The Good, the Bad, and the Ugly: Scaling and Replicating a Course Redesign in Arithmetic & Prealgebra

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D.R.E.A.M.
OVERVIEW

- Understand a conceptual framework for effective developmental education reform
- Learn about the course redesign: Concepts of Numbers for Arithmetic and Prealgebra
- Review the evaluative outcome data and reflections from replicating colleges
- Understand challenges and levers of change when bringing an innovation to scale
A project of the Community College Research Center funded by the William and Flora Hewlett Foundation

CCRC and partner colleges work to adapt and scale promising developmental education reforms at new institutions

Faculty-driven effort, with intentional focus on professional learning and classroom practice

For more information visit www.scalinginnovation.org
A Case Study for Scaling Meaningful and Sustainable Reform
All learning outcomes of a traditional arithmetic course are covered but in a different order.

Students are assessed on the same skills as the traditional arithmetic course.

Lessons proceed through concepts using a discovery approach.
CONCEPTS' GUIDING PRINCIPLES

• Faculty become facilitators of knowledge; students learn through discovery
• New embedded skills are introduced on an as-needed basis
• If a student understands a skill and its usefulness, practice problems can be kept to a minimum
• Calculators are not used in this course
• All students can learn math

“Teach me, and I will forget. Show me, and I will remember. Involve me, and I will understand.”

Chinese Proverb
CONCEPTS OF NUMBERS OUTLINE

Unit 1: History of Numbers
Unit 2: The Real Number System
Unit 3: Comparisons
Unit 4: Addition
Unit 5: Subtraction
Unit 6: Multiplication
Unit 7: Division
Unit 8: Combinations

For more information, watch “Concepts of Numbers – Faculty Online Orientation” at: http://stream.mc3.edu/faculty/blontz/
UNIT 1: HISTORY OF NUMBERS

• In understanding the evolution of numbers, students will better understand/appreciate our present system

• The following civilizations are covered:
  Babylonian
  Greek
  Egyptian
  Roman
  African
  Mayan

• The concepts of place value and place holders are explored
UNIT 4: ADDITION

• Addition (combining) of the following quantities:

| whole numbers | decimals | fractions | integers | algebraic expressions |

• Application of the addition concept (perimeter, money problems)

• Identity element, commutative & associative properties, and binary operation concepts are introduced
UNIT 8: COMBINATIONS

Simplifying expressions involving multiple operations (order of operations)

Solving multiple step applications, (ratio & proportion)

Solving algebraic equations:
6(x+5) = -2(x -5)
**OUTCOME DATA**

**Success Rates:** Success is a grade of C or better: Withdrawals count as non-success

<table>
<thead>
<tr>
<th></th>
<th>Fall 2008</th>
<th>Spring 2009</th>
<th>Fall 2009</th>
<th>Spring 2010</th>
<th>Fall 2010</th>
<th>Spring 2011</th>
<th>Fall 2011</th>
<th>Spring 2012</th>
<th>Fall 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concepts of Numbers</strong></td>
<td>74%</td>
<td>63%</td>
<td>68%</td>
<td>60%*</td>
<td>58%**</td>
<td>57.4%</td>
<td>57.72%</td>
<td>61%</td>
<td>60%</td>
</tr>
<tr>
<td><strong>Traditional Arithmetic</strong></td>
<td>45%</td>
<td>34%</td>
<td>41%</td>
<td>40%</td>
<td>40%</td>
<td>37.8%</td>
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* the top 13% of Arithmetic Accuplacer scorers were accelerated into the next course (a 4 credit beginning algebra class)

** an additional top 12% of Arithmetic Accuplacer scorers were accelerated into the next course (a 4 credit beginning algebra class)
DISCOVERY APPROACH LESSON

Locate the following points on the number line:

0.3, $\frac{-21}{7}$, 2, $\sqrt{7}$, $\frac{9}{11}$, 0.3, -1.5, $\frac{-5}{3}$
SCALING A PROMISING REFORM

• Institution buy-in
  – financial
  – time for development

• Department approval
  – bringing to a larger scale
  – faculty willingness to try something new
  – training

• Monitoring/Assessing

• Replicating Process
In Fall 2011, Concepts of Numbers became part of Scaling Innovation. Montgomery County Community College has established partnerships with Reading Area Community College, Berkshire Community College, Triton College, and Palomar College to replicate and scale the course.
DEEPER LEARNING

- Implementation Team
- Universal Portal

- course improvements
- journaling (reflections)
- video segments
- class observations
- best practices
• Selected to participate in Fall 2012
• Four sections of Concepts
• Four faculty participating
• Success rate = 71% for n = 45 students
Faculty reflections:

• It has been great sharing this teaching experience with my three colleagues. We have been able to discuss our successes, struggles, and share ideas to enhance our lessons.

• I have loved teaching this course this fall! I have had the opportunity to watch students grow in their math skills and math self-esteem, and it has given me the opportunity to work much more closely on content and skill development with them in discovery.
BERKSHIRE COMMUNITY COLLEGE

• Selected to participate in Fall 2012
• Three sections of Concepts: traditional (2 days/week; late start 2 days /week; evening 3 hours)
• One faculty member: Annette Guertin
• Success rate = 72 % for n = 43 students (W’s not included)
Faculty Reflections:

• In the past, students who completed basic mathematics would struggle with the next course--algebra. The approach empowered my students to share and learn mathematics. This course bridges the divide.

• *Concepts* has been a great experience for me. All the press that I had read regarding the course is true! Beginning the second semester using this approach, I look forward to working with my students.
Jennifer Kumi Burkett stumbled on an article about Concepts doing online research; the success rate numbers intrigued her.

One pilot class in Fall 2012

19/24 were successful in the class for a 79% pass rate; the mean and median on the final exam was 81.9%
Faculty Reflections:

• Students know more than I had given them credit for. My role is to draw knowledge out, help dispel misconceptions, and build confidence. I thoroughly enjoyed teaching this course. The students were engaged from day 1 and really took ownership of the class. I did a lot less talking than usual. The students realized that they needed to actively engage with the course material at each class meeting and at home in order to be successful. The results were amazing!

• Could have used a more formal professional development, as the course is quite different than a traditional arithmetic course
• Palomar STEM grant
  - goal to improve math pathway completion

• Why Concepts of Numbers?
  - Conceptual approach
  - Discovery learning
  - Success data
  - Truly different from what has been tried before
  - Changes to traditional approach make sense
FACULTY EXPERIENCES

- Piloted 3 Prealgebra class sections in Fall 2012
- Training and use of course portal were imperative
- History of numbers motivated students
- Students were willing to participate and try
- Large class size (33+ per class) was a challenge

Success rates:
- Concepts of Numbers (n=112): 64.3%
- Other Prealgebra curricula (n=613): 56.3%
SCALING UP

• Supportive administration

• Strong initial and ongoing professional development, including use of course portal

• In Spring 2013, 7 faculty teaching 11 sections

• Focus on data collection and analysis of range of student outcomes. How do students perform in subsequent math classes?
Lessons from Research and Practice
1. Instructors’ questions about teaching in innovative courses vary over time and according to their personal and professional dispositions and identities.

2. Faculty learning activities related to curriculum and pedagogy are most powerful when purposeful, contextualized and responsive to instructor needs.
VARYING FACULTY QUESTIONS AND NEEDS

Reform Implementation

Faculty Identity and Disposition

Ready to act

Have ideas for improvement

Unsure how to improve

Reluctant to change

Discomfort with new approach

Disagree with reform premise

Satisfied with status quo

How will this reform address student needs?

What is the evidence of success?

What is the problem with the current system?

How is the new course structured?

Which students are eligible?

How will students get enrolled?

What are course policies?

How will I use class time?

What are the course materials?

How are students assessed?

What are the assignments?

What instructional techniques are most effective?

How are students learning?

Disagree with reform premise

Discomfort with new approach

Have ideas for improvement

Unsure how to improve

Ready to act

Satisfied with status quo
CONTEXTUALIZING FACULTY LEARNING

LESS CONNECTED TO CLASSROOM PRACTICE
- Designed for broad appeal across disciplines and/or colleges
- Presentations by consultants
- One-time workshops
- Descriptions of “best practices”
- Generalized descriptions of context
- Sharing strategies in the abstract

GROUNDED IN DAILY TEACHING WORK
- Infrastructure for ongoing collaboration, experimentation and refinement
- Examination of course materials, including classroom activities, assignments, and assessments
- Review of wide array of data including course outcomes and student work
PURPOSEFUL AND RESPONSIVE FACULTY LEARNING

**Audience**
- What are instructors’ dispositions toward the reform?
- What expertise do they bring?
- How will participating in the activity benefit them?

**Purpose**
- Is the purpose clear to participants?
- Are the activities tied to instructors’ day-to-day work of teaching?
- Are conversations contextualized in practice?

**Structure**
- What venue and activities best meet the purpose?
- What format is realistic given time and resource constraints?
ADOPTION AND ADAPTATION FRAMEWORK

ADOPTION

Diagnosis
Selection
Preparation

ADAPTATION

Assessment
Refinement
Scaling
FOR MORE INFORMATION

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