

# Outcomes-Based Assessment in Precalculus

## The need; and the innovation that addresses it

### Traditional Assessment

Grades for this class traditionally were largely based on two midterms and a final. Students who performed poorly on midterms were faced with dropping the class or being stuck with a ceiling on their grade. The grades did not fully capture progress and could sometimes reflect an outlier exam score (e.g., not feeling well that day).

### Outcomes-Based Assessment

Students are tested weekly on a list of "Learning Outcomes" for the course. They are not penalized for getting something wrong -- they just have to try again the following week. Once they demonstrate mastery of a particular outcome, they can stop doing those problems. Students are required to achieve a B+/A- level of mastery on each outcome. They always know what they already learned and what they still need to work on.

## Evidence: Impact of this innovation on students/faculty

### End-of-year Survey

- *The grading scheme helped me to know what to do to achieve my goals.*  
Avg = 4.2 out of 5
- *The fact that getting something wrong did not count against me reduced my anxiety.*  
Avg = 4.3 out of 5  
(5 means "strongly agree")

### Student Evaluation Comments

- *"I really liked how the class was more targeted at actually learning the principles rather than learning it for one test."*
- *"The assessments helped me to be able to correct things I did wrong, while also constantly refreshing my memory by having to solve older problems from class."*

### Future impact

We will continue to use this in Precalculus and may add it to Calculus classes.

## Resources at Brandeis and external

- **Book**  
Our implementation was based largely on the book *Specifications Grading: Restoring Rigor, Motivating Students, and Saving Faculty Time* by Linda B. Nilson
- **Math 5a Grading Scheme**  
Our course has a list of Learning Outcomes -- these are mathematical facts and skills that comprise the content of the class, e.g., "Solve an exponential equation" and "Graph a piecewise function". Students have to master 28 out of 30 outcomes to get an A, 25 to get a B, 22 to get a C.
- **Math 5a Syllabus**  
We also used Team-Based Learning and Reflections in our pedagogy, but these aspects are not required for Outcomes-Based Assessment.  
[http://people.brandeis.edu/~rtorrey/M5a\\_S19\\_Syllabus](http://people.brandeis.edu/~rtorrey/M5a_S19_Syllabus)

## How Brandeis faculty might adopt the innovation

- **Communication**  
Helping students understand this unusual system is one of the biggest challenges. Some ways we learned to help with this:
  - Keep it as simple as possible.
  - Give students some sample end results of hypothetical students and have them compute the resulting grade.
  - Provide easy-to-understand color-coded spreadsheets so students can visualize their progress and see where they stand at a glance.
- **Lunch/Coffee**  
Ask Becci to join you for lunch or coffee to talk about whether any of the techniques we used could help you and your students achieve your goals.  
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