The National Center for Academic Transformation

Experts in improving learning and reducing cost in higher education.

HOW TO REDESIGN A DEVELOPMENTAL MATH PROGRAM USING THE EMPORIUM MODEL

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Introduction

From working with large numbers of students, faculty, and institutions since 1999, the National Center for Academic Transformation (NCAT) has learned 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 is the key element 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.

This how-to guide is designed for those of you who want to improve learning and reduce costs in developmental math and use NCAT's Emporium Model to do it. The guide makes two basic assumptions:

- We assume that your developmental math program faces some kind of academic problem such as poor student performance, poor completion rates, an inordinate amount of time for students to get through the developmental math sequence, and a lack of consistency in developmental math courses, leading to poor performance in college-level courses. You may also face a number of financial problems such as budget cuts, the need to serve more students on your current resource base, and difficulty in finding qualified faculty both full-time and adjunct.

- We also assume that you have heard about the Emporium Model and its spectacular track record of proven success. A summary of the outcomes achieved in improving student learning, increasing student completion, and reducing instruction costs can be found on the NCAT website.

NCAT has received national and international recognition of its course redesign work. Most recently, NCAT was awarded a $2.2-million grant from the Bill & Melinda Gates Foundation to conduct the largest-ever effort to remake developmental math courses using technology. That program, which we called *Changing the Equation*, involved the redesign of 114 courses at 38 institutions and affected more than 120,000 students annually. You will see references to the participating institutions from that program, as well as others that conducted successful redesigns in developmental math, throughout this guide.

This guide focuses on redesigning the entire developmental math *sequence* rather than a single course. Another NCAT guide describes how to redesign a *single* math course at both the developmental and college levels. While there is substantial overlap between the two guides, there are also substantial differences.

We at NCAT could not have produced this guide by ourselves. It represents a compendium of the good ideas created and actions taken by hundreds of faculty and administrators working on this issue since 1999. In particular, we would like to thank the original six NCAT Redesign Scholars in mathematics who have both worked tirelessly to create and sustain the Emporium Model and consistently given us and others throughout the United States great advice over the past decade: Betty Frost, Jackson State Community College (retired); Jamie Glass, University of Alabama; Phoebe Rouse, Louisiana State University; John Squires, Chattanooga State Community College; Kirk Trigsted, University of Idaho; and Karen Wyrick, Cleveland State Community College. We would also like to thank the following colleagues who graciously took

the time to review this guide, assuring us where we went right and correcting us where we went wrong: Susan Barbitta, Guilford Technical Community College; Megan Bradley, Frostburg State University; Betty Frost, Jackson State Community College (retired); John Harwood, Penn State University; Ron Henry, Georgia State University (retired); Crystal Ingle, Northwest-Shoals Community College; LaRonda Lowery, Robeson Community College; Eric Matsuoka, Leeward Community College; Teresa Overton, Northern Virginia Community College; and John Squires, Chattanooga State Community College. This guide is also a product of the experiences of thousands of students who once dreaded the thought of taking a math class but now say, “I can do it!”

In the coming pages, we will tell you how to replicate this success.

I. The Essential Elements of the Emporium Model

From working with large numbers of students, faculty, and institutions since 1999, NCAT has learned what works and what does not work in improving student achievement in developmental 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 is the key element 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.

NCAT has identified 10 elements that are essential to the Emporium Model. If any of these elements are absent, it is unlikely that student success will improve at a reduced instructional cost. If all of these elements are present—and you select an appropriate cost-reduction strategy as described in Chapter VI—we guarantee that student success rates will improve and costs will be reduced. Over the years, faculty members have said to us, "We have an Emporium," by which they mean they have a computer lab or they use instructional software as a supplement for homework. The Emporium Model is not one or two of the following elements; the combination of and interaction among all 10 are what make the model so successful.

Element #1: Redesign the whole course sequence and establish greater course consistency.
Element #2: Require active learning and ensure that students are "doing" math.
Element #3: Hold class in a computer lab or computer classroom using commercial instructional software.
Element #4: Modularize course materials and course structure.
Element #5: Require mastery learning.
Element #6: Build in ongoing assessment, and prompt (automated) feedback.
Element #7: Provide students with one-on-one, on-demand assistance from highly trained personnel.
Element #8: Ensure sufficient time on task.
Element #9: Monitor student progress and intervene when necessary.
Element #10: Measure learning, completion, and cost.

#1: Redesign the whole course sequence and establish greater course consistency.

In the traditional format, consistency among different developmental math instructors or different campuses within the same institution is often lacking. Any developmental math course taught by multiple instructors faces the problem of course drift, especially when large numbers of adjunct faculty members are involved. The phrase *course drift* refers to what happens when individual instructors teach the course to suit their individual interests rather than to meet agreed-upon learning goals for students. This results in inconsistent learning experiences for students and inconsistent learning outcomes. Students are often assessed in a variety of ways, which leads to overall grading differences and grade inflation. Contributors to grade inflation in the traditional format include (1) having no clear guidelines regarding the award of partial credit, (2) allowing students to fail a required final exam yet still pass the course, (3) failing to establish common standards for topic coverage (in some sections, entire topics are not covered, yet students pass), and (4) failing to provide training and oversight of instructors, especially part-time ones.

In the Emporium Model, the whole course sequence—rather than a single class or section—is the target of redesign. The Emporium Model creates consistency of course content and course delivery. A team of faculty is responsible for course development and course delivery strategies to ensure that all students have the same learning experience regardless of the instructor or campus location. Students are assessed on common outcomes by means of common assessment methods. Redesign that ensures consistent content coverage and consistent learning experiences for students produces significant improvements in course coherence and quality control. This results in every student's moving forward to credit-bearing math courses, having mastered defined learning outcomes for the developmental math sequence. Training and ongoing monitoring of all instructors (full-time faculty and adjuncts) and tutors also contribute to consistent student learning experiences and outcomes.

#2: Require active learning and ensure that students are "doing" math.

In the traditional model, students spend a lot of time watching or listening to a lecture given by someone else. The three hours that students spend listening to lectures each week are three hours that can be spent doing math. As one community college redesign team correctly observed, "The primary reason many students do not succeed in traditional math courses is that they do not actually do the problems. As a population, they generally do not spend enough time with the material, and this is why they fail at a very high rate."

The Emporium Model makes significant shifts in the teaching-learning enterprise, making it more active and more learner centered. Lectures and other face-to-face classroom presentations are replaced with an array of interactive materials and activities that move students from a passive, note-taking role to an active-learning orientation. As one math professor puts it, "Students learn math by doing math, not by listening to someone talk about doing math." The Emporium Model obligates students to become actively engaged in learning the course material. The role of the faculty moves from one of dispenser of knowledge to one of partner or helper in the learning process.

Instructional software and other Web-based learning resources assume important roles in engaging students with course content. Resources include tutorials, exercises, and low-stakes quizzes that provide frequent practice, feedback, and reinforcement of course concepts. Each student is required to spend a minimum number of hours each week in the lab, using interactive software for instruction and practice with support from instructors and tutors. Students are also expected to engage in these activities outside the structured lab setting if needed. In moving from an entirely lecture-based to a student-engagement approach, learning is less dependent on words uttered by instructors and more dependent on problem solving undertaken actively by students.

Encouraging active learning is a well-accepted pedagogical principle that leads to improved student learning. 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."

#3: Hold class in a computer lab or computer classroom using commercial instructional software.

In the traditional model, developmental math courses typically meet three hours per week for 15 weeks and are taught in a didactic lecture format. Students often have access to a math help lab or tutoring center if they choose to take advantage of it, but most fail to do so.

Having students work on math during class is fundamental to the success of the Emporium Model. Students work in computer classrooms/computer labs on a fixed or combination fixed/flexible schedule each week. The nature of the computer classroom makes it impossible for students to adopt a passive strategy in the course, as is often the case with lecture-discussion approaches to teaching mathematics. During the scheduled class meetings, students spend more time working problems and doing math rather than watching their instructor work examples. The mantra "students learn math by doing math" is the redesign standard.

In the lab/computer classroom, students spend most of their time working with interactive computer software. The use of effective online instructional software (e.g., Pearson's MyLabsPlus/MyMathLab, McGraw-Hill's ALEKS online learning system, and Hawkes Learning System) is a key component of the Emporium Model. Each instructional software package offers consistent, high-quality, customizable content and creates a student-friendly introduction to the math courses.

Modularized online tutorials present course content with links to a variety of additional learning tools: video lessons, lecture notes and exercises, animated examples, step-by-step explanations, electronic textbooks, study plans, homework assignments, quizzes, practice tests, and posttests. Navigation is interactive; students can choose to see additional explanations and examples along the way. The software gives students multiple resources (hints on how to solve problems, videos, animations, worked problems similar to the one missed, solutions to frequently asked questions, and links to the e-textbook) to correct their understanding if they do not master a skill. Instructional software supports auditory, visual, and discovery-based learning styles. All resources are in the same online location and can be accessed anywhere, anytime. Students can work on assignments from any computer with Internet access.

#4: Modularize course materials and course structure.

The traditional format assumes that all students need to study all remedial/developmental math course content at the same pace, treating students as one size fits all. However, one-third may be in the middle of the material in any given class, one-third may have already accomplished the goals of today's class, and one-third may be lagging behind. Some students are bored because other students' questions mean that instructors repeatedly explain material they have already mastered, and other students feel overwhelmed by the amount of material covered in even just one class session.

In contrast, modularization assumes that each student is different, each student has different learning gaps, each student will move at a different pace—faster or slower—through different parts of the curriculum. The Emporium Model divides the developmental math sequence into a series of modules or mini-modules. Modularization does not mean merely dividing the course content into modules (after all, that's no different from chapters in a textbook) and continuing to meet in small groups in traditional classroom settings with teacher-led activities. Modularization means individualizing the student experience. When students understand the material, they can move quickly through it and demonstrate mastery. When students get stuck, they can take more time to practice and receive individualized assistance. Students should also be able to earn variable credit based on how many modules they successfully complete during a term.

There is no right or wrong number of modules. Each module should correspond to a learning objective or competency within the course sequence. Some institutions retain course titles. For example, at Lurleen B. Wallace Community College, modules 1, 2, 3, and 4 equate to Basic Math (module 5 is the final exam); modules 6, 7, 8, 9, and 10 equate to Elementary Algebra (module 11 is the final exam); and modules 12, 13, 14, 15, and 16 equate to Intermediate Algebra (module 17 is the final exam). Other institutions get rid of the old course structure and simply offer modules in the context of one developmental math course. For example, Nashville State Community College and Volunteer State Community College each eliminated their three traditional developmental math courses. The schools' redesigned curricula are based on topics corresponding to high school–level math and ACT content that translates to five competencies or five modules that students are required to complete for the course.

Progress through the course(s) requires completion of each module at mastery level before moving to the next. This includes completing the online quizzes, homework problems, and notebook assignments that cover the objectives for the week. Students can complete one course early and move into the next course in the same semester. If the second course is not finished at the end of the semester, the student can continue the next semester at the point the student left off the previous semester. Students who do not finish the required modules in one semester can begin work the next semester exactly where they left off the previous semester.

#5: Require mastery learning.

In the traditional format, students can exit developmental math courses by simply attaining a total cumulative score of at least 70 percent or 75 percent. Based on averaging grades, students can earn a C or better by passing enough tests and learning enough competencies but not necessarily all. In traditional sections, students often continue on to the next topic without having demonstrated mastery of the previous one. The consequence of this practice is that they are unprepared for the next course in the sequence and unprepared for college-level work.

The Emporium Model requires each student to complete homework assignments, quizzes, and exams at a designated mastery level before moving ahead to the next unit—a learning approach that guarantees that students will be successful as they move forward. Each institution should set its own mastery level (prior redesigns have set mastery levels ranging from 75 percent to 90 percent of the material.)

A typical module sequence would be for students to begin by taking a quiz to demonstrate mastery and thus bypass the module—or move directly to the homework if they feel they are unfamiliar with the material. Before students can move from one homework assignment to the next, they are required to demonstrate mastery on each assignment. After all homework for a module is completed, students take practice quizzes in which online learning aids are not available. Students who do not demonstrate mastery on the practice quiz have to remediate on missed concepts before taking the quiz again. Students typically are allowed multiple attempts on the practice quiz. Though not part of the grade calculation, the quiz requires mastery before students are permitted to take the module posttest. Once prepared, students take a proctored posttest. To move to the next module, students have to demonstrate mastery on the posttest. Students unable to do so should have an opportunity to meet with the instructor, who can review a student's work on the test and recommend remediation techniques before the student retakes the test.

Mastery learning thus means that students are doing more work and learning more in redesigned courses than in traditional ones. This can take longer, and some students may not complete a particular course by the end of the term. They are, however, able to start where they left off in the subsequent term. Mastery learning, though it sometimes takes longer to accomplish, ensures that students are well prepared to take on college-level work.

#6: Build in ongoing assessment, and prompt (automated) feedback.

Increasing the amount and frequency of feedback to students is a well-documented pedagogical technique that leads to increased learning. In the traditional model, students typically turn in homework problems that are hand graded and then returned days after they did the problems and made mistakes. By the time students see the graded homework, they are not sufficiently motivated to review their errors and correct their misunderstandings.

The Emporium Model utilizes computer-based assessment strategies. A major advantage of using interactive software is the immediate feedback provided for students. Students receive individualized help from the tutorials, practice problems, and guided solutions that are built into the software. Instant feedback lets students review their errors at the time they make them. A large bank of problems for each course topic is built into instructional software, and assignments are graded on the spot. Students can work as long as needed on any particular topic, moving quickly or slowly through the material—depending on their comprehension and past experience or education—until mastery of a concept is achieved. When working a homework assignment, students get immediate feedback that tells them whether an answer is correct or incorrect. When students get stuck, they can ask the software to provide an example (Show Me How) or a step-by-step explanation (Help Me Solve This). Automation of the feedback process grades every problem or question, and students receive specific information about their performance. This in turn leads to more-efficient and more-focused time on task and higher levels of learning.

The Emporium Model also shifts the traditional assessment approach of relying on midterm and final examinations to an approach of continuous assessment. Students can be regularly tested on assignments via short quizzes that probe their preparedness and conceptual understanding. These low-stakes quizzes motivate students to keep on top of the course material, structure how they study, and encourage them to spend more time on task. Quizzing encourages a do-it-till-you-get-it-right approach: students can be allowed to take quizzes as many times as they want to until they master the material. Automation of assessment facilitates repeated practice and provides prompt and frequent feedback—pedagogical techniques that research has consistently shown to enhance learning.

#7: Provide students with one-on-one, personalized, on-demand assistance from highly trained personnel.

The traditional model increases the likelihood that students will get discouraged and stop doing the work for two reasons. First, they have to do most of their work (homework) without immediate support. Students who are unable to receive help at the time they need it will too often give up and not complete the task they have been assigned. Second, in traditional lecture or classroom formats, students are often unlikely to ask questions because they have to admit in front of fellow students what they do not understand. Because most students would rather remain invisible than interact with the instructor in a public way—to protect themselves from embarrassment—they often do not resolve the questions they have. Office hours attempt to mitigate this problem, but students notoriously do not take advantage of them. Students need help at the time they are stuck rather than during fixed times or by appointment.

The Emporium Model replaces lecture time with activities that take place in computer labs or computer classrooms staffed by instructors, professional tutors, and/or peer tutors. Students receive one-on-one assistance. When students get stuck, the tutorials built into most software programs may not be enough to get them moving again. Students need human contact as well as encouragement and praise to assure them that they are on the right learning path. Highly trained, instructional staff are available to provide individual assistance if students encounter difficult concepts while working on problems. A tutor or instructor can look at a student's work and determine whether the student is making errors due to carelessness, lack of understanding of concepts, or misuse of the computer software. The availability of on-demand individual assistance in the lab/computer classroom ensures that students receive immediate help when needed.

An expanded support system enables students to receive help from a variety of different people. The varying levels of personnel allow students to seek help from someone with whom they are most comfortable and whose teaching style is best suited for that individual student's learning needs. So-called teachable-moment opportunities in the lab or classroom allow instructors and students to build relationships and further foster learning. Students tune out less when they receive targeted information to meet their perceived needs. Students also get help from fellow students. And computer stations can be arranged in pods of four to six to encourage student collaboration.

Helping students feel they are a part of a learning community is critical to their persistence, learning, and satisfaction.

#8: Ensure sufficient time on task.

As Chickering and Gamson note in *Seven Principles for Good Practice in Undergraduate Education*, "Time plus energy equals learning. There is no substitute for time on task. Learning to use one's time well is critical for students and professionals alike. Students need help in learning effective time management." Even though we know that time on task is essential to effective learning, it is difficult for faculty members in traditional formats unaided by technology to ascertain how much time on task each student is actually spending and to take corrective action.

NCAT has learned that student participation in the math lab/class <u>must be required</u>. As NCAT's Redesign Scholars have repeatedly said, "Don't even bother to redesign if you are not going to require lab hours." It is absolutely necessary to have an incentive for attending lab/class and/or a penalty for not attending. At successful institutions, attendance counts as 5 to 10 percent of the final grade. This provides sufficient motivation for most students to attend lab/class. Some institutions penalize students for lack of attendance (e.g., students who miss, say, 12 hours of class are administratively withdrawn from the course.)

Since 1999, NCAT has repeatedly seen that when institutions have neither an attendance/participation policy nor a reward for meeting that policy (points), most students do not go to the lab/class. "Freshmen don't do optional" is another mantra of successful course redesign. Whenever optional lab time is offered, the vast majority of students fail to take advantage of it. When students go to lab/class and do the work, they become able to master the concepts and succeed. Students participate more, score higher, and spend longer on learning activities when course credit is at stake.

Even though the Emporium Model adds greater flexibility in the times and places of student engagement with the course, the redesigns are <u>not</u> self-paced. 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 especially in disciplines that may be required rather than chosen) and that most students simply will not succeed in a self-paced environment.

The Emporium Model ensures student pacing and progress by requiring students to complete modules and master specific learning objectives according to reasonably established milestones for completion. Students need a concrete learning plan with specific mastery components and milestones of achievement, especially in more-flexible learning environments. Weekly, achievable schedules provide a guideline for students on the pace of work necessary to complete the course on time. These schedules are of significant value in helping students see what they have left to accomplish in the course and to ensure that each course can be finished within one semester.

#9: Monitor student progress and intervene when necessary.

Requiring attendance and awarding attendance points are essential, but they are just the starting point. Two additional steps need to occur. First, someone—typically, the instructor in a fixed Emporium Model but sometimes another person in a fixed/flexible Emporium Model (see below for a description of these model variations)—must monitor each student to see who is and who is not meeting the attendance policy. Which students are lagging behind? Which students are not coming to lab and not doing the work? Second, once these students have been identified, follow-up is key. Someone must consistently contact them—by either e-mail, telephone, text, or tweet or in person—and indicate clearly and strongly the expectation of meeting with the student individually to help the student make progress.

Most developmental math software packages have excellent tracking features, allowing faculty members and others to monitor the time each student spends using the software, attending lab, and completing assignments as well as how well the student performs on quizzes and exams. Record keeping is made easy through the online Gradebook. Instructors who require that students spend hours in an open lab can be provided with logs that indicate the dates and time intervals that students visit the open labs.

Other options for monitoring student progress include using (1) a weekly score sheet that includes points for staying up-to-date with videos, worksheets, homework, and quizzes as well as points for class and lab attendance and (2) a paper workbook or notebook that students are required to maintain that contains class notes, notes from the software's learning tools, and solutions to exercises, which facilitates working through the steps of problems by hand. By recording the progress of each student every week in the student's respective workbook or notebook, instructors can knowledgeably discuss progress in the course with each student.

At many institutions, instructors meet with each student individually each week to assess the student's progress and to help the student develop a course of action for the next week. This face-to-face meeting helps students develop a sense of personal responsibility for their work. Weekly meetings allow students and faculty to become more comfortable with each other and provide additional support and encouragement for students. Whatever the method, instructors must monitor each student's progress as well as time on task and take appropriate action when needed.

#10: Measure learning, completion, and cost.

Very few institutions consistently measure student learning under the traditional model. Almost none measure instructional costs. Some may know their pass rates based on final grades, but few have examined whether or not those grades are awarded fairly. National statistics show that exit rates from the developmental math sequence are abysmal at most institutions, yet few are changing how they teach, and even fewer are measuring the impact of any changes they try to implement. The developmental math community is filled with unproven assumptions and ideas about what works best to improve student success.

An important element of the Emporium Model is measurement, both initial and ongoing. To demonstrate that the Emporium Model increases student learning outcomes, improves students' success rates, and reduces instructional costs, NCAT redesigns measure those three factors in the traditional format and again after the redesign is fully complete. As a result, we have hard data that demonstrate conclusively that the Emporium Model accomplishes these three goals.

Measurement of whether a redesign has in fact met the three aforementioned goals provides clear evidence of the Emporium Model's efficacy for those who are uncertain about whether redesign is a good idea. Having data that demonstrate that students learn more math and complete the developmental sequence in greater numbers while costing both students and the institution less is persuasive to both faculty and administrators. If the data show no change or poor results, it is a clear signal to the redesign team that something is amiss in their implementation.

Measurement of the three factors needs to be ongoing. NCAT has found that over time, the initial learning and completion results after the first term of full implementation have continued to improve at a higher rate. The only way to know that such improvements occur and continue—and the only way to know if the results do not continue—is to consistently collect data and analyze the results. By assessing student learning outcomes, completion of the developmental sequence rates, and instructional costs each year, the institution can assure all stakeholders that the redesign continues to work as initially conceived and implemented.

Versions of the Emporium Model

In redesigning their developmental math sequence, NCAT's partner institutions have found that the Emporium Model has consistently produced spectacular gains in student learning and impressive reductions in instructional costs. These institutions have found that two versions of the Emporium Model have been successful: a fixed version and a combination of a fixed and a flexible version. In both 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. **(**At most four-year institutions, a flexible version of the Emporium Model has predominated. This means that even though a minimum number of lab hours are mandatory, they may be completed at any time—at the student's convenience. In addition, mandatory group meetings enable instructors to (1) follow up when testing has identified weaknesses, (2) emphasize particular applications, or (3) build community among students and with instructors.)

- *Fixed attendance*: Mandatory lab hours are scheduled by the institution. Students are divided into course sections and meet at fixed (scheduled) times—in the lab or in a computer classroom with an instructor—equivalent to meeting times in the traditional format: two to four times a week.

<u>Examples</u>

  - <u>Jackson State Community College:</u> Basic Math, Elementary Algebra, and Intermediate Algebra

- Nashville State Community College: Basic Math, Elementary Algebra, and Intermediate Algebra
- West Virginia University at Parkersburg: Basic Arithmetic and Elementary Algebra

Most community colleges have implemented the fixed version. For example, of the 38 institutions that participated in Changing the Equation (described in the Introduction), 23 (61 percent) implemented a fixed version requiring a range of 2.5 to 6 hours of student participation in a lab or computer classroom each week.

- *Fixed/flexible attendance*: Cleveland State Community College developed the third version, which is a combination of fixed and flexible hours. In this version, three to five mandatory hours are required each week, but they are a combination of one fixed classroom meeting, flexible hours in the lab, and additional hour(s) spent working with the software from anywhere (e.g., from home.)

Examples

- Cleveland State Community College: Basic Math, Elementary Algebra, and Intermediate Algebra
- Leeward Community College: Basic Math through Problem Solving, Introductory Algebra with Geometry, and Algebraic Foundations I and II
- Northern Virginia Community College: Arithmetic, Algebra I, and Algebra II

Fifteen Changing the Equation institutions (39 percent) implemented a combination of the fixed and flexible versions, requiring a range of three to five hours of participation each week.

A chart summarizing the variations of the Emporium Model adopted by the Changing the Equation institutions is available at http://www.theNCAT.org/Mathematics/CTE/SchoolData/Fixed_vs_Flex.html.

II. Improving on the Essentials

Chapter I delineates the essential elements of the Emporium Model. We call these *essential* because including each element in the redesign is absolutely necessary in order to ensure success.

We have, however, discovered a lot of very good ideas that you should consider as you develop your redesign plan. They are not essential to success, but if NCAT were directly responsible for a redesign, we would certainly include them in our redesign plan.

Q: Have you examined whether you might be teaching college-level math in your remedial/developmental courses and if so, how much? Are you unnecessarily prolonging the student experience by doing so?

A: The ACT college readiness assessment is commonly used to assess students' academic readiness for college. ACT defines such readiness for college-level math at a score of 22 and above. Many institutions have discovered that their developmental math courses include a lot of college-level content. This insight has led the Tennessee Board of Regents, for example, to reconsider what constitutes developmental versus college-level course content. The result has been to restructure the curriculum and accelerate students' entry into college-level courses.

<u>Example</u>

When Jackson State Community College (JSCC) redesigned three remedial and developmental math courses, they replaced them with 12 clearly defined modules mapped to the competencies originally required in the three courses. Courses were divided as follows: Modules 1, 2, and 3 for Basic Math; Modules 4, 5, 6, and 7 for Elementary Algebra; and Modules 8, 9, 10, 11, and 12 for Intermediate Algebra.

After the first full year of implementation of the redesign JSCC mapped its competencies to ACT's College Readiness Standards by score range. JSCC discovered that Modules 1–3 (Basic Math) mapped appropriately to score range 16–19. The college also discovered that 11 of the 20 competencies included in Modules 4–7 (Elementary Algebra) mapped appropriately to score range 16–23 but that 9 of the competencies mapped to score range 24–32 (i.e., were college-level competencies rather than developmental, according to ACT.) JSCC also discovered that all but one of the 22 competencies included in Modules 8–12 (Intermediate Algebra) mapped to score range 24–32 (i.e., were college-level competencies rather than developmental, according to ACT.)

Q: Are you preparing all students to succeed in science, technology, engineering, and mathematics (STEM) majors, even though most will not major in a STEM field?

A: ACT studies show that 80– 90 percent of students need an assortment of skills from Basic Math, Elementary Algebra, Geometry, and Statistics to succeed in college-level math courses, and they do not need as much algebra as the traditional remediation approach provides. Are you looking backward or forward? Are you remediating high school algebra deficiencies in your remedial/developmental courses or preparing students to succeed in college?

<u>Example</u>

Jackson State Community College (JSCC) recognizes that student goals are different: students may variously plan to enter a program of study that requires advanced mathematics, to complete a general education mathematics course, or to apply for admission to a nursing or allied health program. Consequently, JSCC's redesign moves away from remediation of students' high school algebra deficiencies and toward preparing students for their particular educational goals. Students are required to master only the concept deficiencies that are relevant to their educational and career goals.

After defining the competencies to be included in each of JSCC's 12 modules, the math faculty determined which modules were necessary for student success in each college-level general education math course. All other departments identified which modules were necessary for success in their college-level courses as well as their discipline's core math requirements. Departments with programs not requiring college-level math determined the modules necessary for success in those programs. Changes in developmental math prerequisites were approved by the college curriculum committee.

Of the 48 programs of study at JSCC requiring college-level math courses, 35 require only 7 modules (47.1 percent of the students); 4 require 8 modules (31.2 percent of the students), and 7 require all 12 modules (20.3 percent of the students). One program requires only 6 modules (0.8 percent of the students), and one requires only 4 modules (0.6 percent of the students).

Students are advised of their multiexit opportunities based on their program-of-study choice and of the need to take more modules if they later change their majors. This is accomplished via information sheets for each major, focus group sessions, and individual counseling with math instructors and the students' academic advisers. The team also makes a campuswide presentation at in-service trainings and conducts sessions for adviser training in order to educate the college faculty and staff.

By changing the requirements for developmental math completion, JSCC was able to reduce by 31 percent the number of sections/modules it needed to offer. As an example, during the 2008/09 academic year, 1,836 students were enrolled in developmental math. JSCC needed to offer the equivalent of 15,241 modules to serve these students under the new policy. Assuming similar placement distributions, JSCC would have had to offer 22,032 modules under the old policy.

Q: Do you need to administer diagnostic assessments beyond your initial placement test?

A: Because there is a common belief that large numbers of developmental math students can test out of some—or perhaps all—modules and accelerate their progress through the developmental math sequence, many institutions require module pretests as the first task that confronts the student. As most have discovered, however, very few students are able to test out. Frequently, only one or two students are able to do so.

Given this situation, we urge you to consider whether giving pretests for every module is sending a negative message to students: I failed the first test. Rather than allowing students to move quickly, the pretests become yet another hurdle for students and reinforce their view that they can't do math, math is hard, they will have difficulty; that is, the pretests represent failure before students have even begun to learn.

We strongly suggest that you think about whether pretests are adding anything to the developmental math program or whether they are actually adding to math anxiety and demotivating students. One can always retain the option of allowing students who believe they already know the material to challenge a module by taking the pretest, but we think that pretesting should be an option rather than the rule.

<u>Example</u>

When Jackson State Community College (JSCC) redesigned the three remedial and developmental math courses, they replaced them with 12 clearly defined modules mapped to the competencies originally required in the three courses.

JSCC experimented with module placement by ACT scores and ACT Compass scores. The school found that over 95 percent of the students would have been placed above their deficient level if ACT or ACT Compass placement were the only tool used. The school concluded that while the ACT and ACT Compass tests may be sufficient to determine whether a student is college ready or not for mathematics, they are not appropriate diagnostic tools to determine mastery of specific competencies.

Consequently, JSCC developed its own diagnostic assessment by using MyMathTest, which corresponded to the competencies in the 12 modules. Of the 1,067 new students tested in fall 2007 and spring 2008, only 3 percent of the students did not need to study the competencies in Modules 1–3 (Basic Math). Based on these results, JSCC decided that requiring students to take the additional diagnostic assessment was a waste of time because 97 percent of the students tested into Module 1. Now each student passes each module, proving mastery of each skill rather than a general level of competency as indicated by ACT/ACT Compass scores.

Q: While the cost savings goal of the Emporium Model is to reduce the institutional cost of offering developmental math, do students benefit financially as well?

A: The Emporium Model can produce substantial savings for students, depending on the decisions that institutions make. Here are some ways in which students saved money because of the redesign:

- *Saving tuition dollars.* Modularizing the developmental math sequence allows students to move from one course to the next within the same semester. At most institutions, students save on tuition because they are allowed to complete as many courses as possible in one semester while paying tuition for only the one in which they register. Those who work through all the modules can finish the entire program in one semester and pay for one course instead of two or three, as they would have done in the traditional format.

- *Reducing the required number of credits*. Several institutions have redesigned multiple courses in the developmental math sequence to eliminate duplication and topics that are beyond the scope of developmental math. This allows the total number of credit hours for the sequence to be decreased, which represents savings for students by decreasing the number of credit hours for which they needed to pay tuition.
- *Lowering the cost of course materials*. Many institutions have been able to lower the cost of materials significantly, creating additional savings for students. Students purchase only one textbook and one software access code, as opposed to purchasing three different textbooks, to complete their developmental work. Several institutions have developed customized textbooks that include the material for all courses in the sequence. Other projects have entirely eliminated textbooks, requiring only the purchase of an access code (which includes an electronic textbook at no additional cost to the student).
- *Accommodating life events*. Many students, especially community college students, are juggling many responsibilities such as jobs, families, and care of parents. As a result, they are often unable to complete courses in a single term. Many of them may be working diligently, but a life event occurs that prevents them from reaching their educational goals. When life events interfere in the traditional model, students must withdraw—thereby losing tuition and any progress they have made—and start over the following term. In the Emporium Model, they can adjust their schedules instead of having to withdraw from the course. Later, they can return to the class and pick up where they left off.

III. Getting Ready to Redesign

Before they begin a redesign of developmental math, most institutions have found it extremely useful to think through their readiness to engage in such a redesign. There are two categories of issues to consider when an institution assesses its readiness to undertake course redesign: institutional support for the redesign and available resources to support the redesign. Successful redesign requires both institutional support and needed resources to be in place before a redesign begins.

Assessing Your Institution's Readiness to Redesign

<u>Campus Support</u>

Do you have sufficient support on campus to initiate a redesign? If not, you need to develop a plan to secure that support before you begin an actual redesign plan.

- *Faculty support*. This guide assumes that those who wish to initiate a course redesign have identified the academic and/or resource problem(s) that the Emporium Model can address. You need to clearly specify the problem and gather data that support the need for change, such as student pass rates for the past several years and the percentage of students who successfully exit the developmental math program. The question then becomes, Do all faculty members in the department understand the nature and extent of the problem? Even though many institutional teams that have worked with NCAT believed that the scope of their identified problem and the need to solve it were well-known among their peers, they subsequently learned that others did not share that understanding. You need to be sure that all members of the department are aware of the problem and are supportive of the need to address it. Most instructors are not familiar with the Emporium Model and will need assistance in understanding it.

- *Administrative support*. Do academic administrators (department chairs, deans, vice presidents, provosts, and presidents) understand the nature and extent of the problem? Have they seen the data? Even though many administrators do understand the scope of the developmental math problem (indeed, it may be the administration that initiates the redesign), others surprisingly do not and need to be informed. Most administrators are not familiar with the Emporium Model and will need assistance in understanding it. Administrative issues will need to be addressed throughout the redesign process, and campus resources will be needed; consequently, having solid administrative support is extremely important to the success of the redesign. In addition, administrators may need to step in to support the redesign effort when colleagues or other departments or divisions question the redesign. Senior administrators must be prepared to provide that support.

- *Unionized campuses***.** Faculty unions strive to ensure that faculty members work in a secure and productive working environment with a reasonable workload. On some campuses, there are work rules that may seem to be obstacles to redesign. Because one of the goals of the Emporium Model is to reduce instructional costs, unions often conclude that faculty will automatically lose jobs or be required to carry a heavier workload. NCAT has successfully worked with institutions in many states that have faculty unions, including New York, New Jersey, and Massachusetts. Those initiating the redesign and the campus administration need to take into account the particular union contract under which the redesign will occur.

NCAT's Scope of Effort Worksheet (see Appendix D) has been designed to help campuses document that the number of hours faculty devote to the redesigned course will be the same as or fewer than those devoted to the traditional format of the course, even if class size grows or the number of sections that faculty carry increases. This is possible because the Emporium Model offloads to the technology certain tasks like grading and monitoring student progress. Explaining how this occurs and documenting the changes by using the Scope of Effort Worksheet allow redesign leaders to help union leadership understand the benefits of redesign for both students and faculty. Having union support is key to a successful change on a unionized campus.

Financial Resources

Do you have sufficient financial resources available to support a redesign? If not, you need to develop a plan to secure that support before you begin an actual redesign plan. Financial resources are needed to support three things:

- *Computer labs/classrooms*. Some institutions have existing computer labs/classrooms that are underutilized and can be rescheduled and repurposed. Other institutions need to expand the labs/classrooms they have because more students will be using them than was true before the redesign. Still others need to build new labs/classrooms. When repurposing or expanding existing labs/classrooms or creating new ones, senior administrators are typically those who make these important space decisions. As noted earlier, they must understand the reason for the redesign and the anticipated benefits for students and the institution.

- *Technological infrastructure*. Some institutions have robust infrastructures, but many need to expand their infrastructures to support larger labs or to equip small classrooms. Typically, the Emporium Model means that more students will be using on-campus computers and accessing the campus network. Thus, an institution's technological infrastructure will need to be examined and may need to be expanded as new demands are placed on it and the volume of student engagement increases. Again, senior administrators are typically those who make these important infrastructure decisions. As noted earlier, they must understand the reason for the redesign and the anticipated benefits for students and the institution.

- *Faculty released time*. To focus on planning the redesign, a subset of full-time faculty will need released time from some or all of their teaching responsibilities. Financial resources are needed to pay qualified adjuncts to teach their sections so that those faculty key to the redesign can have time to do the work. Not all faculty involved in the redesign need released time. Those granted released time should hold pivotal roles in the planning and development of the redesigned courses.

  NCAT does not recommend using extra service or overtime pay rather than released time. Because faculty members were presumably fully employed prior to the beginning of the redesign process, paying overtime means that faculty must work on the redesign in the evening or on weekends. Using overtime payments also means that faculty may have greater difficulty in scheduling important meetings with team members or others on campus. This method of remuneration forces faculty to place the redesign lower on their priority list, because their current classes and students must come first. Paying overtime during the summer may work, but we definitely recommend against it when time for planning the redesign is needed during a regular school term.

If your developmental math program has no full-time faculty, you will need to pay part-time faculty to take on the extra work of leading the redesign effort.

Even though all successful redesigns will reduce instructional costs over time, some financial resources are needed up front. Where do these financial resources come from? Some institutions have redirected internal funds to support the redesign. Other institutions have received outside funding from Title III or Title V grants or from private foundations that seek to improve student retention and success. Being able to articulate clearly the problem the institution is trying to solve by using the Emporium Model will go a long way to enabling any funder (either internal or external) to understand and support the redesign effort.

Preparing to Develop a Plan

Once the institution has a clear understanding of its goal and believes it has the necessary support and resources to move forward to develop a redesign plan, both faculty and administrators need to learn more about the Emporium Model, what its strengths are, and how it actually works.

<u>Form a Course Redesign Team</u>

The first step in developing a redesign plan is to form a course redesign team. Successful course redesign is the product of a team effort. It is not a faculty project; it is not an administrative project; it is not a professional staff project. It takes all of these people because it is a team effort. In evaluating prior redesign programs, we have found that taking a team approach always receives the highest possible rating from participants.

Institutions should establish institutional teams that include the following types of people:

- *Faculty experts*. Course redesign requires that faculty experts explicitly identify the course's desired learning outcomes and agree on course content. Developmental math programs typically include more than one faculty member. To ensure course consistency, these faculty experts must work together on the redesign—resolving any differences in how the course will be offered—and must collaboratively plan the most effective way to accomplish the redesign goals.

- *Administrators*. Because redesigns impact multiple sections, large numbers of students, and academic policies and practices, it is important that the team involve academic administrators. The level of these administrators will depend on the organization and size of the institution. For some, it will be the provost/academic vice president or designee; for others, it will be a dean or department chair. These team members play important roles when institutional issues arise such as changes in scheduling or the use of classroom space. If unexpected implementation issues arise in the process of redesign implementation, administrators can help the team resolve them quickly and effectively across institutional offices.

- *Technology professionals*. These team members provide expertise so that the redesign goals are accomplished in ways that make the technology as easy for students to use as possible. Technology professionals contribute ideas about how to increase interaction with content as well as with other students. They also suggest design approaches to ensure that the technology does not limit students' learning options.

- *Assessment experts*. In Chapter VII, NCAT offers straightforward methods to enable student learning in the redesigned course to be compared with that in the traditional course. It is, however, useful to include on the team a member who is knowledgeable about assessment and research design, particularly if the institution seeks to measure additional facets of the redesign such as performance in downstream courses or student satisfaction, to name a few. This expertise may be found in departments of education or psychology or in offices of institutional research.

- *Instructional designers*. If your campus is fortunate to have instructional designers on staff, you may wish to add one to the team. The instructional designer can help guide the re-sequencing of instruction and provide insight into learning theory and modularization. Subject-matter experts are not always learning experts, and such guidance can be critical.

<u>Take Advantage of NCAT Resources</u>

- *Background reading*. A bibliography of NCAT articles about redesigning developmental math is included before the Appendices. Sharing these articles among the redesign team and other colleagues on campus and discussing them as a team and with others are good activities to pursue in preparing to develop a redesign plan.

- *Redesign case studies*. NCAT has provided the higher education community with almost 200 case studies of redesigns that both improved learning and reduced costs. The NCAT website has an array of free resources for use by those seeking to implement a successful redesign. Forty of these case studies are of redesigns that have successfully used the Emporium Model (see http://www.theNCAT.org/PCR/model_emporium_all.htm), including both two-year and four-year institutions. While more institutions have used the Emporium Model, the 40 on the NCAT website have measured both improvements in learning and reductions in cost. These 40 and others across the United States can provide good guidance about how to successfully implement the Emporium Model and reap its multiple benefits for students.

- *Campus visits*. The redesign team should also consult with and visit institutions that have successfully implemented this model. Visiting multiple institutions is a good way for teams to observe exactly what occurs in an Emporium Model and to see the interaction between students and instructors. The team can also discuss particular issues that may have arisen during the planning stage. Campus visits have been quite definitive in convincing those faculty and administrators who may have hesitations about the Emporium Model or cannot envision either exactly how it would work in practice or its effectiveness.

  It is also important for senior administrators to understand the benefits of the Emporium Model. After some explanation from the faculty and department chair, it would be useful for these senior administrators to talk to or visit colleagues at institutions that are using the Emporium Model. Just as in the case of faculty, when senior administrators see the Emporium Model in action, talk to students, and talk to their colleagues, they tend to understand that redesign using the Emporium Model is a viable way to solve the "math problem" at their institutions.

- *Redesign Scholars*. In 2006, NCAT established a Redesign Scholars Program to link those new to course redesign with more-experienced colleagues to whom they can turn for advice and support. Trained in NCAT's course redesign methodology, Redesign Scholars have led successful redesigns that have been sustained over time. Only exemplars in course redesign are selected to be Redesign Scholars.

Individual institutions that want to initiate course redesigns may wish to invite a Redesign Scholar to visit their campuses. Site visits focus on issues of curriculum and pedagogy, administrative matters, assessment and evaluation efforts, and implementation issues. Redesign Scholars are also available to campuses via telephone and e-mail for ongoing consultation. Redesign Scholars are engaged on a per-event basis and determine their consulting fees individually.

NCAT has designated a number of Redesign Scholars in mathematics, 12 of whom have particular experience in modularizing the developmental math sequence using the Emporium Model (see http://www.theNCAT.org/RedesignAlliance/BiosModel.htm). Many of the Redesign Scholars have redesigned some of their college-level math courses as well. Follow the links to read about each Redesign Scholar's background and redesign project in order to choose someone who would make a good fit with your particular redesign idea. Contact information is also provided.

Readiness Checklist

- Have you identified clearly the problem the redesign will solve? Do you have data to support the extent of the problem? Do others on the campus also acknowledge the problem?
- Do you have sufficient resources to support the redesign? Have you identified sources of external or internal funds to support the redesign?
- Do the senior administrators who make funding and space decisions understand the needs of the redesign? Do they have sufficient information to make appropriate decisions?
- If your campus is unionized, has the redesign plan been discussed with union leadership? Have you shared the Scope of Effort Worksheet to document that the redesign will not increase workload?
- Have you formed a redesign team that includes faculty, administrators, technology professionals, and assessment experts? Does this team understand the scope of the task?
- Have you established specific assignments for team members and others for the planning period?
- Have the team and others read about successful redesigns on the NCAT website and discussed them?
- Have you visited other campuses that have implemented successful redesigns in developmental math or had telephone discussions with their faculty and administrators? Were others who might have reservations about the redesign invited to join the visits or the phone calls?
- Have you considered asking one or more NCAT Redesign Scholars to visit your campus and provide advice about the redesign?

IV. How to Set Up the Lab

Setting up the lab or computer classroom involves a lot of details and decisions. Ensuring that the lab/computer classroom is properly set up with well-functioning software and hardware, well-trained tutors, and effective scheduling is crucial to success in the Emporium Model. The following questions are frequently asked by teams working on new redesigns; the answers have been collected from those who have successfully implemented and sustained a math Emporium Model. For some questions, the same answer applies to both the flexible and the fixed attendance versions of the Emporium Model. For others, the answers differ. A description of the two versions can be found in Chapter I.

Software

Q: How do we choose the right instructional software package?

A: Some teams initially believe that they will choose the software that accompanies the text they are currently using. Although that's certainly a possibility, it is useful for teams to consider the range of software options now on the market. Prior to making a software selection, a team should invite various vendors to demonstrate their products and discuss particular institutional needs to determine how well the software could meet those needs.

The following list was developed by Phoebe Rouse at Louisiana State University. It provides a structure for teams to use as they consider which software package would work best with their students at their institutions.

Must-Haves (Without these, nothing else matters!)

- *Reliability*. Students and faculty need to know that the software will operate consistently and without major or frequent downtimes.
- *High-quality content.* Faculty must be confident that the content included is comprehensive, current, and well explained.
- *User-friendliness*. The software must be easy to use. Explanations to faculty for setting up the software with the appropriate learning resources, homework, and assessments should be clear. Software should be easy for students to use so that they can focus on learning math, not learning software.

Other Features to Consider

- Ease of installation
- Cost to student
- Cost to institution
- Quality and accessibility of technical support
- Vendor willingness to provide training
- Browser restrictions
- Platform restrictions
- Capability for faculty to communicate with students
- Algorithmic exercises available
- Tutorial features
- Textbook included

- Videos
- Partial credit for multipart questions
- Pooling for tests
- Sophistication of testing mechanism
- Coordinator/master course capability
- Gradebook features
- Ease of ability to export grades
- Feedback after submission
- Ability to print student work
- Multiple attempts allowed on assignments
- Settings for individual students
- Software compatibility with Americans with Disabilities Act
- IP address restriction capability

Q: What about using free (open-source) software?

A: Some teams have considered using free software or resources available in repositories at the state or national level, but all of the successful implementations of the Emporium Model have based their redesigns around commercial software. Free resources should be evaluated using the earlier list. A key consideration is the decision about who will maintain and update the free resources over time. Companies are committed to doing so; free resources are often produced as one-offs, as part of a particular project or grant program.

Q: What should we do if students cannot purchase software access codes at the beginning of the term for financial aid reasons?

A: Some of the commercial software providers have an option that gives students temporary access codes for several weeks while waiting for their financial aid. When a student buys the access code, the student retains the work done, as if the student had bought the code at the beginning of the term. If the student does not purchase the access code by the end of the grace period, the student's work cannot be accessed. When interviewing software companies, you should ask whether they provide such a grace period for students.

Q: Do students also need a textbook?

A: Institutions have made different decisions regarding whether students need a textbook. Some believe it is important for students to see the course content in a hard-copy format; others believe that the software accompanied by an online text is sufficient and view the hard-copy text as an unnecessary but temporary crutch. Still others make the hard-copy textbook optional, depending on student preference. Making the decision about whether to require a textbook should occur after the software has been selected, so that the kinds of resources included in the software are known.

Q: How do we interface our instructional software with our campus student information system?

A: It is difficult to generalize about this issue because the variety of course structures, software packages, and student information systems and their interaction with one another can create multiple kinds of problems and multiple kinds of issues. Technological problems unique to modularizing a developmental math sequence have to do with interfacing with various campus student information systems (registration, financial aid, billing, registrar) due to the nontraditional organization of the modularized course[s]). Establishing an interface between instructional software packages with their built-in course management systems and the larger, campuswide systems also can present challenges. Suffice it to say, addressing these issues early in the redesign process facilitates a smoother transition, and the cooperation of IT and other campus offices is essential.

Hardware

Q: How do we determine how many computers we need in the lab for students?

A (*fixed attendance*): If you do not have a large lab and/or your numbers are small, we strongly recommend that you schedule lab hours for students rather than rely on an open lab. This would ensure that the number of computers available matches student demand. What is most important in the Emporium Model is that students be working in the lab the requisite number of hours, not the flexibility of those hours. Block scheduling can be as effective as open scheduling in this model.

The lab should have sufficient numbers of computers for each student to have one during scheduled times, but some additional computers should be available for those students who would like to work additional hours in the lab beyond the scheduled meeting times.

A (*flexible attendance*): Here are some things to consider:

- There is obviously a relationship between the number of hours that the lab is open and the number of computers needed. (The more hours open, the fewer computers needed and vice versa regardless of the number of students enrolled in the course.)
- You should carefully stagger due dates and weekly class meetings to even out the times students go to the lab.
- Even with careful scheduling, all open labs experience peak attendance periods. (For some, it’s late afternoon and early evening; for others, it’s early afternoon and early evening.) Planning must take this into account; that is, you don’t want students routinely arriving at the lab to find that all computers are taken.
- You should determine when the lab will be open based on your institution’s demographics, especially when students tend to be on campus.
- If possible, create a space within the lab for students to use their own laptops to supplement the number of PCs needed.

Many of the redesigns that use the Emporium Model have large numbers of students and keep their labs open 60 or more hours per week. In addition, campuses may be primarily residential, which means that student participation is relatively evenly distributed throughout the day. Those institutions’ experience, based on requiring three hours of lab participation per week per student and keeping the lab open 60 or more hours per week, translates into the following rule of thumb:

> The number of computers required =
> the number of students ÷ 15 if you do not test in your lab
> *or*
> the number of students ÷ 11 if you do test in your lab

Examples without testing
1,000 students ÷ 15 = 67 computers
800 students ÷ 15 = 54 computers
500 students ÷ 15 = 34 computers

Examples with testing
1,000 students ÷ 11 = 91 computers
800 students ÷ 11 = 73 computers
500 students ÷ 11 = 46 computers

Even though the calculations translate roughly to 4 computer hours per student, if you do not test and to 5.5 computer hours per student if you do test, the large numbers of open hours and the relatively even distribution of student participation are necessary components of making those ratios work. Once your lab is open fewer hours, which might be necessary because of staffing constraints or lab availability or student attendance patterns, these ratios do not hold. Smaller numbers of students and smaller numbers of open hours create additional constraints that require special attention in order to make an open lab work.

Example
200 students
Lab is open 20 hours per week
Requires 40 computers
Ratio = 5:1

Example
240 students
Lab is open 12 hours per week
Requires 120 computers
Ratio = 2:1

Q: What kinds of technological problems can we anticipate?

A: Most technological problems occur during the early stages of implementation and concern, for example, periodic Internet outages (sporadic interruptions in access to the course software or campus network interruptions), late-arriving equipment, and software server glitches. Course management systems and delivery servers may need to be upgraded to a more robust enterprise version. When the Internet is not available, it is important to have an alternative plan to engage students.

Q: Should students bring their own computers to the lab, or should they use those already in the lab?

A: Different institutions have made different decisions. Institutions with a laptop requirement create emporiums consisting of tables, and students use their own laptops. In essence, every classroom can be an emporium. The downside to this approach is that students may be more likely to visit other websites and neglect their course work. Thus, other institutions believe that students should use only computers that are in the lab, where access locations can be limited to those related to the modules. For testing, using lab computers with restricted Web access is important so that it is clear that the students are doing their own work. Walk-around proctoring can address both problems.

Tutors

Q: How many tutors will we need in the lab?

A (*fixed attendance*): In this version of the Emporium Model, instructors meet with their individual sections in the lab at fixed times. Additional tutors may be needed during those times and are definitely needed at times when the lab is open but there are no scheduled classes. The ratios described below for later in the semester then apply. If testing is done in the lab when classes are not scheduled, be sure to have an appropriate test proctor—rather than student tutors.

A (*flexible attendance*): For the first three to four weeks, you will need one tutor for every 15 students. As the semester progresses and students become familiar with the lab and the software, that ratio drops down to 1:25 and often is as low as 1:40 by the end of the semester. If testing is done in the lab, be sure to have an appropriate test proctor rather than student tutors.

Q: Who are the lab tutors? What qualifications and background do lab tutors need to have?

A: You will need your instructors to tutor in the lab; their presence is essential. In addition, undergraduate math majors and other interested undergraduate students make excellent tutors. Volunteers from the community such as retired high school teachers can tutor. Adjunct faculty may be paid extra to work additional hours in the lab. Math graduate students can tutor if they are available.

Q: How much training is needed for lab tutors?

A: Many institutions experience problems because they underestimate the degree of training—both initial and ongoing—that is required in order to implement their redesigns successfully. The new format inevitably requires certain kinds of interactions with students that are very different from those in the traditional teaching format. Developing a formal plan for initial and ongoing training of all personnel rather than assuming they will pick up the new methods on their own will go a long way to ensuring a successful redesign. Tutors working in a redesigned setting for the first time need enough training to understand the new philosophy of teaching.

Q: What should tutor training include?

A: The most important aspect of tutor training is how to teach in the Emporium Model, because the one-on-one assistance the computer-based format requires is very different from the teaching format that instructors have used and/or experienced in the past. Tutors need to be coached in how to facilitate and engage students in problem solving rather than in resorting to lecturing or providing answers for students. Training should include:

- A full explanation of the Emporium Model, including its rationale and benefits
- Clear guidelines on tutors' responsibilities in the new model
- Instruction in use of the instructional software

- Discussion of all emporium policies and procedures
- The importance of maintaining consistency in implementation of all elements of the redesign

Q: Do tutors need to work through the course modules?

A: It is helpful for new tutors to work through the modules. Doing so enables them to become familiar with the order in which the material is presented, grow accustomed to the wording of questions, and recognize the ways the software expects answers to be entered.

Q: How often do we need to train tutors?

A: The desire to go back to old ways of doing things has to be overcome. Ongoing mandatory training of tutors is the only way to ensure that success will be achieved. All personnel need to be reminded of the policies and procedures and learn about changes in the software. We recommend holding a meeting with all experienced tutors at least once each semester to review old policies and point out any new ones.

As new tutors are brought into the course over time, it is important to help them go through the same steps of accepting a different learning model and to point out ways of creating the types of connections attributed to the traditional, lecture format. We recommend holding a workshop for tutors new to redesign at the beginning of each semester and then monitoring their work throughout that initial term of working in the Emporium Model.

<u>Scheduling</u>

Q: How should we track lab participation?

A (*flexible attendance*): You will need a system to track students when they arrive and when they leave using a commercial product or a homegrown program. Most institutions use a card swipe with student IDs and have some mechanism to move this information to specific instructors on a weekly basis by email or by direct download to grading software.

A (*fixed attendance*): Instructors take attendance via a sign-in sheet when their sections meet in the lab. For institutions that also require students to spend additional hours in the lab, you will need a system as described earlier.

Q: How can we smooth out demand for the lab throughout the week?

A (*flexible attendance)*: There are typically peak usage times in the lab, so it is important to stagger due dates and weekly class meeting times to spread out demand on the lab because most students tend to do their work at the last minute. That is, don't schedule all weekly class meetings on the same day of the week, and don't have all assignments due on the same day of the week. Spread assignment deadline dates across each day of the week; thus, 20 percent of students have deadline dates for assignments, tests, and quizzes on Monday, 20 percent on Tuesday, and so on.

A (*fixed attendance*): In this version of the Emporium Model, demand is smoothed out by scheduling weekly class meetings appropriately.

Q: What are the peak times in the lab?

A (*flexible attendance*): Of course, this varies among institutions, but many institutions have peaks around 10:30 a.m., 1:30 p.m., and again around 6 p.m. For some unknown reason, it appears that Tuesday afternoon is the busiest time at many institutions. Keep track of lab attendance every quarter hour—entering numbers in a table—and study the table to determine staffing decisions for future semesters. Colleges have also found it useful to communicate information about peak demands with their students. Then students can plan their time so that they don't arrive when the lab is already full.

A (*fixed attendance*): In this version of the Emporium Model, peaks are managed by scheduling section meetings appropriately. Most institutions include extra computers beyond the number needed for the scheduled section(s) so that students can drop in for additional help or stay beyond their scheduled time if they desire to do so.

V. How to Make Course Policy Decisions

Prior to the pilot term, you need to develop a number of policies and procedures in order to implement the Emporium Model consistently. The following questions are frequently asked by teams working on a new redesign; the answers have been collected from those who have successfully implemented and sustained a math emporium. Some questions have definite answers; that is, there is consensus among all successful redesigners. Other questions do not have specific answers. You will need to make certain decisions within your own institution. In the latter case, to help you make those decisions, we have provided examples of options that other institutions have chosen. For some questions, the same answer applies to both the flexible and the fixed attendance versions of the Emporium Model. For others, the answers are different. The various versions of the Emporium Model are described in Chapter I.

Course Credit

Q: How should credit be assigned for the redesigned developmental math courses?

A: Some institutions keep the traditional course names and credit amounts and modularize the content within the courses. Others develop a set of modules and assign one credit for each module.

A third option is to use what are called *shell courses*. Invented at Jackson State Community College, 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. These shell courses could be called, for example, 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. The student must complete some specified, minimum number of modules each term to earn a grade for that term. However, the student may complete more than the minimum and may complete the entire sequence of modules if possible. For example, if the total number of modules needed to exit the developmental math program is 12, the minimum needed may be only 4 each term. That would allow a student three terms to complete the total of 12. However, a student could enroll in Developmental Math I, complete all 12, and exit the program in one term. If a student completes only, say, 6 modules, the student would then enroll in Developmental Math II and would need to complete at least 4 of the remaining 6 modules or could complete all 6 and exit the program at the end of Developmental Math II. If this student completes only, say, 4 of the 6 remaining, the student would then enroll in Developmental Math III for two credits and complete the final 2 modules to exit the program.

Modularizing Student Progress

Q: Are these courses self-paced?

A: Definitely not. Self-pacing implies that students move at their own individual pace without any guidelines or benchmarks. Every institution has determined minimum expectations that students must meet to earn credit for that term and has established timelines for completion. Developmental math students are generally not accomplished time managers, and they need the structure provided by weekly deadlines and other progress indicators to be sure they keep up a pace that will allow timely completion. At some points, students may proceed more quickly than the timeline would indicate; at other points, the same students may need some extra time on a topic. Having a guide for pacing also helps faculty know when to intervene with students who are lagging.

Q: What happens if students have not finished the course at the end of the term or, for that matter, if they finish early?

A: Students can complete one course early and move into the next course in the same semester. If the second course is not finished at the end of the semester, students can continue the next semester at the point they left off the previous semester. Students who do not finish the required modules in one semester can begin work the next semester exactly where they left off the previous semester.

NCAT recommends that institutions award a making-progress (MP) grade to students who are making substantial progress at high mastery levels but have not yet completed the course or the course equivalent at the end of a given term. Definitions of the MP grade should be roughly equivalent to a grade of C or better in the traditional courses (e.g., must have completed 80 percent of modules at 70 percent mastery, 75 percent of modules at 75 percent mastery, 75 percent of modules at 80 percent mastery).

Q: If students have to drop out of a course, do they have to start over when they return?

A: No. The traditional developmental course structure presents significant obstacles to students. Sometimes students who begin a developmental course withdraw due to work, family or health issues. In the traditional format, students who withdraw and then return the following semester must begin the same course from the beginning, even though they may have demonstrated mastery of some portion of the material prior to their withdrawal. In the Emporium Model, students begin the next semester where they left off in the previous semester. They do not repeat what they have already mastered.

Q: Suppose some students don't come back immediately (i.e., must skip a term)? Do they have to start over?

A: This is a decision for the institution. Some institutions decide that students who have demonstrated mastery at some earlier time should pick up where they left off and move on. Other institutions require students to start over because they are concerned that students will have forgotten too much of the material. Students who have not forgotten should be permitted to take challenge tests for the earlier modules and quickly move on.

<u>The How Manys</u>

Q: How many modules should we have?

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

- 5 institutions (13 percent) created 5–9 modules.
- 11 institutions (29 percent) created 10–13 modules.
- 14 institutions (37 percent) created 14–19 modules.
- 8 institutions (21 percent) created 20–31 modules.

Q: What level of mastery should be required? Should mastery levels vary for homework assignments, for quizzes, and for tests?

A: There are no right or wrong answers to what NCAT calls the *how-many* questions. Following are examples of decisions other institutions have made about the mastery level required for various kinds of assessments:

	College #1	College #2	College #3	College #4	College #5	College #6
Homework	90%	70%	80%	85%	80%	90%
Quizzes	80%	75%	65%	85%	75%	80%
Module tests	75%	70%	75%	80%	75%	75%

Q: What assignment setting is best for homework and quizzes?

A: Homework should be open from the beginning of the semester, with unlimited attempts prior to the due dates. Feedback should be immediate, with the opportunity to rework an exercise until mastery. Mastery levels can be set before students are allowed to move on to the next homework assignment. Students should use all tutorial resources available to them for homework.

Quizzes should be set so that no tutorials and no feedback are allowed until submission. Remember that quizzes are preparations for tests. Students should be given many attempts to retake quizzes. Questions on quizzes should be pooled so that additional attempts allow students to see a range of questions or problems within one objective. Students should not be able to go back and rework individual items on a quiz to improve their grades. Often, quizzes are timed to give students a more realistic sense of the upcoming test situation. The best score should be the one kept so as to encourage students to continue taking a quiz to improve their grade or just to get additional practice with no penalty.

Q: How many attempts should students be allowed on quizzes, tests, and final exams?

A: There are no right or wrong answers to what NCAT calls the *how-many* questions. Multiple testing opportunities are musts if mastery is required, and a plan should be in place to require an amount of time to go by so students can prepare for a retake. For example, after two attempts without success, the student should be required to meet with an instructor to review errors prior to attempting the test a third time. Following are examples of decisions that other institutions have made:

	College #1	College #2	College #3	College #4	College #5	College #6
Quizzes	6	NA	Unlimited	10	2	10
Module tests	3	10	3	2	2	3
Final exam	3	10	NA	1	1	1

Q: What percentages of course points should be awarded for each course component?

A: There are no right or wrong answers to what NCAT calls the *how-many* questions. Following are examples of decisions that other institutions have made:

	College #1	College #2	College #3	College #4	College #5	College #6
Participation	5%	10%	5%	10%	7.2%	6%
Homework	20%	30%	15%	10%	6.8%	11%
Notebooks	NA	NA	10%	NA	NA	6%
Quizzes	15%	NA	NA	10%	16%	11%
Module tests	45%	50%	70%	45%	40%	48%
Midterm	NA	5%	NA	NA	NA	NA
Final exam	15%	5%	NA	25%	30%	18%

Q: Should partial credit be awarded on tests and/or exams?

A: There are differences of opinion as to what constitutes appropriate policy. Some institutions believe that the correct answer is important and that students should be granted credit for the problem only if they have arrived at the correct solution. Other faculty contend that part of what a student is learning involves the process of thinking through the problem, setting it up correctly, and then doing the calculations. Thus, a student who shows understanding of the process, even though making an error in calculating the answer, should receive partial credit.

If partial credit is to be granted, there needs to be a clear rubric for assigning that credit, so that everyone is treated fairly and partial credit is awarded consistently. Granting partial credit may require that either the problem be identified in preset steps (so that the software can grade it) or that the problem be hand graded. Hand grading is time-consuming, especially for large sections. Some institutions formulate one section of each test (usually about 30 percent) to require that students solve problems and show their work; that section is then hand graded and given partial credit. The remainder of the test is taken online, and only correct answers receive full credit. Whether or not to grant partial credit and under what circumstances are decisions that the faculty need to discuss, arrive at, and apply consistently for all students.

<u>Testing</u>

Q: How should we handle testing?

A: Module tests and final exams should be taken in a proctored environment: a segregated section of the lab, a computer classroom, or a college testing center when available. Keep students who are taking tests segregated from those who are working on homework and other assignments. This allows those proctoring the testing students to know who is actually taking a test. Provide scratch paper for students by using varied-color paper, pick up the scratch paper as students leave, and shred it after the testing window closes. Students should be allowed to take their tests before the deadline as long as a test proctor is present, so that they can proceed through the course at a faster rate.

VI. How to Reduce Instructional Costs

The traditional format of developmental math courses requires instructors to carry out all of the development and delivery aspects of a course on their own. The traditional format assumes that small classes are necessary in order to produce positive learning results because the instructor is responsible for all interactions. Responding to every inquiry, comment, or discussion personally; preparing lectures; and the hand grading of assignments, quizzes, and examinations are labor-intensive. Course redesign involves substituting technology for much of that effort, often with the assistance of different kinds of personnel. Making the substitutions discussed in the following sections enables each instructor to teach more students than before—and without increasing the workload.

Q: How can redesign lead to reduced instructional costs?

A: Redesigning a whole course eliminates duplication of effort on the part of instructors and creates opportunities for using alternate staffing patterns. Since the Emporium Model eliminates the number of lectures or other classroom presentations for which faculty members must prepare and present and instead replaces those formats with interactive learning resources, faculty time can be reallocated to other tasks either within the same course or in other courses, and faculty can serve more students. Moving away from viewing instructors as the sole sources of content knowledge and assistance and toward greater reliance on interactive learning materials offers many opportunities for reducing instructional costs.

Replacing hand grading with automated grading of homework, quizzes, and exams makes it possible to reduce the cost of providing feedback while improving its quality. Online weekly practice quizzes can replace weekly homework grading, and all grading and record keeping can be automated. Replacing time-consuming human monitoring of student performance with course management software makes it possible to reduce costs while increasing the level and frequency of oversight of student progress. Using instructional software also radically reduces the amount of time that faculty members typically spend in nonacademic tasks like calculating and recording grades, photocopying course materials, posting changes in schedules and course syllabi, sending out special announcements to students, and documenting course materials like syllabi, assignments, and examinations so that they can be used in multiple terms.

Q: How can we calculate the number of hours instructors will spend on the redesigned course compared with the traditional course?

A: NCAT has developed a Scope of Effort Worksheet (see Appendix D) to help campuses document that the number of hours faculty devote to the redesigned course will be the same as or fewer than those devoted to the traditional format of the course—even if class size grows or the number of sections that faculty carry increases. This is possible because the Emporium Model offloads to the technology certain tasks like grading and monitoring student progress. Explaining how this occurs and documenting the changes by using the Scope of Effort Worksheet allow redesign leaders to help others on campus understand the benefits of redesign for both students and faculty.

Q: Do cost savings equal saved instructor hours?

A: Planning for cost reduction as a part of redesign consists of two steps. The first is to complete the Scope of Effort Worksheet for the traditional and redesigned formats of the course, which lets you demonstrate how the number of hours spent by each person involved in the course can change. The second step is to translate those saved hours into one of NCAT's Cost Reduction Strategies described later. If you stop at the first step, you might create what NCAT calls *paper savings*. By *paper savings*, we mean savings that represent a workload reduction for individual faculty members or others but do not produce cost savings to the department or institution.

Reducing time spent by individual faculty members and others as displayed on the Scope of Effort Worksheet is an *enabler* that allows you to choose a cost savings strategy. For example, a faculty member or TA who spends half the time on the redesigned course that that faculty member or TA did on the traditional course could increase section enrollment or carry two sections without an increase in workload. That then produces real savings for the institution.

Q: Does it matter whether our developmental math enrollment is growing or remains stable?

A: If the course enrollment is relatively stable (and accommodating more students is not a goal), you must reduce the number of people involved in teaching the course and/or change the mix of personnel in order to produce cost savings.

If accommodating more students is a goal, you do not have to reduce the number of people involved in teaching the course in order to produce cost savings, although you can do this. You can reduce the cost per student (total resources devoted to the course/total course enrollment) by teaching more students with the same staffing.

Q: How can we restructure the course to reduce instructional costs?

A: There are three ways to restructure the course that will reduce costs.

1. Have each instructor carry more students by
   a. increasing section size or
   b. increasing the number of sections each instructor carries for the same workload credit.
2. Change the mix of personnel from more expensive to less expensive.
3. Do both simultaneously.

Each of these strategies can be used whether your enrollment is growing or stable. 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 by the same resource base. In each case, the cost per student is reduced.

Q: Are there examples of having each instructor carry more students by increasing section size?

A: Here's a calculation showing how this works:

Stable enrollment: If your enrollment is stable, this will allow you to reduce the number of sections offered and the number of people teaching the course.

> *Traditional*: 800 students: 40 sections of 20 students each taught by 40 instructors.
> Student-faculty ratio = 20:1

Redesign: 800 students: 20 sections of 40 students each taught by 20 instructors. Student-faculty ratio = 40:1

Growing enrollment: If your enrollment is growing, this will allow you to serve more students with the same number of people teaching the course.

Traditional: 800 students: 40 sections of 20 students each taught by 40 instructors. Student-faculty ratio = 20:1
Redesign: 1,600 students: 40 sections of 40 students each taught by 40 instructors. Student-faculty ratio = 40:1

Cochise College. Prior to the redesign, Cochise College offered 71 traditional sections of developmental math on the main campus, with an average section size of 21 students each. After the redesign, the average section size increased to 38 students. The increase in section size meant that each of 10 full-time faculty carried on average an additional 33 developmental math students each year. The percentage of full-time faculty teaching the developmental math sections increased from 53 percent in the traditional courses to 73 percent in the redesign. The cost-per-student declined from $351 in the traditional format to $306 in the redesign, a reduction of 13 percent.

Stark State College. Stark State reduced the cost of developmental math by increasing section size from an average of 24 to about 48 on the main campus and about 40 overall. A significant, 81 percent enrollment increase (from 4,400 to 8,000 students) occurred also, yet the total cost of offering the developmental math sequence increased by only 36 percent. Stark State also reduced the number of contact hours per developmental math course from four to three. In the traditional format, Stark State had had to pay an additional one hour per section, and faculty could teach only eight sections annually. In the redesign, faculty could teach nine courses per year as part of their load. Together, these two actions reduced the cost per student from $238 in the traditional format to $178 in the redesign, a decline of 25 percent.

Q: What are examples of increasing the number of sections that each instructor carries for the same workload credit?

A: Here's a calculation showing how this works:

Stable enrollment: If your enrollment is stable, this will allow you to offer the same number of sections and reduce the number of people teaching the course.

Traditional: 800 students: 40 sections of 20 students each; instructor time spent per section = 200 hours; each instructor teaches one section for the same workload credit. Student-faculty ratio = 20:1
Redesign: 800 students: 40 sections of 20 students each; instructor time spent per section = 100 hours; each instructor teaches two sections for the same workload credit. Student-faculty ratio = 40:1

Growing enrollment: If your enrollment is growing, this will allow you to serve more students with the same number of people teaching the course.

Traditional: 800 students: 40 sections of 20 students each; instructor time spent per section = 200 hours; each instructor teaches one section for the same workload credit.

Student-faculty ratio = 20:1
Redesign: 1,600 students: 80 sections of 20 students each; instructor time spent per section = 100 hours; each instructor teaches two sections for the same workload credit.
Student-faculty ratio = 40:1

Cleveland State Community College. In the traditional model, Cleveland State's developmental math program comprised 55 24-student sections in fall and spring, 45 of which were taught by full-time faculty (82 percent) and 10 by adjuncts (18 percent). Each course met three times per week. The total cost of the traditional course was $270,675. In the redesigned model, Cleveland State offered 77 18-student sections in fall and spring, all of which were taught by full-time faculty at a cost of $219,258. Each section had one class meeting per week in a small computer lab, and students were required to spend two additional hours in a larger lab staffed by faculty and tutors. The total cost savings was $51,417, a 19 percent reduction. The full-time-equivalent teaching load per faculty member went from 21.2 to 26.0 with no increase in workload. Faculty had been teaching five sections per semester. In the redesign, faculty members taught 10 or 11 sections, which met once per week, and worked 8–10 hours in the lab.

Pearl River Community College. Pearl River Community College realized significant cost savings as a result of redesign. As part of the redesign, full-time faculty workload changed. Pearl River increased the number of developmental math sections taught by full-time faculty each term from five to nine for the same workload credit and reduced section size from 24 to 20. The student load for each instructor increased on average from 134 students each term to over 160 students. In addition, faculty worked five hours weekly in the lab with no change in the overall hours devoted to developmental math. The redesign format allowed one instructor to teach more students than were taught in the traditional format while decreasing class size. In the traditional format, each instructor taught five 3-day-a-week sections with 24 students. In the redesigned format, that same instructor could teach 10 sections of 20 students plus spend five hours tutoring in the lab. This could be accomplished because the class met only once a week and because no hand grading was required. Overall, faculty productivity rose by 31 percent, and cost per student decreased from $252 in the traditional format to $168 in the redesign, a 33 percent reduction.

Q: What are examples of changing the mix of personnel from more expensive to less expensive?

A: Here's a calculation showing how this works:

Stable enrollment: If your enrollment is stable, this will allow you to offer the same number of sections and reduce the total cost of the people teaching the course, because adjuncts, tutors, and undergraduate tutors are paid less than full-time faculty and because tutors and undergraduate tutors are paid less than adjuncts.

Traditional: 800 students: 40 sections of 20 students each; 30 sections taught by full-time faculty; 10 sections taught by adjuncts.
Redesign: 800 students: 40 sections of 20 students each; 10 sections taught by full-time faculty; 30 sections taught by adjuncts.

Growing enrollment: If your enrollment is growing, this will allow you to serve more students, offer more sections, and reduce the cost per student, because adjuncts, tutors, and undergraduate tutors are paid less than full-time faculty and because tutors and undergraduate tutors are paid less than adjuncts.

Traditional: 800 students: 40 sections of 20 students each; 30 sections taught by full-time faculty; 10 sections taught by adjuncts.
Redesign: 1,600 students: 80 sections of 20 students each; 20 sections taught by full-time faculty; 60 sections taught by adjuncts.

Jackson State Community College. In the traditional model, Jackson State offered 89 sections of developmental math with 20–24 students each during fall and spring, 63 of which were taught by full-time faculty (71 percent) and 26 by adjuncts (29 percent). The cost of tutors was $4,510, bringing the total cost of the traditional course to $333,159. In the redesigned model, Jackson State offered 71 sections during fall and spring; 44 sections enrolled 30 students each, and 27 enrolled 24 students each. The number taught by full-time faculty was 37 (52 percent), and the number taught by adjuncts was 34 (48 percent). The cost of tutors was $38,298, bringing the total cost of the redesigned course to $258,529. The cost per student of offering developmental math was reduced from $177 to $141, a 20 percent decrease. These changes enabled Jackson State to reallocate faculty time for other tasks within the mathematics department.

University of Alabama. The redesign of Intermediate Algebra at the University of Alabama generated cost savings by decreasing the number of faculty needed to teach the course while providing greater student interaction and consistency in learning outcomes. The university combined all sections into one and moved all structured learning activity to its Math Technology Learning Center, which was open 65 hours per week. Students also attended a 30-minute class session each week that focused on student problems and built community among students and instructors. The number of instructors needed to teach the course decreased from 10–12 to 6. A significant savings was realized through the use of undergraduate tutors to provide individualized student assistance in the lab in place of more-costly graduate students. The redesign reduced the cost per student from approximately $122 to $82, a 33 percent savings.

Q: What are some examples of doing both simultaneously?

A: Most redesigns employ both strategies simultaneously as the following examples illustrate.

Manchester Community College. The Manchester Community College team increased section size and changed the mix of personnel. Section size was doubled from 25 students in the traditional format to 50 students in the redesigned format. The number of sections offered was reduced from 60 to 31. The cost per student decreased from $255 to $165, a 35 percent savings. Instructors were able to double the number of students because there was significant reduction in faculty time required to grade homework and prepare assessment materials. In addition, instructors were assisted in each redesigned section by two or three tutors. This allowed ample time to provide the assistance needed for all students. There was almost never a time when students had to wait for help, and most instructors felt improved engagement with their students.

Lurleen B. Wallace Community College. At Lurleen B. Wallace Community College, the primary cost-saving technique was that each faculty member (full-time and adjunct) taught two developmental math redesigned sections of 29 students each for one workload credit rather than one section of 24 students as they did in the traditional format. The availability of tutors and instructors in each class made it possible to increase section size and still provide individualized attention and assistance for all students. In addition, the number of faculty hours spent on developmental math was reduced by eliminating duplication of faculty responsibilities. The cost per student decreased from $114 in the traditional format to $53 in the redesign, a 54 percent savings. Faculty time was reallocated for other tasks within the mathematics department.

Q: Can the Emporium Model offer us a cost-effective way to offer low-enrollment sections?

A: A good strategy for dealing with low-enrollment sections made possible by the Emporium Model was conceived at Cleveland State Community College (CSCC) during the college's redesign of developmental math and has been implemented in many institutions since then. We (CSCC and NCAT) call the strategy the *one-room schoolhouse*, which produces both institutional cost savings and clear benefits to students.

When small sections do not fill (particularly at smaller campuses and sites or during certain class times), they have to be either canceled (interrupting student progression through the sequence and incurring lost revenue to the college) or offered at a relatively high cost. Using the one-room schoolhouse means that a college offers multiple developmental math courses in the same computer classroom or lab at the same time. Students work with instructional software, and instructors provide help when needed. Even though students are at different points in the developmental sequence, they can be in the same classroom. This strategy enables the institution to increase course offerings and avoid canceling classes, which in turn reduces scheduling roadblocks for students, enabling them to complete their degree requirements sooner. Because fewer sections are needed to accommodate the same number of students, overall cost per student can also be lowered.

Would the one-room schoolhouse strategy help solve scheduling problems on your campus and enable all students to take the courses they need to complete their programs on time?

In addition to Cleveland State Community College, the following institutions are among those that have implemented the one-room schoolhouse: Cochise College, Cossatot Community College of the University of Arkansas, Lurleen B. Wallace Community College, Northwest-Shoals Community College, Pearl River Community College, and Robeson Community College. To learn more about the specifics of implementation of this approach, follow the links at http://www.theNCAT.org/Mathematics/CTE/CTEInstitutions%20(rev).html for contact information.

Q: Are there further opportunities for cost savings beyond these three strategies in using the Emporium Model?

A: After several terms of full implementation of your redesign strategy, you may achieve further savings through such things as improved retention (increased course completion rates), the impact of modularization, and/or reduced space requirements. There are, however, a number of variables that may influence whether or not you are able to realize those additional savings, such as the number of students who accelerate versus the number who move at a slower pace and scheduling complexities. Because it is difficult to predict how these various elements will play out until you have some experience with the redesign over time, your plan for cost reduction should include one of the strategies listed previously, which will result in immediate savings during the first term of full implementation.

VII. How to Assess Student Learning

The basic assessment question to be answered is the degree to which improved learning has been achieved as a result of the course redesign. Answering this question requires comparisons between the student learning outcomes associated with a given course delivered in its traditional form and in its redesigned form. There are two steps to achieve this goal: (1) establish the method of obtaining data and (2) choose the measurement method.

Q: How and when do you obtain the data?

A: There are various ways to acquire the data.

- During the pilot term

  This comparison can be accomplished in one of two ways:

  1. Parallel Sections (Traditional and Redesign)

  Run parallel sections of the course in traditional and redesigned formats and look at whether there are any differences in outcomes—a classic quasi-experiment.

  2. Baseline Before (Traditional) and After (Redesign)

  Establish baseline information about student learning outcomes from an offering of the traditional format before the redesign begins, and compare the outcomes achieved in a subsequent (after) offering of the course in its redesigned format.

  Note: The number of students assessed should include at least 100 from the traditional format and 100 from the redesigned format.

- During the first term of full implementation

  Because there will not be an opportunity to run parallel sections once the redesign reaches full implementation, use baseline data from (a) an offering of the traditional format before the redesign began or (b) the parallel sections of the course offered in the traditional format during the pilot phase.

The keys to validity in all cases are (a) to use the same measures and procedures to collect data in both kinds of sections and (b) to ensure as fully as possible that any differences in the student populations taking each section are minimized (or at least documented so that they can be taken into account).

Q. What measures should you use?

A: The degree to which students have actually mastered course content appropriately is, of course, the bottom line. Therefore, some kind of credible assessment of student learning is critical to the redesign project.

Following are descriptions of three measures that may be used.

- *Comparisons of common final exams*. One approach is to use common final examinations to compare student learning outcomes across traditional and redesigned sections. This approach may include subscores or similar indicators of performance in particular content areas as well as simply an overall final score or grade. (*Note*: If a grade is used, there must be assurance that the basis on which it was awarded is the same under both conditions—e.g., not curved or otherwise adjusted.)

Examples

Parallel sections. “During the pilot phase, students will register for either the traditional course or the redesigned course. Student learning will be assessed mostly through examination developed by departmental faculty. Four objectively scored exams will be developed and used commonly in both the traditional and redesigned sections of the course. The exams will assess both knowledge of content and critical-thinking skills to determine how well students meet the six general learning objectives of the course. Student performance on each learning outcome measure will be compared to determine whether students in the redesigned course are performing differently from students in the traditional course.”

Before and after. “The specifics of the assessment plan are sound, resting largely on direct comparisons of student exam performance on common instruments in traditional and redesigned sections. Faculty have developed a set of common, objective questions that measure the understanding of key mathematical concepts. This examination has been administered across all sections of the course for the past five years. Results obtained from the traditional offering of the course will be compared with those from the redesigned version.”

- *Comparisons of common content items selected from exams*. If a common exam cannot be or has not been given, an equally good approach is to embed common questions or items in the examinations or assignments administered in the redesigned and traditional delivery formats. This design allows common baselines to be established. For multiple-choice examinations, a minimum of 20 such questions should be included. For other kinds of questions, at least two or three complex problems should be included.

Examples

Parallel sections. “The primary technique to be used in assessing content is common-item testing for comparing learning outcomes in the redesigned and traditional formats. Direct comparisons of learning outcomes will be obtained from 15 common complex problems embedded into course assessments: 5 early in the semester, 5 at midsemester, and 5 in the final examination in both the traditional and redesigned courses.”

Before and after. “The assessment plan will address the need to accommodate a total redesign. The plan calls for a before/after approach using 30 exam questions from the previously delivered, traditionally configured course and embedding them in exams in the redesigned course to provide benchmarks for comparison.”

- *Comparisons of pre- and posttests*. A third approach is to administer pre- and posttests to assess student learning gains within the course in both the traditional and redesigned sections and to compare the results. By using this method, both posttest results and value-added analyses can be compared across sections.

Examples

Parallel sections. “The most important student outcome, developmental math knowledge, will be measured in both redesigned and traditional courses. To assess learning and retention, students will take a pretest during the first week of the term and a posttest at the end of the term. The faculty, working with the evaluation team, will design and validate content-specific examinations that are common across traditional and redesigned courses. The instruments will cover a range of behaviors from recall of knowledge to higher-order-thinking skills. The examinations will be content validated through the curriculum design and course objectives.”

Before and after. “Student learning in the redesigned environment will be measured against learning in the traditional course through standard pre- and posttests. The college has been collecting data from students taking this course, using pre- and posttests to assess student learning gains within the course. Because the same tests are administered in all semesters, they can be used to compare students in the redesigned course with students who have taken the course for a number of years, forming a baseline about learning outcomes in the traditional course. Thus, the college can compare the learning gains of students in the newly redesigned learning environment with the baseline measures already collected from students taking the current version of the course.”

Q: Should the assessments be different from those used in the course?

A: We strongly recommend that you avoid creating add-on assessments for regular course assignments such as specially constructed pre- and posttests. These measures can raise significant problems with student motivation. It is easier to match and compare regular course assignments.

Q: How can we be sure that the students in parallel sections are equivalent if they have not been randomly assigned?

A: If parallel sections are formed based on student choice, it would be a good idea to consider whether differences in the characteristics of students taking the course in the two formats might be responsible for differences in results. Final learning outcomes could be regressed on the following: status (full-time versus part-time), high school percentile rank, total SAT score, race, gender, whether the student was taught by a full-time or part-time faculty member, and whether the student was a beginning freshman.

Q: Are there other comparisons that would be useful to the redesign effort?

A: In addition to choosing one of the three measures described earlier, the redesign team may want to conduct other comparisons between the traditional and redesigned formats such as:

- Performance in follow-on courses
- Attitude toward subject matter
- Student interest in pursuing further course work in the discipline
- Differences in performance among student subpopulations
- Student satisfaction measures

VIII. How to Calculate Comparative Completion Rates

Completion rates refers to the percentages of students who began the course and finished with a grade of C or better. This measure (sometimes referred to as a *pass rate*) is generally accepted in higher education to indicate student "success" in a course.

Completion rates are not the same as measures of student learning. *Assessment of learning* refers to direct and comparable measures of student learning outcomes; *completion rates* refers to final grades.

Q: Why are grades not comparative measures of student learning?

A: Pass rates (grades of C or better) in traditional courses are not reliable indicators of student learning and are almost universally inflated due to prior inconsistencies in grading practices. Students in traditional courses are assessed in a variety of ways that lead to overall grading differences. Inconsistencies include (1) curving, (2) failing to establish common standards for topic coverage (in some sections, entire topics are not covered, yet students pass), (3) having no clear guidelines regarding the award of partial credit, (4) allowing students to fail the final exam yet still pass the course, and (5) failing to provide training and oversight of instructors, especially part-time ones.

Q: Why would one want to look at comparative completion rates as well as comparative measures of student learning?

A: It is important for students to both master the content of the developmental math sequence and complete the sequence as rapidly as possible in order to enroll in college-level courses. It is possible to demonstrate increased student learning through redesign (e.g., final exam means that increase from 50 percent to 70 percent), but if only 5 percent of students take the final exam, you have a problem despite the demonstrated increase in student learning outcomes.

Q: Why are course-by-course completion rates not true measures of success in the Emporium Model?

A: Ideally, one wants to see an increase in both student learning outcomes and completion rates. Unfortunately, there is often a discrepancy. In conducting an extended analysis of situations in which a modularized Emporium Model produced increased learning outcomes and decreased course completion rates, NCAT discovered a variety of reasons that course-by-course completion comparisons are not true measures of the success or lack of success of the model. Among them are:

- *Comparisons of apples and oranges*. In order to compare individual course completion rates, one needs to look at the percentage of students who complete the same amount of material in the same period of time. In the redesign of their developmental math sequences, some institutions collapse what had been three different courses into one, modularized course. Students enrolled in the redesigned course can begin anywhere from Module 1 to Module 15 and so on and pick up in a subsequent semester where they left off in a previous one. Under these circumstances, there is no comparative basis to calculate completion rates.

- *Mastery learning requirement in the redesign*. In the Emporium Model, students are required to master all of the content of all of the courses. Redesign students have to pass each module independently at levels ranging from 75 percent to 90 percent—before being allowed to progress to the next module—by showing mastery in homework assignments, practice tests, and module exams.

In the traditional format, students typically exit the course by simply attaining a total cumulative score of at least 70 percent or 75 percent. Based on the averaging of grades, students can earn a C or better by passing enough tests and learning enough competencies but not necessarily all. In traditional sections, students often continue on to the next topic without having demonstrated mastery of the previous one. Increasing the mastery level above 70–75 percent to 80–90 percent, as many redesigned courses do, essentially raises the cut score for a student to earn at least a C in the redesigned course.

When one uses a mastery learning approach, students do more work and learn more, which often takes longer. That means that many students do not complete a particular course by the end of the term. They can, however, start in the subsequent term where they left off in a previous one. Mastery learning, while sometimes taking longer to accomplish, ensures that students are well prepared to take on college-level work.

Q: If course-by-course comparisons are not valid, how can we measure completion in the Emporium Model?

A: Having recognized the difficulty in using course-by-course completion rates to compare student success, NCAT recommends two valid ways to measure student completion other than course-by-course comparisons.

Making-progress grade. NCAT recommends that institutions award a making-progress (MP) grade to students who are making substantial progress at a high mastery level but have not yet completed the course or the course equivalent by the end of a given term. Definitions of MP grades should be roughly equivalent to a grade of C or better in the traditional courses (e.g., must have completed 86 percent of modules at 80 percent mastery, 80 percent of modules at 70 percent mastery, 75 percent of modules at 75 percent mastery, 75 percent of modules at 80 percent mastery). The Completion Forms included in Appendix B list an MP grade along with a place to indicate how the grade is defined.

As an example, among Changing the Equation institutions (described in the Introduction) that were able to calculate a course-by-course completion rate, the success rate (grade of C or better) was 33 percent. After adding the MP grade to the calculations, the percentage rose to 74 percent. The latter is a much more valid indicator of the success of the program.

Completion of the developmental math sequence. To evaluate the success of the Emporium Model in developmental math, you can compare the rate of completion of the developmental math *sequence*. To do so, you need to create two cohorts of students (one of students enrolled in the traditional course in the past and one of students enrolled in the redesigned course) and track the progress of both. If your traditional developmental math sequence comprised two courses, calculate the percentage of both cohorts of students who completed the sequence (receiving a C or better) in two terms. If your traditional developmental math sequence comprised three courses, calculate the percentage of both cohorts of students who completed the sequence in three terms. These calculations will produce a valid comparison of student completion rates.

Q: What about measuring subsequent success in college-level math courses?

A: Another way to evaluate the success of the Emporium Model in developmental math is to compare student rates of success in subsequent *college-level* math courses. This measure also requires you to create two cohorts of students (one of students enrolled in the traditional course in the past and one of students enrolled in the redesigned course). You then calculate the percentage of both cohorts of students who completed the subsequent college-level course(s) by receiving a C or better.

Examples

- The two most common college-level entry math courses at Northern Virginia Community College are Mathematics for the Liberal Arts and Precalculus. The success rate (grade of C or better) in Math for Liberal Arts for all students in spring 2012 was 67.7 percent; for students who had completed the redesigned developmental math course, the success rate was 72.5 percent. The success rate (grade of C or better) in Precalculus for all students in spring 2012 was 57.7 percent; for students who had completed the redesigned developmental math course, the success rate was 72.0 percent.

- At Northwest-Shoals Community College in Alabama, the percentage of developmental math students successfully completing a college-level math course increased from 42 percent before the redesign to 76 percent after the redesign in 2011.

- At Somerset Community College in Kentucky, the percentage of developmental math students successfully completing college-level applied mathematics courses increased from 56 percent before the redesign to 67 percent after the redesign in 2011.

To truly evaluate the success of the Emporium Model in developmental math, the rate of completion of the developmental math *sequence* and the rate of success in subsequent *college-level* math courses are the two most important data points to use. If only 20 percent of students exit the developmental math sequence but 75 percent pass the college-level course, you still have a problem, just as you did when 50 percent exited the sequence but were unprepared and only 30 percent passed the college-level course.

IX. How to Address Specific Faculty Concerns

Clearly, faculty members are key to the redesign and are involved at every stage. Some issues are, however, particular to their situations such as their changing roles, responsibilities, workloads, and training, all of which we address in this chapter. Some institutions are fortunate to have all instructors buy into and support the redesign, but most encounter some resistance along the way—resistance that ranges from mild to severe. Thus, we also give you some ideas about how others have dealt with faculty resistance to the new way of teaching.

Q: How does the instructor's role change?

A: Faculty members no longer spend time preparing lectures, grading homework, or preparing and grading tests. Therefore, they can dedicate more time to helping students. The faculty role becomes one of facilitator of student learning and of guide for each student's study in math. Instructors meet with classes either in or outside the lab, tutor students, counsel students, monitor each student's progress, and provide support and intervention as needed. Instructors may also lead small-group discussions on topics particularly difficult for groups of students.

Q: How can students possibly learn the material if we don't teach it to them?

A: Most student learning takes place in the lab setting. The instructor role in the classroom is to guide students individually, pull concepts together, and help students avoid common pitfalls. Your role as sage on the stage is not feasible when students are at different places in the course and are trying to master different skills. You trade that role for tutor in the trenches while students are doing their work independently. This is a huge adjustment for many experienced instructors and inexperienced instructors as well. As the same time, it is a very rewarding experience for instructors as reported by experienced redesign teams.

Q: If we meet in a classroom only once a week, how can we possibly teach a week's worth of material in 50 minutes?

A: Don't try to teach a week's worth of material. For those who have a weekly class meeting, its goal is to focus students' attention on the week's upcoming tasks. Prior to class, the instructor should review each student's status so that that instructor is ready to work—especially with students whose progress is lagging.

Here are some tips for what instructors should do in a weekly class meeting:

- Meet individually with each student to review progress and resolve any issues the student has identified.
- Check notebooks, if these are required.
- Have longer discussions and establish goals with students who are lagging behind the pace needed to complete the modules successfully.
- Discuss study strategies.
- Be sure to take attendance.
- Above all, do not try to cram in a traditional lecture, and do not go over homework.

Q: Doesn't the Emporium Model reduce the interaction between students and instructors?

A: On the contrary, there is *more* interaction between students and instructors than ever before, and that interaction is more meaningful, more individualized, and more focused. The main reasons students learn better under this model are that they are less passive and more actively involved in doing math and they receive help based on their individual needs.

Faculty Workload

Q: What redesigned teaching load is equivalent to a traditional three-credit-hour course?

A: There is no simple answer to this question because every institution and every department has a different set of rules (read: policies and procedures) in regard to faculty load. Redesign will require you to revisit some of those rules because of the way that redesigned courses are structured. A teaching assignment that used to be a three-day-a-week, hourlong lecture with paper assessments is now very different because the software both provides most of the "lecture" and automates most of the assessments.

A common assumption in higher education is that instructors spend two hours outside of class (preparing and grading) for every one spent in class. That means that a three-credit course typically requires the instructor to spend nine hours per week on the course. Because both the in-class time and the preparation and grading time are reduced in the Emporium Model, you need to reallocate instructor time accordingly. This might translate to something like two 1-hour weekly class meetings, 2 hours for preparation and review of student progress, and 5 hours in the lab tutoring students each week. You will need to make decisions based on your own institutional rules and the changes you made in the redesigned course structure.

In addition, many institutions ask instructors to schedule some of their office hours in the lab, which adds to the number of hours instructors spend in the lab so that they can provide assistance for all students in the lab when they don't have scheduled appointments with their own students.

Q: Are there tools to help instructors see how much time they are spending in the Emporium Model versus in the traditional format?

A: NCAT has developed a Scope of Effort Worksheet (see Appendix D) to help campuses document that the number of hours faculty devote to the redesigned course will be the same as or fewer than those devoted to the traditional format of the course, even if class size increases or the number of sections that faculty carry increases. This is possible because the Emporium Model offloads to the technology certain tasks like grading and monitoring student progress. Explaining how this occurs and documenting the changes by using the Scope of Effort Worksheet allow redesign leaders to help others on campus understand the benefits of redesign for both students and the faculty.

Q: Who should be responsible for the course?

A: Someone needs to take overall responsibility for ensuring that the course works well, that all students have the same learning experiences and assessments, and that all course policies and procedures are implemented consistently. Make sure you have a course coordinator who can offer the necessary leadership. In smaller institutions, the department chair usually has overall responsibility for ensuring that the course works well, that all students have the same learning experiences and assessments, and that all course policies and procedures are implemented consistently. In larger institutions, a course coordinator may assume that responsibility. At the same time, it is important to emphasize teamwork and to involve others in the decision-making process. Instructors themselves are responsible for their individual sections, as in the traditional format.

<u>Training</u>

Q: How much training is needed for instructors?

A: Many institutions experience problems because they underestimate the degree of training—both initial and ongoing—that is required in order to implement their redesigns successfully. The new format inevitably requires very different kinds of interactions with students from those of the traditional teaching format. Developing a formal plan for initial and ongoing training of all personnel—rather than assuming they will pick up the new methods on their own—will go a long way to ensuring a successful redesign.

Instructors working in a redesigned setting for the first time need enough training to understand the new philosophy of teaching that is required, because a change in the basic mind-set must take place. Some people embrace this change immediately; others may have to be dragged along. Here are some tips:

- Plan to get instructors involved as early as possible.
- Involve instructors in curricular decision making.
- Offer workshops with discussions and presentations.
- Bring in guests from other schools that have successfully implemented an emporium.
- As the semester progresses, meet frequently with all instructors to offer ongoing training. Some institutions meet weekly; others meet on a less-regular basis.

Q: What should instructor training include?

A: The most important aspect of instructor training is how to “teach” in the Emporium Model because the one-on-one assistance the computer-based format requires is very different from the teaching format the instructors have used and/or experienced in the past. Instructors need to be coached in how to facilitate—and engage students in—problem solving rather than in resorting to lecturing or providing answers for students. Training should include:

- A full explanation of the Emporium Model, including its rationale and benefits
- Clear guidelines on instructors’ responsibilities in the new model
- How to use the instructional software
- The importance of maintaining consistency in implementing all elements of the redesign

Q: Do instructors need to work through the course modules?

A: It is helpful for new faculty to work through the modules. Doing so enables them to become familiar with the order in which the material is presented, grow accustomed to the wording of questions, and recognize the ways the software expects answers to be entered.

Q: How often do we need to train instructors?

A: The desire to go back to old ways of doing things has to be overcome. Ongoing mandatory training of instructors is the only way to ensure that success will be achieved. All personnel need to be reminded of the policies and procedures and learn about changes in the software. We recommend holding a meeting with all experienced instructors at least once each semester to review old policies and point out any new ones.

As new faculty are brought into the course over time, it is important to help them go through the same steps of accepting a different learning model and to point out ways of creating the type of connections attributed to the traditional lecture format. We recommend holding at the beginning of each semester a workshop for instructors new to redesign and then monitoring their work throughout their initial term of working in the Emporium Model.

Q: How should we train adjunct faculty members?

A: In addition to involving adjuncts in instructor training sessions, full-time faculty need to mentor part-time faculty during the latter's initial term of working in the Emporium Model. Although time-consuming, doing so will ensure greater consistency in the redesign. Mentoring is an investment that will ensure the continued success of the redesign.

Q: How do we ensure ongoing consistency among instructors?

A: Even when initial training is provided for all instructors, most institutions discover inconsistencies in application of the redesign, especially during the pilot period. For example, students may be required to complete guided-lecture notes before taking a quiz, but some instructors do not monitor guided-lecture-note completion. Despite policies against accessing external resources during lab, some instructors allow students to listen to music with headphones, check e-mail, or use non-math-related Web resources while in the lab. Despite policies to the contrary, some instructors permit use of notes on proctored exams.

The faculty need to formulate firm rules about such matters. Faculty need to adjust to the concept that they cannot make a decision based on their individual interpretations; rather, all have to follow the same rules and guidelines. If an instructor has an idea for improving student learning and/or the process, the idea should be agreed upon and used by all instructors. Because unforeseen issues arise regularly, weekly staff meetings are necessary, with results recorded, published, and distributed so that all faculty and staff can consistently implement those decisions. Although time-consuming, this investment ensures the continued success of the redesign.

Faculty Resistance

Q: How can we overcome faculty resistance to the redesign?

A: There are a number of ways to overcome faculty resistance:

- *Persuade them*. Some developmental math faculty are sincerely concerned that developmental math students cannot learn by working with instructional software and receiving on-demand assistance. They have spent years lecturing, watching students do homework, and grading many, many papers. They have often mothered the students, concerned that students' previous educational experiences have been too harsh or demanding. With greater exposure to situations in which the Emporium Model is working, these sincere instructors will adapt to and embrace the more successful learning environment. The data demonstrating greater student success will persuade them along with the assurances of their colleagues on campus and at other institutions who use the Emporium Model.

- *Train them*. Instructors who want training are not confused. They recognize they are unfamiliar with software that will be used extensively in the redesign even if they have tried using it previously in one or two sections as homework assignments. They know they are used to lecturing and that working with students in a different learning environment will require different approaches, and they seek assistance and training to learn these new methods. Other instructors who are new to using software and the Emporium Model also need training. Both types of instructors know they need greater understanding and practice prior to the full implementation of the Emporium Model. They also want to understand and adhere to the new policies but need training to do so.

- *Mentor them*. As new faculty join the redesign after the initial pilot, they will undoubtedly have questions as the term proceeds. Their confidence will grow with experience, but they will benefit from having a specific person available to help them in dealing with students. Mentors should check in frequently to be sure that new faculty are adapting to the new approaches. Mentoring can occur between full-time faculty, but it is especially important for full-time faculty to mentor adjunct faculty. At most institutions, adjuncts have been permitted to teach however they wanted. The new and consistent redesigned course represents a significant change for part-time faculty. An adjunct who supervises tutors will need guidance in this role because it is a new one for most. Adjuncts are frequently not on campus when most full-time faculty are. They may not be able to observe the emporium when it is being managed by full-time faculty. Having a full-time faculty mentor or an experienced adjunct mentor will be valuable for all, but particularly for those part-timers who teach in the evening or on weekends. Mentoring will assist adjuncts as they join the new model and will help overcome objections related to change.

- *Reassign them*. Some faculty may never see the benefits of the redesign for both students and faculty. They will refuse to change or they will cause major difficulties for the team and for the administration. Even when the results demonstrate that the Emporium Model is leading to more students' exiting the developmental math program and succeeding in college-level math, some faculty will not even agree to try the new approach. These faculty need to be reassigned. Their duties will need to be changed from teaching developmental math to other responsibilities in the institution if they are full-time, tenure-track employees. The preferences of individual faculty to continue to teach as they always have, even when the students are not succeeding, cannot be tolerated by an institution that truly wants students to complete the developmental math program and succeed in college-level math.

- *Fire them*. Sad as it may sound, there are some faculty who care more about getting to do whatever they want than about seeing students succeed. Adjunct faculty who are hired from term to term may need to seek employment elsewhere. Again, institutions seeking to provide learning environments in which students succeed must have faculty who share that goal and who demonstrate their shared agreement through their participation in the Emporium Model.

It is important to remind all faculty why the redesign was undertaken. Some may argue that the college should return to the traditional—or old—way of offering the course, but you need to remind them that to do so would not improve the situation for students because fixing the old way is why the redesign began. Faculty need to be reminded of the successes other institutions have achieved and the benefits to faculty: working more closely with students who need their assistance, reducing the tedious task of grading, and so on.

X. How to Ensure Student Participation

The most important way to achieve student success in the Emporium Model is to make sure students are doing the work. In this chapter, we address how to introduce the Emporium Model to students, how to get them to do the work, what to do if they are not doing the work, and what to do if they say they don't like the emporium. This chapter is a compendium of ideas about how others have dealt with student acceptance of and resistance to the new way of learning.

Introducing the Emporium Model

Q: For students, what is the most difficult period in the redesign process?

A: Making the change from traditional classroom instruction to new ways of learning involves far more than learning to use a computer. Many students are set in their ways after a lifetime (albeit brief) of passive instruction. They need preparation before making the transition to a more active learning environment. The adjustment period is often difficult, but persistence will win out. The pilot semester can be a difficult transition period as the redesign methodology gets introduced. Most common here are negative student reactions to the perception that the class is an "online class" (i.e., will be impersonal) that they did not think they had signed up for or that it "has no teacher" (i.e., will lack opportunities for student-student and faculty-student interaction.) These challenges can be addressed by up-front engagement with advisers to explain what the course will be like and the development of written materials and orientation sessions that explain the new format. Giving careful thought to how students will learn about the redesigned course will help you avoid a number of problems that can arise.

Q: How should we orient new students to the Emporium Model?

A: Most institutions have found it useful to discuss the new approach to teaching developmental math during new-student orientation. You need to develop—and communicate to students and family members—a coherent and compelling description of the Emporium Model that addresses common misconceptions and concerns. Both students and family members should be able to see a demonstration of the course and learn more about why the Emporium Model works so well. Some institutions have also established a website that includes a demonstration version of the course for students and family members so that they can gain a better understanding of the Emporium Model, the results it has produced, and the benefits that students accrue.

As the institutional memory of how developmental math was taught in the traditional format begins to fade and as more and more students become successful, fewer and fewer students and their family members will question why developmental math is taught in the Emporium Model. However, there will always be returning students who do remember the old way and family members who say, "That's not how I learned math." For that reason and because the Emporium Model is so different from the traditional format of other college classes, many institutions continue to include an explanation of the Emporium Model in their student orientation well after the model has become fully established.

Q: Are there specific things we should be sure to avoid when we introduce the Emporium Model to students and others?

A: The most frequent problem that institutions have encountered is emphasizing the technology over the educational purpose of the redesign. Here is an example: "Initial stories in the campus and local presses emphasized the technology of the course. The radical change in instructional style produced what the team dubbed the *no-teacher syndrome*. The stories frightened many students, angered faculty, and confused administrators as family members phoned administrators to ask for details about a so-called instructorless course that was still in the design stage. In hindsight, a better approach would have been to emphasize that technology was already being used in hundreds of other campus courses and that there would be more in-person help available than ever before. It would have been better from the outset to insist that the press stress educational ends rather than technological means. Although improved math skills will always seem less newsworthy than stories about, say, streaming video, it's nevertheless crucial to keep a clear focus on why the technology has been called into play in the first place."

Attendance/Participation

Q: Should lab/classroom hours be required?

A: Don't even bother to redesign if you are not going to require lab hours.

Q: How many lab hours should be required each week?

A (*fixed attendance*): In most institutions, students are divided into course sections and meet at fixed (scheduled) times in the lab or in a computer classroom with an instructor, which is equivalent to meeting times in the traditional format—that is, two to four times a week.

A (*flexible attendance*): In most institutions, for a three-credit-hour course, three hours are required in the lab (along with one hour required in the computer classroom). For a five-credit-hour course, five hours are required in the lab (along with two 1-hour meetings required in the computer classroom).

Q: How do we get students to go to class and/or to the lab?

A: You will never get all students to attend all class meetings or put in the required hours in the lab, but you can get most students to attend regularly by making class and lab participation at least 10 percent of the final grade. (Some advocate a higher percentage for participation.) This is extremely important. Without course points for participation, success rates will be very low.

Some institutions recognize that giving course points for attendance increases student engagement and learning but are hesitant to do so because they think it will inflate grades. To determine what effect giving attendance credit had on final grades, the University of Alabama analyzed the grades of 3,439 students in five math courses during the fall 2005 semester. Attendance credit had no effect on the grades of 86.8% of the students. For 4.5% of the students, attendance credit increased their grade by a plus or minus. For 0.5%, attendance credit allowed them to pass the course. For 1%, attendance credit caused them not to pass the course, and for 7.3%, attendance credit decreased their grade by a plus or minus. These data show giving attendance credit does not inflate grades.

Q: Should students get partial credit for spending part of the required time in the lab?

A: There is some disagreement on this, but most institutions do not give partial credit. Students must spend all the time that is required in the lab to receive any lab credit for a week. Partial lab credit is time-consuming to tally and calculate, and the goal is for students to spend sufficient time in the lab to complete their weekly assignments and assessments. If you do award partial credit, students will decide what grade they want and spend only that percentage of the required time in the lab. Unfortunately, they often misjudge.

Q: Should all students be required to spend the same amount of time in the lab?

A: There are mixed opinions about whether or not students' required hours should be reduced throughout the semester if they earn a certain minimum grade on each test. Some institutions do not change the required amount of time for any student. Others allow the number of hours to decrease if a particular student is maintaining a designated level of mastery on all assignments, quizzes, and tests. No institutions permit students to reduce the required lab hours to zero.

Q: How can we stop students from doing things other than math in the lab?

A: Internet browsing (such as on Facebook) during class time can be a distraction and interfere with students' time on task. Problem-solving websites create academic integrity issues. You need strict rules, and you need to enforce them. Students caught violating the policy must get a severe penalty such as losing participation credit for the week. Be sure to state that policy in the course syllabus. Lab computers can be set to allow access to only certain Internet Protocol sites, and/or software can be installed that locks down Internet surfing. In addition, watch calculators carefully. Many of the new scientific calculators have symbolic manipulation capabilities, so do not allow those types unless you specifically choose to do so. Also, insist that cell phones and other like devices be disallowed. Instructors and tutors walking around the lab can observe what students are doing.

Q: What kinds of problems can we anticipate regarding student computer literacy?

A: Assuming that students' ability to access Facebook or use a smartphone ensures their ability to use mathematical software is a common mistake. Many students like using computer software, especially because they have the chance to work with the software at home. Others, however, find the computer work very stressful, saying they would rather be in a traditional classroom. Plus, many nontraditional students lack computer skills.

One solution is to develop brief training materials to help students get started using the software. These materials may include resources that have already been developed by the software company. Some students are able to quickly get started using the software and are willing to try different options; others prefer a set of instructions as to how to get started. Some institutions have also developed an online orientation quiz on the software's features that students complete during the first week of the term. In finding answers to the quiz questions, students become familiar with the features of the software that they will use. Other institutions offer workshops at the beginning of each semester for students who need to learn basic computer skills. Instructors and tutors should pay particular attention to technophobes to help them overcome computer anxiety and should work with them more frequently if needed.

Q: Should students be able to do homework and quizzes outside the lab?

A: Absolutely. Encourage students to work as much as possible on math anywhere and anytime, but give participation credit only for the required time spent in the lab with tutors available and with certainty as to who is doing the work. Tests should be taken only in a proctored environment—in the lab or at a designated testing site.

What to Do When Students Won't Do the Work

Q: What do we do if students do not start working immediately at the beginning of the term and they fall behind?

A: It is important to contact students at the end of the first week if they have not attended a lab session/class meeting or have not begun working. Students who start late usually have a difficult time completing the course. The software's tracking feature makes it easy to determine who should be contacted early. Sending an e-mail or making a telephone call demonstrates that the instructor has noticed the student's absence and cares that the student has not begun the course. Some students will respond and will come to class because someone has noticed that they are absent and has followed up. These students will continue to need support and encouragement but may become quite self-sufficient once they experience some success with math and see themselves making good progress.

Others will need more-assertive intervention. Those institutions that have early-intervention specialists may be able to learn more about students' concerns or life issues and address them if possible. It may be that the Emporium Model is not the problem. Several institutions have tracked students who did not come to their developmental math classes—yet did not officially withdraw—and discovered that those students had stopped attending all classes. In those cases, the institution administratively withdrew the students and encouraged them to return once they were ready and willing to attend classes.

Q: What do we do if students are not coming to the lab/class for the required number of hours or to the class meetings or are not doing the work?

A: It is essential to monitor student progress and intervene as needed. Faculty (or others working in the course) should track the students' engagement and contact them by e-mail or telephone to set up a time to talk. Ideally, the contact should be personal and during lab or class meetings. The instructor should try to touch base with every student at least once a week to discuss progress and should be certain to talk with students who are behind. These conversations should determine the problems a student may be having with the content, the technology, or the course in general and help the student overcome whatever the barrier may be. If a student has taken a test and done poorly, the student should be asked to meet with the faculty member in class or in the lab to discuss the errors.

Q: Should we communicate with students about problems only?

A: Absolutely not. It's easy to send out a weekly e-mail to all students in the course with study tips or other encouraging thoughts. At some institutions, when a student has taken a major test and done well, the software sends an automatic congratulatory e-mail to the student.

Q: What do we do if students say they don't like the redesign format?

A: When students arrive in college, they expect a particular way of learning: the traditional lecture format, which requires them to listen, take notes, and take tests. The Emporium Model requires different behaviors: it requires that students engage with the content in an active learning environment and master the content before moving on. Thus, when students declare they don't like the redesign, many are actually objecting to having to do more work in order to pass the course.

Faculty must be prepared to explain clearly why the new model is better and how it has improved the success rates of prior students. Merely explaining how the emporium works is not enough. Faculty need to help students understand that additional work will lead to additional learning and success in college and that they will be supported with personalized assistance in the process. Although students might initially complain that they are working harder than they expected to or harder than their friends did in the traditional courses, their satisfaction with the new format will increase once they acquire the ability to master the course content and experience success. Student complaints will also diminish once they recognize that the new model is here to stay.

XI. Planning and Implementing the Redesign: A Timeline and Checklist

Implementing the Emporium Model involves four phases: (1) planning and development, (2) conducting a pilot term, (3) making revisions to the redesign plan as needed based on the pilot experience, and (4) fully implementing the redesign in all sections of all courses in the developmental math sequence, including assessing and evaluating the full implementation.

Based on the nearly 200 redesigns that NCAT has conducted, a reasonable timeline for completing these four phases is as follows:

- *Six months prior to the pilot term.* Take six months to plan and develop, during which teams engage in concrete preparation for a pilot term.

  Once the decision is made to redesign the developmental math sequence by using the Emporium Model, the team should develop a concrete plan that addresses the topics discussed in Chapters I–X. (Chapter XII describes what a plan should include.) Once a solid, well-articulated plan with appropriate approvals and any needed funding is in place, concrete action to prepare for the plan is needed. The checklist found later summarizes the items that need to be addressed in the planning and development phase.

- *Spring term*. Pilot the redesign with a subset of students, and include all or almost all aspects of the redesign.

  NCAT recommends that every large-scale redesign conduct a pilot before moving to full implementation. What do we mean by a *pilot*? A pilot involves testing the redesign idea—including most if not all of the important quality improvement and cost savings characteristics of the planned redesign—with a subset of students enrolled in the course. Enrollment in the pilot section(s) needs to be large enough so the redesign team can learn what problems students are likely to face and how to resolve them prior to scaling up to full implementation in all sections of the course. The pilot period provides an opportunity for the redesign team to uncover technology issues or any problems that might emerge with the newly designed assignments or activities. For some institutions, the pilot term also provides a time to collect consistent data on student learning from both traditional and redesign sections that can be compared when consistent historical data are not available. For many institutions, the pilot has provided a time to make sure (1) that important audiences both on and off campus have been informed of changes in the course and (2) that all potential bumps in the road have been smoothed. Overall, a pilot provides the redesign team with a dress rehearsal of the redesigned course and an opportunity to resolve any issues that may arise. Teams have learned that it is much easier to solve problems with 150–200 students rather than with 1,000 students.

- *Summer term*. Continue implementing the redesign with all developmental math students in the summer term while resolving issues that have arisen in the pilot.

  Conducting the pilot in the spring term gives the team time during the summer to address issues which may have arisen in the pilot. Inevitably, you will need to tweak the redesign, so that any problems encountered can be resolved. The team may need to modify and/or add policies and procedures to address issues which emerged during the pilot. Training plans may need additional refinement to include new policies or procedures which have been adopted during the pilot. The team should also check with other offices on campus to resolve any difficulties they may have encountered. Some institutions have conducted focus groups with students to uncover problems which can be corrected during this period.

- *Fall term*. Fully implement the redesign with all students enrolled in developmental math including all aspects of the redesign.

  A goal of the Emporium Model is to include all students at the institution enrolled in developmental math in the redesign. NCAT calls the first term when this occurs "full implementation" of the redesign. All students benefit from the new learning environment and both students and the institution benefit from reduced costs. Course policies and procedures are consistently applied to all students, and all students have the opportunity to succeed at a pace which is individualized for them. While there may be some modifications of the policies and procedures, these will likely be minimal if the team has carefully thought through their plan and made corrections after the pilot.

Planning and Implementation Checklist

The following set of questions, organized according to the Essential Elements of the Emporium Model, serves as a checklist to ensure that you have addressed all aspects of a good redesign prior to the pilot term. If you are able to answer each of these questions thoughtfully and concretely, your plan has an excellent chance of achieving its academic and financial goals and benefits for students, faculty and your institution. Some institutions have assumed that once they have addressed each of these questions, the redesign activity is over. However, that assumption is mistaken. These questions need to be actively addressed in the planning phase, implemented in the pilot, reviewed and modified during the revision stage and carefully monitored and updated in future terms. The ongoing attention to these ideas will sustain the redesign and help insure its effective continuation.

Element #1: Redesign the whole course sequence and establish greater course consistency.

- Do you intend to redesign the whole course sequence?
- How will you establish greater course consistency?
- Which version of the Emporium Model do you intend to use? Why have you selected it?
- Has the importance of consistency for all students been clearly established among all faculty, both full-time and adjuncts? How will this consistency be assured?
- How will you build and maintain consensus among the multiple redesign stakeholders?
- How will you prepare students (and their parents) for the transition from the traditional format to the redesigned format?
- Has a course coordinator been identified? Have the responsibilities of the coordinator been specified?
- Has a training plan and schedule been established for full-time and adjunct faculty?
- How do you plan to move beyond the initial course design team and enlist other faculty in teaching the redesigned course?
- Have you determined how credit will be assigned for the redesigned developmental math courses?

Element #2: Require active learning and ensure that students are "doing" math.

- How will students be actively engaged with course content?
- How many lab/computer classroom hours will be required each week?
- Do faculty members understand how their roles will change in the Emporium Model?

Element #3: Hold "class" in a computer lab or computer classroom using commercial instructional software.

- Do you have sufficient computer lab space and/or computer classrooms?
- Is the campus technological infrastructure sufficient for the number of students who will use it once the redesign is fully implemented? If not, is there a plan to expand it?
- Will students use their own computers in the lab or will they only use campus computers?
- Do you have a plan to maintain and update the labs/computer classrooms going forward?
- Have you selected appropriate commercial software? Has the software been installed and tested, if necessary?
- How will you deal with software changes and updates?
- Has the IT department created an interface between the instructional software and the campus student information system?
- How will you provide technical support for students in navigating instructional software? Who will do this?
- How will you ensure the integrity of testing?
- If needed, have you established and shared a plan for smoothing out demand in the lab?

Element #4: Modularize course materials and course structure.

- Have you modularized the course sequence from individual courses to a series of smaller modules or "chunks" of content?
- Have you eliminated content overlap among courses?
- Have you decided how students will progress through the modules?
- How will students register for the developmental math courses?
- How will module completion be recorded in the student information system and on student transcripts?
- How will advisors know where their students are in the developmental math sequence?
- How will the redesign conform to financial aid requirements?

Element #5: Require mastery learning.

- Have you established mastery levels for homework and assessments that are doable in the time allotted for the module?
- Have you decided how many times can students submit homework and take quizzes and tests?
- Will you award partial credit? If so, have you developed a rubric to ensure consistent scoring?

Element #6: Build in ongoing assessment and prompt (automated) feedback.

- How do you plan to incorporate ongoing assessment and prompt feedback for students?
- Do you have a plan to automate grading where possible (e.g., low-stakes quizzes, homework exercises, and so on)?

Element #7: Provide students with one-on-one, personalized, on-demand assistance from highly trained personnel.

- How will you provide students with more individualized assistance? Who will do this and how?

- Have you considered the use of various kinds of personnel that can provide needed student assistance and complete administrative tasks (e.g., undergraduate peer tutors, course assistants, tutors, and so on)? Who will do what?
- How will you select, orient and train lab tutors, both initially and ongoing?
- Has a tutor scheduling plan been established? Does it include greater staffing during the early weeks of the term when students need more assistance?

Element #8: Ensure sufficient time on task.

- How will you ensure that students spend sufficient time on task?
- Do you plan to develop materials in addition to the software (notebooks, directions, task lists) to help keep students on task? Have they been reviewed for completeness and clarity?
- Do you have a clear timeline and weekly schedules for students that will enable them to finish on time?

Element #9: Monitor student progress and intervene when necessary.

- How will you monitor student progress? How will you deal with students who are falling behind?
- Have you investigated how the software can monitor and track student performance and support course administration?

Element #10: Measure learning, completion and cost.

- Have you selected a method for obtaining data to compare student learning outcomes during the pilot phase and full implementation phases?
- Will you be able to use existing traditional data or will you collect parallel data from the traditional and redesigned sections during the pilot term?
- Which of the three measurement methods will you use in each phase?
- Have you decided how you will implement your assessment plan, including working with others who may need to collect or analyze data?
- How will you measure completion?
- Have you investigated whether or not there was grade inflation in the traditional format?
- Have you decided to award a Making Progress (MP) grade? If so, have you determined its definition?
- Have you selected a cost reduction strategy to be used in the redesign?
- Have you completed the assessment planning forms, the completion forms and the Cost Planning Tool to document your plans?

Building Consensus among All Stakeholders

From working with more than 200 course redesigns, NCAT has found that the most important implementation issues they encountered revolve around building and maintaining a consensus about the redesign among all stakeholders: students, parents, faculty, professional staff and senior administrators. The need to develop a shared understanding of the redesign begins with developing a redesign plan; continues through the pilot as the redesign plan becomes “real”; becomes even more necessary during full implementation as more students, more faculty and more staff are involved; and, equally important, continues to be maintained on an ongoing basis.

Chapter XIII discusses this issue in detail with an emphasis on sustaining consensus, but it is important for you to consider during the planning period. Having a great plan is not enough; there must be consensus among key stakeholders about that plan. You need to think about building initial consensus by focusing on the following questions:

- How will you prepare students (and their parents) for the transition from the traditional format to the redesigned format?
- How do you plan to achieve faculty consensus about the redesign?
- How do you plan to achieve departmental commitment to the redesign?
- How do you plan to achieve commitment and cooperation from campus offices that will be affected by the redesign (e.g., registrar, financial aid, IT, facilities, advising)?
- How do you plan to achieve commitment and support from administrators?
- What strategies do you have to orient new personnel in college offices and at the senior administrative level?

XII. Developing a Written Redesign Plan: Why It's Important

It would be hard to overstate the importance of having a written, specific course redesign plan. Writing things down ensures that you have addressed each issue. Writing things down ensures that everyone involved in the redesign knows what has been agreed to. A written plan can be referenced and revised when necessary throughout the process, serving as a road map to keep everyone on track.

In a written redesign plan, you should:

- Describe how you will implement the Emporium Model and how you intend to embody its Ten Essential Elements within it.

  We describe the Ten Essential Elements of the Emporium Model in Chapter I. You need to describe specifically how you will embody those elements within your redesign implementation.

  WHY: As we said in Chapter I, if any of these elements are absent, it is unlikely that student success will improve at a reduced instructional cost. If all of these elements are present and you select an appropriate cost reduction strategy, we guarantee that student success will improve and costs will be reduced. We call these elements *essential* because they are. You need to be sure you have addressed each one of them in your plan.

- Describe specifically how the lab component of your redesign will operate (i.e., number of computers, hours open, staffing plans, testing, attendance management, and other logistics).

  We discuss these issues in Chapter IV. You need to describe specifically how you will implement the lab component of your redesign.

  WHY: The lab component of the Emporium Model involves lots of details; hence, your planning should be detailed. You must have a lab that consistently functions as you want it to in order to be successful.

- Name and describe the learning materials/software you intend to use.

  You need to make a decision about what software you will use. This decision should be made prior to beginning your redesign implementation.

  WHY: Redesign is not a software-centered process. It focuses on pedagogy and course structure and organization. Choosing a software package up front will allow you to focus on the more important and more difficult elements of redesign. In addition, you cannot begin to implement your redesign without having made a software choice. This should be done early in the planning process.

- Describe the assessment method you will use. Complete the two Assessment Forms for the pilot and full implementation of your redesign project.

  We discuss the choices of assessment methods in Chapter VII. You need to capture your plan for assessing student learning in the traditional and redesigned formats on the Assessment Forms, which are included in Appendix A.

WHY: Because you will face skepticism about implementing and sustaining the Emporium Model (because it represents radical change and lots of people do not like change), you will want to be able to prove that it works. Having valid and reliable student-learning outcome data that demonstrate improvement will address that skepticism and assure you that you are on the right track. Data trump subjective judgment.

- Describe how you will address the completion issue. Complete the two Course Completion Forms for the pilot and full implementation of your redesign project.

  As we discuss in Chapter VIII, comparing course completion rates in a modularized Emporium Model with past practices is a complex issue. You need to investigate your particular situation and capture your plan for measuring comparative course completion on the Completion Forms, which are included in Appendix B.

  WHY: If all students who take the final exam score above 90, but only 50 percent of students take the final exam, you have a problem. An important goal of course redesign is to improve developmental math sequence completion rates. You need to measure completion rates for the same reasons that you need to measure student learning outcomes. Data trump subjective judgment.

- Describe the cost reduction strategy you intend to use. Complete the Cost Planning Tool.

  We discuss cost reduction strategies in Chapter VI. You need to capture your plan for reducing instructional costs on the Cost Planning Tool (CPT), which is included in Appendix C. You need to provide a brief narrative that explains the entries in the CPT where necessary. You also need to explain why you chose a particular strategy and what you intend to do with the savings.

  WHY: Course redesign has two goals: improving learning and reducing costs. Our purpose here is not to convince you of the value of reducing costs; it is to help you understand how to do it and how to document it.

- Describe how you will build and maintain ongoing consensus about the redesign.

  We discuss the need to build and maintain ongoing consensus among all stakeholders about the redesign in Chapter XIII. You need to describe specifically how you will address each of the relevant stakeholders in the pilot, during the first term of full implementation and on an ongoing basis.

  WHY: The best-laid plans of mice and men often go astray. Even though it is impossible to anticipate all of the problems you may encounter in your redesign implementation, you should at minimum prepare for those that hundreds of others have faced.

- Include a brief timeline for your redesign project.

  We describe the four phases of planning and implementing your redesign in Chapter XI.

  WHY: Thorough planning is essential to ensuring a successful redesign implementation, but moving to implementation of your redesign as quickly as possible is equally important. Practice makes perfect!

- Develop a project budget that describes the support needed for your redesign effort and a budget narrative that explains each expenditure category.

WHY: As described in Chapter III, the budget should include funding for building, rehabbing, or repurposing computer labs/classrooms, equipment purchases, and released time for faculty team leaders. The total dollar amount will vary from institution to institution depending on what is already in place and what needs to be purchased.

XIII. Building and Maintaining Consensus

From working with more than 200 course redesigns, NCAT has found that the most serious implementation issues encountered had to do with building and maintaining consensus about the redesign among all stakeholders: students, parents, faculty, professional staff, and senior administrators. The need for a shared, campuswide understanding of the Emporium Model begins when a redesign plan is developed; it continues through the pilot period as the plan becomes real; it becomes even more necessary during full implementation as more students, more faculty, and more staff get involved; and, equally important, it must continue on an ongoing basis.

Redesigning developmental math is not simply a faculty project but, rather, a solution to a recognized, institutional problem. The sustainability of that solution is based on continuing institutional agreement at all levels. Ongoing communication with all stakeholders about the redesign's effectiveness keeps the goals of the redesign and its outcomes clearly visible. The team needs to keep everyone updated on student success rates, student satisfaction, and cost reduction and remind everyone of the situation prior to the redesign. Even though the *team* may be familiar with these facts, others in the institution may be new or may not know the history or be aware of the reasons the change was made.

Some institutions have not encountered these implementation issues because they foresaw them and dealt with them in advance. Others did not anticipate them and had to deal with them in midredesign. Some worked on resolving the issues constructively and ended up with successful redesigns; others backslid and abandoned key aspects of their redesign plans as consensus among various stakeholders waned.

We encourage you to pay special attention to how you will achieve initial and ongoing consensus among:

- Faculty
- Campus offices
- Senior administrators

Achieve initial and ongoing faculty consensus about the redesign.

The biggest implementation issue faced by most redesigns is achievement of consensus on a variety of issues among all faculty teaching the course. Because course development in the traditional format is usually done by a single faculty member working on a single course, the redesign of an entire course sequence by multiple faculty can present a number of challenges, such as reaching agreement on core course outcomes, instructional formats, topic sequences, and a common website. And because instructors are usually not used to talking about such issues, they need time to work through them. As several institutions have commented, however, this can be a good problem to have. Collective decision making and departmental buy-in are key factors that lead to successful redesigns.

About two-thirds of institutions have reported challenges about the redesign when it comes to achieving faculty consensus within the department. Some of this was attributed to leadership issues—for example, interim department chairs who were reluctant to press resisting faculty. All institutions stress the need for strong leadership and administrative support to overcome these challenges. Some team leaders thought they had solved the problem of faculty buy-in at the outset but were surprised to find they had not communicated as effectively as they had thought.

Team leaders thought they had their colleagues' support, but when the redesign got under way, they discovered that the opposition was stronger than anticipated. This underlines the importance of constant communication to check signals and maintain momentum.

Examples

> "Even though the math faculty agreed to the redesign initially, once it was accomplished there was some opposition from several faculty members. In retrospect, the team needed to do a better job of communication and inclusion and actively involve the other 16 full-time faculty in improving redesign components and course evolution. This has been largely overcome and is not an issue with adjunct faculty."

> "Due to some instability in leadership in the math department during the transition period, there was a large disparity among full-time faculty in the amount each was involved in the process. This led to some not being aware enough of processes and procedures when the semester started. It was expected and understandable that faculty used to lecturing had reservations about adopting the Emporium Model, but many quickly saw the value to students and embraced their new roles. Some were unable or unwilling to adapt to their new roles. And undesirable behaviors like checking e-mail instead of checking on students during emporium class or open lab hours were the result."

> "The mathematics department has consistently supported redesign. Although there were initial skepticism and inertia to overcome, the result has been a very collegial process and one that has strengthened the department. The adjunct faculty are now fully involved with the implementation, having received extensive training and mentoring. The college has hired professional part-time tutors and one full-time tutor specifically for the developmental math lab."

Achieve initial and ongoing consensus among campus offices.

Institutions frequently encounter challenges associated with preparing others on campus for the redesigned format. Most such challenges involve advising, wherein advisers do not provide correct information for students or simply misunderstand what the course is about. Team leaders need to constantly and consciously market the redesign to key campus constituencies that know little about the new format and how it differs from more-traditional offerings. Taking a proactive approach by offering sessions about the Emporium Model for various campus offices, explaining the benefits of the redesign to student government officers and organizations, using the summer to visit advisers and coaches to describe the benefits of the new approach, and immediately addressing colleagues' concerns can help during the transition period.

As full implementation continues, the team cannot assume that those who were informed about the development of the plan at the onset of the pilot still support the Emporium Model. Some campus offices may have thought the redesign was merely an experiment rather than a permanent change. In addition to keeping math colleagues informed, the team needs to be sure that advisers and others who work with students know that their ongoing support is needed.

Examples

> "Although the department worked closely with administrators while planning the redesign, more effort needed to be given to preparing the entire college community for the changes. Even though a thorough explanation of the redesigned rationale, benefits, and structure was presented to academic advisers and student service personnel, some were not as supportive as needed to encourage students to accept the change and take advantage of the ability to complete developmental math faster than in the past."

> "Regular meetings were held with the professional advising staff to share information about the redesign curriculum and course policies. Frequent communication between the department chair and the assistant registrar was also necessary."

> "The team made a campuswide presentation at an in-service training and conducted sessions for adviser training in order to educate the college faculty and staff. Some of the college's instructors and advisers still do not understand the Emporium Model well enough to register students."

Achieve initial and ongoing consensus among senior administrators.

Institutional commitment to a course redesign includes building and sustaining that commitment throughout the life of the redesign. In the course of implementing a redesign, things happen: lead faculty members leave or retire; departments get reorganized; presidents and provosts get new jobs. Faculty members—on their own—can show and have shown spectacular success in creating highly effective new learning environments, but for those successes to be sustained or for them to have real impact on the institution as a whole, both departmental leadership and institutional administrative leadership need to play active and continuing roles.

You will inevitably encounter problems in implementing your redesign as you make a transition to a new form of instruction. Without a full commitment to preserving the key elements of the redesign while addressing the problems you encounter, the institution may simply abandon the redesign, thus forgoing either the learning gains or the cost savings benefits or both.

About half of all institutions cite the need to build institutional commitment to redesign outside their home department, especially among senior administrators. Participants frequently cite leadership and administrative support as factors in sustaining and expanding interest in redesign. In some cases, redesign is encouraged by system-level leadership; another team notes support by trustees as a factor. Like the building of acceptance within the department, however, the broadening of institutional commitment requires continuing attention and support even under favorable circumstances.

Examples

> "Our greatest challenge involved institutional support. Some administrators viewed this redesign as a grand experiment or a test case. The redesign has exposed a number of issues that need to be addressed regardless of its success. The university needs to develop—and communicate to parents and students—a coherent and compelling description of our e-learning initiatives that addresses common misconceptions and concerns (e.g., that the university is becoming a distance-learning campus). Far from being an insulated and isolated initiative, this redesign was simply the first of many such efforts.

The more the university can do now to learn from and address the larger support and public relations issues raised by this effort, the easier it will be for future redesign teams."

"In the middle of the redesign, the department of mathematics and computer science became split into independent departments—in different colleges. The importance of having strong support from departmental (and university) leadership became increasingly clear after the department was split. Team members ended up in *both* departments, which created conflicting priorities that affected the pace of redesign. Unlike the joint department head, the new computer science department head was not a member of the redesign team, which resulted in a change in scope because of a decision about how the target courses would be used. The fragility of creating and sustaining major pedagogic change under changes in leadership, which could bring changed priorities, was evident. Existing redesign features at the time of the split have been sustained and more fully developed, but aspects of the redesign that were not yet in place have been problematic to initiate due to changing interests and changing personnel. The team is still working to achieve all of the redesign goals; however, the pace of implementation has been slowed."

"All three of our campuses successfully implemented the full redesign with all 3,600 students, demonstrating increased student learning gains and decreased costs. Nevertheless, some faculty preferred the old model. In response to that faculty preference, a number of changes occurred on the three campuses. In the term immediately following the successful redesign, the college began offering a choice of either the redesigned or the traditional lecture format at two of the campuses. Altogether, 11 redesigned sections and 10 traditional sections were offered. The third campus developed a model that uses the redesign model but also incorporates pencil-and-paper homework requirements. Topics and term schedules are still coordinated between two of the campuses because some students use labs on both campuses; however, tests are developed independently. Although the workshops on math study skills and time management were successful, they are no longer part of the redesigned course. These techniques have been combined into a credit course not applicable to a degree; the course is offered occasionally."

Ensuring Sustainability: The Fundamentals

Once a successful pilot has been conducted, once the bumps in the road have been smoothed out, and once full implementation is in place, most institutions expect that sustainability would be a given. After all, the redesign has both improved student success and reduced instructional costs. Why wouldn't the redesign be sustained? Making the assumption that redesign will automatically be sustained without continuing attention will turn out to be a big mistake. Because the Emporium Model is so different from the traditional way of teaching in higher education, it must be continually sold and resold to all campus constituents. As the players change, continued focus on building and maintaining consensus cannot be underestimated.

Executive leadership. The important role of senior administrators does not end when full implementation occurs. Senior administrators need to be prepared to support the redesign and guard against the desire of some to backslide to the traditional format. The provost or president will need to remind those wanting to go back to the old way of why the redesign occurred in the first place and what the evidence is that proves its ongoing success.

Faculty leadership. Strong and continuing faculty leadership of the redesign is key to sustainability. While the individual providing the leadership may change, the importance of the role does not. The designated leader must continue to ensure the consistency of the course among sections as well as adherence to policies and procedures established initially. The leader also serves as liaison with other departments and divisions whose support is needed to maintain the Emporium Model.

Ongoing data collection. Some institutions believe that demonstrating the initial success of the redesign through data comparisons is sufficient to generate campuswide consensus. They assume that similar results will continue, but they neglect to continue to collect and analyze the data that support that continuation. Many institutions have initially seen a small increase in student success after the first term of implementation, but as they continued to tweak the redesign and become more familiar with how to implement it, the number of students successfully completing the developmental math program continued to grow. Through ongoing measurement, institutions can see continuing improvement that will help sustain consensus and become aware of problems that need to be corrected.

Ongoing communication. It is important to continue to communicate with campus offices and other departments on an ongoing basis. Keep them updated on student success rates, student satisfaction levels, and cost-effectiveness, and remind them of the situation prior to the redesign. While the *team* may be familiar with these facts, others in the institution may be new and may not know the history or the reasons the change was made. Letting them know about the successes other institutions have achieved using the Emporium Model will make them feel they are not outliers but, rather, part of an important new trend.

Some institutions have developed a handout that explains the new way that developmental math is being offered. Advisers can use such a handout to assist them as they explain the Emporium Model, modularization, and mastery learning to students. Students can take the handout with them to review later. Some institutions have worked with the college newspaper to publish an article that explains the Emporium Model and includes data to demonstrate the successes students are experiencing.

Orientation of new personnel. Changes in personnel are common at most institutions, particularly among part-time instructors. New full-time instructors are also hired from time to time. Turnover at the department chair, dean, and executive levels occurs more frequently on most campuses than in the past. New faculty and new administrators need a good understanding of why the Emporium Model is used, how it works, and what benefits it offers. New faculty, staff, and administrators should learn about the emporium from more than just an e-mail or a data report. They should be invited to visit the emporium and talk with students, with tutors, and with faculty. They need to see firsthand how the redesign works and how all constituencies are benefiting.

Financial plan. To ensure long-term sustainability, a financial plan that keeps the lab/computer classroom current and functional will be needed. Such things as upgrading or replacing computers, hiring lab tutors, buying new versions of the commercial software, and so on require ongoing investment. Some administrators mistakenly believe that creating the labs/computer classrooms is a onetime investment. Others may not remember that the Emporium Model actually saved resources for the institution while improving student success. Unless administrators are reminded annually how cost-effective the Emporium Model is and what its important components are, they will forget. Some institutions annually calculate how many instructors would have been needed to teach the same number of students in the traditional format, and they compare those costs with the costs of the emporium. Such data provide evidence to remind administrators why providing needed resources is important.

Sustainability Checklist

NCAT recommends that all institutions develop an annual plan to sustain the Emporium Model. Do you have an ongoing plan to:

- Collect data on learning outcomes, completion, and cost?
- Disseminate recent learning-outcome, completion, and instructional cost data to all stakeholders to document the redesign's continued success?
- Refurbish the lab/computer classrooms as needed?
- Orient new students and their parents to the Emporium Model?
- Orient and train new faculty in the department to work in the Emporium Model?
- Recruit and train lab tutors?
- Orient new administrators to the Emporium Model and invite them to visit the lab?
- Visit campus offices such as the registrar, advisers and IT staff to ensure their continued support of the Emporium Model?
- Invite representatives of campus offices to visit and observe the Emporium Model in action?
- Review course policies and procedures and make changes if needed?

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