

Teaching experience

Thomas Harris

I undertook various mathematics teaching at the University of Southampton:

- Teaching assistant and homework marker for first year modules in mathematics and computer science: *Calculus I* (Autumn 2011 and 2012), *Linear algebra II* (Spring 2012 and 2013), *Number theory and cryptography* (Autumn 2013), and *Foundations of computer science* (Autumn 2012, 2013, and 2014).
- Coursework marker for third year modules in mathematics: *Further number theory* (Spring 2014 and 2015) and *Metric spaces and topology* (Autumn 2014).
- Drop-in centre for engineering mathematics. Students from engineering courses (or other courses with maths 'service' modules) could come along and ask one of several PhD students for help with any aspect of mathematics.

In the academic year 2014–2015 I was employed by Winchester College to teach Galois theory to a small group of advanced students in their final year of school. This was a rather unique experience in finding good ways to present sharp students with very abstract concepts for their first time.

In the summer of 2013 I initiated a series of seminars for undergraduates at Southampton, which cover interesting topics from outside their syllabus. Some talks are contributed by PhD students, while others are given by the undergraduates themselves. I secured some funding for this seminar to go ahead, gave several talks myself, and have continued to organise it until I finished my PhD.¹

Strategy and philosophy

Mathematics may or may not have an objective independent existence, but the practice of mathematics is a human activity. Most students do not learn mechanically, beginning from axioms, and proceeding lemma by lemma. Knowledge is acquired through experience, repetition, and exposure to a variety of viewpoints, and our teaching ought to reflect this. This summarises the core of my approach.

Different students learn best in different ways, and a good teacher should aim to identify the approaches that work best by varying their approach. Sometimes one can make informed choices about presentation in advance², but often these things only become clear once teaching has begun. It is therefore important for a good teacher to be flexible. Variation in styles is particularly important when teaching a group as it is almost guaranteed that not all of the students will learn best in the same way.

As is often remarked, maths is not a spectator sport, and my teaching takes that into account. Nobody (save the occasional savant) learned mathematics just by reading the textbook or listening to lectures. Students must engage with maths to learn it. When helping with a problem, one should never just show the student the solution. That is the easy way out (for both of you). The harder, but better, way is to show the student how to move just a little closer to a solution of their own.

Homework exercises are important, but we require these anyway. What is more important, in my view, is that lectures are *participatory*. A good lecturer should ask questions of the audience, and openly invite questions in return. This fosters a sense that the students are responsible for their own learning (and helps to keep their attention!). Good lectures are lively.

Finally it is important that, wherever possible, students should be encouraged to explain mathematics to each other. I have often found that I did not truly understand something until I taught it to someone else. Through teaching we learn.

¹The seminar is still running; its website is: <http://ugseminars.co.nf/>.

²For example, when teaching Galois theory to sixth-formers it was clear at the outset that the theory should be presented entirely over \mathbb{C} rather than an arbitrary field.