Noah Snyder: Teaching Statement

I have long enjoyed teaching, and have had a wide variety of teaching jobs over the past dozen years. I've worked in many different capacities at summer math programs for nine summers, I taught a sophomore tutorial at Harvard, I've given over 30 seminar talks at Berkeley, and I taught four sections of Calculus at U.C. Berkeley. Beyond a general interest in teaching, I have strong particular interests in curriculum development, in discovery-based teaching techniques, in graduate level seminars, and in education for gifted students.

Teaching experience. At U.C. Berkeley in 2004 I taught two sections of first-semester calculus for engineering students and two sections of second-semester calculus for engineering students. These sections met for 3 hours per week and complimented 3 hours of large lectures by a senior professor. For the first of these classes I was responsible for writing quizzes, structuring classroom time, and choosing worksheets. For both of these classes I was popular with the students. For the first class, where I had the flexibility to organize my own classes, 18 out of 40 students rated my teaching as 7 out of 7. My average rating as a teacher were 6.1, 6.0, 5.9, and 5.8 respectively. The overall scores for the sections were 5.8, 5.7, 5.9, and 5.0.

One student in my calculus class wrote:

> "He has a great talent for explaining even difficult subjects in a clear elucidating fasion. He also has an infectious enthusiasm for the subject that encourages students to learn."

Another said,

> "[He] keeps individual track of students progress including those who are doing poorly (and approaches them)."

Most of my recent teaching has been at the Canada/USA Mathcamp, a summer program for exceptionally talented teenagers. As a mentor my job included developing new classes, writing problem sets, teaching classes, giving colloquia, observing new mentors, and supervising student research projects. The hiring process for mentors is very competitive, roughly three in four applicants are rejected, and of the new hires roughly half are granted tenured status and asked to return. I've taught a variety of classes on number theory, topology and algebra. In 2008, my 12-hour 5-day class on planar algebras was one of the most popular classes with a 6.48 out of 7.

Curriculum development. The most exciting part of teaching for me is developing new curricula and new ways of making math exciting. Creatively thinking about structuring a class so that one can reach deep and beautiful results without relying on excessive prerequisites is a great joy. I developed and taught a sophomore tutorial at Harvard on "L-functions and ζ-functions" based on material from my undergraduate thesis. At Mathcamp I've developed classes on unique factorization, number theory of polynomials, basic category theory, and planar algebras. I've also developed for mathcamp a longer

discovery-based curriculum called "Rational numbers... in space!" proving results in diophantine approximation using elementary geometry of the plane. At Berkeley I organized a semester long seminar on topological invariants and quantum algebra, tying together many introductory results in quantum algebra and quantum topology into a coherent thread. These experiences will be useful at the university level in developing new general interest freshman seminars, higher level seminars for math majors, graduate seminars and topics courses.

Discovery-based teaching. Since I was a student at the Ross summer math program in 1996, I've been interested in discovery-based teaching techniques. The Ross program is centered around long daily problem sets which students solve largely on their own. Counselors are there to listen and occasionally give a hint, but by cleverly breaking up the problems into bite-sized chunks, most students can discover key ideas themselves. This leads to better mathematical maturity, teaches students about the research process, and results in better long-term retention of the material. I worked as a counselor at Ross for 4 years, taught a thrice-weekly seminar there, and worked rewriting and editing the problem sets in 2002.

I've used this experience with exploration-based teaching in other settings since. At U.C. Berkeley for one semester I incorporated the Berkeley worksheet system. Here students are given problems that they work on in small groups at the board. The teacher must constantly scan the room keeping all groups moving and interested, while not giving so much of a hint as to spoil the problems.

I've used a hybrid of the Ross approach and the Berkeley worksheet system in two classes at Mathcamp. Much of the work was done by students outside of class, but inside class they would break up into small groups and continue working with occasional prodding from me. At Mathcamp I have also taught a class using the Moore method. This is similar to the above techniques in that the students are given bite-sized lemmas leading up to theorems to work on outside of class, but differs in that in class students present their solutions at the board. When this system works, the students find each others mistakes. To promote this behavior the teacher must be patient, but intervene when necessary to keep discussion moving in a positive direction.

I plan to continue incorporating discovery-based techniques culled from the Ross programs techniques, the Berkeley worksheets, and the Moore method in classes that I teach in the future.

Graduate Seminars. At Berkeley I have had extensive experience organizing graduate student seminars and teaching in a wide variety of graduate seminars. These seminars were instrumental to my experience as a graduate student and I plan to continue organizing graduate seminars in the future. I organized my own seminar on "Topological Invariants and Quantum Algebra," where I chose the topic, gave half of the talks, and recruited speakers for the other talks. I also co-organized the student representation theory seminar. I gave over 30 talks in half a dozen different seminars on topics ranging from number theory, to operator algebras, to representation theory, to topology.