Avoiding Lonely Math! Active classroom problem-solving with your students

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Just because you’re standing, with your back to your students, doing math for 50 minutes does not mean you can’t have an engaging and maybe even fun discussion section! This workshop will discuss how to create and how to maintain an environment in which your students not only participate, but in which they will do so with a minimal amount of awkward silence. We will discuss how to establish a participation-friendly classroom before the math even starts. We will also discuss how to encourage participation by the kind of questions you ask, by structuring participation in an unintimidating way, and by tracking your students’ understanding.

The following are four key strategies that will help foster an environment in which your students actively engage with you in problem solving.

1. Cultivate a relationship with your students.
   • Remember your role, be approachable. As the TA, you are there to give small group instruction and one-on-one aid. This is an especially vital role to large lecture courses, as your students will likely have very limited access to the professor. So it is important for you to be gracious and patient with your students when they ask for help during discussion, during office hours, or via email.
   • Treat your students and your job with respect. If your students see that you treat them with respect and they see that you put effort into your job (which directly benefits them), then they will be more inclined to show you the same respect. If students don’t like you or if they feel like they are an inconvenience to you, they will not participate.

2. Set a tone of participation on day one and offer some first-day-of-class transparency about the methods you will use for getting participation.
   • Make your students talk during the first meeting. You need them to feel comfortable talking, so it’s important to break the ice the first time you meet for discussion. I have my students go around the room and introduce themselves. After everyone shares, I also have them re-introduce themselves to the people around them. This helps make your students more comfortable talking to you and to each other, both of which will foster participation.
   • Explain your expectations for participation and your methods for getting it. For example, in the first discussion section I tell my students that (1) I am going to ask them a lot of questions during discussion, and those questions will often be very easy, and (2) the reason I ask so many questions is because if they are working the problems with me and staying engaged in the problem-solving process, then they will be getting much more out of section than if they just copy down what I write on the board.

3. Create an environment where talking is low pressure – minimize the fear of giving the wrong answer. A detractor from participation in math-oriented courses is that there are right and wrong answers and students don’t the “embarrassment” of giving a wrong answer.
• Encourage your students to just “shout out” the answer instead of going through the formality of raising their hand and being called on. A benefit to teaching a math-oriented course is that the answers to questions you ask will likely be short and fact-based (as opposed to longer and opinion-based). As a result, students can shout out an answer and be done speaking before a majority of their classmates even realize who is speaking. This method also increases the number of students who answer each question you ask. Both of these will diminish the perceived embarrassment of getting an answer wrong.

• Ask easy arithmetic/definitional questions. Asking easy questions will keep students engaged and make it much easier for them to participate. Fears of talking diminish greatly when instead of asking difficult, concept-based question, you ask things like “What are the total profits?” when the board has written on it “Profit = 30 – 45 = ”. Definitional and arithmetic questions are also beneficial to your students: arithmetic questions are beneficial if students cannot use calculators on exams; definitional questions are beneficial in helping your students memorize terms and equations.

• Ask questions that involve only small steps for difficult problems. When working through a problem that is difficult, ask questions that only require your students to make little steps in the process. As the semester progresses, problem-solving methods build on themselves and it is easy for students to be overwhelmed. Give your students the overall question, but immediately follow it up by asking your students where to begin. This tends to be the hardest step, so don’t necessarily expect many to speak up. After getting past the first step, however, students are typically very willing to participate.

• Ask multiple choice questions (verbally). Suppose you are working a difficult problem and you ask your students what the next step is only to get nothing but silence and blank stares. Instead of waiting in silence for minutes on end until someone answers, offer your students a few options as to what correct response should be. This keeps students participating and it keeps the class rolling much more smoothly.

4. Ask if there are any questions frequently, and pay attention to your students’ responses.

• Constantly make sure your students are following along. You should be sick of hearing yourself ask things like “any questions so far?”, “are you all with me?”, or “does this make sense?” by the end of a day of teaching. If you ask one of these questions and no one responds, ask it again. These questions are not meant to be rhetorical.

• Take note of nonverbal communication from your students. I realize this may seem counterintuitive in a discussion of how to increase participation. But, at the start of the semester your students will often be too shy to speak up. During that period, figure out which students will give you facial cues about whether or not they are confused and allow them to ask for help nonverbally! As students learn the value of getting clarification on difficult problems during section, they become more willing to ask for help verbally.

• If you just did a complicated step in a problem, but no one is saying they don’t understand, go ahead and offer to walk through the step again. A lot of times, students will accept your offer, but were either too embarrassed or too confused to ask. As with the previous point, this will actually increase their participation over time.