Teaching Statement

Han-Bom Moon

"Because he loves what he teaches, it makes us want to learn."
- Calculus for Business student, 2014

"Not only he is extremely intelligent, but he has a phenomenal talent for teaching."
- Abstract Algebra student, 2014

"As someone who is not the biggest fan of math, the instructor made the class enjoyable."
- Finite mathematics student, 2015

During the past four years, I have been lucky enough to teach sixteen courses ranging from pre-calculus to abstract algebra. I served as a teaching/grading assistant for different kinds of courses such as engineering mathematics and algebraic geometry in my graduate program. Additionally, I have also helped undergraduate and graduate students by organizing seminars, mentoring their research, and guiding a math club. The effectiveness of my teaching skill is reflected in my course evaluations and awards. On my course evaluation at Fordham university, the overall rating on the instructor is 7.85/9, while the department average is 6.36/9. I won an outstanding teaching assistant award, presented by the Faculty of Liberal Education.

1. Philosophy

When we study mathematics, we are training ourselves in clear expression and exposition. This pursuit of logical and lucid communication can help both individuals and society as a whole. For this reason, teaching students in the classroom, the scene of mathematical communication, is as exciting a job for me as exploring the frontiers of mathematics as a researcher.

I want to teach mathematics not as a collection of facts but as a result of communication, in particular questioning and answering. To this end, I encourage students to ask many questions and I ask them a lot of questions which serve to engage them in the discussion. These questions have a variety of purposes and different levels of difficulty. Some are only simple reminders of definitions or formulas, others are designed to lead students to discover an idea about a new concept, and a few reveal interesting connections between these new concepts and those they are already familiar with. All of the questions I prepare are not meant to be extremely difficult, but instead encourage participation. Even if a student does not answer correctly, I respond in a positive way so that, rather than become humiliated or depressed, the student feels encouraged to inquire further into the subject.

Here is one example of a situation which I taught the differentiability of multivariable functions. Before giving the definition, I encourage students to remember the differentiability in single variable calculus, by asking them for it. Then I inquire about the consequences of differentiability. Students give various answers, including the evaluation of slopes, the rate of change, tangent lines, the computation of maximum, and so on. After encouraging several people to propose an

answer, I then explain a connection between the equation of a tangent line and the definition of differentiability, and suggest that the definition of the differentiability of multivariable functions should be the existence of a unique tangent (hyper)plane. Next, I write a rough (and wrong) version of the definition on the blackboard, ask for potential problems with it, and work with the students to correct it.

I have found that students participate in class more passionately when they feel that I take care of them in terms of both their emotional and learning needs. For their emotional needs, I try to maintain a pleasant and friendly atmosphere in class. I bring the roster to the class so that I can memorize all of my students' names in the first month. In my experience, students concentrate more in class if I remember their names.

For their learning needs, it is important to provide immediate thorough feedback. Since I first began teaching, I made it my goal to rewrite notes for the next lecture after finishing the previous lecture. This is because I had a better idea of what my students understood well and where they need help only after we worked together in class. If I see blank eyes in class, I repeat the explanation or give another example. Whenever I move to another topic, I pause and allow time for students to ask questions. When grading homework or exams, I work diligently to return them as soon as possible before students forget what they were thinking as they worked on them. I also create solutions to help them write correct mathematical expressions.

As students with diverse academic, cultural, and intellectual backgrounds all come together in the same classroom, it is often impossible to satisfy every student during our limited time in class. Therefore, class assignments and out-of-class opportunities are important. In particular, I have always stressed that students should attend my office hours, and I encourage students to visit whenever they want to in order to review class content, discover more challenging subjects to explore, or ask any questions they may not have had a chance to ask in class.

During a conversation in office hours or in the math help room, I usually use the Socratic Method if the time allows. When a student asks how to solve a specific problem, my first question is, "What did you try?" The student then explains his/her approach which does not work, and I follow with more questions leading the student to clearly understand why his/her method is improper. In this stage, I give a suggestion that the student can try and try to explain the method as little as possible in an attempt to encourage the student to think critically. After repeating this procedure several times, the student get the answer as well as insight into how to face similar problems. Although it takes a longer time, the outcome of the Socratic Method is much more worthwhile in most cases; however, it is not appropriate for very weak students. Instead of responding to these students' questions with another question, I carefully explain the relevant materials, making sure to go as slowly as necessary, and then give them a sequence of similar problems of increasing difficulty. If, while going through these simpler exercises, I notice the student is beginning to grasp the subject, I may revert to the Socratic Method to encourage higher level thinking.

In a classroom, I prefer to deliver lectures in a classical style using a blackboard and chalk. Although lecturing has been criticized and many educators have recommended that teachers should assume the role of "a guide on the side," I believe that lecturing is one of the best pedagogical

methods given limited time and resources. While some kinds of classes may thrive with a different teaching style, I prefer traditional lecturing because the weak points of this method are able to be overcome by asking a lot of questions and engaging students' participation both during and after class.

Listening to criticism is an indispensable part of good teaching. As an instructor, I pay close attention to all comments given in teaching evaluations. Based on student advice, I work to improve my teaching every semester. I recognize that every year brings different challenges and different students to the classroom, so it is necessary to be flexible in my teaching style. If the evaluations I receive reveal a weakness in any area, I attempt to reconcile this shortcoming to the best of my ability.

Teaching mathematics has been one of my favorite things since I first explained how to find the area of a circle to my friends in elementary school. It inspired me to major in mathematics education in a college, and while I find mathematical research quite exciting, it would be less enjoyable without discussing mathematics in a classroom and engaging students in the subject that I love. It is my goal to balance my career as a mathematician between that of a professional researcher and that of a mathematics teacher in order to continuously excite myself with future mathematical implications and attempt to instill the love of mathematics that I have in the students I encounter in the classroom.

2. Teaching Experience

At Fordham University

- Discrete Mathematics (Fall 2015)
- Mathematical Modeling (Spring 2015)
- Finite Mathematics (Spring 2015)
- Two sections of Math for Business: Precalculus (Fall 2014)
- Two sections of Abstract Algebra (Spring 2014, Fall 2014)
- Two sections of Math for Business: Calculus (Spring 2014)
- Multivariable Calculus I (Fall 2013)
- Three sections of Math for Business: Finite (Fall 2013, Fall 2015)

At University of Georgia

- Four sections of Calculus for Engineering and Science II (Fall 2012, Spring 2013)
- Two sections of Calculus for Engineering and Science I (Spring 2012)

At Seoul National University

- Teaching Assistant (2005 - 2011): Calculus I, Calculus II, Honor Calculus I, Honor Calculus II.
- Grading Assistant (2005 - 2010): Graduate Algebra, Undergraduate Algebra, Algebraic Geometry, Linear Algebra, Differential Geometry, Engineering Mathematics, Geometric Algebra

3. Credentials and Activities

Organizing graduate student seminar

- Graduate student algebraic geometry seminar in Fall 2011, Fall 2012, and Spring 2013.
- "Mini workshop on toric varieties," a graduate student workshop in Seoul National University (Jan. 14–18, 2011).

Undergraduate students' mentor

- I guided a summer research project of three undergraduate students Charles Summers, James von Albade, and Ranze Xie in Summer 2015. The result was summarized as a research paper "Birational contractions of $\overline{\mathrm{M}}_{0,n}$ and combinatorics of extremal assignments", arXiv:1508.03915.
- I guided a math club SEHM in Department of Mathematics Education, Seoul National University during 2005 - 2011.

Outstanding Teaching Assistant Award - 2006. I was awarded an Outstanding Teaching Assistant Award presented by the Faculty of Liberal Education, Seoul National University.

License of secondary school mathematics teacher. During an undergraduate course, I learned about theoretical and practical aspects of teaching mathematics and completed a teacher training program. As a part of the program I taught two classes in a lower secondary school about 20 hours.