

# Blending Team-based Learning with Standards-Based Grading in a Calculus I classroom

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## What is Team-Based Learning?

Team-based learning is an active learning strategy that uses the following important ideas:

- Students are required to prepare ahead of class, and are held accountable for doing so.
- All in-class work is in groups, which do not change throughout the semester.
- Peer-evaluation ensures that student's grades are directly related to their level of group participation.

## Setting the stage on the first day

Students are generally unfamiliar with team-based learning. It's important to set the stage on the first day of class.

- Explain why the course is structured differently from what students may find typical.
- Focus on the goals of a college education, and how the course structure supports those goals.
- Reference the need for personal accountability in earning the desired grade.
- Give students time with their teams.
- Provide plenty of detail, as the grading structure tends to be complicated.

## Assigning Teams

The instructor should take care in how teams are assigned.

- An initial survey of students is helpful in creating teams.
- Spread out ability/confidence levels.
- Teams last for the entire semesters.
- Peer evaluations that affect final grades keep students accountable to their teams.

## Getting Students to Prepare for Class

- Readings are posted well in advance.
- Students are given the expectation that the work is to be completed before class.
- The preparation can be more than just a textbook.
- Videos, instructor created or otherwise, are helpful.
- Accountability is pushed to the students, and checked via readiness assessments.
- Feedback should be immediate when a student arrives unprepared.

## Individual and Team Readiness Assessments

- Multiple choice assessments, given following each reading/preparation assignments.
- The quizzes are given to the students as individuals (iRAT), then the same quiz is given to the team (tRAT).
- Grade the iRAT while the team is completing the tRAT.
- Zipgrade helps with quickly scoring the iRAT, while keeping the solutions a secret until after the tRAT is finished.
- Scratch off sheets for the tRAT give immediate feedback.

## Using Standards-Based Grading for Exams

- 1 Students are presented with a list of all learning objectives for the course on the first day.
- 2 Objectives are tested every 2 weeks, and graded on a 1 point scale.
- 3 Objectives that are missed may be re-attempted on each assessment.
- 4 Students have individual folders so they know what objectives still need to be met.
- 5 Each assessment contains all previously tested objectives.
- 6 The final exam includes all objectives, and gives students a chance to show any previous missed objectives have been mastered.

## Example Standards

- 1 Show, via the definition, that a function is continuous at a point.
- 2 Calculate an antiderivative of a polynomial function.
- 3 Use the 1st derivative test to classify extrema of a function.
- 4 Evaluate an indefinite integral using substitution.

A single problem might allow students to pass multiple standards.

- 1 A 1.5m tall woman is walking towards a 10m tall lightpost at 2 m/s. How fast is the length of her shadow changing when she is 10m away from the post?
  - Correctly set up a problem involving at least two related rates.
  - Solve a problem involving at least two related rates.
  - Correctly find the derivative of an implicit function.
  - Calculate the derivative of a polynomial function using the power rule.

## Benefits of the method

- Understanding the course content - most importantly, this can be done without lectures. Students are given the readings and the RATs assess student understanding (first, individually and then with their team).
- The immediate feedback lets the instructor know what gaps exist in understanding after the readings.
- Team activities leave room for more complex applications, rather than just drilling skills.
- Developing the skills for working effectively on a team - crucial skills to prepare our students for careers after college.
- Students become comfortable with failure. Getting an answer wrong is an opportunity to improve, rather than something for which they are penalized.
- A student who passes this course can be safely said to have fully mastered at least 70% of the content. This avoids the issue of a student who has passed the course through partial credit, without fully mastering any skills.
- Students report feeling accountable to their team-mates, which increase attendance and engagement.
- Students report feeling lower anxiety in the course, because their failures have the opportunity to be productive.

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