Moving Developmental Mathematics Students to Credit Bearing Courses

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- Carnegie “Highest Research Activity” (R1) institution
- Approximately 85% of applicants are admitted
- Approximately 40% of new freshman need at least on developmental mathematics course
- Approximately 20% need two developmental courses
- >33% of the students are students of color
- About 5% are veterans
- About 40% are first generation college students
- About 20% are international students

Students in the developmental course

- Students come in with a Wisconsin Placement score of 0 and a Math ACT of <16 (at the 40th percentile nationally)
- 58% are female
- 62% were ethnic minorities
- 93% were eligible for federal Pell grants
- Most students have experienced math or test anxiety
- Most students have not been successful at math in their previous experience

Setting students up for success

"Teaching and imparting knowledge make sense in an unchanging environment. This is why it has been an unquestioned function for centuries. But if there is one truth about monden man, it is that he lives in an environment that is *continually changing."*

"We are, in my view, faced with an entirely new situation in education where the goal of education, if we are to survive*, is the facilitation of change and learning." (pg. 120)*

References

Rogers, C. (1983). The interpersonal relationship in the faciltation of learning. In C. Rogers, *Freedom to learn for the 80's* (pp. 119-134). New York: Macmillan Publishing Co.

Accelerating Students

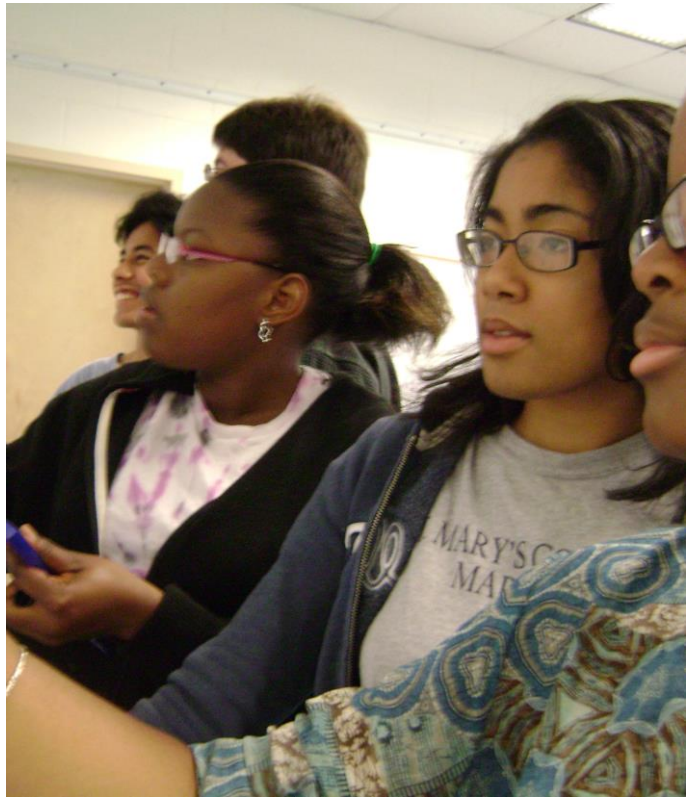
- *Goal:* Advance the student to a credited math course in the course of one semester
- Basic Math through Beginning Algebra
- Six credit hours as a developmental course
- Four 75 minute lectures (M-R)
- One 75 minute lab per week

Traditional Classroom

Then this happens at home

Flipped Classroom

School



Home

Flipping the Classroom

- Students watch about 30 minutes videos outside of class each day (or read an eBook)
- Students MUST attempt workbook homework before coming to class - *mistakes are allowed and encouraged*
- During class the students write the workbook problems on the board and we talk about any mistakes that are made
- High emphasis is placed on technical fluency
- Students are allowed to change and rework their problems while we go over them in class
- In-class activities support learning, done almost every day

Before class begins for the semester

- Email and phone class to all students in the class
  - Inform them they have homework due the first day about 3 hours
    - They have a pre-survey about their mindset in regards to mathematics
    - They have a pre-assessment in their online homework system to determine where they are in their mathematical knowledge
  - Email stress the amount of work required for the course
  - See if they have any questions
  - Let's them know their instructor has their interest at heart

First and Second day of Classes

- Format of the course is discussed
- Stress is placed on the amount of work for the course
- Students are accountable for the assignments given before class starts
- Students present the syllabus the second day of class

Modular Approach

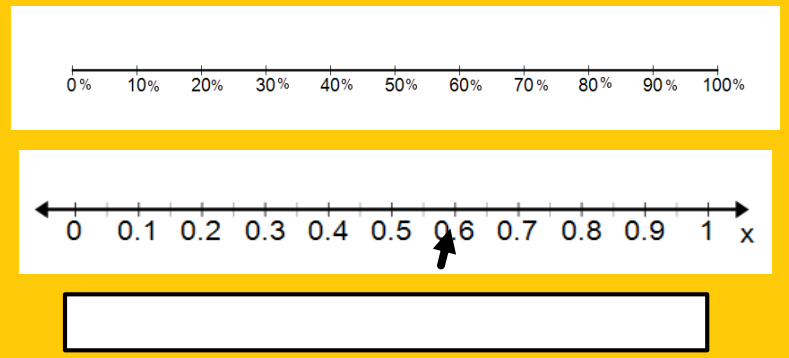
Students learn concepts across all basic algebraic structures in a group, to reinforce similarity

For example – division of whole numbers, division of fractions, division of polynomials, and so on

Groups:

1. Definitions – Numbers to Functions
2. Arithmetic Operations – Emphasis placed on the similarities between different mathematical objects. Inverse operations are taught early.
3. Solving all types of equations and inequalities side by side
4. Graphing and Applications

Workbook Sample

Visual Model - show both on the percent ruler and a strip diagram	Percentage	Fraction	Decimal Form
			

Workbook Sample

Decimal Representation		Percentage	
Definition	Characteristics	Definition	Characteristics
Examples	Non-examples	Examples	Non-examples
Fraction		Equivalent Fractions	
Definition	Characteristics	Definition	Characteristics
Examples	Non-examples	Examples	Non-examples

Visual Model	The value of each partition	The value of the shaded region	Division Statement
		$\frac{4}{6}$	
		$\frac{15}{12}$	
		$\frac{3}{8}$	
		$2\frac{7}{10}$	
		$\frac{1}{3}$	
		$\frac{45}{60}$	
		$\frac{3}{x}$	

Different Lecture Approaches

- We use manipulatives including
  - Base 10 blocks
  - Algebra Tiles
  - Fraction circles
- Worksheets to help enhance discovering the “Why”
- Spiral reviews on previous concepts

Using online homework

- Students must complete online homework on a weekly basis
- They have weekly goals that correspond to the topics discussed in class
- There is a mandatory weekly discussion
- They must complete their entire pie in learning to earn a C or better

Accountability

- Students must check in with the instructor each day to show that they have attempted their workbook assignment – this counts for some of their grade each day
- Instructors keep track of the students every week. If a student is falling behind they need to meet with the instructor.
- When students fall behind for more than two weeks advisers are notified if needed

Exams are a Privilege

To earn an exam students must:

- Complete all workbook homework assignments that correspond to the exam
- Complete all reviews
- Complete a certain number of online homework topics

If a student does not qualify they can qualify and take the exam on the retake day

Conditions for Exam Retakes

- Scoring less than 80% requires a retake
- Also for students not ready at the time of the original exam
- Students must complete all the requirements to take the exam and meet with the instructor
- Retake may be an oral exam or a new written exam
- Maximum score for a retake is 80%

Exam Corrections

- Exam corrections are a required assignment for every exam.
- Points are not added back to the exam grade – it an assignment
- Students must rework the problem
- Students must identify the type or error the made
  - Careless
  - Mis-read directions
  - Concept
- Students must complete the corrections right away
- Students needing a retake must have the corrections complete before they are allowed to retake the exam

Study Skills

- “Winning at Math” by Paul Nolting has been integrated into the course
- Students must read and complete assignments that correspond to “Winning at Math”
- We talk about taking notes, reducing anxiety, test taking strategies, and time management

Productive Persistence

- Students are encouraged to struggle with the homework and in-class activities
- When students are struggling the instructor encourages them
- Mistakes are encouraged
- Struggling + Mistakes = Learning

Accelerating into a Credited Course

- If a student completes their entire ALEKS pie by the middle of the semester, they can add Intermediate Algebra
  - They still come to class and complete the workbook homework
  - They work on the Intermediate Algebra ALEKS pie
  - They complete Intermediate Algebra worksheets
- Fall 2014 we had 39 of the 440 students attempt Math 105 (36 of the students passed with a C or better)
- Spring 2015 we had 9 of the 140 students attempt Math 105 (All passed with a C or better)
- Fall 2015 we had 25 of the 400 students attempt Math 105 (23 of the students passed with a C or better)

Hard Work = Success

- Fall 2014 was our first run with 440 students
- Overall pass rate increased by **19%**

(Fall 2014 vs. previous semesters)

- Targeted minorities pass rate increased **21%**

(Both relative to historic remedial completion rates)

More Results

Longitudinal data shows that the first cohort of students that went through the redesign effort completed their credit bearing mathematics course at a rate of 62% compared to 38% that was in a cohort that started in 2012

The redesign group completed 44.3 credits in three years, compared to 38 credits to the traditional 2012 cohort

Any Questions?

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