TEACHING PHILOSOPHY

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My teaching philosophy centers around incorporating multiple techniques to engage the students in the material. I draw from my experiences as both a student and teacher to add excitement and interest to each class. As a teacher I have run discussion sections (for Calculus I and II and for an interdisciplinary course discussing the creativity of great people in Science, Architecture and Music), taught my own small lecture that had a course chair (for Precalculus and College Algebra), and taught my own course (Number Theory in a summer session). In general, I use question-based teaching and I incorporate the use of group work, technology (calculators), student presented material, and quizzes. I also enjoy teaching very much and look forward to continuing to improve my teaching skills.

As an undergraduate student, three of my upper-level classes (Linear Algebra, Complex Analysis, and Real Analysis) were essentially run by the students. The professor wrote class notes that included both homework problems and in-class problems and presented the more difficult theorems. The in-class problems were presented by the students during lecture and were either examples or proofs of some of the less difficult theorems. I think this setup benefited me greatly because it gave me experience teaching other students, which I think is ultimately the best way to really learn the material. I feel that this technique is best used in a smaller class when done for the whole semester, although I will incorporate it into some of the larger classes I teach occasionally. It also leads to the students coming to office hours more often, and this can help a student who is struggling.

For Calculus I and II the class was set up for group work. The sections met twice a week for 80 minutes and in each class the first 20 minutes were set aside for homework questions and the rest of the time was spent on worksheets done in groups. I walked around the groups and asked questions that would lead them through the problems. A problem with this type of discussion, that became evident after the first exam, is that you can only determine what the "smartest" group member doesn't understand. To correct this problem I began giving quizzes once a week. This gave the students a better sense of what would be asked of them on an exam and helped me determine which students were having trouble. Another valuable lesson I have taken from this type of class is how to have students use their calculators to better understand the material, but not become overly dependent on them. For example, the students had a question that asked them to determine the limiting (end) behavior of a general polynomial. I asked them to graph a few examples on their calculator, which helped them answer the question. While I am concerned about how much some students depend on their calculators to do algebra as well as calculus, I do respect how they can help the students better understand the material. I balance this use of technology by asking the students to use their calculators during class, but ask them not to use them on some exams.

This helps ensure that the students really understand the material and not just how to use their calculators.

The interdisciplinary class was set up for question-based discussion as well as group work. The class covered great people in Music, Architecture, and Science and related the different aspects of their personalities that helped them be creative. The goal was to help the students understand the connections between the areas through the creativity of people in each area. The discussion sections met once a week for 75 minutes and in each class I spent 20 minutes reviewing the major points of the course material for the week based on questions from the students, then the students worked in groups on questions comparing the various people we covered in lecture, while leaving about 15 minutes for a quiz. Each week the students wrote a short essay (approximately one paragraph) based on the material covered in class. Often the questions they asked in discussion led to a more thorough answer of the essay question. I feel that the writing portion of this class was very important. I will continue to ask my students essay questions on occasion to help with their communication skills. For example, I recently gave a quiz in Calculus that asked the students to explain the Intermediate Value Theorem in their own words. This helped me to discover which students really understood the theorem and gave me insight on how to explain it more clearly.

In the small lecture classes (approximately 25-30 students), I was the sole contact for the students, but a course chair wrote the syllabus and the exams. Each day I went over homework at the beginning of the hour and then lectured for the rest of the hour, except for once a week when I gave a quiz. During lecture I tried to engage the students and have them to work through examples with me. This sometimes slowed down the pace of class, but I feel this is one of the best ways to help the students understand the material and realize that being in class is worthwhile. In the future, I will also set aside time for group work, because it is important for the students to also be able to communicate mathematics to each other. On occasion I have been asked to slow down in class. I do this by repeating myself three times, once while writing down the statement, a second time while drawing a picture or underlining the important points and a third time to give the students time to catch up. I learned this from my undergraduate advisor and it has been a valuable technique.

When I taught Number Theory, I had complete control over the course. I chose the text (Rosen), wrote the syllabus, exams and quizzes, and I chose the homework problems. The class had 26 students and met every day for 80 minutes for six weeks. I had a wonderful experience with this class. The students really worked hard and surpassed my expectations. The class was set up to be an introductory proof course, but I was able to do more proof theory than normal. I believe this was mostly due to the group of students I had, but also because I didn't "know better," and therefore asked them to work harder than a more experienced teacher might have. I spent each class period going over homework questions and then lecturing on the course material. Approximately once a week I gave a quiz. I tried

to make the quizzes harder than the exam questions to help keep the students on top of the material. I also used the quizzes to emphasize what material I thought was most important. While lecturing, I used examples to motivate proof techniques. For example, in Rosen's text, he does an example before showing that the summatory function of a multiplicative function is multiplicative. I found that presenting this in class really helped the students understand the proof and where the technique for the proof came from, which is often a hurdle for students who are just learning to do proofs. I used this approach for the rest of the summer and I will also use this in future classes. One of my greatest compliments as a teacher came this semester when two of my summer students recommended me as a tutor to one of their friends who was having some trouble in Number Theory.

In summary, the techniques that I incorporate into my teaching are question-based teaching, use of technology to give a visual understanding of the problem, asking the students to present problems in class, having the students work in groups so that they can learn from and teach each other, and giving quizzes that help the students understand what will be expected of them on an exam. Also, when I teach I try to be enthusiastic. I have often been told that it is obvious that I enjoy math and teaching. A great moment occurred this semester while the students were working through a question that asked them to generalize an earlier problem. They were asked to take a derivative, find the zeros of the derivative and then explain how the zeros were related. It was wonderful to watch the students as they realized that the third zero was just the average of the first two for this particular class of functions. Their comment was "So this works for all values. Wow, that is cool."