Two Roads Toward Success in Developmental Math Redesign

Curtis Mitchell and Jim Cochran
Kirkwood Community College
Cedar Rapids/Iowa City, IA
Cedar Rapids Main Campus

- On the south side of Cedar Rapids
- 27 buildings over 685 acres
- ~ 17,000 students
- 2,303 students enrolled in Elementary and Intermediate Algebra during 2010-11
- Mix of degree programs
- Impending renovation of Linn Hall (home to Math/Science)
Kirkwood (CR) Developmental Math as of Fall 2009

MAT-052 Pre-Algebra
3 Cr.

MAT-062 Elementary Algebra
3 Cr.

MAT-102 Intermediate Algebra
4 Cr.

MAT-107 Survey of Mathematics
4 Cr.

MAT-115 Mathematics and Society
3 Cr.

MAT-155 Statistical Ideas*
3 Cr.

MAT-117 Math for Elementary Teachers
3 Cr.

MAT-157 Statistics*
4 Cr.

MAT-140 Finite Mathematics*
3 Cr.

MAT-120 College Algebra
3 Cr.

MAT-150 Discrete Math
3 Cr.

MAT-138 College Algebra with Limits
4 Cr.
Why redesign?

Low success rates in the algebra sequence:
- 41% for Elementary Algebra
- 46% for Intermediate Algebra

Incremental changes did not produce significant improvement:
- Prerequisite enforcement
- Online homework systems
- Professional development
- Hybrid model

Conversations with faculty and students brought up the following issues:
- Pace – too slow or fast
- Unrecognized gaps in learning
- Life situations interfering
Modified Emporium Model

• Create a single new course (MAT-076)
  – Combines material from Pre-Algebra, Elementary Algebra, and Intermediate Algebra
  – Students can earn credit for MAT-076 up to 3 times

• Individually-paced and computer-based
• Modularized curriculum based on mastery
• Students attend class at a specified time
Accommodating the Redesign

• Fall 2013: new 117 student “Emporium” space should be ready
Accommodating the Redesign

• Pre-remodel, pilot in computer labs
  – 40 students and 2 instructors per lab
Modularization

- 13 thematic modules
- Based on learning objectives from traditional classes
- Three “Exit Points” based on the student’s intended college-level math course
- All students start in Module 1, but can “pre-test” out of Modules 1-5
- Module completion exported to Colleague as a “placement test score”
- Implemented using software
## Piloting Redesign

<table>
<thead>
<tr>
<th>Term</th>
<th>Cedar Rapids Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2011</td>
<td>130</td>
</tr>
<tr>
<td>Summer 2011</td>
<td>47</td>
</tr>
<tr>
<td>Fall 2011</td>
<td>219</td>
</tr>
<tr>
<td>Spring 2012</td>
<td>241</td>
</tr>
<tr>
<td>Summer 2012</td>
<td>55</td>
</tr>
<tr>
<td>Fall 2012</td>
<td>289</td>
</tr>
</tbody>
</table>
Faculty Roles - In Class

- Respond to student questions
- Start and proctor tests
- Provide “just in time” teaching
- Check in with students
- Monitor student progress
- Cover lab for 1 hour outside class hours
Faculty Roles - Out of Class

- Contact students about their progress
- Grade Concept Questions
- Review student tests and progress reports
- Work with teaching group to plan for the upcoming class period
- Attend all-faculty meetings, participate in professional development, develop course policies and materials
Assessing the Pilot

**Standard #1**: Compare completion and success rates to traditional Elementary Algebra and Intermediate Algebra classes.

**Standard #2**: Compare student performance on common exam items.

**Standard #3**: Compare the percentage of students who move on to and successively complete a college-level math class.

**Standard #4**: Examine feedback from student evaluations and focus groups.
## Success Rates (A-C)

<table>
<thead>
<tr>
<th>Course</th>
<th>Spring 2011</th>
<th>Fall 2011</th>
<th>Spring 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prep for College Math</td>
<td>56%</td>
<td>61%</td>
<td>50%</td>
</tr>
<tr>
<td>Elementary Algebra</td>
<td>42%</td>
<td>49%</td>
<td>40%</td>
</tr>
<tr>
<td>Intermediate Algebra</td>
<td>46%</td>
<td>53%</td>
<td>41%</td>
</tr>
</tbody>
</table>
Success in CR Face-to-Face Classes

- MAT-062
- MAT-076
- MAT-102
Common Exam Items

• Department uses common finals for Elementary and Intermediate Algebra
• Comprehensive exams in redesign
  – After Modules 5, 8, and 12
  – Most questions taken from common finals
• Redesign students significantly better on 39 of 46 common questions
• Comp exam averages after Modules 8 and 12 about 15% higher than final exam averages
Feedback

• Instructors enjoy teaching the course and feel they see more evidence of student learning.
• Most students, especially those who struggled in traditional math classes, greatly preferred the new format.
• Some students (especially early in the pilot) felt they needed more instruction, support, or structure.
In Their Own Words

• “This class actually helps you learn better. I learned more this semester than I did last semester and my junior year of high school combined!”

• “Professors are easy to talk to and help a lot!! This class is great for anyone who is struggling with math.”

• “I’ve taken five college math classes and this is the first time I felt like I was actually learning the material.”

• “You should keep offering this class forever!”
Iowa City Outlet Campus

- 30 Miles from our main campus
- Near the University of Iowa
- Two buildings with 25 classrooms
- Average classroom size (32)
- ~ 3000 students
- % taking developmental math
- Minimal careers programs
- 1 computer lab (40)
- 1 math lab (14)
Our Students

• Seeking 2 year degrees
• Large percentage seeking to transfer to a four-year institution
• Some dual enrolled
• Approx. 50% enrolled in Dev. Math
Emporium Hurdles

- Facilities
  - Lack of Space
  - Lack of Computers
Our Facilities

1 full-time math classroom 30 with computers
Our Facilities

Computer classroom we may reserve
Other resources

- 32 laptops ready for classroom use
- Testing center
- Computer lab
- Math lab
Adjusting for our facilities

• Kept students grouped by level
• Kept normal class sizes (26 to 32)
• Mixed lecture with lab time
• Adopted a mastery level approach
• Created 1 more classroom with (30) computers
• Scheduled as many classes as possible into our computer room
• Utilized our computer lab classroom and laptops more often
Changes I had to make

- Letting go of “one-size fits all”
- Not keeping the class together
- Less lecturing
- More individualized instruction
Flexibility and Creativity

• Accepting organized chaos
• Students at different places in the course
• Students testing at different times
• Adjusting the course to fit student’s needs
• Offering extensions
• Allowing students to start where they left off
• Changing the traditional approach
How Students are adjusting
How Students are adjusting

• More active in class
• Doing more problems
• Asking more questions
• Reviewing tests and quizzes
• Reading more examples
• Not settling for missing problems
• Using the math lab more
• Better understanding of application problems
Student Perception

4 = more True than False  5 = Definitely True

I put forth my best effort in this class. 3.9

The computer system helped me learn the content of this course. 4.1

Having to achieve certain percentages in the course encouraged me to practice more. 4.2
Student Perception

4 = more True than False      5 = Definitely True

This course helped me improve my ability to think mathematically. 4.3

If I had to do this semester over, I would register for this course again. 3.9

I would recommend this course to someone else. 4.2
Success stories

Kelly: “Our baby was due mid-October, and I knew I need to finish through module 8 to get into Math for Elementary Teachers, so I worked hard and finished all my work before October. Now I am ready to help with the new baby and also ready to take my next math course in the spring.”
Success stories

• Troy: “I didn’t quite finish all of the modules by the end of the term, but with the extension offered I was allowed to complete the work and receive a passing grade for the course before the start of the next semester. Now I am ready for my next course and didn’t have to retake Intermediate Algebra”
Success stories

• Sam: “Last semester I didn’t complete enough modules to pass, things got too busy in my life to keep up with school. I took the course over this fall and now I am on my way to completing what I started. It was nice to start on the module I left off on in the spring, and not have to start over again.”
Success stories

• Ashlee: “I am on my way to completing enough modules in one semester to move directly into a college level math course. This saved me a semester of time and over $400!”
Moving Forward

• Continual education of student and adjuncts
• Creating a 1 hour completion course
• Running parallel sections
• Continual communication between campus
The Future: Challenges and Opportunities

• Work with career programs to better align exit points.
• Use reports and data analysis to make improvements and assess success.
• Increase the use of “just in time” teaching and structured learning opportunities.
• Identify best practices for the online version.
• Update the rest of the curriculum (whither Elementary & Intermediate Algebra?).
The Last Slide

S055
Grand 2
Thursday, 1:40 – 2:30 pm

James.Cochran@kirkwood.edu
Curtis.Mitchell@kirkwood.edu

“Using Hawkes in a Modular Emporium-Style Developmental Math Redesign”
Friday, 4:00 – 4:45 pm; City Terrace 4