Improving Learning and Reducing Costs for Online Learning

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INTRODUCTION

Every college and university in the United States (US) is discovering exciting new ways of using information technology to enhance the process of teaching and learning, and to extend access to new populations of students. For most institutions, however, new technologies represent a black hole of additional expense. Most campuses have simply bolted new technologies onto a fixed plant, a fixed faculty and a fixed notion of classroom instruction. Under these circumstances, technology becomes part of the problem of rising costs rather than part of the solution. In addition, comparative research studies show that rather than improving quality, most technology-based courses produce learning outcomes that are simply "as good as" their traditional counterparts — what often is referred to as the "no significant difference" phenomenon. By and large, colleges and universities have not yet begun to realize the promise of technology to improve the quality of student learning and reduce the costs of instruction.

BACKGROUND

Supported by an $8.8 million grant from the Pew Charitable Trusts, the Program in Course Redesign (www.center.rpi.edu/PewGrant.html) was created in April 1999 to address these issues. Managed by the National Center for Academic Transformation (www.center.rpi.edu/), the Program is supporting colleges and universities in their efforts to redesign instruction using technology to achieve quality enhancements as well as cost savings. Selected from hundreds of applicants in a national competition, 30 institutions each received a grant of $200,000, with the grants awarded in three rounds of 10. The 30 institutions include research universities, comprehensive universities, private colleges and community colleges in all regions of the US.

The Center has required each institution to conduct a rigorous evaluation focused on learning outcomes as measured by student performance and achievement. National experts have provided consultation and oversight regarding the assessment of learning outcomes to ensure that the results are reliable and valid. To date, results show improved student learning in 25 of the 30 projects, with the remaining eight showing no significant difference. Each institution has also been required to develop a detailed cost analysis of both the traditional and the redesigned course formats, using a spreadsheet-based course-planning tool (www.center.rpi.edu/PewGrant/Tool.html) developed by the Center. Preliminary results show that all 30 institutions reduced costs by about 37%, with a range of 20% to 77%. Other outcomes include increased course-completion rates, improved retention, better student attitudes toward the subject matter and increased student satisfaction with the mode of instruction. Collectively, the 30 redesigned courses affect more than 50,000 students nationwide and produce a savings of approximately $3 million each year.

The course-redesign projects focus on large-enrollment, introductory courses in multiple disciplines, including the humanities (6), quantitative subjects (13), social sciences (6) and natural sciences (5). What do these projects have in common? To one degree or another, all 30 projects share the following six characteristics:

1. **Whole course redesign:** In each case, the whole course—rather than a single class or section—is the target of redesign. Faculty begin the design process by analyzing the amount of time each person involved in the course spends on each kind of activity, a process that often reveals duplication of effort among faculty members. By sharing responsibility for both course development and course delivery, faculty save

substantial amounts of time while achieving greater course consistency.

2. **Active learning:** All of the redesign projects make the teaching-learning enterprise significantly more active and learner-centered. Lectures are replaced with a variety of learning resources that move students from a passive, note-taking role to an active, learning orientation. As one math professor put it, "Students learn math by doing math, not by listening to someone talk about doing math."
3. **Computer-based learning resources:** Instructional software and other Web-based learning resources assume an important role in engaging students with course content. Resources include tutorials, exercises and low-stakes quizzes that provide frequent practice, feedback and reinforcement of course concepts.
4. **Mastery learning:** The redesign projects add greater flexibility for when students can engage with a course, but the redesigned courses are not self-paced. Rather than depending on class meetings, student pacing and progress are organized by the need to master specific learning objectives, which are frequently in modular format, according to scheduled milestones for completion.
5. **On-demand help:** An expanded support system enables students to receive assistance from a variety of people. Helping students feel that they are a part of a learning community is critical to persistence, learning and satisfaction. Many projects replace lecture time with individual and small-group activities that take place either in computer labs—staffed by faculty, graduate teaching assistants (GTAs) and/or peer tutors—or online, enabling students to have more one-on-one assistance.
6. **Alternative staffing:** By constructing support systems consisting of various kinds of instructional personnel, the projects apply the right level of human intervention to particular student problems. Not all tasks associated with a course require highly trained, expert faculty. By replacing expensive labor (faculty and graduate students) with relatively inexpensive labor (undergraduate peer mentors and course assistants) where appropriate, the projects increase the person-hours devoted to the course and free faculty to concentrate on academic rather than logistical tasks.

Although all 30 projects have these characteristics in common, each has chosen a design model that implements the characteristics according to the discipline involved, the particular student audience and the preferences of faculty. After examining the similarities and differences in how these common characteristics are arrayed, the program has been able to identify five distinct course-redesign models: supplemental, replacement, emporium, fully online and buffet. A key differentiator among them is where each model lies on the continuum, from fully face-to-face to fully online interactions with students.

FIVE MODELS OF COURSE REDESIGN

The Supplemental Model

The supplemental model retains the basic structure of the traditional course; particularly, the number of class meetings. Some of the supplemental redesigns simply add technology-based, out-of-class activities to encourage greater student engagement with course content. Others change what goes on in the class meetings as well as add out-of-class activities.

The redesign of general psychology at the University of New Mexico (UNM) (www.center.rpi.edu/PewGrant/RD3 Award/UNM.html) and the redesign of introductory statistics at Carnegie Mellon University (www.center.rpi.edu/PewGrant/RD2 Award/CMU.html) exemplify the first version of the supplemental model of redesign. Each institution kept the lecture portion of the course intact, including the number of class meetings, but supplemented lectures and textbooks with a variety of computer-based activities.

At UNM, students receive credit for completing three online mastery quizzes each week. Students are encouraged to take the quizzes as many times as needed until they attain a perfect score. The more time students spend taking quizzes and the higher their scores, the better they perform on in-class exams.

Carnegie Mellon has redesigned the laboratory portion of its statistics course, while leaving the lecture portion intact. The redesign uses an automated, intelligent tutoring system that monitors students' work as they go through lab exercises. The system provides them with feedback when they pursue an unproductive path and closely tracks and assesses individual students'