Chris Elliott – Teaching Statement

Teaching is a crucial responsibility for any academic mathematician, and one that I take very seriously. At Northwestern I've served as a teaching assistant for classes at a range of levels, from introductory calculus classes for students having little experience with mathematics, to Fourier analysis and algebraic topology classes aimed at mathematics majors approaching the conclusion of their degrees. While I try to maintain flexibility in my lesson plans so that I can adjust them based on the needs of the students in each class, I have found that there are common challenges involved in instruction at each level which lead me to use common techniques and approaches. In the rest of this document, I'll describe my teaching experience and philosophy, discussing first introductory undergraduate teaching including calculus, then more advanced undergraduate teaching, and finally my other relevant experience, including running seminars at the graduate level.

I've served as a teaching assistant at Northwestern for calculus classes at several levels – including an introductory differential calculus class that presented material at a slower pace, and several vector and multivariate classes for students at different levels – as well as classes in linear algebra. As well as grading and holding office hours, I ran problem sessions for these classes which consisted of a mixture of answering student questions, presenting worked examples, and administering quizzes. In addition, in the Summer of 2011 I assisted with the Northwestern "Summer Bridge Program", an intensive precalculus program for incoming undergraduates interested in medicine who required remedial precalculus instruction. In these classes the principal aim is often to develop students' facility with calculation, so one of the most important parts of preparing for such a course is the selection of representative worked examples. When preparing for classes like these I aim to construct a set of examples to work through with the students that demonstrate the subtleties and common pitfalls that they are likely to experience. Likewise, it is important that the exercises assigned to the students are chosen carefully, in order to model as many as possible of the problems they are likely to experience when they apply what they've learned to future classes. I've found my in-class interactions to be most successful when I provide a framework for my examples, but have the students work through the steps of the calculation. This helps ensure as many students as possible are engaged, which builds their confidence while demonstrating those points that may need additional explanation.

I have also assisted with Northwestern undergraduate classes at a more advanced level, including classes on Fourier theory and PDEs, group theory, algebraic topology, and graph theory. In classes like this, in addition to fostering an understanding of the material it is important to build students' confidence and mathematical maturity. I try to do this in several ways. Firstly, I consciously exhibit a personal interest in and enthusiasm for the topic. To build interest I try to discuss examples that exhibit a broader theme or a connection to another area of mathematics; in my experience, my own excitement about the broader relevance of a subject inspires some excitement in the students! More importantly, drawing these connections is beneficial for other reasons: it can improve the students' understanding of the class by linking the topic they're studying to subjects they've encountered in the past, or that they might be motivated to learn about in the future.

At all levels, but especially in more advanced and more theoretical classes, I've found that it can be effective to break the flow of a session by dividing the class into small groups or pairs to discuss a question or problem. This ensures that each student has a chance to talk through and grapple with an example. In the same vein I believe that time with the instructor in small groups can be extremely valuable, both for the students' immediate understanding and for the instructor's familiarity with the progress of each individual. In a small enough class I would like to organise Oxbridge style "supervisions", where students are required to schedule meetings with me individually, in pairs, or in small groups a few times during the course to discuss examples they've worked through in advance. Small group interactions have the additional advantage of facilitating the participation and engagement of students who are members of groups traditionally under-represented in mathematics, who might face particular challenges

speaking in a whole-class setting.

As a graduate student I have consistently organised graduate student seminars on a range of topics in representation theory and mathematical physics. Running these seminars has given me considerable logistical experience. I have outlined topics for 3 month long lecture series, with lectures presented by different members of the seminar, in order to collectively learn a difficult topic. Organising these seminars has additionally involved meeting one-on-one with members of the group to discuss their progress, and making suggestions for their talks. A lot of this experience, not to mention the experience of regularly presenting in these seminars, will facilitate my future organization and teaching of undergraduate and graduate classes. I am very interested in organising undergraduate seminar classes involving regular presentations by class members: learning to present well is an important skill which, in my experience, can be neglected in undergraduate mathematics education.

I look forward to implementing these ideas in the mathematics classes I will teach in the future, and to continuing to learn from new experiences and to develop as an educator.

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