Changing the Equation

Application

from

Northern Virginia Community College

Contact:

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Abstract

Northern Virginia Community College (NOVA) plans to redesign all three developmental mathematics courses (MTH 2, Arithmetic; MTH 3, Algebra I; and MTH 4, Algebra II) into one unified course, MTH 1, Developmental Mathematics. During the summer, spring and fall of 2009-2010, enrollment in our current courses totaled 9392 students, with 1070 students in an existing version of MTH 1; 1032 in MTH 2; 3862 in MTH 3; and 3428 in MTH 4. Enrollment has been growing at an annual rate between 5 and 15 percent over the last several years.

The overall success rate in these courses is currently below 50%. Most of the MTH 2, 3, and 4 classes are taught using a traditional lecture method in which the instructor sets the pace of the course. More prepared students often lose motivation while they are waiting for the class to get to the point where their individual difficulties begin. The pace is often too fast for the less prepared student. Typically, a student who fails the course has to repeat the entire course. With so many instructors involved in the delivery of these courses, it is difficult to maintain consistency in the learning outcomes.

The redesign will streamline the path through developmental courses into college level math courses, by putting in place revamped content along with processes that have a potential to produce significantly higher success rates. The content of the developmental sequence will be structured into 11 modules. MyMathLab (within MyLabsPlus) will provide diagnostic and record-keeping functions, and immediate feedback to students. Each campus will establish a Math Computer Lab staffed by faculty, instructional assistants and peer tutors to provide one-on-one assistance to students as needed. Each student will be required to spend a minimum of two hours per week in the lab, in addition to a scheduled two hour class in a computer classroom. The class instructor will discuss the weekly progress with each student, provide support and encouragement, and build a sense of community among the learners.

This redesign will address students’ varying levels of preparation. The course will be more active and learner-centered, with more time-on-task than the current model. Based on a mastery approach, it will require uniform learning outcomes that will be reinforced through frequent practice and immediate feedback. Students will be allowed to focus just on the skills they are lacking, and to progress through the units at their own pace. If a student fails a module, he or she will be required to repeat only that module, not the entire course. There will be multiple exit points, depending on the student’s planned degree program.

During the pilot phase in Spring 2011, we will use the Parallel Sections Method for assessment. The student learning outcomes currently being written will be shared with instructors of the traditional sections. To assess the pilot, we will compare results on at least 30 common content items from selected exams given to the redesign sections and to an equal number of traditional sections. Comparison of success rates (as measured by course grades) for the two methods will be challenging in light of the different standards for assigning grades in the redesigned course compared to the current courses. A further challenge is expected by Fall 2011 when we believe the Virginia Community College
System will adopt a new grading standard for developmental math, based on typical A, B and C grades rather than the current S, R and U.

Our calculations indicate that the redesign will result in approximately a 7% decrease in per-student costs for offering the course. Faculty will receive three credits for their workload instead of the current four credits received for the traditional course. This will allow the hypothetical fulltime faculty member assigned exclusively to developmental math to teach an additional 2.5 sections during the academic year. Since our enrollments are projected to continue increasing, some of the cost savings will be directed toward serving additional students. Other cost savings will be allocated to provide reassigned time for a developmental math manager on each campus, to fund training and salary for tutors who will staff the labs, and to offer additional upper level math courses.

Application Narrative

Description of the Redesign Model

NOVA will redesign our developmental math courses using an Emporium Model with modules and a mastery-based learning strategy. We are developing the course materials within MyMathLab, a powerful, online teaching and learning environment designed to support instruction with dependable and easy-to-use homework, tests, personalized study plans, guided solutions, multimedia learning aids, and eTextbooks. Pearson will develop a MyLabsPlus site for our course, which will allow us to manage batch course creation, batch course copying, and batch enrollment of students from our Student Information System. This additional feature also provides a higher level of customer support when technical glitches occur.

A team consisting of two math faculty members from each campus, along with an instructional designer and an administrator, and supported by our IT departments, is serving as the steering committee for the redesign. Along the way, drafts of all of the plans (learning objectives, PowerPoint tutorials, homework assignments, quiz and test questions, course syllabus, and so on) will be shared with the math faculty at large so they can stay informed and provide input regarding the redesign.

We will organize the content of MTH 2, MTH 3 and MTH 4 into a total of eleven modules. Each module will consist of a proctored pre-test, three or four units (each with a PowerPoint tutorial, video lecture, homework assignment and a proctored quiz), and a proctored post-test. To reinforce concepts, each post-test will cover material not only from the current module but also a few questions selected from previous modules. A student will progress through the course module-by-module. All first-time students will start in the first module, to make sure they have a solid foundation in the essentials of basic math. For each module, the student will first take the pre-test, which will consist of about 25 questions. If a score of 80% or higher is achieved, the student is done with that module and will move on to the next one. Thus, no time is wasted in going over material which the student already knows. Students who score less than 80% on the pre-test will work systematically through all three or four units of the module, culminating in the post-test.
Placement into developmental math will still be determined by the College Placement Test (COMPASS). A student who is placed into developmental math will enroll in a four-credit “shell” course. The instructor will work with each student at the beginning of the course to find out the student’s degree plans, and to develop the student’s personalized plan regarding which modules are required to reach their personal exit point from developmental math into credit-level math courses.

The study requirements for each module will be as follows. For each unit, the student will first view a video lecture and/or PowerPoint presentation and be required to take notes on the material, which will be checked by the instructor. This practice strengthens the student’s note-taking ability, a skill which will be needed in college-level math courses. Next, the student will complete a set of homework problems in MyMathLab. The student must solve 90% of the homework problems correctly before he/she can continue to the next step. When a submitted problem is marked wrong, the student will have the opportunity to view a step-by-step solution, then to rework a similar problem and submit it. After completion of the homework problems for the unit, the student will take an online quiz on the material. If he/she achieves 80% or better, the student is finished with the unit. If the score is less than 80%, the student will review the material in the unit and retake the quiz. This will continue until the student scores 80% or better.

After the student completes all three or four units in the module, the student will take the proctored post-test for the module. If 80% or higher is achieved, the student will move on to the next module. If a student gets less than 80%, the student will review and retest until the 80% threshold is achieved.

Students will be expected to complete a minimum of one unit per week. Points will be awarded for attendance, for homework completion, and for note-taking, among all other facets of the course, since grades are such a powerful motivating feature for most students.

The student will attend class two hours per week at a scheduled time for an instructor-supervised computer tutorial session, which will provide an opportunity for community-building among the students and with the instructor, and allow the instructor time to individually monitor and track student progress and provide support and encouragement. In addition, each student will attend the open computer mathematics-homework lab for a minimum of two hours per week, but not necessarily at any set time.

A developmental math instructor will meet with his/her class for two hours per week, and will also work in the open math computer lab for two hours a week at scheduled times, serving in the laboratory for two hours per week for each section taught. Labs will also be staffed with fulltime instructional assistants, adjunct faculty tutors and peer tutors, to provide on-demand assistance when students encounter difficulties. Attendance patterns will be examined to determine the peak hours so that staffing and hours of operation can be adjusted. We anticipate that each emporium will be open at least 60 hours per week.

In order to implement the above, we will need adequate computer classrooms and Emporium computer labs. Once we reach full implementation in Fall 2011, we plan the following for each of the 5 campuses where developmental math is taught:
It will also be critical that we have sufficient staffing for each emporium so that students will have ready
access to help whenever they need it. In addition to the 2 hours per week that each instructor will
provide for each section they teach, we will need 2 fulltime instructional assistants (3 at the largest
campus) to work in each emporium. We will also use student tutors heavily, on a schedule such as the
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Total Hours per Week | 146 | 356 | 188 | 146 | 146
The Six Principles of Successful Course Redesign

The six principles of successful course redesign have all been accounted for in our plans. We are redesigning the entire developmental math curriculum, which will result in all offerings at all campuses operating from a common syllabus and with common procedures and standards. Continuous monitoring will occur and feedback will be requested regarding improvements that should be incorporated for future semesters. Active learning has been built into the course structure, so that students will “learn math by doing math, not by listening to someone talk about doing math”. The course delivery system we have selected will have links to a variety of learning tools, and will support auditory, visual, and discovery-based learning styles. Students will have ready access to individual assistance, both during their scheduled class time and during their time working in the math computer lab. On-going assessment and prompt, automated feedback are a design feature of MyMathLab. Diagnostic feedback will point out why an incorrect response is inappropriate, and will direct the student to material which they need to review prior to their next attempt. We have built in the structure and the motivating rewards that should encourage the students to spend sufficient time on task, but ultimately, that will be a personal decision by each student. The MyMathLab software and lab attendance monitoring system will allow us to track students’ time on task, and instructors will monitor student progress, proactively seeking out the students who are lagging behind, to encourage better habits. And finally, the student learning experience will be modularized, allowing students to focus on the skills that they are lacking, and to study only topics in which they are unprepared and which will be needed based on their academic goals.

Cost Reduction Strategy

Our redesign plan modifies the workload for faculty, giving them three credits towards their workload versus the current four credits received for each course. This will allow faculty to teach on average 2.5 additional sections each academic year. Instead of roughly 46 fulltime-equivalent-faculty assigned to all developmental math sections across the college in fall 09, we will require only 36 fulltime-equivalent-faculty to teach the same number of students under the proposed redesign model. Since our enrollments are projected to continue increasing, some of the cost savings will be directed toward serving additional students.

Designing the curriculum so that students take only the modules they need as prerequisites in their program of study should ultimately reduce the number of sections that need to be offered. When a student is not successful, he or she will repeat a module, rather than an entire course. This should also result in fewer sections being needed, until we factor in the overall expected growth at the college.

Some cost savings will be allocated to provide reassigned time for a developmental math manager on each campus, to fund training and salary for tutors who will staff the labs, and to offer additional upper level math courses across the college. The campuses will also need to hire additional classified staff members as fulltime lab/instructional assistants to work in the labs.
Our calculations indicate that the redesign will result in approximately a 6.5% decrease in per-student costs for offering the course. The implementation of this course redesign will incur upfront costs in space renovations and in purchases of furniture and computers. We believe, however, that there will ultimately be a positive return on our investment. More important to us, though, than any possible cost savings, is the potential that we feel the redesign has for improving the success of our developmental math students, and moving them into credit courses and on to completing a degree.

The Five Critical Implementation Issues

1. Prepare students (and their parents) and the campus for changes in the course: Members of the redesign team are already meeting with counselors and other faculty at each campus, to inform them of the upcoming changes. During the fall semester, in preparation for the pilot, and again next summer prior to full implementation, there will be a concerted effort to educate counselors, student services specialists and testing center staff so that they can appropriately advise and inform the students. We hope to choose a slogan or acronym for the project, and develop a publicity campaign with posters and flyers to also help to educate the students.

2. Train instructors, instructional assistants and peer tutors: A training program will be developed which can serve as a model for each of the campuses to use, as we approach the beginning of the pilot stage and full implementation. Our Center for Excellence in Teaching and Learning will be able to lend support to this effort. We will develop a policies and procedures document that will be in the hands of all instructors and staff involved with the redesign, to ensure uniformity in the way the course is implemented. All faculty are comfortable with technology, as a result of a college-wide effort this past year to have all faculty at least minimally competent in the use of Blackboard. The majority of our developmental math instructors are already using MyMathLab (or the scaled-down version, MathXL).

3. Ensure an adequate technological infrastructure to support the redesign as planned: The Vice President of Instructional and Information Technology has developed a plan to purchase the required computers for all of the computer classrooms and math computer labs at each campus, funded by the college’s Technology Plan budget. A total of 631 computers are in this plan, augmented by some computers classrooms that are already equipped. His staff is also looking into the cabling needs and bandwidth issues to be sure any problems in those areas are resolved well in advance of the time when they will be needed.

4. Achieve initial and ongoing faculty consensus about the redesign: We realize that we are much more likely to get faculty buy-in if everyone has been given an opportunity to provide input in all aspects of planning for the redesign. While a core team of two faculty members per campus is overseeing the development of the redesigned course, drafts will be shared with the faculty at all stages in the planning, to solicit their feedback. Meetings with the math faculty have already occurred at each campus to discuss the structure and goals of the redesign. The redesign will be a major topic at the math faculty cluster meetings at the beginning of fall and spring semesters, to answer questions and concerns that the faculty might have regarding the project, and to share progress reports. Those faculty who are skeptics about the plans will not be forced to initially serve as instructors of redesigned
sections, but will be invited to volunteer some time in the math computer labs to see the project in action.

5. **Avoid backsliding by building ongoing institutional commitment to the redesign:** We are fortunate to have the full support of the President, the Executive Vice President for Academic and Student Services, the Vice President of Instructional and Information Technology, the Vice President of Institutional Research, Planning and Assessment, and all of the Provosts. We also expect that the recommendations of the Virginia Community College System’s Developmental Math Redesign Team will be approved and implemented by Fall, 2011. These recommendations include modularizing and streamlining the curriculum using the same structure that we are incorporating in our redesign plans. In addition, the huge investment that will be made in the infrastructure and equipment for the math computer labs will lessen the possibility of backsliding.

**Timeline**

**SUMMER 2010**

- Attend Changing the Equation conference
- Establish redesign team
- Identify content of the modules and the specific learning objectives
- Select and begin customizing a textbook
- Work with Pearson to establish a MyLabsPlus site
- Work with IT to plan locations of emporiums and computer classrooms and ensure electrical capacity, cabling, bandwidth, etc, are suitable
- Investigate software/hardware to track student attendance in open lab via student ID card swipe and produce reports to each instructor
- Resolve interface issues between MyMathLab and Student Information System to record module completion data for each student
- Submit Final Proposal for Changing the Equation Grant

**FALL 2010**

- Create MyMathLab master course with pretests, homework assignments, quizzes, practice tests, posttests, and assessment questions
- Edit PowerPoint tutorials for each unit
- Create “notes outlines” for each unit for the students to complete
- Create course syllabus
- Create instructor policies/procedures/best practices guidelines
- Create student course checklist/gradesheets
- Create a survey to assess students’ attitude changes towards math
- Select slogan for the redesign project and implement a publicity campaign with posters, flyers and meetings with faculty, counselors and students to promote awareness of the upcoming redesign
• Determine which modules are needed for each degree program or gateway credit math course
• Hire instructional assistants and tutors and provide training
• Finalize space allocations and furniture and computer purchases for 1 computer classroom per campus and small emporium at each campus
• Receive and incorporate feedback from all math faculty at all steps

SPRING 2011

• Run pilot sections at each campus (total of 30 sections)
• Troubleshoot as glitches occur
• Monitor peak times of usage in the math computer labs and adjust staffing schedules as needed
• Administer 30 or more common test questions for students in pilot sections and students in parallel traditional sections

SUMMER 2011

• Review results from spring pilot and implement appropriate changes for summer when feasible, or for upcoming fall
• Review assessment results from spring, and run the same assessment again for summer sections
• Finalize space allocations and furniture and computer purchases for 1 or 2 additional computer classrooms and full emporium at each campus
• Hire additional instructional assistants and tutors needed for full implementation
• Train all instructors and tutors who will be involved with the course in the fall

FALL 2011

• Fully implement the redesign at all campuses
• Monitor peak times of usage in the math computer labs and adjust staffing schedules as needed
• Conduct ongoing training and monitoring
• Incorporate assessment results into improving student learning

Project Budget

The $40,000 grant funds will be spent on a combination of reassigned time for one lead team member per campus and for the MyMathLab administrator during the fall semester, and furniture for converted spaces to accommodate computer classrooms and math computer labs at the campuses. The proposed breakdown is as follows:

Five Developmental Math Managers $9,651
  total of 10.3 credit hours of reassigned time, valued at $937 per credit

MyMathLab Administrator $13,118
  14 credit hours of reassigned time, valued at $937 per credit
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