

# Grading as Effective Teaching in Mathematics

How Assessment Can Help Students Learn

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## Anonymous Poll

What types of assessments do you currently use in math classes?

## Anonymous Poll

Do those assessments tie directly to your course-level student learning outcomes?



# Today's Environment

- Students as "Customers"
- Lack of Preparation
- Ties between classes and the "real" world are lacking
- What does an "A" mean? "Passing" mean?



# Traditional Grading Systems

- ▶ Student learning outcomes at the course level
  - ▶ How to assess them?
- ▶ Partial Credit as a Game
- ▶ Who has the responsibility for a grade?
- ▶ How to master complex material?
  - ▶ The importance of time and repeated assessment



# Mastery-Based Grading or Standards-Based Grading

- ▶ Specific standards developed that tie course content directly to student learning outcomes
- ▶ Frequent - low-stakes assessments (Quizzes, Uber Quizzes, Final Exam)
- ▶ Everything is rubric graded
  - ▶ Standards: Mastery, Proficiency, Developing, Beginning, Not Assessable
  - ▶ Problems: Completely correct, correct with minor errors, incorrect but on the right path, incorrect and not approached correctly, not assessable
- ▶ Why change?

# Example - Quiz Problem - Assessing Content

- ▶ Describe the first four terms of the following sequence

- ▶  $a_{n+1} = \begin{cases} 2a_n - 1, & \text{if } a_n \text{ is even} \\ 3a_n + 1, & \text{if } a_n \text{ is odd} \end{cases}, a_1 = 6$

- ▶ Correct Work:

- ▶  $a_1 = 6, a_2 = 2(6) - 1 = 11, a_3 = 3(11) + 1 = 34, a_4 = 2(34) - 1 = 67$

## Typical Incorrect Work:

- $a_2 = 2(6) - 1 = 11$

- $a_3 = 2(11) - 1 = 21$

- $a_4 = 2(21) - 1 = 41$

- $a_2 = 3(6) + 1 = 19$

- $a_3 = 3(19) + 1 = 58$

- $a_4 = 3(58) + 1 = 175$

- $a_2 = 2(6) - 1 = 11$

- $a_3 = 3(11) - 1 = 33$

- $a_4 = 3(33) + 1 = 100$

# Example - Quiz Problem - Assessing Content

- ▶ Find the radius of convergence for  $\sum_{k=0}^{\infty} \frac{5^k(x-3)^k}{7^{k+2}}$

Correct Work:

- ▶ Ratio test results in  $\left| \frac{5(x-3)}{7} \right| < 1$
- ▶ Solving this inequality gets you the interval  $\left( \frac{8}{5}, \frac{22}{5} \right)$

Typical Incorrect work:

- ▶ Not using the ratio test
- ▶ Not knowing to set the result of the ratio test to be less than 1
- ▶ Not being able to solve an absolute value inequality



## Grading to Allow for Demonstration of Mastery

- ▶ Two assessment opportunities through in class quizzes and uber quizzes
- ▶ Reassessment quizzes - upon request
- ▶ Other requirements: mandatory homework completion, mandatory participation in a group project



# Results

- ▶ Clarity of Grades - clear distinction between Success and Failure
- ▶ Almost no "C" grades. Mostly A, B, and F.
- ▶ Increased focus on higher level thinking (analyze, model, create, critique)
- ▶ Student Empowerment
- ▶ Growth Mindset focused - opportunities to Fail Forward



# In Summary: Mastery-Based Grading

- ▶ Reduces scheming and grade grubbing
- ▶ Places the onus on students for their grades
- ▶ Assessments are kinder and track with studies in cognition
  - ▶ Interleaved Practice
  - ▶ Repetition
- ▶ Increase metacognition and self-awareness in students

# Anonymous Poll

How interested are you in implementing a mastery-based/standards-based grading scheme?



# Mastery-Based Grading At Scale: Is It Possible?

- ▶ Challenges in implementing MBG at scale
- ▶ Reassessment is a time sink
- ▶ Close course coordination challenges

## In the Chat Pod...

- ▶ How many sections of each pathway course will you be offering in Fall 2018?
- ▶ If you have chosen a co-requisite/support course model, how many co-requisite sections will you be offering?



# Using Thoughtful Grading to Design Math 1090 - Statistics

## Grading pieces

- ▶ Low stakes, high importance:
  - ▶ Attendance
  - ▶ Pre-reading
  - ▶ Adaptive online homework
  - ▶ In class clickers

<input checked="" type="checkbox"/> Basic Participation Badge	<input checked="" type="checkbox"/> Silver Participation Badge	<input checked="" type="checkbox"/> Gold Participation Badge	<input checked="" type="checkbox"/> Basic Attendance Badge
			
Basic Participation	Silver Participation	Gold Participation	Basic Attendance
<input type="checkbox"/> Silver Attendance Badge	<input checked="" type="checkbox"/> Gold Attendance Badge		
			
Silver Attendance	Gold Attendance		



# Using Thoughtful Grading to Design Math 1090 - Statistics

## Grading pieces

- ▶ High(er) stakes - tied to course outcomes
  - ▶ Exams
  - ▶ Labs
  - ▶ Offline/paper homework exercises
  - ▶ Paper/Project (Poster opportunity for A/B students)

# Technology As a Critical Tool to Support Strong Assessment

## Online textbook

- ▶ E-book with pre-reading quizzes
- ▶ Adaptive homework

## Canvas Integration

- ▶ Deep integration for gradebook support
- ▶ Integration of clickers for participation

## Canvas Tools

- ▶ Online discussion boards (graded for participation)
- ▶ Rubric grading and Learning Mastery gradebook

# Questions?

Feel free to contact me:

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