The National Center for Academic Transformation

HOW TO REDESIGN A COLLEGE-LEVEL OR DEVELOPMENTAL MATH COURSE USING THE EMPORIUM MODEL

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 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 eight 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 eight are what makes the model so successful.

Element #1: Redesign the whole course 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: Build in ongoing assessment and prompt (automated) feedback.
Element #5: Provide students with one-on-one, on-demand assistance from highly trained personnel.
Element #6: Ensure sufficient time on task.
Element #7: Monitor student progress and intervene when necessary.
Element #8: Measure learning, completion and cost.

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

In the traditional format, consistency among different math instructors or different campuses within the same institution is often lacking. Any 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—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. 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 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. Engagement with an array of interactive learning materials and activities moves 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 involved 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 an important role in engaging students with course content. Resources include tutorials, exercises and low-stakes quizzes that provide frequent practice, feedback and reinforcement of course concepts. Each student is required to spend a minimum number of hours each week in a 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, 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 labs/computer classrooms on a fixed or combination fixed/flexible schedule each week. The nature of the lab/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. While working in the required lab/computer classroom, students spend more time solving 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.

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 post-tests. 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.

In addition, some redesigns hold a required weekly meeting in a traditional classroom where the instructor may give a short recap of the previous week’s material; explains and connects important concepts, pointing out common errors; focuses on examples that combine multiple skills; and, briefly reviews the upcoming week’s material and schedule.

#4: 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 to 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. 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 mid-term 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.

#5: 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.

Computer labs or computer classrooms are 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.

#6: 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 lab/computer classroom must be required. 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/computer classroom 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 the lab/computer classroom. 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/computer classroom. "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 the lab/computer classroom 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.

Note: Those redesigns that include a weekly meeting in a traditional classroom should also require student attendance for all the reasons that apply to the lab/computer classroom.

Even though the Emporium Model adds greater flexibility in the times and places of student engagement with the course, the redesigns are not 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.

#7: 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 that they are expected to come to lab and do the work. Ideally, an individual follow-up meeting with the student should be scheduled.

Most 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.

#8: 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 math courses are not what they should be at most institutions, yet few are changing how they teach and even fewer are measuring the impact of any changes they try to implement.

An important element of the Emporium Model is measurement, both initial and ongoing. To demonstrate that the Emporium Model increases student learning outcomes, improves student 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 course 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, course completion 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 math courses, 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 three versions of the Emporium Model have been successful: (1) a flexible version, (2) a fixed version, and (3) a combination of a fixed and flexible version. In all 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.

- *Flexible Attendance*: A minimum number of lab hours are mandatory, but they may be completed at any time at the student's convenience. In addition, mandatory weekly group meetings outside of a computer lab enable instructors to [1] follow up where testing has identified weaknesses, [2] make connections among concepts, [3] emphasize particular applications or [4] build community among students and with instructors.

Examples

- Louisiana State University: College Algebra
- The University of Alabama: Intermediate Algebra
- The University of Idaho: Precalculus

- *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.

Examples

- Jackson State Community College: 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

- *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