Improving Learning and Reducing Costs:
Fifteen Years of Course Redesign

by

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In spring 1999, The National Center for Academic Transformation (NCAT) launched the Pew Grant Program in Course Redesign. Funded by an $8.8 million grant from the Pew Charitable Trusts, the program supported colleges and universities in redesigning instruction using technology to achieve quality enhancements and cost savings. Selected from hundreds of applicants in a national competition, 30 institutions redesigned one large-enrollment introductory course each.

The application guidelines laid out the reason for the program:

> Recognizing that tuition increases can no longer be used as a safety valve to avoid dealing with the underlying issues of why costs increase so much, campuses have begun the hard work of cost containment. But after sharpening priorities, sometimes making tough choices in light of those priorities, campuses are still groping for ways to wrestle costs under control.

> At the same time, colleges and universities are discovering exciting new ways of using technology to enhance teaching and learning and to extend access to new populations of students. Most campuses have, however, bolted on new technologies to a fixed plant, a fixed faculty, and a fixed notion of classroom instruction. By and large, colleges and universities have not yet begun to grab hold of technology's promise to reduce the costs of instruction.

> Containing costs—and making use of new technologies to do so—requires challenging the fundamental assumption of the current instructional model: that faculty members meeting with groups of students at regularly scheduled times and places is the only way to achieve effective student learning.

Fifteen years later, the challenge that drove the program is still very much in play. But now, NCAT has proven that it is possible to improve quality and reduce cost in higher education. In partnership with more than 200 colleges and universities—and with support from private foundations, government agencies, and systems of higher education—NCAT has demonstrated how course redesign can offer a broad solution to higher education's historic cost/quality trade-off.

Course Redesign Defined

Course redesign is the process of redesigning whole courses—rather than individual classes or sections—to achieve better learning outcomes at lower costs by taking advantage of the capabilities of information technology.

The quality-improvement strategies leading to greater student success and the cost-reduction strategies leading to more-productive learning environments are equally applicable to all disciplines: mathematics, social science, humanities, natural science, and professional studies. They also work for both introductory and advanced-level courses; on-campus and distance-learning courses; small, medium-sized, and large institutions; two- and four-year colleges; and traditional-age and working-adult students.

Results of Course Redesign

- NCAT and its partner colleges and universities have initiated 195 redesign projects, 80 percent of which were completed.
- Of the 156 completed projects, 72 percent improved student learning outcomes, while 28 percent showed learning equivalent to traditional formats.
- Of the 156 completed projects, 153 reduced their costs by 34 percent on average (ranging from 4 to 81 percent).
- Collectively, the 253 courses that have been redesigned enroll about 250,000 students annually.
- Other positive outcomes include increased course-completion rates, better student attitudes toward the subject matter, and increased student and faculty satisfaction with the new mode of instruction.

ENHANCING QUALITY

Improving Student Learning Outcomes

NCAT's redesign methodology produces consistent evidence of improvements in student learning. For example:

- At Tallahassee Community College, students in a redesigned English composition course scored significantly higher on final essays than students taught using the traditional model, with an average score of 8.34 compared to 7.33 for traditional students. At the same time, the cost per student was reduced from $252 to $145, a 43 percent savings.

- At the University of Central Missouri, the average intermediate algebra final exam score was 63 percent in the traditional format and 85 percent in the redesigned format. Student success rates (a final grade of C or better) increased from 68 percent to 85 percent while the cost per student was reduced from $118 to $103 per student, a 13 percent savings.

Increasing Course-Completion Rates

Many students who begin postsecondary education drop out before completing a degree. High failure rates in freshman courses—on average 15 percent at research universities, 30 to 40 percent at comprehensive universities, and 50 to 60 percent at community colleges—are costly to both institutions and students.

The first year of college is the most critical to a college student's success and to degree attainment, and successful completion of introductory courses is critical for first-year students. NCAT's redesign methodology produces increases in course completion—and thus, overall student retention.

For example:
- Leeward Community College increased its developmental-math completion rates in the course Whole Numbers from 62 to 67 percent, from 45 to 75 percent in pre-algebra, and from

56 to 64 percent in algebra. The cost per student was reduced from $319 to $287, a 10 percent decrease.

- At the University of Maryland Eastern Shore, the number of students who earned a grade of C or better in the traditional chemistry course was 54.5 percent. In the redesigned course, it was 69.4 percent. The cost per student was reduced from $268 to $80, a 70 percent reduction.

Key Quality-Improvement Strategies

Based on our experience over the past 15 years, NCAT has identified seven strategies that are essential to improving the quality of student learning. If *any one* of those strategies is absent, it is unlikely that student success rates will improve. If *all* of the strategies are present, we guarantee that student success rates will improve. The combination of and interaction among *all seven* are what make course redesign so successful.

- *Redesign the whole course and establish greater course consistency across sections*. Any course taught by multiple instructors faces the problem of course drift, which occurs when individual instructors teach the course to suit their interests rather than to meet agreed-upon learning goals for students. This results in inconsistent learning experiences and outcomes. Students are also assessed in a variety of ways, which results in grading inequities and grade inflation.

  Course redesign creates consistent course content and delivery. A team of faculty is responsible for ensuring that all students have the same learning experience. Students are assessed on common outcomes using common assessment methods. Such consistency produces significant improvements in course coherence and quality control.

- *Require active learning*. The three hours that students spend listening to lectures each week in the traditional format could be spent actively engaged with course content. Course redesign replaces lectures and other classroom presentations with an array of interactive materials and activities that move students from passive note-taking to active learning.

  Instructional software and other web-based learning resources engage students with course content. Tutorials, exercises, and low-stakes quizzes provide frequent practice, feedback, and reinforcement of course concepts.

  All resources are in the same online location and can be accessed anywhere, anytime. Software both provides support and frees up in-class time for other active-learning practices such as in-class or online team-based learning and the use of personal response systems ("clickers").

- *Increase interaction among students*. Student-to-student interaction is often inhibited by class size. But as Arthur W. Chickering and Zelda F. Gamson note in their 1987 *Seven Principles for Good Practice in Undergraduate Education*, "Learning is not a spectator sport. Students do not learn much just sitting in classes listening to teachers, memorizing prepackaged assignments, and spitting out answers."

  Within a lecture-hall setting, an active-learning environment can be created by using a combination of group work and clickers. Lecture time can also be replaced with individual and small-group activities that take place in computer labs where faculty, teaching assistants, and/or peer tutors offer students one-on-one assistance. Small online discussion groups enable student interaction.

- *Build in ongoing assessment and prompt (automated) feedback.* In the traditional model, students typically turn in homework that is hand graded and returned days later. Because of the delay, students rarely review their errors and correct their misunderstandings. Course redesign utilizes computer-based assessment strategies. Students receive immediate feedback from tutorials, practice exercises, and guided solutions that are built into software. Every problem or quiz question is graded on the spot, giving students specific information about their performance.

  Course redesign also replaces midterm and final examinations with continuous assessment. Students can be tested regularly on assignments via short quizzes, which they take until they master the material—a "do-it-until-you-get-it-right" approach. Automation of assessment facilitates repeated practice and provides prompt and frequent feedback—pedagogical techniques that research has consistently shown enhance learning.

- *Provide students with one-on-one, on-demand assistance from highly trained personnel.* In the traditional model, students get discouraged and stop doing the work for two reasons. First, they do most of their work without immediate support. Those who don't receive help when they need it give up and do not complete the assignment. Second, students do not ask questions in class because they do not want to admit what they do not understand. Office hours are designed to mitigate that problem, but most students do not take advantage of them.

  Students need help when they are stuck rather than during fixed times or by appointment. Course redesign replaces or supplements lecture time with activities that take place in computer labs, help rooms, and/or online, which are staffed by different levels of personnel. Students seek help from someone with whom they are comfortable. Students cannot live by software alone: They need human contact as well as encouragement to assure them that they are on the right learning path.

- *Ensure sufficient time on task.* "Freshmen don't do optional" is a mantra of successful course redesign. Student participation in all course activities *must be required.* Whenever optional activities are offered, the vast majority of students fail to take advantage of them.

  An incentive for attendance/participation and a penalty for not doing so are both necessary. Attendance/participation typically counts as 5 to 10 percent of the final grade. Students participate more, spend more time on learning activities, and score higher when course credit is at stake.

  While course redesign adds greater flexibility to the times and places of student engagement, the redesigns are *not* self-paced. Students need a concrete learning plan, especially in more-flexible learning environments. Some institutions initially thought of their designs as self-paced, open entry/open exit, but they quickly discovered that students need structure, especially first-year students and those in courses that may be required rather than chosen.

- *Monitor student progress and intervene when necessary.* Requiring attendance and awarding attendance/participation points are essential, but they are only the starting points. Two additional steps need to be taken: First, someone must monitor each student to see who is and who is not meeting the attendance/participation requirement. Second, once those students have been identified, someone must contact them and indicate clearly that they are expected to come to class and do the work.

  Most software packages have excellent tracking features, enabling faculty members and others to monitor the time each student spends using the software and completing

assignments, plus how well the student performs on quizzes and exams. Other options for monitoring student progress include a weekly score sheet or a paper workbook that students are required to maintain. Whatever the method, course personnel must monitor each student's progress and time on task and take appropriate action when needed.

In a July/August 2003 *Change* article, "Improving Quality and Reducing Cost: Designs for Effective Learning," I discussed which quality-improvements strategies were most effective in the first 30 Pew-funded projects, all of which are repeated above. That article concluded:

> People who are knowledgeable about proven pedagogies that improve student learning will find nothing surprising in the above list. Among the *Seven Principles for Good Practice in Undergraduate Education* are "encourage active learning," "give prompt feedback," "encourage cooperation among students," and "emphasize time on task." Good pedagogy has nothing to do with technology, and we've known about good pedagogy for years.

But we also said in 2003, and have since reaffirmed, "What is significant about the faculty involved in these redesigns is that they were able to incorporate good pedagogical practice into courses with *very large numbers of students*—a task that would have been impossible without technology."

REDUCING COSTS

Increasing Capacity

At many institutions, enrollment demand cannot be met through existing delivery modes. Many also cannot hire enough faculty members to accommodate escalating demand for certain subjects, thereby creating academic bottlenecks for students and slowing graduation rates. NCAT's redesign methodology enables institutions to increase student enrollments without increasing associated costs.

For example:
- At Arizona State University, the number of students served in a redesigned organizational-behavior course increased from 270 to 360 students, which reduced the cost per student from $373 to $154, a 59 percent decrease. As new larger classrooms are built, ASU will be able to increase annual enrollment to ~500 from the current 360 without additional resources. Exam scores in the traditional course averaged 67.4 percent; in the redesigned course, they averaged 76 percent.

- At Manchester Community College, section size in developmental math doubled from 25 to 50 students, decreasing the cost per student from $255 to $165, a 35 percent savings. Instructor time needed to grade homework and prepare materials was significantly less. In addition, instructors were assisted in each redesigned section by two or three tutors, allowing ample time to provide assistance to all students. Comparative student scores on common test items went from 34 to 50 percent in elementary algebra and from 49 to 57 percent in pre-algebra.

Freeing Up Resources

Most colleges and universities are trying to deal with budget cuts without diminishing the quality of the student learning experience. Many want to offer additional or new courses or to increase faculty released time for research, renewal, or additional course development but do not have the resources to do so. Course redesign frees resources for these uses.

For example:
- Chattanooga State Community College reduced the number of general psychology sections (18), ranging in size from 18 to 95 students, to six sections of 100 students each. One face-to-face meeting and a variety of online activities replaced lectures. The number of full-time faculty teaching the course was reduced from 10 to 6, and all adjunct instructors were eliminated.

  Students in the redesigned course showed a pre/post-test gain of 11 points versus five points for students in the traditional course. The cost per student decreased from $130 to $42. Because instructors were responsible for three rather than nine hours of lecture per week, they had time to develop and teach new upper-level courses.

- Arizona State University's redesign of the course Women in Society increased class size from 150 or 200 to 400 and reduced the annual number of sections from nine to four. The instructional mix was changed to include fewer regular faculty and more graduate teaching assistants and peer tutors, who worked with small groups online.

  Both midterm and final exam grades increased significantly, while the cost per student went from $78 to $57. The cost savings enabled the department to accommodate student growth and meet the demands of a new graduate program.

Key Cost-Reduction Strategies

The traditional format requires instructors to develop and deliver courses on their own. That format is based on the assumption that small classes are needed to produce learning gains because the instructor must responsible for all interactions.

Course redesign uses technology and assistance from different kinds of personnel for many of these interactions, rather than expecting the instructor to respond to every inquiry, comment, or discussion personally; prepare lectures; and hand grade assignments, quizzes, and examinations.

Share course-development and delivery tasks. When the whole course is redesigned, substantial amounts of time that individual faculty members spend developing and revising course materials and preparing for classes can also be reduced, while achieving greater course consistency. Faculty begin the design process by analyzing the amount of time that each person involved in the course spends on each kind of activity, which often reveals duplication of effort among multiple faculty members.

Make use of interactive-learning resources. When redesign reduces the number of lectures or other classroom presentations that faculty members must prepare for and present and replaces them with interactive and team-based learning strategies, faculty time can be reallocated to other tasks, either within the same course or in other courses. Moving toward greater reliance on interactive learning and student-to-student interaction offers many opportunities for reducing instructional costs.

Take advantage of automated assessment. Automated homework grading, low-stakes quizzes, and exams for subjects that can be assessed through standardized formats increases feedback to students and offloads these activities from faculty. Many redesigns automate all grading; others automate some and hand grade where appropriate. Automated grading and record keeping reduce the cost and improve the quality of feedback.

Utilize course-management systems. Using course-management software makes it possible to reduce costs while increasing the level and frequency of oversight. Sophisticated course-management systems enable faculty to monitor student progress and performance, track time on task, and intervene on an individualized basis.

Using course-management systems also radically reduces the amount of time that faculty members spend on non-academic tasks such as calculating and recording grades, posting changes in schedules and course syllabi, sending out announcements to students, and creating and revising course materials.

Substitute less expensive staff. By constructing a support system that comprises various kinds of instructional personnel, institutions can apply the right level of human intervention to particular kinds of student problems. Highly trained (and expensive) faculty members are not needed to perform all the tasks associated with delivering a course. By replacing expensive with relatively inexpensive, less-expert labor when appropriate, it is possible to increase the person-hours devoted to the course and the amount of assistance provided to students.

In the 2003 *Change* article, I discussed what cost-reductions strategies were most effective in the first 30 Pew-funded projects, all of which are repeated above. But we have learned something important since 2003: Reducing costs as a part of redesign comprises not one but two steps.

The first is to compare the number of hours spent by each person involved in the traditional and redesigned formats of the course. The savings in faculty time that the strategies produce can be reallocated to address departmental or institutional needs.

The second step is to translate those "saved" hours into a cost-reduction plan that describes how they will be reallocated to benefit the institution. For example, faculty members or teaching assistants who spend half the time on the redesigned course than they did on the traditional one could increase section enrollment or carry two sections without an increase in workload.

That produces real savings for the institution. If you stop at the first step, you create what NCAT calls *paper savings*—savings that represent a workload reduction for the individual but do not produce cost savings for the department or institution.

When enrollment is stable, cost reduction means fewer resources are devoted to the course. When enrollment is growing, cost reduction means more students can be served with the same resources. In each case, the cost per student is reduced.

LEADING CHANGE

NCAT has always viewed course redesign as a means to an end: the transformation of the way the campus community considers the relationship between quality and cost. At the first Pew-funded workshop we offered in early 2000, a young faculty member from the University of Colorado Boulder correctly observed, "You're not trying to redesign a single course; you're trying to redesign the entire university."

NCAT's course-redesign methodology increases learning outcomes, improves completion rates, and reduces instructional costs. We have succeeded in changing the national conversation about the relationship between quality and cost in many settings, particularly at the national level. We have developed and publicized models, techniques, case studies, and various other resources, including a series of how-to guides to support campus efforts in course redesign (see Resources for details). But while our efforts have been cited, praised, and awarded, there has been precious little large-scale adoption of course redesign throughout higher education.

Foundations, government agencies, journalists, and policy makers have repeatedly asked me, "Course redesign is so great—why isn't everyone doing it?" or, its variant, "Yes, course redesign is great, but will it scale?" As the New America Foundation's Kevin Carey once wrote, "While Twigg's efforts are widely known in higher education circles, there has been no great

rush to replicate them nationwide." Generally, these questions and observations have occurred in the context of the cost issue.

I used to take this personally, especially since I was usually being asked about *my* plan to scale course redesign. But I finally had a revelation: The three-person NCAT staff can't possibly scale course redesign. The responsibility to do so is not ours—it's yours, especially if you are a campus executive, board member, or policymaker, because you have the power to implement change. Scaling course redesign must occur at the campus level.

Doing so requires active and thoughtful leadership. Here's what campus leaders need to do.

Learn how to talk with faculty about reducing costs. NCAT has worked with thousands of faculty at all types of institutions in all kinds of disciplines. Faculty are not the problem: They are a critical part of the solution to higher education's historical trade-off between quality and cost. Once faculty understand that it is possible to reduce costs while increasing or maintaining quality and learn about strategies to address both simultaneously, they become willing to include cost reduction in their redesign plans.

It is important to choose the right language. When NCAT discusses cost reduction with faculty, we ask them to think about it as a reallocation of resources that enables them and their institutions to do things they'd like to if they had additional resources. Some of those might include offering new courses and programs; breaking up academic bottlenecks; increasing faculty released time for research, renewal, or additional course development; and dealing with budget cuts without diminished quality.

Run a campus-wide program. The reason NCAT has achieved success is that we run *programs* based on what we have learned. A course-redesign program is organized like the grant programs offered by public agencies and private foundations. It is public—easily accessible to and understandable by all campus constituencies. It includes clear goals, a detailed timeline with specific activities and deadlines, the number of grants to be awarded, the monetary amounts of the grants, and selection criteria.

Course-redesign programs are organized in rounds. The primary goal of the initial round is to produce good models that are supported by data that can serve as proof of the possibility of improving learning while reducing costs and that will inspire others at the institution to engage in further course redesign. Rounds are repeated until a sufficient number of models have been created to take the next step.

NCAT's most recent how-to guide, *[How to Organize a Campus-Wide Course Redesign Program Using NCAT's Methodology](),* explains how to run a campus-wide course-redesign program.

Integrate course redesign into the campus resource-allocation strategy. After producing, say, 9 to 15 excellent models, institutions should move beyond a demonstration-program mode. They should require all departments to engage in course redesign as part of a campus-wide strategy to accomplish the joint goals of improving quality and reducing costs. This means using a combination of carrots and sticks—rewarding those departments that engage in redesign and penalizing those that do not.

Because institutional circumstances differ, each college or university will need to develop a strategy that fits its particular environment. In the following examples, each strategy assumes that many departments have produced successful models as part of a campus-wide course-redesign program, that both faculty and students are satisfied with the new mode of instruction, that a specific goal is made clear to the campus community, and that course redesign is chosen as the way to achieve it.

- An institution may set a goal of breaking up academic bottlenecks to increase the number of students who graduate on time. Prior to the program's launch, data are collected to identify which departments and/or courses are creating the bottlenecks, whether the reason is academic (high failure rates) or financial (insufficient resources to offer enough sections and/or courses).

  Campus leaders meet with the departments that did not participate in the original course-redesign program and say, "We want you to build on the campus models for increasing enrollments in critical courses. We will support you throughout the process, but if you do not make the necessary changes, your department will not receive new equipment, travel to conferences, take sabbaticals, and so on."

- Or an institution may set a goal of reducing its reliance on non-tenure-track faculty from 60 percent to 35 percent without increasing tenure-track faculty workload. Campus executives meet with the departments that have not yet redesigned their courses and say, "We are cutting your temporary-instructor allocation by 25 percent. We want you to absorb this cut by building on the redesign models on campus. We will support you throughout the process, but you must do it."

  Campus executives will need to make a number of decisions about the funds that will be saved. For example, should the funds stay entirely in the departments? Should they be split between the central administration and the departments in some way? Should faculty members receive raises as an incentive to participate?

- Or after receiving a state-mandated budget cut of 5 percent, an institution sets a goal of maintaining the same number of program and course offerings at the same level of quality despite a decreased resource base. Campus executives meet with the non-participating departments and say, "We want you to absorb this cut by building on the models on campus. We will support you throughout the process, but you must do it." Departments that redesign their courses would have their budgets cut less than those that do not.

To paraphrase former Citibank chairman Walter Wriston, the job of campus leadership is to create wealth, not to allocate shortages. Course redesign enables you to create that wealth, especially when you integrate it into the overall campus resource-allocation strategy.

Some may wonder why I have put so much emphasis on cost reduction in this retrospective, given the successes NCAT has had in quality improvement. Here's the thing: Everyone seems to be working on the student success agenda, but practically no one is working on cost. Unless higher education addresses the cost issue, the nation's completion goals are, I believe, unattainable.

Higher education has traditionally assumed that high quality means low student-faculty ratios and that large lecture-presentation techniques supported by cheap labor constitute the only viable low-cost alternative. But it is now clear that course redesign using technology-based, learner-centered principles can offer higher education a way out of this historical trade-off between cost and quality. For the first time, we can have our cake and eat it too.

RESOURCES

- **How To Organize a Campus-Wide Course Redesign Program Using NCAT's Methodology**
  This "how-to" guide describes how to develop a campus-wide course redesign program as a means to an end: the transformation of the campus community's consideration of the relationship between quality and cost.

- **How To Redesign A College Course Using NCAT's Methodology**
  This "how-to" guide describes how to implement NCAT's course redesign methodology in a *single* course in any academic area other than mathematics.
- **How To Redesign A College-Level or Developmental Math Course Using the Emporium Model**
  This "how-to" guide describes how to redesign a single math course at both the developmental and college levels.
- **How To Redesign A Developmental Math Program Using the Emporium Model**
  This "how-to" guide describes how to redesign the entire developmental math sequence (typically offered at community colleges).
- **Course Redesigns**
  This resource includes elaborated case studies of more than 150 large-scale course redesigns sorted by discipline, by model and by degree of success.

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