Facilitating Inclusivity and Student Engagement Through Use of Pre-Class Activities

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As a mathematics professor, I hear some variation of the following comment from students every semester: "I thought I understood the material, and everything makes sense during lecture. But then I get to an exam, and I cannot even start the problems!" This is not an unusual realization for college math students, and it is one of the reasons that active learning has had such a strong emergence of late in my discipline—if we spend more time letting the students actually *do* math, instead of just demonstrating it for them, we should be able to identify those that are falling through the cracks much earlier. To that end, I have sought ways to incorporate additional opportunities that allow my students to engage with the material in low-stakes environments, and to enable myself to intervene at critical junctures to improve student retention and success.

Several years ago, I first implemented pre-class assignments (akin to Just-in-Time Teaching, or JiTT) in a 300-level probability course. These assignments were short (15-30 minute) activities graded for effort only, which students would complete the evening before each class. The intention was to front-load some of the introductory material of each lecture (motivating ideas, basic definitions, etc.) into these activities, leaving more time during class for hands-on examples and worksheets. A typical activity (crafted using Desmos Classroom, a platform for creating interactive, online math content) might consist of a short reading assignment, some conceptual short answer questions, an invitation to create their own examples of the material to share with classmates, and/or requests for them to illustrate their understanding with a graph or diagram. Notably, every assignment ends with a check-in slide, where I invite students to share what is going well, what is going poorly, and how they feel about the class in general. A subset of slides from a recent course with sample student responses is shown in Figure 1.

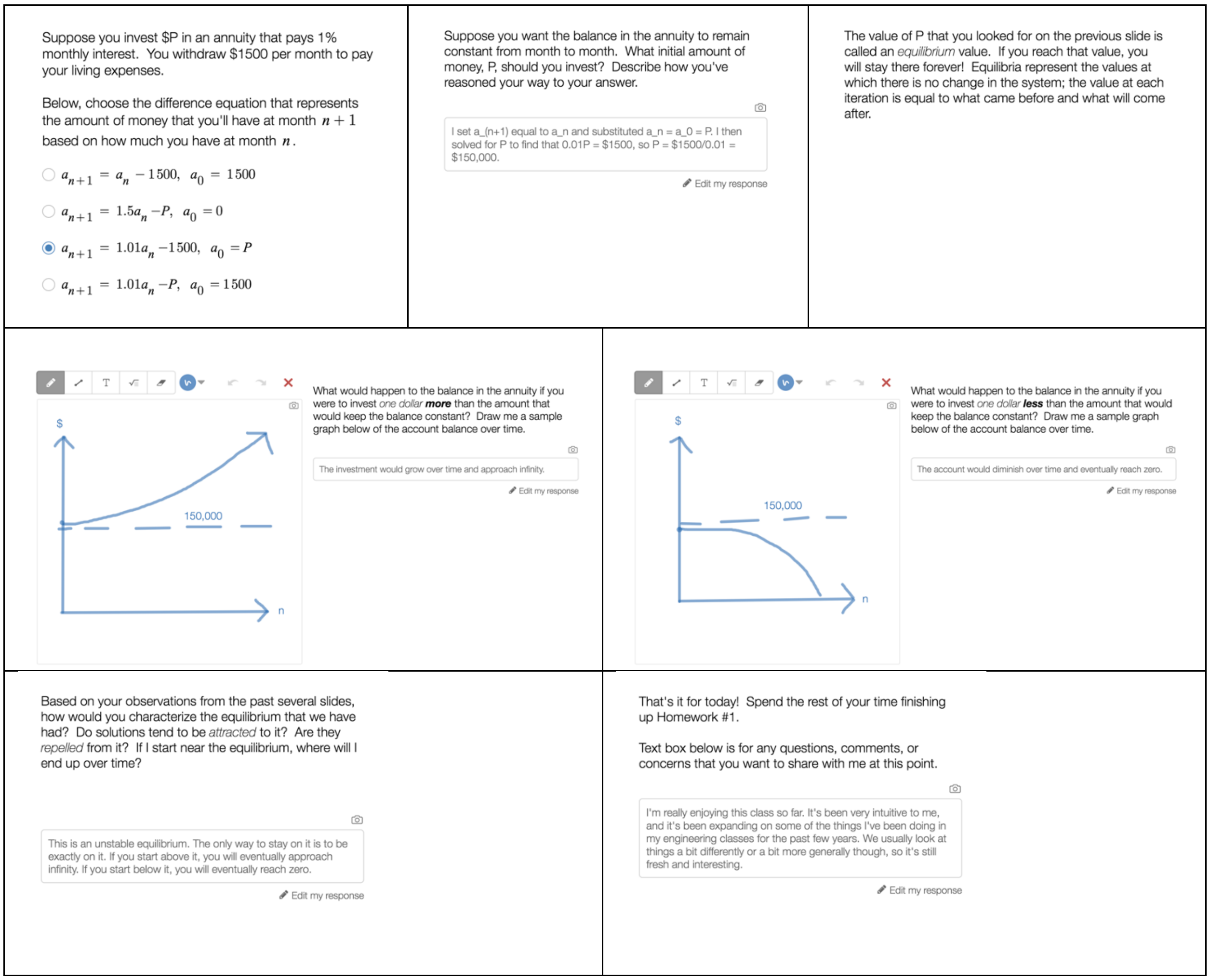

Figure 1: A subset of slides with actual student responses from a pre-class activity in a Techniques of Math Modeling course.

Though the original goal behind introducing these activities was to increase time for active learning—an outcome demonstrated to increase inclusivity in and of itself—a number of other unintended benefits have contributed to the creation of a more inclusive and equitable learning environment. In particular, I noticed that my students:

- Have a chance to familiarize themselves with upcoming material, which may prompt them to review certain concepts or prepare questions.
- Demonstrate increased confidence in posing and answering questions during class, due to having had time to think about the concepts in advance.
- Learn how to read, interpret, and digest textbook material, a skill which helps them to become more independent learners.
- Receive multiple rounds of exposure to the same material: first at an introductory level in the pre-class activity, again at a deeper level during class, and finally through assessment on homework and projects.

The benefits are not limited to the student side, either. As the instructor, I look over student responses to these activities before class each day, using their answers to adjust my lecture pacing and material to address any common gaps in student understanding. Often, student responses prompt great discussion topics, and bringing these ideas into the classroom— while acknowledging the students that provided them— promotes a whole new level of engagement. Additionally, students are willing to offer feedback in the check-in venue that they might be uncomfortable expressing in person. For instance, students have used these check-ins to communicate disappointment over their recent performance in class, inform me that they are struggling with a certain concept, or point out an in-class activity or project that they enjoyed.

This space has been particularly beneficial for traditionally underrepresented students in mathematics (e.g., female, or non-binary students, and students of color). Such students often lack confidence in their mathematical abilities or experience stereotype threat (decreased engagement arising from a fear of confirming a negative stereotype about one's marginalized group identity), and they are therefore less inclined to speak up during class. Gathering feedback from these check-ins helps me to identify struggling students early and establish a connection to get them back on track. Overall, the activity design has promoted an action-oriented space:

students are empowered to voice their challenges, and I am better equipped to help them overcome these obstacles.

As the benefits of these activities have become clear, I have started to weave them into more of my courses at all levels, tweaking them each semester to maximize their utility. One aspect which is always a struggle is getting student buy-in. While many students have enjoyed these assignments and the opportunities to give me daily feedback on their learning, others have treated them as busy-work, failing to engage with them at an impactful level. Among the strategies I have developed to mitigate this are (a) discussing my reasoning for including such work at the start of the course, (b) keeping activities short and focused, and (c) providing occasional one-on-one feedback to students about their responses. While it is not feasible to reply to all students each day, I do make a point of casually conversing with students before and after class about ideas that they posed. This helps students understand that I am serious about addressing their questions. Over several years, I have noticed a considerable uptick in the proportion of students who have taken these activities seriously, using them to optimize their learning experience.

Students are not—or at least, they should not be—indifferent problem-solving machines. We want them to think critically, connect ideas to what they have seen elsewhere, reflect on what they are learning, and consider how it might be applied. Moreover, we want all students—regardless of background—to be able to meet these objectives. I have found that the increased accessibility that these activities provide to both the course material and to me as the instructor has empowered my students to achieve these goals, and I am committed to refining the use of these activities across a wide variety of courses for many years to come.