

TEACHING STATEMENT

JACK SHOTTON

I have been teaching mathematics in one way or another since I was an undergraduate. I enjoy teaching greatly and find it both personally and mathematically rewarding.

I aim to teach with clarity and with empathy.

Clarity, because the power of mathematics lies in its ability to express precisely intuitive ideas about quantity, space, change, shape and pattern. An example of this occurs in any first year calculus class: by carefully and precisely expressing what is meant by the rate of change of a quantity, it is possible to build an entire theory of rates of change, with great computational and expressive power. But a careless or imprecise lecturer could easily obscure the value of the mathematical point of view.

Empathy, because the requirements of teaching always depend on the particular needs of a particular student at a particular time. I have taught students whose ambitions have ranged from town planning to mathematics graduate school; students who struggled with intuition and students who struggled with rigour. Each individual needs something different from their mathematics courses.

Teaching with clarity is one of my strengths. Many students have commented that my classes are clear and lucid. From a recent evaluation:

“Jack is a very clear lecturer. Every proof is properly motivated, approached with care, and understandable.”

The keys to clear teaching are good preparation and sensitivity to classroom mechanics.

Even ‘easy’ material should be prepared in advance. Although I usually teach without notes, I nevertheless always write notes beforehand. This not only means I can present in a direct and streamlined way, but frees up mental resources when lecturing, which can be spent on presenting well and being attentive to the reaction of the class. The preparation and presentation of enlightening examples is especially important. For instance, in a recent algebra class, I prepared a colourful diagram of the various orbits of points in the plane under the action of D_8 to illustrate the orbit-stabiliser theorem.

As an example of classroom mechanics, consider boardwork. I learned early on in my teaching that students find my cursive completely illegible. Consequently, I now write on the board exclusively in capital letters. Another

example: to hold the attention of a class it is important to move away from the board and use the space of the classroom. I have found that students respond very well when you step in to them, make eye contact, and explain how to think about what you are about to do, or what you just did, on the board.

Teaching with empathy means understanding the difficulties that students are having and adjusting my teaching based on the needs of particular students. To understand my students' difficulties, I always aim to create a class environment where students can freely ask questions. This means taking frequent pauses in the lecture, and never treating any question as stupid. I am never satisfied until I can find the explanation that works for a student and often I will provide multiple explanations — with pictures, words, symbols, or examples — until the idea seems to click.

Something else I try very hard to do is to be receptive to students' ideas. In small group interactions, such as in office hours, I see one of my roles as to facilitate a student's own solving of a problem, and to suggest further directions. In a recent office hour a student and I together found a solution, that I had not seen before, to the group theory problem of showing that a group of even order has an element of order two. It was based on the student's idea of using the inclusion-exclusion principle. From recent student feedback:

“[I] really love that Jack, especially during office hours, will make every question an exploration of math that makes the student really feel like Jack is exploring with him/her.”

The course of which I am most proud was my “Introduction to proof in analysis and linear algebra” class in Spring 2016. The brief was to progress from axioms for the real numbers to rigorous multivariable calculus in a single quarter, for students with a computational calculus background — a very tough ask. By carefully choosing what to include and what to omit, and setting homework that was interesting but accessible, I was not only able to do this but to do it in a way that the students understood and enjoyed (this class had my best ever evaluations):

“Jack was fantastic, fun, and passionate about the subject. He helped me fall in love with math, and did a wonderful job in inspiring me!”.

Teaching materials for my courses at the University of Chicago are available at math.uchicago.edu/~jshotton.