

## **Increasing Student Success in Developmental and College-Level Mathematics: A Summary of NCAT's Course Redesign Achievements**

### Background

- What does NCAT mean by course redesign? Course redesign is the process of redesigning whole courses (rather than individual classes or sections) to achieve better learning outcomes at a lower cost by taking advantage of the capabilities of information technology. Course redesign is not about putting courses online. It is about rethinking the way we deliver instruction, especially large-enrollment core courses, in light of the possibilities that new technology offers.
- NCAT's [Program in Course Redesign](#), funded by the Pew Charitable Trusts, 1999 – 2003, demonstrated that it is possible to improve student learning while reducing instructional costs in higher education. Thirty institutions redesigned large-enrollment, introductory courses; seven projects were in mathematics.
- NCAT's [Roadmap to Redesign program](#) (R2R), funded by FIPSE, 2003 – 2006, introduced a streamlined course redesign methodology based on what was learned in the Pew-funded program and expanded course redesign adoption to 20 additional institutional projects, 12 of which were completed. Of those, seven were in mathematics.
- NCAT's [Colleagues Committed to Redesign](#) program (C2R), funded by FIPSE, 2006 – 2009, expanded course redesign adoption and completed 21 course redesigns, seven of which were in mathematics.
- NCAT's [System- and State-wide Redesign Initiatives](#), funded by sponsors, 2006 – 2010, expanded the number of course redesigns to an additional 54 institutions, 47 of which have been or will be completed. Of those, 14 are in mathematics.
- Of those 49 large-scale course redesign projects in mathematics, most involved more than one course. Of those projects that initially involved one course, most have gone on to redesign additional mathematics courses.

### Observations

- From working with large numbers of students, faculty and institutions over the past 10 years, NCAT understands what works and what does not work in improving student achievement in both developmental and college-level mathematics.
- The pedagogical techniques leading to greater student success are equally applicable to both developmental and college-level mathematics.
- The underlying principle is simple: Students learn math by doing math, not by listening to someone talk about doing math.

- Interactive computer software combined with personalized, on-demand assistance and mandatory student participation are the key elements of success.
- NCAT calls this model for success, the Emporium Model (named after what the model's originator, Virginia Tech, called its initial course redesign.)

Outcomes Achieved (See the attached charts for supporting data)

- The outcomes of nine college-level math redesigns and 13 developmental math redesigns demonstrate NCAT's understanding of what will improve student success while reducing instructional costs in developmental and college-level mathematics.
- Enrolling ~13,000 students annually, nine college-level math redesigns increased student success (final grade of C or better) by 25% on average, with a range of 7% to 63%.
- These same nine redesigns reduced the cost of instruction by 37% on average, with a range of 15% to 77%.
- Enrolling ~10,000 students annually, 13 developmental math redesigns increased student success (grades of C or better) by 51% on average, with a range of 10% to 135%.
- These same 13 redesigns reduced the cost of instruction by 30% on average, with a range of 12% to 52%.

Observations

- NCAT has collected data on direct comparisons of student learning outcomes (e.g., common final exams, common pre/post tests, etc.), which we require of all projects, that support these achievements. We have listed comparative success rates in the interest of brevity and comparability.
- Comparing grades of C or better most likely understates the achievements of the redesigns since grading standards under the redesigns are higher and more consistent than under the traditional format—e.g., no curving, no partial credit, consistent performance standards.
- NCAT is unaware of any reform examples that show increased student learning in mathematics at a reduced cost of instruction other than its course redesign projects.
- NCAT is unaware of any significant reform examples (large numbers of students) that show increased student learning other than its course redesign projects.
- Together with its partner institutions, NCAT is now in a position to work with new institutions to replicate the successes achieved thus far.

## Supporting Documents

- An article by Carol Twigg, "Math Lectures: An Oxymoron?" that summarizes what NCAT has learned about improving student success in mathematics:  
<http://www.thencat.org/PlanRes/Math%20Lectures%20Editorial.htm>.
- An [article](#) by Carol Twigg, "Increasing Success in Developmental Math: Following the NCAT Playbook," that describes a recent outstanding redesign project in developmental math in Tennessee.
- An article by NCAT's Redesign Scholars, "How to Structure a Math Emporium: Frequently Asked Questions," that codifies many of NCAT's lessons learned about successful mathematics redesign:  
<http://www.thencat.org/R2R/AcadPrac/CM/MathEmpFAQ.htm>.