# TEACHING STATEMENT

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**Overview:** I am a dedicated teacher and mentor. I have taught and been in charge of two lower level courses (calculus I and an introductory mathematical modeling course) at the University of North Carolina at Chapel Hill, three midlevel courses (ordinary and partial differential equations, twice; and multivariable calculus) as well as an advanced course on real analysis (entitled advanced calculus) at Duke University. I am well qualified to teach and would enjoy teaching courses on calculus, linear algebra, statistics and probability, discrete mathematics, ordinary and partial differential equations, real and complex analysis, numerical methods and scientific computing (I will be teaching this course at Duke in the spring), mathematical biology and mathematical modeling, stochastic calculus, and asymptotic analysis/perturbation methods. I have included a summary of my student evaluations in table 1 below.

## As an instructor in the classroom

As a teacher I have been continuously experimenting with methodologies to cultivate a strong sense of community in my classroom and between my students. I have had the students submit, via email, weekly reflections to which I respond either individually or to the entire class to foster a dialogue between myself and the students. I heavily encourage student participation within the classroom so that students have a chance to frame where there understanding stops, or have a chance to apply the skills they have learned. I always make sure to frame questions and answers in the light that knowledge and the ability to acquire it is not static, but that one must have the courage to be wrong. I do my best to foster a safe environment where it is ok to be wrong, or to be lost, and where one is always welcome to ask questions to get back on track or to test and push their abilities. I have also implemented mandatory office hours so that students who might be reluctant to seek help have a mandatory process where they can see that having a dialogue with their teacher can lead to deeper understanding.

**Weekly reflections:** To encourage reflection and a synthesis of knowledge, in the majority of my classes I have the students write a summary of the course each week. Such a tool challenges the students to consider what they have learned each week and also provides me with weekly feed back both in terms of the students's understanding of the material, and in terms of what in the class room is working and what can be improved upon. For example, in my first class on ordinary and partial differential equations, homework's were assigned based

| | Knowledgable | Helpful | Positive dynamic | Effective | Enthusiastic |
|---|---|---|---|---|---|
| MATH 353, Fall 2013 | | | | | |
| My average | 4.79 | 4.93 | 4.71 | 3.86 | 4.86 |
| Dept. average | 4.67 | 4.42 | 4.26 | 3.96 | 4.48 |
| MATH 353, Fall 2014 | | | | | |
| My average | 4.77 | 4.64 | 4.32 | 3.41 | 4.68 |
| Dept. average | 4.73 | 4.44 | 4.26 | 3.93 | 4.52 |
| MATH 431, Spring 2015 | | | | | |
| My average | 4.13 | 4.63 | 4.00 | 3.75 | 4.63 |
| Dept. average | 4.68 | 4.38 | 4.17 | 3.98 | 4.48 |

TABLE 1. Personal student evaluation statistics compared with the average department rating per term. The departmental rating was calculated over all other courses. Statistics comparing myself to past instructors or across block courses were unavailable. I would also like to point out that although my worst score (relative and absolute) was in my effectiveness for the fall of 2014, my section was the best performing section on the common block final exam with a score of $72.2 \pm 13.2\%$ compared with the ensemble block score of $65.7 \pm 16.1\%$ (over seven sections).

on the material taught in class and therefore students were always able to contextualize the material without much work on their own end. After the first test, the students requested test like problems which required them to reflect on the course as a whole, first determining what topic the question was testing on; I implemented this idea and believe it helped the students both on tests and in grasping the material. In this section my class performed statistically equivalently all other sections. When I implemented this strategy from the beginning of the class in the fall of 2014, my class average was 72.2% with a standard deviation of 13.2% compared with the ensemble average of all seven sections at 65.7% with a standard deviation of 16.1%.

Furthermore, I receive questions from the students on these reflections and answer them in a group email (the source of the question remains anonymous). The ability for the students to see me respond to questions in a patient manner and on a regular basis allows the students to (i) understand that it is ok to let people know you don't understand something, (ii) to work on the skill of asking pointed questions so that one may move from a sense of being lost or overwhelmed toward understanding, and (iii) to realize on a weekly basis that their knowledge and their ability to acquire knowledge is not static, but is constantly improving. These messages are consistent with that of an article published by the American Association of University Women which has found that emphasizing the idea that students can increase their ability through effort and practice, rather than considering ability as a static property, can be especially empowering to groups that tend to be underrepresented [2].

**Student participation:** I do my best to generate a comfortable and safe atmosphere in the classroom, encouraging students to reflect on where they do not understand material and to ask questions to remedy this. If they are reticent in asking, I will begin to ask them questions at random to determine where their understanding is lagging; if they do not know or understand, I make sure to let them know it is fine not to know, but it is important they seek to correct this. Although this method can, at times, slow class progress, I believe

that teaching with reflection and engagement is a far more effective method for student comprehension. I also emphasize the importance of asking pointed and precise questions; which is to get them to think, "if I knew *this*, then I would be one step closer to figuring things out." Such questions may be a simple as determining a definition, or what the main idea of a subject is, but the point is to refine and zoom in on where one is stuck.

**Mandatory office hours:** I have also required that students come to my office hours at least one time throughout the semester, counting this attendance as a homework. The idea behind this connected back to the larger goal of creating a social and engaged educational experience for the students. I try to teach the students that they must demand their education from the teacher. Learning is something for which they have to start taking responsibility and this must come from action and engagement on their part, rather than passively going to class and going through prescribed motions. I have attempted to convey this to them through multiple means including the New York Magazine's article "How Not to Talk to Your Kids," telling them that they should cultivate their perceived effort and abandon protecting others's view of their intelligence [1].

**Performance and student feedback:** Although I am happy both with my performance in the classroom and with my student evaluations (see table 1), I am still looking to grow and develop as a teacher. The opportunity to run and pace my own classes has helped me refine my communication skills. In particular I have learned that students need to hear concepts repeatedly and see them in many different lights. When I ask the students questions on the material in class, it is as much a tool to help them understand as it is to help me explain the material more effectively; I acknowledge that I am not a perfect communicator and am always looking for better ways to impart understanding. I believe this commitment to growth in my abilities as a teacher will not only help me to become a better teacher, but will also inspire my students to realize that they don't have to be perfect, but they do have to work.

In terms of teaching evaluations, the above strategies appear to be paying off. In the two block classes I have completed at Duke (ODE and PDE, 353), my students have performed at the mean during my first time teaching, and out performed all other sections during my second time teaching, receiving a score of $72.2 \pm 13.2\%$ when compared to the ensemble score of $65.7 \pm 16.1\%$. Many of my students seem to enjoy my style as well. Selections of student comments from anonymous evaluations are

> "One of the best math teachers I've ever had. He really knew his stuff, but more importantly, tried really hard to connect with the students, seem approachable, and offer help whenever possible... the atmosphere the professor created in the classroom really helped students feel comfortable with asking questions"
>
> "Greg really cared whether the students understood the material and always made an effort not to leave anyone behind, and he was also very generous w/ out of class help. Most of all he was always extremely kind + respectful."
>
> "I think that Greg was a very good teacher who was clearly passionate about the subject. He spent a lot of time explaining the process and the theories

> rather than just having us memorize formulas. If there was anything I didn't understand, he was always available to help and made sure I understood."

I have also students thank me through the reflections mentioned above. Although the assignment was to focus on the material, many of my students have used their final reflections to thank me and the effort I have put into my courses. I have included several examples of unsolicited praise from students who have already received a final grade in my course and who have not since asked me for a letter of recommendation:

> "I would like to sincerely thank you for the year. The immense patience you have shown to our class in explaining and re-explaining the material was absolutely appreciated. I was also pleasantly surprised that, at this level, a professor would take personal time to thoroughly go over material outside of class and office hours."

> "[T]his final reflection is more of a thank you letter for the semester... just being required to revise the content I had learned on a weekly basis along with being able to share my thoughts on the class with you helped make the experience much better... I really enjoyed this class significantly more than had I taken it with another professor, because you took the time to carefully walk through all of the important things in the class. You also made sure to challenge us, but were more than willing to help is along the way and made yourself very accessible when we had questions. "

### As a mentor

> "If you want to build a ship, don't drum up people to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea." -Antoine de Saint-Exupery

I am enthusiastic about being a mentor both a graduate and undergraduate students. As a postdoc I have already undertaken several undergraduate mentorship rolls. In two eight-day mathematical biology workshops during the summers of 2014 and 2015 I mentored one and two students (respectively). The projects (in each respective year) involved (i) an introduction to disorder and statistical mechanics and (ii) diffusion limitations leading to the relative size of life. This workshop was designed to engage students from smaller schools in research and encourage them to consider pursuing research careers via graduate school. I have also mentored two students from Duke in two research experiences for undergraduates (REU) programs also taking place over six weeks of the summers of 2014 and 2015. My first student studied protein folding and is still involved with this research today, and my second student studied information content in the brain via information theory and writing her own code.

The goal with my workshop students was to introduce them to a mathematically deep problem that directly related to the world and biology to whet their interest in pursuing answers to difficult questions. The REU was more in depth and in these programs I allowed the students to choose their own projects of interest, and then worked with them to get established in their chosen fields by reading background literature, learning about the underlying mathematical tools (the first project in statistical mechanics and probability theory

and the second in information theory), and, most importantly, finding collaborators in these respective fields. My first student, David Zhou, became involved and is still involved with the Donaldson Lab, which studies computational protein folding, over a year after the workshop; my second student, Emily Shannon, became involved and is still involved with Dr. Warren Grill on measuring information content in data taken from rats with Parkinson's. In contrast with the workshop students who I wanted to hand an interesting problem, I wanted my REU students to formulate their own interesting problem that they were excited about and help them get established in these fields.

I have also looked for opportunities to connect my classroom students with research opportunities. One of my old students from Duke, Rhianna Lee, is still involved in the research labs of Brian Button and Rob Terran at UNC, after she expressed an interest in Cystic Fibrosis to me and I set her up with my collaborators at my alma mater.

Finally, I have organized and ran three informal reading groups at Duke, each of which primarily involved myself and a single graduate student. Michael Bell (graduate student; mathematics) and I read "Introduction to Smooth Manifolds," by John Lee, and received occasional guidance from Professor Robert Bryant; Michael has since continued with differential geometry and Professor Bryant is now his graduate mentor . Brendan Williamson (graduate student; mathematics) and I read "Methods of Information Geometry," by Amari and Nagoaka; we also frequently met with Professor Bryant and were occasionally were joined with Michael Bell. Finally, Yuchen Zhao (graduate student; physics) and I have read "Beyond Thermodynamic Equilibrium," and frequently met with Professor Jian-Guo Liu to discuss our reading. Yuchen, Professor Liu and I have since begun a collaborative project on granular materials.

## As an member of the community

The role of educator does not stop at the classroom or mentorship. I believe that it is a teacher's duty to help students become established in the existing community wether it be through workshops, conferences, or seminars and colloquiums. I have organized a mathematical biology workshop during the summer of 2014, which was aimed at students from smaller schools to encourage them to consider pursuing research careers via graduate school, and believe such workshops are essential for fostering a healthy mathematical community. I have also organized and run a colloquium on mathematical biology during the fall of 2014 and was responsible for inviting and organizing the visits of faculty across the country. Throughout my time at Duke, I have ran mathematical biology seminars roughly five times per semester in which graduate students and I would read several papers relevant to the upcoming mathematical biology colloquium and then present the ideas and work to other graduate students interested in mathematical biology. I plan on staying involved in such administrative roles within the community as I believe that fostering a healthy and connected community is essential for undergraduate students, graduate students, and faculty alike.

I believe I will be an asset to your teaching staff due to my commitment to communicate clearly and my committed role in my teaching duties, due to my commitment toward mentorship in research, and due to my drive to reach out and connect my students with the

larger mathematical and scientific community. Thank you for taking the time to read this statement.

## References

[1] P. Bronson. How not to talk to your kids. *New Yorker Magazine*, 2007.
[2] C. Hill, C. Corbett, and A. St. Rose. Why so few? women in science, technology, engineering, and mathematics. *American Association of University Women*, 978-1-879922-40-2, 2010.