Teaching Statement

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I received my Ph.D. in mathematics from the University of California, Irvine in 2013, and my B.A. degree in mathematics and physics at Colby College in 2007. I have been teaching for eight years, and have considerable experience and success as both as an instructor and as a teaching assistant for many courses covering a broad spectrum of lower and upper division courses. In addition to these teaching experiences, I have been involved in online teaching and educational outreach. My undergraduate time was spent at a great liberal arts college, and I currently enjoy teaching in the same environment at Furman University as a Visiting Assistant Professor. I think that a liberal arts education is an experience that is unmatched, and I truly want to do my part to make it stronger. My teaching experiences have provided a very fulfilling career and passion so far, and I am excited to see where it continues to lead me.

I began my teaching experience in my senior year as an undergraduate student at Colby College. One of my professors asked myself and another student to be teaching assistants for the school's honors calculus course. My duties were to coach the class in problem solving, proof-writing, and to help with grading. Additionally, the course taught many interesting upper-level topics such proof techniques, analysis, and topology, ensuring that my first teaching experience prepared me for teaching a wide variety of courses.

Since the very beginning of my time at UC Irvine I have become heavily involved with teaching. In the lower division courses I have been a teaching assistant for most of the calculus sequence, linear algebra, infinite series, logic, and math education. I have been an instructor as well as a teaching assistant for the complete first year calculus program many times, so I have a good idea of what works when teaching students from a diverse variety of majors, interests, and backgrounds. I have been an upper division teaching assistant for a number of courses as well, from the introductory proof-writing course to analysis, topology, and graph theory. In all of these classes, my primary duty was to lead discussion sessions several times per week. In these classes I solved problems, answered questions, and provided my own lesson plan with examples that complemented the professor's lecture, providing a more thorough understanding of the material. Almost every one of these classes also required that I wrote quizzes and helped grade homework, quizzes and exams.

I had a particularly involved role as a teaching assistant to our proof-writing course, helping with curriculum development. At the time, the course was being taught by a different professor than usual, and she wanted to take the opportunity to re-evaluate the curriculum. I offered my help, and we worked for many hours to produce a quality course. Although the class is primarily for teaching proof-writing, it is also an introduction to many miscellaneous concepts which are used later, such as relations, modular arithmetic, and metrics. I drew from my experience with upper division students who had already taken the course to help evaluate what subjects needed more or less coverage. For example, I pointed out that all upper-division courses in our program assumed but did not teach knowledge of cardinality, but our course's curriculum did not include formal coverage of it. With that in mind, we added several lectures and discussions, as well as homework, quizzes and exam questions that covered the new material.

In addition to my roles as a teaching assistant, as a graduate student I was the sole instructor for pre-calculus, integral calculus, and linear algebra & infinite series. During the past year since I received my Ph.D. I have taught differential equations, math for economists, and integrals and infinite series. I am currently teaching several classes of differential calculus. Each of these experiences has been unique for me. The pre-calculus course was through an online system called ALEKS, and I learned what it takes to teach an online course effectively. I gained a lot of experience teaching via online whiteboard and voice chat applications. It was a learning experience for myself, as I got to see a lot of the things that worked, as well as some of the inevitable pitfalls of online education. The linear algebra & infinite series course was taught over a short five week summer session, and since the class teaches two disparate subjects I was under strong pressure to get through each one quickly. To manage this, I modified our existing curriculum, distilling the most important information in a manner that would best serve students going into their subsequent courses. I wrote all of my own exams, practice exams, and homework assignments. I find that writing homework assignments is an interesting challenge. You must provide enough practice in all of the important topics, with some foresight about the exams you will be writing, while at the same time not overloading students. The same could be said for the exams themselves. The first time I lectured integral calculus as a graduate student, my students averaged significantly higher than the other two sections of the course in the common final exam, including one section taught by a seasoned full time instructor. As this was my first experience as being the sole lecturer for

a class, I considered it a great success and I was very proud of my students. Both differential equations and math for economists were populated by non-math majors, providing unique challenges. The former class had mostly freshman students, whereas the latter had a range of mid-level to fairly advanced students. Consequently each course required very different approaches. For example, while teaching differential equations I had to be very careful about what proofs I chose to give or omit, so that I avoided alienating students who tend to zone out during proofs, and so that I did not make the advanced students feel as though their time was wasted.

Now I am very much enjoying my time teaching professionally after graduate school. Each semester I observe how my courses have been taught in the past by myself and others, and then look for ways to improve them. For example, I think a major issue is that many students do most of their studying immediately before deadlines. Unfortunately, in most of these classes this simply doesn't work, since they need to practice consistently until they gain some intuition of their own. I have experimented with changing the balance between quizzes and exams in order to encourage more steady levels of work.

My time teaching at Furman University has been markedly different than my time at UC Irvine. It has been an interesting challenge to direct similar course material to groups of students which differ greatly in backgrounds, goals, and approaches to academia than those of a large university. Furthermore, with much smaller class sizes and greater control over the material that I teach, I have had the freedom to adapt my courses on the fly. For example, if a particular section challenges my class, I will add a problem solving day in which I can guide students who are working in small groups. I have found this to be particularly effective. I've also recorded videos of worked problem on a lightboard at our blended learning studio, to further explore the notion of a "flipped classroom." I think this is a very useful approach for lower level courses, and I will continue to pursue it in the right contexts. In the spring semester, I will be teaching several sections of Finite Mathematics, for which I can choose the material that we will go over. I'm looking forward to developing a solid course that engages students who are not normally mathematically-inclined, one which will involve several group projects.

At the end of the 2011-2012 academic year, I was awarded the Outstanding Mathematics Teaching Assistant Award at UC Irvine. I was nominated for the award because "Ryan has an overall outstanding attitude towards his teaching. He is enthusiastic and has a real interest in the success of his students. Students enjoy taking

classes with Ryan because his positive attitude makes it easier for students to get excited about the course material."

This quote serves as a good introduction to how I like to teach. I think that as educators we have to be aware that for many students there is a stigma associated with mathematics, in which it is believed that math is difficult and unapproachable. I firmly believe that mathematics does not have to be inaccessible, and it is this fear that makes it unapproachable for students. Therefore when teaching I do my very best to make the subject material seem logical and straightforward. For example, when working through a proof on the board, one could just write the solution from start to finish. However, I prefer to teach the class not just the steps, but the thought process that I go through when coming up with each step. This makes the solution seem less like magic and more like something the students could think of themselves. Teaching particular proofs is secondary; my primary purpose is teaching students how to come up with their own solutions.

The reason for this philosophy is simple. For example, if someone shows you how to paint a flower step by step, then you may be able to replicate it and make your own paintings of that same flower. However, if you are instead taught the fundamentals of composition, colors, perspective and so on, then you can paint many different subjects in addition to that flower, in your own style. If I can teach students to be critical thinkers who can find their own approaches, then I will have helped produce much higher-quality mathematicians, and more generally speaking, problem solvers.

As an example, I would like to refer to topology. When teaching metric spaces, I would give the class the problem of building their own metric on functions on $[0, 1]$ by integrating. Together we would build this metric piece-by-piece. Through their own examples, they discovered why they had to restrict their metric to $C[0, 1]$, and in doing so I found they gained a real working knowledge, far better than if I had simply defined the metric for them.

Each day that I teach, I try to think, "What would I like this course to be if I were taking it? Is this a course that I would find interesting enough to be excited to attend? How much would I be learning, and is this lecture easy to follow?" With this in mind, I have always tried to emulate my most influential professors while still taking my own approach. Like these professors, I try my best to make mathematics intuitive. When many students see a definition, a theorem, or a problem on the board or in the textbook, they tend to draw a blank. So if I am stating a theorem, for example, I alway first write it out in math language, and then I translate it into

plain english. I then give a simple and demonstrative example of what the theorem might say about a familiar object or situation, if possible. Again taking the example of topology, I would immediately apply theorems about metrics to the discrete metric or the Euclidean metric so that the students could see the theorem working. Also like my previous professors, I try to make class very interesting and fun. After going through standard examples of some new concept, I like to go through very unusual examples that they might not normally see. This is usually pretty interesting, and often I can use this to tie the course in with other classes they might be taking.

I believe that I am very successful in my approaches to teaching. I consistently get very good reviews by my students. For example, when I assisted linear algebra & infinite series, a student wrote: "He is knowledgeable enough to be an instructor himself. Has well formed concepts of the math we are learning and is capable of explaining them in a coherent manner. He always seems to be in his comfort zone and is very professional in how he handles the class. He is very receptive to questions and actually prepares the classes beforehand. His method of going over examples is extremely good. He also finds a way to tie an entire lecture together, which is really pretty awesome." Another comment which I feel is representative of the reviews I get is: "Gives tons of examples, goes over everything more than enough, makes the class interested and makes us comfortable enough to ask questions. Discussion is the reason I succeeded in this class." One student wrote about my integral calculus course lecturing: "I've taken a few calculus courses, and this teacher is, by far, the best. I never understood calculus as well as I do now."

During my last year in graduate school, I co-taught special monthly outreach classes for high school students, under the NSF RTG grant. We have interested students from area high schools visit the university to take part in a half day series of workshops. By being led through fun activities such as building matchbox computers and playing a very simplified version of chess, students are introduced to game theory and group theory. By doing so, they see that there is much more to mathematics than basic algebra and crunching numbers. At the conclusion of the day, a panel of undergraduate math majors to talk to the students about life at UC Irvine, to get them excited about the prospect of going to college.

Lastly, research is a critical part of what I do. I do research in set theory and I am very passionate about it. I would very much like the chance to design and teach a set theory course at some point in my career. Additionally, I know how important it is for prospective graduate students to begin research early. I think it is very beneficial

for undergraduates to get their feet wet under the care of a mentor who can offer encouragement as well as experience. As an undergraduate I did research in a laser lab with a physics professor for a year. It was a project that crossed the disciplines of physics, math, and computer science, and gave me a first look at the world of science outside of the classroom. I would love to provide the same kind of experience for undergraduate students by guiding them in research projects. In addition to set theory and logic, recently I have been exploring data science, and I have a number of projects which would be perfect for undergraduates to jump into. Lastly, I have had quite a few students from old classes with whom I continue to talk to. We discuss their current and future classes, research interests, job prospects, and plans for graduate school. I would love to be able to advise students, as I have a lot of fresh experience with which to guide students along various paths.

It has made me very happy to be making an immediate and noticeable difference in the academic side of so many students' lives. I have really come to love teaching during my time at UC Irvine and Furman University, and I truly look forward to continuing doing so.

Courses Taught at Furman University:

- Math 110 - Finite Mathematics
- Math 140 - Integrated Precalculus/Calculus I
- Math 141 - Integrated Precalculus/Calculus II

Courses Taught at UC Irvine:

- Math 1B - Pre-Calculus
- Math 2A - Differential Calculus
- Math 2B - Integral Calculus
- Math 2J - Linear Algebra & Infinite Series
- Math 3A - Introduction to Linear Algebra
- Math 3D - Elementary Differential Equations
- Math 4 - Math for Economists

Teaching Assistant positions at UC Irvine:

- Math 2A - Differential Calculus
- Math 2B - Integral Calculus
- Math 2D - Multivariable Calculus
- Math 2J - Linear Algebra & Infinite Series
- Math 4 - Math for Economists
- Math 6B - Boolean Algebra & Logic
- Math 8 - Explorations in Functions and Modeling
- Math 13 - Introduction to Abstract Math/Proof-writing
- Math 121A - Linear Algebra I
- Math 140B - Real Analysis II
- Math 141 - Introduction to Topology
- Math 174A - Modern Graph Theory I

Teaching Assistant position at Colby College:

- Math 161 - Honors Calculus