the new learning environment
- Develop method of incorporating assessment results into improving course design
- Design progress mechanisms to use formative assessment results
- Design format for students' individualized learning contracts
- Determine efficient methods for including students' written work as a component of grade
- Work with Maintenance and Office of Information Technology to remodel space for the Learning Center
- Determine the hours of operation for the Learning Center
- Work with Registrar and the Director of Financial Aid to find solutions to problems created by offering Developmental Math as one course divided into nine modules
- Create and conduct training of all instructors and tutors

SPRING 2008

- Implement Phase I Pilot
- Schedule parallel sections in the Learning Center and in the traditional format to compare student learning
- Leave some seats available in the Learning Center to accommodate students' needed change in schedules and course delivery or for those who desire to do more work there
- Periodically evaluate the choice of hours of operation for the Learning Center
- Compare performance in redesigned classes and traditional classes
- Evaluate students' attitude changes towards math and student/faculty perceptions of the new learning environment
- Conduct ongoing training and monitoring
- Incorporate all assessment results into improving student learning in Phase II Redesign
- Appraise the course requirements and learning strategies including requiring student written work
- Consider keeping the Learning Center open one week beyond the end of the semester
- Develop a job description and conduct a search for the part time lab assistant/data compiler
- Identify college-level courses that can be made available to students completing required developmental modules by mid-semester

FALL 2008

- Implement Phase II Pilot
- Schedule all sections in the Learning Center except for lecture sections for students who were in the spring 2008 lecture classes and can complete the course in one more semester
- Leave seats available in the Learning Center for drop-ins and for those students who desire to change from the traditional sections
- Implement the use of focus groups of students with common education goals to provide connectivity of learning
- Compare performance in redesigned classes and traditional classes
- Evaluate students' attitude changes towards math and student/faculty perceptions of the new learning environment
- Conduct ongoing training and monitoring
- Survey faculty and students to assess possible changes
- Continue to identify and offer college-level courses that can be made available to students completing required developmental modules by mid-semester
- Evaluate the need to enlarge the Learning Center to accommodate more students
- Incorporate all assessment results into improving student learning

SPRING 2009

- Serve all sections of developmental studies math in the Learning Center, as well as appropriate college-level math offerings
- Compare performance in redesigned classes with the baseline data from the parallel sections offered in the traditional format during the pilot phase
- Compare performance in subsequent math classes taken
- Evaluate students' attitude changes towards math and student/faculty perceptions of the new learning environment
- Conduct ongoing training and monitoring
- Incorporate all assessment results into improving student learning