The National Center for Academic Transformation

Changing the Equation: Facts at a Glance Narrative

by
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Changing the Equation (CTE) is a major program to engage the nation's community colleges in a successful redesign of their remedial/developmental math sequences. Each institution participating in the program will improve student learning outcomes while reducing costs for both students and institutions using NCAT's proven redesign methodology.

NCAT has accumulated a significant amount of data about these institutions' existing developmental math programs, which, we believe, are indicative of the national state of developmental math instruction at two-year institutions. We thought you would find these data of interest. The article below summarizes these data and provides links to a number of specific data charts.

In addition, while all 38 projects will redesign their developmental math sequences using the same pedagogical principles, there are differences among them in the ways in which they will implement their redesigns. This article also summarizes these differences and provides links to charts that list specifics for each institution.

What is the scope of *Changing the Equation*?

Changing the Equation is a large-scale redesign project which will impact about 120,000 students annually at 38 participating two-year institutions in its first year of full implementation. The total number of individual mathematics courses that will be redesigned is 114, and the total number of individual sections that will be redesigned is 4,531. These courses currently enroll about 112,000 students.

After the redesign, the total number of sections offered will be 3,416 enrolling about 120,000 students. This means that the number of developmental math sections offered at these institutions will be reduced by about 25% while the student enrollment will increase by about 5.5%.

Are the *Changing the Equation* institutions representative of the nation's community colleges?

The participating institutions appear to be fairly representative of the nation's community colleges but are somewhat skewed toward larger institutions:

- 31% of community colleges have a fall headcount of less than 2,000 students; for CTE it's 18%.
- 36% of community colleges have a fall headcount between 2,000 and 6,000 students; for CTE it's 39%.

- 27% of community colleges have a fall headcount between 6,000 and 20,000 students; for CTE it's 37%.
- 5% of community colleges have a fall headcount between 20,000 and 60,000 students; for CTE it's 5%.

What are the current student success rates at the 38 participating institutions?

Among the *Changing the Equation* institutions, the average percentage of students who receive a grade C or better rate in developmental math in the spring semester is 48.2%. In the fall semester, that rate is 50.7%.

Passing rates in spring terms are typically lower than in fall terms since spring includes those who failed to pass in fall, math avoiders, etc. In spring 2010, 59% of students among the *Changing the Equation* institutions had a success rate of less than 50%. In fall 2009, that percentage was 46%.

How many developmental math courses are currently offered in each sequence, and how will that number change after redesign?

Most community colleges in the U.S. offer a series of remedial and developmental courses taught primarily in traditional classroom settings in a semester or quarter format. Weaker students may be required to complete a significant number of full terms of coursework prior to advancing into regular college-level courses. Further, students are required to take an entire course even though they may only be deficient in a portion of the topics. All students are required to learn at the same pace and with the same instructional strategies as the entire class.

Although developmental math is largely viewed as a relatively coherent body of content, the number of courses that cover that content varies considerably. While the majority of the 38 institutions offer a two- or three-course sequence, about a quarter of the institutions offer between four and six developmental math courses.

Traditional Courses

- 13 institutions (34%) offer 2 courses.
- 17 institutions (45%) offer 3 courses.
- 5 institutions (13%) offer 4 courses.
- 1 institution (3%) offer 5 courses.
- 2 institutions (5%) offer 6 courses.

Since all but one of these institutions offer courses on a semester basis, the time that students must remain in developmental math before moving on to a college-level math course can be considerable.

After the redesigns are complete, the majority of the institutions will offer a one- or two-course sequence, and no institution will offer more than four courses. Half of the institutions will keep the number of courses the same, and half will reduce the number of courses they offer.

Redesigned Courses

- 12 institutions (32%) will offer 1 course.

- 11 institutions (29%) will offer 2 courses.
- 13 institutions (34%) will offer 3 courses.
- 2 institutions (5%) will offer 4 courses.

Five of the institutions will follow the example of Jackson State Community College and offer one or more "shell" courses. Shell courses have no topics and no credits associated with them. They are simply devices to allow students to enroll from one term to another. Jackson State calls these shell courses Developmental Math I, Developmental Math II and Developmental Math III. Any student in any given shell course can be studying any topic in the total developmental math sequence.

Since all *Changing the Equation* redesigns will allow students to move from one course to another as soon as the content has been mastered, student progress through the developmental sequence will be much more rapid.

How many modules will each institution create?

NCAT has learned that the combination of a modularized curriculum (rather than a course-based curriculum) and a mastery-based learning strategy (rather than "you get it or you don't and, if you don't, you start over") is critical to increasing success in developmental math. Because learning in these skills-based courses occurs in specific increments and the time required to master each increment varies from person to person, a course-based system lacks the flexibility that can lead to greater student success. Thus, an important feature of each redesign conducted as part of *Changing the Equation* will be to allow students to start anywhere in the developmental course sequence based on their learning needs. Students will progress through content modules at a faster pace if possible or at a slower pace if necessary, spending the amount of time needed to master the module content.

The number of modules created by the *Changing the Equation* participants varies considerably:

- 5 institutions (13%) will create between 5 and 9 modules.
- 11 institutions (29%) will create between 10 and 13 modules.
- 14 institutions (37%) will create between 14 and 18 modules.
- 8 institutions (21%) will create between 20 and 31 modules.

Which version of the Emporium Model will predominate?

In redesigning developmental and introductory mathematics courses, NCAT's partner institutions have found that the Emporium Model has consistently produced spectacular gains in student learning and impressive reductions in instructional costs. All participants in *Changing the Equation* will implement the Emporium Model. They will, however, do so in various ways.

Prior to the launch of *Changing the Equation*, three versions of the Emporium Model have been successful: 1) a flexible version, 2) a fixed version, and 3) a combination of the fixed and flexible versions.

In all three versions, mandatory attendance (e.g., a minimum of three hours weekly) in a computer lab or computer classroom ensures that students spend sufficient time on task and receive on-demand assistance when they need it. In all three versions, mandatory weekly group

meetings enable instructors to follow up where testing has identified weaknesses, emphasize particular applications or build community among students and with instructors.

At most four-year institutions, the flexible version has predominated. This means that while a minimum number of lab hours are mandatory, they may be completed at any time at the student's convenience.

At Jackson State Community College, the fixed version—that is, mandatory lab hours scheduled by the institution for student cohorts—was successfully implemented. Cleveland State Community College developed the third version—that is, three mandatory hours are required each week but they are a combination of one fixed meeting, one flexible hour in the lab and one additional hour spent working with the software from anywhere (e.g., from home.)

Changing the Equation institutions will implement the Emporium Model in the following ways:

- 23 institutions (61%) will implement a fixed version, requiring a range of 2.5 to 6 hours of student participation in a lab or computer classroom each week.
- 2 institutions (5%) will implement a flexible version, requiring 2 to 3 hours of participation in a lab plus 1 hour in a focus group each week.
- 13 institutions (34%) will implement a combination of the fixed and flexible versions, requiring a range of 3 to 5 hours of participation each week.

Which commercial software packages will be used?

All 38 of the participating institutions will base their redesigns on using instructional software readily available in the commercial marketplace. The success of developmental and college-level math redesigns at NCAT partner institutions over the last decade, impacting hundreds of thousands of students, have demonstrated beyond a shadow of a doubt the efficacy of using commercial materials to improve student learning while reducing instructional costs.

In *Changing the Equation*, four commercial software packages will be utilized: ALEKS, Carnegie Learning, Hawkes Learning Systems and MyMathLab.

How will student learning outcomes be assessed?

Each of the 38 institutions will measure the impact of the redesign on student learning by comparing learning outcomes in the traditional format with learning outcomes in the redesigned format.

- 15 institutions will compare scores on common final examinations.
- 17 institutions will compare performance on common content items selected from final examinations.
- 1 institution will compare performance on pre- and post-tests.
- 6 institutions will compare both final exam and pre/post test scores.

(There are 39 institutions listed because one institution will use different assessment methods in different courses.)

What does it cost to deliver developmental math in the traditional format at these community colleges?

The total cost to deliver developmental education in the traditional format at the 38 institutions is $22.5 million. This figure is based on 2009-2010 salaries. This total cost translates to an average of about $221 per student enrollment.

Cost of traditional developmental math programs by institution:

- At 6 institutions (16%), the cost is between $1m and $2.6m.
- At 8 institutions (21%), the cost is between $500,000 and $1,000,000.
- At 21 institutions (55%), the cost is between $100,000 and $500,000.
- At 3 institutions (8%), the cost is $100,000 or less.

Cost of traditional developmental math programs by cost-per-student:

- At 3 institutions (8%), the cost-per-student is $400 or more.
- At 5 institutions (13%), the cost-per-student is between $300 and $400.
- At 12 institutions (32%), the cost-per-student is between $200 and $300.
- At 8 institutions (21%), the cost-per-student is between $150 and $200.
- At 10 institutions (26%), the cost-per-student is between $100 and $150.

What will it cost to deliver developmental math in the redesigned format at these community colleges?

The total cost to deliver developmental education in the redesigned format at the 38 institutions is projected to be $17.7 million. This total cost translates to just over $161 per student enrollment.

Cost of redesigned developmental math programs by institution:

- At 4 institutions (11%), the cost is projected to be between $1m and $2.6m.
- At 5 institutions (13%), the cost is projected to be between $500,000 and $1,000,000.
- At 23 institutions (61%), the cost is projected to be between $100,000 and $500,000.
- At 6 institutions (16%), the cost is projected to be $100,000 or less.

Cost of redesigned developmental math programs by cost-per-student:

- At no institution is the cost-per-student projected to be more than $350.
- At 4 institutions (11%), the cost-per-student is projected to be between $300 and $350.
- At 6 institutions (16%), the cost-per-student is projected to be between $200 and $300.
- At 6 institutions (16%), the cost-per-student is projected to be between $150 and $200.
- At 22 institutions (58%), the cost-per-student is projected to be between $100 and $150.

What is the total projected amount of cost savings generated by the program?

The total cost of developmental education in the redesigned format is projected to be $17.7 million. This total cost translates to just over $161 per student enrollment. Thus, the total projected savings attributable to the redesigns will be about $4.8 million. This figure is also based on 2009-2010 salaries.

Note: NCAT's costing methodology uses the following approach. Prior to beginning their redesigns, each team analyzed the costs of the traditional format of the course during AY 2009-10. Each project also projected what their savings would be as a result of the redesign in the first year of full implementation, AY 2011-2012 using the same salary figures (from AY 2009-2010). Were one to use actual 2011-2012 salaries, the effect may be to "deflate" the savings simply because of salary increases at the institution between the two timeframes. (Example: instructor salaries in 2009-10 = $30,000; instructor salaries in 2011-12 = $32,000.) The reason for using the same baseline salary figures rather than the actual salaries is to understand the effect of the structural changes made in the course on cost and to isolate the impact of the redesign on those changes.

The average projected reduction in the cost-per-student is about 27%.

- 8 institutions (21%) project a reduction in the cost-per-student of 15% or less.
- 12 institutions (32%) project a reduction in the cost-per-student of between 15% and 30%.
- 13 institutions (34%) project a reduction in the cost-per-student of between 30% and 40%.
- 5 institutions (13%) project a reduction in the cost-per-student of between 40% and 55%.

NCAT calculates each institution's projected cost reduction in two ways: the total dollar decrease and the decrease in the cost-per-student. The average reduction in total dollars is 24.6% whereas the average reduction in the cost-per-student is 27.5%. What accounts for the difference?

The impact of planned enrollment growth at some of the institutions accounts for the difference in the average cost reductions. Most of the institutions will decrease the cost of offering the course(s) and hold enrollment constant. Under these conditions, the percentage decrease in the total dollar cost and the cost-per-student is the same.

When an institution plans to increase enrollment, however, the percentage decrease in the cost-per-student will be different from the percentage decrease in the total dollars. While the total cost could increase, particularly if the enrollment increase is large, or decrease somewhat, the cost-per-student will decrease even more since more students are being served with fewer resources than would have been needed under the traditional model.

How will cost reduction be achieved by the participating institutions?

There are two primary ways that cost reduction will be achieved: 1) by increasing section size, and 2) by increasing the number of sections that full-time and adjunct faculty count toward their load. Both of these strategies will be implemented without increasing faculty workload because of the elimination of repetitive tasks such as hand-grading homework, quizzes and exams.

Increasing section size:

Thirty-one of the 38 institutions plan to reduce costs by increasing section size.

In the traditional format, all institutions offer developmental math in section sizes of ~30 or less:

- 11 institutions (28%) have section sizes of 20 or less.
- 25 institutions (64%) have section sizes of between 20 and 30.
- 3 institutions (8%) have section sizes of 30 or 31.

In the redesigned format, 70% will have section sizes of 30 or more:

- 12 institutions (31%) will have section sizes of less than 30. (vs. 100% in the traditional).
- 8 institutions (21%) will have section sizes of 30 to 35. (vs.0% in the traditional).
- 19 institutions (49%) will have section sizes of 40 to 60. (vs. 0% in the traditional).

(There are 39 institutions listed because one institution has different section sizes for different courses.)

Increasing the number of sections counted in load:

Seven institutions plan to increase the number of sections that counts as a full load while keeping section size the same or decreasing section size. The number of sections that will count as a full load will increase by 30% to 100%. (Example: In the traditional format, a full-time faculty member taught 10 sections per year; in the redesigned format, he/she will teach 12, 13, 15 or 20 sections per year.)

- 2 of these 7 institutions will also pay adjunct faculty teaching four credits of the redesigned developmental math the equivalent of three credits of traditional developmental math.

Increasing section size and the number of sections counted in load:

- 3 institutions will both increase section size and increase the number of sections counted in a full-time faculty member's load.
- 1 institution will both increase section size and pay adjuncts teaching two sections of the redesigned developmental math the equivalent of one section of traditional developmental math.)

Why is the 28% average reduction lower than NCAT's 37% average?

The average cost reduction in 120 completed NCAT redesigns has been about 37% whereas the average cost reduction in the *Changing the Equation* projects is projected to be about 28%. What accounts for the difference?

Despite their utilization of the cost strategies described above, a large number of the redesigns plan to increase the proportion of full-time faculty teaching developmental math:

- The total number of traditional sections offered at the 38 institutions is 4,185. Of these 1,623 (39%) are taught by full-time faculty and 2,562 (61%) are taught by adjuncts.

- After redesign, the total number of sections planned to be offered is 3,159. Of these, 1,377 (44%) will be taught by full-time faculty, and 1,782 (56%) will be taught by adjuncts.

A five percentage point swing in full-time/adjunct ratios may not seem like a lot, but since full-time faculty are generally paid about three to four times as much per section as adjunct faculty, the impact of this shift is quite dramatic.

Currently, the proportion of full-time faculty teaching developmental math is less than 50% at the majority of institutions:

- At 10 institutions (26%), the proportion of FT faculty teaching developmental math is less than 25%.
- At 17 institutions (45%), the proportion of FT faculty teaching developmental math is between 25% and 50%.
- At 11 institutions (29%), the proportion of FT faculty teaching developmental math is more than 50%.

In the redesigns, 55% of the institutions (N=21) plan to increase the proportion of full-time faculty teaching developmental math, ranging from a 6% to a 161% increase. At nine institutions (24%), the full-time/part-time ratio will stay the same. Eight institutions (21%) plan to decrease the proportion of full-time faculty, ranging from an 8% to a 71% decrease.

Conclusion

While *Changing the Equation* is at an early stage, we can draw a number of preliminary conclusions. The first is that currently there appears to be no relationship between the amount of dollars spent on developmental math and the success rates achieved. The current cost of offering developmental math varies widely (from $100 to $400 per student) with no concomitant impact on the outcomes achieved. Throwing money at the problem of abysmal pass rates in developmental math is not a solution. In fact, the participating institutions will follow the example of their NCAT predecessors and reduce their costs while improving outcomes. These cost reductions will be achieved, in many cases while *increasing* the percentage of full-time faculty teaching developmental math and without increasing faculty workload.

Second, it is absolutely clear that the developmental math commercial marketplace is sufficiently mature to support these redesigns with high-quality instructional materials at a reasonable cost. Access to reasonably priced software for developmental math students is a non-problem. Thanks to the availability of this software, faculty can focus on pedagogy rather than materials creation. Faculty can also work with more students due to the capabilities of this of software--they can work smarter not harder.

Third, despite the association of the Emporium Model with the need for a large lab due to its successful implementation at places like Virginia Tech, LSU and the University of Alabama, we now know that it can be implemented in relatively small spaces and at relatively small institutions. The majority of the Changing the Equation institutions will implement the model in small labs or small computer classrooms.

Finally, the size of the target population of *Changing the Equation* (120,000 students) makes this program the largest developmental math reform project ever conducted. Assuming that

these redesigns replicate the prior successes achieved at NCAT partner institutions, we may well be on the way to solving the developmental math problem throughout the nation.