Malcolm Roberts: Teaching Statement

Teaching Philosophy

Teaching is important. While requiring a great deal of energy, it also provides great rewards. From my first experience teaching English as a second language to kindergarten students in South Korea to lecturing to a class of one hundred engineering students in Canada, much the same process takes place: know your subject, determine what students need to do to understand the subject, and then transmit that information.

Students in mathematics course can be best characterized by their diversity. This creates a significant challenge: students with different backgrounds and abilities will approach the subject in different ways, so I try to use a variety of teaching techniques so that I can reach as many students as possible. For example, when teaching the heat equation, I tried to present students both abstract and concrete perspectives, by considering the solution to the heat equation as a point in a vector spaces, as well as appealing to their physical intuition with real-world examples. I also presented with the problem in constructive, visual, and explanatory methods, by having students derive solutions to analogous equations, showing them animations of particular solutions, and providing arguments for why sine and cosine should lie at the heart of the solution. I also encouraged students to teach each other the material; this develops important collaboration skills, as well as being a very effective way for students to review while allowing for "massively parallel" communication.

Students will learn better if they understand the importance of what they are being taught. This can be accomplished in two ways. First, I try to determine what knowledge the students require for their courses and careers. Thus, it is very important to maintain a dialogue with other areas of the university to determine what skills would be useful to one's students in other areas. Second, the students should see that the material is important because it is worth learning in its own right. Mathematics is beautiful, and I believe that students will be able to use their mathematical skills more effectively if they are in possession of this æsthetic sense.

Teaching Experience

I have been the primary lecturer for one second-year math course of 100 students, assisted in the supervision of several PhD students, taught dozens of math labs comprising over 1000 students total, and been involved in community outreach and education throughout my career.

As a primary lecturer, I taught a second-year differential equations course for engineers. I designed innovative new course materials, describing procedures for solving problems with flow charts, and these resources continue to be in use today. Student evaluations of my teaching were around 4.5/5, and contained many positive comments.

In math labs, which are supplementary review sessions attached to a lecture, I reviewed class material, provided examples, and gave weekly quizzes. Topics covered included introductory calculus (I and II), linear algebra, differential equations, and vector calculus. Teaching evaluations were very positive, with an average rating of 4.7/5. I was awarded the University Teaching Services Graduate Teaching Award, largely based on student reviews. I have been assisted with the supervision of Masters and PhD students from a variety of backgrounds during my time at Aix-Marseille University and the University of Strasbourg.

Service Activities

Having spent so much time and energy developing materials and learning techniques in teaching, I felt it very important to collaborate with other educators so that we could take advantage of each others work. For example, I found that students in our MatLab-based linear algebra labs were wasting a lot of time entering data (sometimes incorrectly), so I created copy-able inputs for each lab. These are now available to the entire department in a version-controlled repository, allowing other members of the department to download copies and to add changes as they see fit. In an introductory differential equations course, I noticed that teaching assistants were spending significant amounts of time recreating material to use in their labs. To solve this problem, I co-wrote a lab manual for this class. These notes have recently been open-sourced, and are available at `github.com/malcolmroberts/denotes`.

In addition to developing shared resources, it is important for instructors to share experiences. I noticed that graduate-student education, in particular, is an area where we often face similar challenges, but rarely have a chance to share solutions. To address this issue, I organized the PIMS Mathematical and Statistical Graduate Education Round-table, a two-day event held at the Banff International Research Station in Banff, Alberta. The subject of the workshop was the education of graduate students in mathematics and statistics, and was attended by faculty, administration, and graduate students from eight Canadian universities.

Universities play an important role in educating the general public, and I have been involved in community outreach during my academic career. The math/stat graduate student organization outreach program, with which I was active for four years, organizes classroom visits to schools in the Edmonton area and leading sessions at semi-annual math fairs. Students tend to decide in their school years their attitude towards mathematics; these outreach opportunities are therefore very important to the mathematics community as a whole. Feedback from teachers and students was very positive. In addition to school-based outreach, I was also interviewed by Science for the People, a popular radio show/web cast, about applied math which allowed me to elaborate my turbulent theories about pouring beer and foaming milk to an audience of over 60 000 listeners.