MASTERY-BASED GRADING IN THE CALCULUS CLASSROOM

INCREASING RIGOR, IMPROVING TRANSPARENCY, AND EMPOWERING STUDENT SUCCESS

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/SPECIFICATIONS-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

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

- 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:

- $a_2 = 2(6) - 1 = 11$
- $a_3 = 2(11) - 1 = 21$
- $a_4 = 2(21) - 1 = 41$

- $a_2 = 3(6) + 1 = 19$
- $a_3 = 3(19) + 1 = 58$
- $a_4 = 3(58) + 1 = 175$

- $a_2 = 2(6) - 1 = 11$
- $a_3 = 3(11) - 1 = 33$
- $a_4 = 3(33) + 1 = 100$

REASSESSMENT TO ALLOW FOR DEMONSTRATION OF MASTERY

- Two assessment opportunity 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 Assessment – 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