



Cost-Effective Strategies for Improving Student Performance: Redesign + MyMathLab® in Higher Education Mathematics Courses

In the face of continued funding reductions, rising enrollments, and increased demand for financial aid, today's higher education administrators are looking for ways to contain costs without sacrificing academic quality. This report details how eight two- and four-year institutions are using National Center for Academic Transformation (NCAT) redesign methodology and Pearson's MyMathLab to support and improve some of their largest introductory math courses.

NCAT Redesign + MyMathLab: A Proven Solution

The National Center for Academic Transformation

Founded and led by Dr. Carol A. Twigg, NCAT is an independent, nonprofit organization that promotes the redesign of whole courses by using information technology to produce better learning outcomes at reduced cost. More than putting courses online, redesign is about rethinking the way technology can help deliver instruction and help students learn.

NCAT's initial program, Program in Course Redesign, ran from 1999 to 2003 at 30 two- and four-year colleges. The 30 redesigned courses enrolled more than 50,000 students annually. The results were exceptional and proved that through more-effective use of information technology, it *is* possible to improve quality and reduce cost in higher education. Twenty-five of the 30 course redesign projects showed significant increases in student learning; and all 30 institutions reduced their costs by an average of 37 percent, ranging from 20 percent to 77 percent, representing a collective annual savings of about \$3 million.

Since that first program, NCAT has furthered its mission through a number of initiatives designed to support educational systems interested in improving quality and using resources more effectively. Recent and ongoing initiatives include Roadmap to Redesign, Colleagues Committed to Redesign, and redesign programs for entire state educational systems.

All NCAT initiatives involve an institution's selecting one of six distinct redesign models: Buffet, Emporium, Fully Online, Linked Workshop, Replacement, and Supplemental. Certain models have proved over time to be more appropriate for certain disciplines. In mathematics, the Emporium (Lab) model has consistently produced both impressive student gains and cost savings. The Replacement (Hybrid) model has also been used to redesign large-enrollment mathematics courses. Definitions of the models, taken from the NCAT Web site, follow.

Buffet model Customizes the learning environment for each student based on the student's background, learning preference, and academic/professional goals and offers students an assortment of individualized paths for all students to reach the same learning outcomes.

Emporium (Lab) model Eliminates most or all class meetings and replaces them with a learning resource center featuring online materials and on-demand personalized assistance, using either an open attendance model or a required attendance model depending on student motivation and experience levels.

Fully Online model Eliminates all in-class meetings and moves all learning experiences online, using Web-based, multimedia resources, commercial software, automatically evaluated assessments with guided feedback, and alternative staffing models.

Linked Workshop model Provides remedial/developmental instruction by linking workshops that offer students just-in-time supplemental academic support in core college-level courses.

Replacement (Hybrid) model Reduces the number of in-class meetings and replaces some in-class time with out-of-class, online, interactive learning activities and makes significant changes in remaining in-class meetings.

Supplemental model Retains the basic structure of the traditional course and supplements lectures and textbooks with technology-based, out-of-class activities, and changes what goes on in the class by creating an active learning environment within a large lecture hall setting.

For detailed information about NCAT programs and initiatives, visit www.theNCAT.org



Pearson's MyMathLab

Since 2001, more than 1,850 higher education institutions have integrated Pearson's MyMathLab into their seated-classroom and online programs—and achieved positive results in the form of increased pass rates, increased retention rates, increased levels of student success in subsequent courses, and increased achievement by underserved populations.

The linchpin of MyMathLab's success is its focus on the student. MyMathLab is customizable, can be used in self-paced or directed courses, is deliverable anywhere with Web access, and is adaptable to each student's level of knowledge. Unlike the traditional, lecture-based model of course delivery, wherein students are passive recipients of information, MyMathLab enhances course delivery by engaging students in active learning. They learn at the time, in the place, and according to the style and pace that best suit them.

Faculty, too, benefit from MyMathLab. By transferring the tasks of content delivery, student assessment, and grading to a powerful suite of course management tools, MyMathLab enables faculty to spend more hands-on time with students.

The Power of Two: Student Achievement and Cost Savings

A clear examination of their foundational philosophies reveals why the one-two punch of redesign + MyMathLab is an institution-wide success: both are grounded in methods and models that improve the quality of student learning. Use of MyMathLab in an NCAT redesign successfully creates the following proven characteristics for student achievement:

- Active learning
- Student engagement with the material
- Reduced number of lectures/class meetings
- On-demand, individualized assistance
- Round-the-clock access to online learning resources
- Adaptability to differences in learning style
- Course management software to monitor student performance
- Consistent practice and reinforcement
- Immediate feedback from automated grading of homework, quizzes, and exams

Redesign + MyMathLab benefits aren't limited to student success; they include cost savings as well. By constructing scaled implementations consisting of various kinds of instructional personnel, redesign + MyMathLab courses increase the amount of time faculty have for face-to-face, academic tasks and free them from tedious and cost-intensive logistical ones. This can positively influence an institution's cost per student in the following four ways:

1. Newly available faculty time, which can be reassigned to other courses or responsibilities
2. Actual dollar savings
3. The capacity to serve more students
4. A decline in faculty workload for the course

The institutions included in this report employed a number of time-saving and structural tactics, as dictated by their particular goals. The tactics included:

- Coordinating development and delivery of the whole course and sharing instructional tasks
- Replacing hand grading of homework, quizzes, and exams with automated grading
- Replacing human monitoring with course management software for monitoring of student performance and course administration
- Reducing the number of sections and increasing section size
- Reducing the number of graduate teaching assistants involved in the course

Money saved through course redesign is retained within the department and applied to further improving teaching and learning experiences for both students and faculty via:

- Continuous course improvement and/or redesign of other courses
- Greater range of offerings at upper-division or graduate level
- Serving more students with the same resources
- Offering distance-learning sections
- Reduction in teaching load and more time for research
- Improvement in training of part-time faculty

Redesign + MyMathLab In Action

Successful redesign + MyMathLab courses have been conducted across the breadth of learning environments, from community colleges to public and private colleges and universities, to state and system educational authorities. Courses have included the entire spectrum of mathematics and statistics courses, from basic math to calculus.

Community Colleges

While the fiscal environment affects public and private institutions alike, community colleges are particularly vulnerable. Limited resources combined with a trend toward rapidly increasing student enrollments—including nontraditional, remedial, limited-English-speaking, and disabled students—can test the limits of a community college’s operating budget. Following are descriptions of how three community colleges are employing the redesign + MyMathLab model. Their results are powerful, inspiring, and—for Cleveland State Community College—award-winning. See Table 1 for more community college cost-savings data organized by course.

Cleveland State Community College

Cleveland State Community College (CSCC)

Cleveland State Community College is part of the Tennessee Board of Regents’ 2008 developmental studies redesign initiative. With the primary goal of addressing low completion rates, the institution redesigned Basic Math, Elementary Algebra, and Intermediate Algebra by using the Emporium model and MyMathLab.

The redesign put students to work in computer classrooms and a large computer lab, increased section offerings, and reduced class sizes, thereby shifting the departmental focus to more personalized learning and instruction. CSCC anticipated an overall cost reduction of 21 percent, from an average cost per student of \$222 to \$175, representing more than \$58,000 in savings annually. Additional savings were anticipated from a \$5,000 reduction in copying costs.

In just one year, student results have soared: developmental math completion rates increased 47 percent; the institution met its cost reduction goals; and CSCC was awarded the 2009 Instructional Programs and Services Bellwether Award from the Community College Futures Assembly. “MyMathLab has been a major factor in the success of our program,” says John Squires, CSCC’s math department chair. “We use 100 percent online homework and grading, which gives the students instant feedback and frees the instructors to spend their time helping students.”

CSCC plans to continue its success by redesigning College Algebra, Finite Math, and Introductory Statistics this year—for another \$29,000 in savings. Squires reports that redesign + MyMathLab cost savings will remain in the mathematics department to make changes and improvements in the courses as needed.



Hagerstown Community College (HCC)

Hagerstown Community College is a 2007/08 participant in NCAT’s Colleagues Committed to Redesign program and is one of the fastest-growing community colleges in Maryland. HCC chose to pilot the Replacement model redesign with MyMathLab to support a demand for College Algebra that is outpacing the college’s available classroom space. By decreasing the number of sections from 33 to 19 and increasing section sizes from approximately 25 students to 40, HCC administration projected a 54 percent decrease in cost per student, from \$211 to \$97.

According to HCC’s 2008 progress report, the redesign “has produced equal to better student performance while saving operating costs and making classrooms available for other departments.” HCC moved ahead with full implementation in spring 2008. Savings incurred by the redesign + MyMathLab will remain in the math department—it will be used to support expanded use of the Collegiate Assessment of Academic Proficiency test and to link students back to their Computer-Adaptive Placement Assessment and Support Services Placement tests.



Niagara County Community College (NCCC)

Niagara County Community College is in the early implementation stage of redesigning Introduction to Statistics using the Replacement model + MyStatLab.™ Previously taught in a traditional lecture format, the course has the largest enrollment of all mathematics courses at NCCC but faced low success rates and inconsistent instructional delivery across sections.

Institution	Course	Average Cost per Student		Savings per Student	Percent Reduction	Annual Savings
		Traditional	Redesign + MML			
Cleveland State Community College*	Basic Math, Elementary Algebra, Intermediate Algebra	\$222	\$175	\$47	21 percent	\$63,000
Jackson State Community College*	Basic Math, Elementary Algebra, Intermediate Algebra	\$181	\$86	\$95	52 percent	–
Hagerstown Community College*	College Algebra	\$211	\$97	\$114	54 percent	–
Harry S. Truman College*	College Algebra	\$246	\$140	\$106	43 percent	–
Niagara County Community College*	Introduction to Statistics	\$339	\$162	\$177	52 percent	–

Table 1. Cost Savings at Community Colleges Employing Redesign + MyMathLab, Organized by Course

* Projected cost savings. Actual savings may vary. Final results to be reported in January 2010 update.

The redesign + MyStatLab model will provide a structure for consistent, quality delivery, as well as the opportunity for students to work through problems at their own pace, receive immediate feedback, and obtain individualized assistance.

NCCC projects a reduction in instructional cost per student from \$339 to \$162, a 52 percent savings. Full-time faculty members will partner with adjunct faculty to team-teach two sections simultaneously. Final outcomes will be assessed in spring 2009.

Public and Private Institutions

Some of the first redesign + MyMathLab results were observed in large-enrollment, four-year public and private institutions. Today they continue to reap positive results. Following are descriptions of how five four-year institutions are employing the redesign + MyMathLab model. See Table 2 for more cost-savings data from four-year institutions.



Austin Peay State University (APSU)

APSU redesigned Elementary Algebra and Intermediate Algebra by using the Linked Workshop model. Under this model, the developmental courses, which carry no university credit, were eliminated; and enhanced sections of two core college-level courses—Fundamentals of Math and Elements of Statistics—were created in their place. The core courses are linked to workshops in which students requiring developmental instruction receive supplemental academic support on a just-in-time basis via MyMathLab.

Preliminary results from fall 2008 indicate that by eliminating the developmental math courses and their 52 accompanying sections and replacing them with 13 enhanced sections of Fundamentals of Math and 21 enhanced sections of Elements of Statistics, APSU not only saved \$110,000 a year but also freed up 70 additional classrooms per week and more than doubled its student success rate.

According to APSU's progress report, cost savings will be used to expand the mathematics department, improve academic advising, and improve the collection of data about student retention initiatives.



Jackson State University

Jackson State University is presently in the early implementation stage of a larger, Mississippi Institutions of Higher Learning Course Redesign Initiative. As such, Jackson State will be redesigning Intermediate Algebra and College Algebra by using the Replacement model + MyMathLab/MathXL® in the pilot phase and then gradually segueing to the Emporium model + MyMathLab/MathXL. Both courses have used MyMathLab and MathXL for the past two years and, as a result, have experienced a decline in drop/failure/withdrawal rates and an improvement in final exam scores. Redesign + MyMathLab/MathXL will enable Jackson State to address the persistent issues of (1) increased enrollments and (2) students with different levels of course preparedness.

Redesign plans include decreasing the number of College Algebra sections from 59 to 29 and increasing section size from approximately 30 to approximately 60 students each. Plans for Intermediate Algebra include decreasing the number of sections from 29 to 15 and increasing section size from approximately 30 to approximately 60 students each.

Jackson State projects that the redesign + MyMathLab/MathXL will reduce the cost per student for College Algebra from \$173 to \$135, a 22 percent savings; and reduce the cost per student for Intermediate Algebra from \$153 to \$125, an 18 percent savings. These changes will also allow Jackson State to increase enrollment in Intermediate Algebra from 813 to 900 students.



Louisiana State University (LSU)

Louisiana State University was one of the original participants in NCAT's Roadmap to Redesign. In 2005, using the Emporium model + MyMathLab, LSU redesigned College Algebra, a course taken by approximately 5,000 LSU students annually. Primary redesign goals included increasing active student learning, increasing students' opportunities for individualized attention, and decreasing instructors' grading tasks and other administrative tasks.

Section sizes remained the same (40 to 44 students), but the number of class meetings per week was reduced from three to one. Although the cost of adding tutors in the learning center and increasing the amount of time for coordination and systems administration reduced the net savings, in just one year the redesign project resulted in a reduction in cost per student from \$121 to \$78—a 36 percent savings of \$120,700.

LSU administration was equally pleased with the impact that redesign + MyMathLab had on student learning and satisfaction. The fall 2006 final exam median was 78 percent—the highest ever achieved to that date. What's more, student surveys indicated that 89 percent of students think that using MyMathLab helped them learn mathematics; 88 percent would recommend the redesign + MyMathLab model to a friend.

Since its initial pilot in College Algebra, LSU has phased in the Emporium model + MyMathLab for all of its precalculus courses, which have a total annual enrollment of approximately 7,500 students. By scaling the lab infrastructure created by the previous redesign, LSU has achieved even further savings.



University of Central Florida (UCF)

In fall 2007, the University of Central Florida used the Emporium model + MyMathLab to redesign College Algebra, a course with an annual enrollment of more than 4,100 students. Prior to redesign, the course was taught in three modes: large lecture sections, independent sections, and reduced seat-time sections. The student success rate (C or higher) was 65 percent for the whole course and 51 percent in the reduced-seat sections. UCF’s goals for redesign included addressing the low rate of student success and more cost-efficiently serving the course’s large, diverse population.

Redesign plans included decreasing the number of College Algebra sections from 65 to 13 and increasing the size of the sections to an average of 342 students each; using MyMathLab for homework assignments, online quizzes, and student progress monitoring; and requiring at least three hours of lab participation per week. They anticipated reducing the cost per student from \$77 to \$44, a 37 percent reduction. In addition, the department and the university anticipated cost benefits from the increased availability of much needed classroom space for other courses. Initial pilot results indicated a need for more personnel than originally anticipated. UCF administration notes that this will increase the projected cost per student to a yet-to-be-determined figure.

According to UCF’s most recent progress report to NCAT, the redesigned sections had a success rate of 74 percent and a decrease in the withdrawal rate of students in the reduced-seat sections. Student comments included mention of the benefit of working in an environment that was conducive to learning and appreciation for the quick and individualized help they received in the lab. Unforeseen benefits to the redesign + MyMathLab model include an increased level of collaboration and communication among instructors; pedagogical improvement to other courses via proctored online testing and immediate feedback to students in Finite Math, Trigonometry, and Precalculus; and a printing and paper cost savings.

Institution	Course	Average Cost per Student		Savings per Student	Percent Reduction	Annual Savings
		Traditional	Redesign + MML			
Wayne State University	Beginning Algebra	\$185	\$105	\$80	43 percent	\$134,000
Austin Peay State University*	Elementary Algebra, Intermediate Algebra	-	-	-	28 percent	\$57,812
Jackson State University*	Intermediate Algebra	\$153	\$125	\$28	18 percent	-
Southeastern Louisiana State*	Intermediate Algebra	\$201	\$100	\$101	50 percent	-
University of Southern Mississippi*	Intermediate Algebra	\$96	\$76	\$20	21 percent	-
University of Alabama	Intermediate Algebra	\$127	\$82	\$45	33 percent	\$42,870
Georgia State University	College Algebra	\$96	\$87	\$9	9 percent	\$13,545
Jackson State University*	College Algebra	\$173	\$135	\$38	22 percent	-
Louisiana State University	College Algebra	\$121	\$78	\$43	36 percent	-
Oklahoma State University*	College Algebra	\$102	\$74	\$28	27 percent	-
SUNY College at Old Westbury	College Algebra	\$176	\$155	\$21	12 percent	-
University of Central Florida*	College Algebra	\$77	\$44	\$33	37 percent	-
University of Missouri–St. Louis	College Algebra	\$170	\$119	\$51	30 percent	-
University of North Carolina at Greensboro	College Algebra, Precalculus for Business, Precalculus I & II	\$109	\$71	\$38	35 percent	\$64,000
Auburn University*	Precalculus	\$128	\$75	\$53	41 percent	-
University of Idaho	Precalculus	-	-	-	31 percent	\$103,000
Mississippi State University*	Introduction to Statistics	\$133	\$110	\$23	17 percent	-

Table 2. Cost Savings at Four-Year Institutions Employing Redesign + MyMathLab, Organized by Course

* Projected cost savings. Actual savings may vary. Final results to be reported in January 2010 update.



University of Missouri–St. Louis (UM-SL)

University of Missouri–St. Louis redesigned College Algebra by using the Emporium model + MyMathLab in 2005 as part of NCAT’s Roadmap to Redesign program. The primary reason cited for the redesign was low success rates (about 50 percent). Because College Algebra is a required course for students majoring in biology, business, chemistry, computer science, economics, elementary and secondary education, engineering, mathematics, nursing, and physics—which represents about half the student body—the high failure rate in the course was recognized as a leading cause of low student retention and was therefore a major concern for the university. The course had previously been taught traditionally: in a lecture format with paper-based homework, quizzes, and exams.

In the Emporium + MyMathLab redesign, students are required to attend one class meeting a week plus two 120-minute lab sessions at a lab technology center, where they can work on MyMathLab homework problems or obtain help from online tutorials, video lectures, other students, or the tutors and faculty who staff the center. All homework is assigned via MyMathLab, and class meetings are used for introducing new material, providing examples, reviewing past and future assignments, troubleshooting student problems, and ensuring that students are on track.

The impact on student learning and retention was immediate. Students learned more in the redesign + MyMathLab course than in the traditional one. Combined results for two academic years indicated that 56.6 percent of students in the redesigned sections achieved in the top two of six score ranges, while only 31.5 percent of students in the traditional sections did so. The drop/failure/withdrawal rate decreased from 36.7 percent in the 2002/03 academic year before the redesign to 21.6 percent for the 2005/06 academic year, after full implementation.

UM-SL's cost savings were equally as impressive. Reducing the number of sections offered in the course and increasing section sizes from 35 students to 70 reduced the number of personnel required for the course. In addition, the use of MyMathLab substantially decreased the time required for grading homework assignments and quizzes, course management, and record keeping. The university decreased its cost per student from \$170 to \$119—a savings of approximately \$42,000 a year.

Conclusion

Today's stagnating state revenues don't mean that past years' hard-won academic gains are lost. Far from it. Each of the institutions included herein is putting its students' ongoing successes first by making MyMathLab an integral part of its teaching and learning paradigm. MyMathLab ensures that students spend the bulk of their course time doing math problems, that they spend more time on things they don't yet understand and less time on things they've already mastered, and that they receive immediate feedback and round-the-clock assistance when they encounter problems doing math.

Right now may be your biggest opportunity to move your institution forward: to innovate, to streamline, and to implement the kinds of teaching and learning practices that not only consistently reap increased student gains and faculty satisfaction, but also yield exponentially more cost-efficient and sustainable use of resources.

We look forward to updating and sharing final results from these and other institutions at the end of the academic year.

Resources

For more information, please see the following resources:

National Center for Academic Transformation: www.theNCAT.org

Pearson's MyMathLab: www.mymathlab.com

Making the Grade, Version 3

Making the Grade, Version 2

Making the Grade, Version 1

ABOUT PEARSON

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