Teaching Statement

My enthusiasm for teaching is driven by a desire to see students gain a deep appreciation for the implications, subtleties and applications of the subject material, since it is precisely these aspects that are not evident to the novice student and which can inspire enthusiasm and interest. I aim to achieve this by ensuring that students have a sound grasp of the fundamental concepts, and then challenging them with directed tasks that require them to hone their problem-solving skills.

1 Multi-variable Calculus

For the past year I have lectured first-year multi-variable calculus to classes of up to 30 students. This subject is intended for both mathematics and engineering students and comprises just 2.5 hours of lectures per week. Students have no tutorial classes and are expected to absorb theory and examples for the entirety of each lecture, and then to complete weekly sets of homework exercises. This course has a reputation amongst faculty for being difficult to teach, by virtue of compressing a large syllabus into a single course, and a reputation amongst the students for being difficult for the same reason.

In my first lectures I presented both concepts and worked examples. Students stuggled to draw parallels between the lecture content and the homework exercises, which took them hours to complete. In response, I divided each lecture into three parts:

- The raw material; concepts, theorems, proofs, formulae;
- Several worked examples, the first being near-trivial and subsequent examples increasing in difficulty; and
- Class exercises, to be attempted individually or in small groups (typically for the final 20–30 minutes of class).

The class exercises were selected using the following criteria:

- Requiring limited algebra, so students could focus on the **concepts**;
- Revealing new insights or unforeseen complications;
- Increasing in difficulty, from trivial to extremely difficult;
- Using real-world situations to motivate the question, where possible.

With each class I attempt to foster an interactive and collaborative atmosphere by asking students to help narrate the content presentation and to navigate solutions to worked examples. While students attempt the class exercises I roam the classroom, monitoring their progress, responding to questions, and asking students to explain their chosen approach. These interactions help drive further discussions and stimulate a collaborative atmosphere that, as the semester progresses, asserts itself without my initiation.

This semester I am presenting all of the lecture content via slides (made available to students 24–48 hours before class) that allow me to step through worked solutions without spending valuable time at the blackboard. This allows me to present complex parametric plots as produced by software packages rather than attempting to sketch them on the

blackboard; this is particularly beneficial when discussing complex double and triple integrals. I also use colours to highlight portions of equations to allow students to identify common elements throughout the entirety of a worked solution.

My students students have been uniformly enthusiastic about this class structure and repeatedly commented (unprompted) that they felt much more comfortable with the material as a result. These sentiments are reflected in my teacher course evaluations (TCEs) from the Spring semester,where my scores ranged from 4.0–4.6 on a scale of 1–5; 4 being "good" and 5 "excellent".

2 Modelling Symposium

I also presented two lectures for a first-year symposium subject on the topic of mathematical modelling. I chose to focus on cellular automata (CA); my aim was to demonstrate how surprisingly complex dynamics can be produced from small sets of simple rules. I guided students to discover some of these complex dynamics (e.g., gliders) by evaluating successive states of CA by hand. I also presented other phenomena using model simulations and video recordings (e.g., reaction-diffusion systems in petri dishes). Most of the students remained after the lecture had finished and told me that the classes had been extremely interesting and stimulating. One of the students subsequently contacted me to ask if I had a research project to which they could contribute; unfortunately, I did not.

3 Future Teaching

My preference is to teach subjects that cater to students both within and outside of the mathematics department (e.g., engineering and other sciences) where students are exposed to the beauty of mathematics and discover how real-world applications motivate the subject material (e.g., calculus, differential equations, linear algebra, modelling).

I am excited to further develop my teaching method. In particular, I am keen to increase the range of material that is available to students prior to each lecture, so that the class time can instead focus on the implications, subtleties and applications of the subject material, since it is precisely these aspects that are not evident to the novice student and which can inspire enthusiasm and interest.

4 Conclusion

Student engagement with the material is what drives my passion for teaching. I design my lectures and problem sets with the express purpose of surprising students with unforeseen connections and conclusions, to be discovered by their own hand where possible. I vividly remember the extreme boredom I experienced in (the thankfully few) classes I took where the lecturer read word-for-word from sets of slides, or simply wrote equation after equation on the blackboard. I would be horrified to think that I am putting students through a similar experience.