TEACHING STATEMENT

SIÂN FRYER

1. Teaching Philosophy

When preparing a short talk for a general mathematical audience, I was given the following piece of advice: *"try to give a talk that suits the audience, not the talk that suits you"*. This advice is equally relevant to teaching, and underpins my whole teaching philosophy: it is important to be aware of each class's individual needs and level, and be prepared to moderate your own style accordingly. In this statement I will outline some of the ways I have attempted to put this philosophy into practice in my own teaching.

When introducing a new concept or definition to a class, I like to ensure that they not only understand and can apply the formal definition where needed but also have an intuitive grasp of *how* and *why* it works, since either one on its own is all but useless without the other. Of course, everyone's intuition is different and what works for one student will be unhelpful for another, so it's important to look for several different ways of explaining each concept and be ready to switch between them as needed.

This approach has paid off on several occasions, from coming up with a simple gameshow-style analogy to illustrate the difference between $\forall x \exists y$ and $\exists y \forall x$ to foundation year students to stressing the intuitive interpretation of a quotient ring to final-year maths students. I believe it is crucial that students understand the underlying concepts of what they learn, as this is the only way they will be able to apply their knowledge outside the narrow confines of an exam question.

My teaching style is informed partly by what I found helpful as an undergraduate student, and partly by experience gained from working with students at Manchester and Leeds over the last five years. I have made a deliberate effort to teach as many different types of class and student as possible: from tutoring 16 year old school students in preparation for their maths GCSE exam, to supporting students specialising in other areas (e.g. engineering or computer science) to leading examples classes for large groups of final-year mathematics students. In my final two years at Manchester I was also assigned to work with small groups of first year maths students (a job normally reserved only for lecturers) providing an opportunity for support and discussion as they struggle with their first introduction to abstract mathematical thinking.

PhD students at UK universities often have limited or no opportunity to give lectures (in particular, lecturing was strictly forbidden for PhD students at Manchester), but I have taken the opportunity to lecture an undergraduate course at the first opportunity in my current position at Leeds, despite the fact that I currently hold a research postdoctoral position with no requirement to teach. I look forward to using this experience to continue to improve my teaching ability.

My aim is to ensure that students get as much as possible from the classes they take, while hopefully enjoying themselves in the process. I expect them to work hard and to make a genuine attempt at problems before asking for help, but in return I make sure I am as well-prepared as possible for each class and ready with good answers to as many spin-off questions

as I can predict in advance. Teaching is a two-way process, but by setting the bar as high as possible I hope to inspire students to push themselves and to succeed.

2. Mathematical Outreach

In addition to teaching school students and university undergraduates, I also enjoy getting involved in mathematical outreach events with the general public. Not only does explaining interesting ideas from mathematics to people with limited mathematical background force me to think carefully about how to present information in a clear and concise manner, I believe it is also important for mathematicians to be able to engage the public about the beauty and relevance of their work.

Possibly the most ambitious outreach event I have been involved in was the construction of the Domino Computer at Manchester Science Festival 2012. Conceived of by mathematician and stand-up comedian Matt Parker, the aim was to focus on something we all take for granted - computer chips - and explain how they work at the most basic level by building a working replica of a 4-bit binary adding machine out of standing lines of dominoes.

Using stationary dominoes to represent a 0 and falling dominoes to represent a 1, we explained the concept of logic gates and encouraged people to think about how to build them using rows of dominoes. We found that this visual, hands-on approach resonated with many more people than a simple diagram or truth table did. For myself as well, it was an excellent exercise in teamwork and thinking outside the box.

I enjoy the challenge and variety of mathematical outreach: in addition to building logic gates out of dominoes, in the last few years I have done everything from helping young children build paper rockets powered by air pressure at Jodrell Bank Observatory to motivating the concept of a bar chart using coloured sweets at Manchester's Museum of Science and Industry. I have also presented several posters on my research to various general interest audiences, including Members of Parliament at the SET for Britain 2015 event. These problem-solving and public speaking experiences are not only a great learning opportunity for myself, but also allow me to continue to improve my skills as a teacher.

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