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Statement of Teaching Philosophy

Soon after I started leading calculus discussion classes during my first semester of graduate school, I found that I was most effective as a teacher when I knew how well my students could apply what they had learned. If I had a sense for what aspects of the course material they did and did not understand, then I could tailor the class to my students' specific learning needs instead of guessing what would be best to review. Thus I devoted as much class time as possible towards putting my students in a challenging problem-solving environment where I could watch them work and discuss the material with them in smaller groups. I used the information I gathered from these class observations to inform what I would review during the next meeting. The feedback I received from my students at the end of the semester was overwhelmingly positive: many students explicitly mentioned how much they appreciated the review sessions I led, and how much the challenging problem sets helped them prepare for exams.

After years of honing this in-class problem-solving approach in my discussion sessions as a teaching assistant, I had the opportunity to use it in my own course. During the summer semester of 2017, I was the primary instructor for an engineering calculus class at Cornell. Throughout the course (which met every weekday for six weeks), I applied my ideas for a problem-solving-oriented class and directly observed the results. Two days per week were designated as "problem session" days, during which I would break the students into groups and have them work on practice problems for most of the class. While the students were working, I would move around the room, answer questions, and watch and listen to students attempt the problems. Just as when I was a teaching assistant, this helped me develop a strong sense for how adept each student was with the material, and what topics I should focus on reviewing. Additionally, because the problem sessions came at the expense of time that would otherwise be spent lecturing, I compensated by producing video lectures for the students to watch at home. Besides freeing up class time, the benefit of the video lectures was that the students could watch the lectures at their own pace, with the ability to pause and rewind the video as needed. They were then able to apply the knowledge and techniques presented in the video lectures to the material in the problem sessions. By focusing more class time on actually practicing calculus rather than just observing it, I provided my students with a structured environment to build the problem-solving intuition that I believe is paramount to their success.

Students build math knowledge and skills over time, so the intuition that students develop early on in their education helps direct them to becoming more successful mathematicians later in their learning career. Hence I believe that it is my responsibility as a teacher of introductory math courses to guide students towards developing this intuition. Many students believe that intuition for mathematics is binary: you either have it or you don't. Though it seems true that the most successful students have already built a strong intuition for the topics presented in a class, it is possible for a student to develop and hone this ability with good instruction. Students can learn how to look at a problem and see potential approaches – and possibly determine the entire solution – without writing anything down. Using this carefully cultivated intuition, they generate an initial insight, and then proceed to build a complete solution using the knowledge and techniques they have learned in class.

I have found that leading active learning-style problem-solving sessions is the most effective way for me to help students efficiently develop their intuition and ultimately build their confidence and competency in calculus. I think of myself as a math *coach*: I have goals (learning outcomes) I want my team (the class) to accomplish, and I help them reach those goals through guided practice and then assess their progress. Having students work on problems in class provides a focus on problem solving that is not achieved by traditional homework problem sets, and allows students to get immediate feedback from the instructor and their peers. Group-based problem solving also has the added benefit of helping students develop socially as they begin their college experience.

Good assessment (both formal and informal) not only benefits students as they get feedback on their learning, but also benefits the instructor by providing feedback on their teaching. The in-class problem solving sessions serve as a useful opportunity for informal assessment that gives me feedback about what students are and are not learning. As for formal assessment, I've found that written exams can sometimes fall short of evaluating how well a student understands the material in a math course – instead, they measure how well the student can take written exams. I prefer to weigh student work completed outside of test situations more heavily than exams. For example, during the summer course I taught, I took notes on each student's participation in problem sessions and evaluated the work they did during class. Unfortunately, time constraints and academic expectations led me to put more emphasis on exams, so I was unable to be so idealistic. I am interested in exploring the use of more flexible and individualized assessment schemes – such as oral exams – in small or medium-sized classes.

Just as I seek to develop my students' intuition for mathematical problem solving, I would like to develop my own intuition for individualized teaching. That is, I wish to enhance my ability to identify what a student needs to improve based on what I see in their group performance and written work. To that end, I regularly seek feedback from my students. I ask questions like "is the way the class is being run working for you? What type of in-class activities would you like to see more of? Less of?" I occasionally ask these questions to students in person (e.g., one-on-one in office hours), but I find that I get more honest feedback through anonymous surveys, which I collect at least once a semester in addition to the formal end-of-semester course evaluations. I also spend a substantial amount of time talking to my peers and mentors about teaching, trying to get a sense for whether they think my teaching ideas are appropriate as well as looking to them for new approaches that I might not have considered. I use the advice of skilled teachers and mentors to make adjustments to improve my teaching.

Using the feedback I receive by talking to my students, from reading their surveys, and from observing their performance in class, I am able to make adjustments throughout a course to better meet students' learning needs. By the end of the course I taught this past summer, many of the students who struggled the most at the beginning of the class were showing the most drastic improvements during the problem solving sessions; their final exam scores also reflected this. After collecting evidence about the problem-solving sessions over the summer, I feel confident that this is an effective way for me to organize a first-year math course. Supervised problem solving provides a focused environment in which students can apply and expand upon the skills and intuition they have acquired in class, and it allows me as the instructor to monitor students' progress and adapt my lesson plans based on what I observe. As I pursue a career focusing on undergraduate education in math, I will look for opportunities to encourage my students to build their intuition and to help them reach that goal by tailoring my instruction based on their performance and feedback.