Heather C. Smith's Teaching Philosophy

Equipping students to improve their logic and reasoning skills, understand the material, and experience success in my course fuels my passion for teaching. I seek to invest in the individuals of my classroom. While maintaining a high standard of learning, I believe each student can succeed in mathematics and I want to enable them to meet and exceed this standard.

Since the beginning of college, I have had a zeal for teaching. In addition to my mathematics degree, I earned a bachelor's in adolescence education and a teaching certificate for New York state. During my semester student teaching in middle school and high school, I thoroughly enjoyed sharing my love for mathematics in each lesson. Nonetheless, I found myself hungry to explore mathematics at a deeper level. This led me to a master's degree and, subsequently, a Ph.D. Over the past 6 years, I have taught 9 different courses and a total of 18 different sections including Vector Calculus, Calculus I, and College Algebra. At the University of South Carolina, I received the "2012/2013 Outstanding Graduate Teaching Assistant" award from the Department of Mathematics. During the summer of 2014, I was asked to teach MATH 546 Algebraic Structures I but regretfully had to decline because I had already accepted funding to workshops that would further my research.

As I prepare for class, many considerations enter into my lesson planning. I strive to place new material in the context of prior lessons to aid in student understanding. I then invite the students into a discussion that requires them to use their reasoning skills, and not just take notes as we make connections together. This approach exemplifies another goal of mine – to reduce memorization and enable the students to re-create concepts as needed. I take it as a personal challenge to figure out how students think and anticipate their questions. I draw on my prior teaching experience and reflections about the classes I have taken and students I have tutored. Upon identification of the places students struggle, I adapt my next lesson to limit confusion.

A typical class consists of a student-centered, interactive lesson. I pose many questions to gauge the students' understanding. After introducing a new idea and working through one or two examples, I assign a few problems for the students to try in pairs. These often have an extra twist, asking the students to practice the new material but also to use their reasoning skills to further the lesson. For example, I may ask the students to develop a rule for the derivative of a^x after covering the chain rule and the derivative of e^x. As they work, I assess student progress, identifying their struggles and allowing students to examine their own understanding. The outcome is a flurry of activity as students ask questions and discuss problems with one another. Listening to discussions around the room, I answer some questions while leaving others open for student discourse. It is important to give students time to think so they can internalize the problem and develop the skills needed to tackle more challenging problems. I encourage students to work together to foster learning. As in research, collaboration is a time for multiple people to build on one another's ideas. If some students are struggling with the material, others in the group can offer a new perspective to help them understand. Those explaining will benefit personally from a deepened understanding of the material.

When time permits, I employ one of my favorite teaching methods, discovery-based learning. In teaching function transformations, I start the students with a simple function, such as $y = x^2$, and ask them to alter the function in a way that will reflect the graph over the x-axis or shift the function in any of 4 directions. Once they have experimented for several minutes in groups, I ask them to propose a generalization of their finding. At this point, they can test their rules on more complex functions such as $y = x \sin x$. This exploration gives the students a better understanding of the rules and improves their retention.

I strive for activities which lead students to a mathematical concept through their own reasoning skills. In this way, students take ownership of the result. In my high school geometry course, I was asked to produce proofs that fit into the textbook mold. Later in college, I learned about the creativity and freedom in proof-writing. I made the proofs my own and enjoyed the challenge of structuring my ideas in a logically valid manner. It is this freedom and ownership that I want my students to experience.

Student feedback is invaluable. In Discrete Structures last semester, I asked my students to include a cover sheet with each assignment, answering the question, "What problems were you unable to complete or gave you the most difficulty and why?" Students do not always recognize their struggles until they are working through problems on their own. These checkpoints gave the students a safe way to share their struggles and the honest answers left me to reflect on my teaching. As a consequence, I used some class time to reinforce concepts and exam reviews to address other concerns.

Gauss once said "Treat an individual as he is and he will remain as he is. But if you treat him as if he were what he ought to be and could be, he will become what he ought to be and could be." I believe that students can succeed if they devote enough time and effort to learning the material and seek help if they start to fall behind. It is with this mindset that I interact with my students. While it is difficult for me to understand why some students are not willing to accept help, I combat this with a more individual approach. If someone is struggling, I pull them aside after class and invite them to office hours or remind them of the many free university services. To those missing classes, I send an email to express my concern and offer assistance in catching up. Last year, one of my students had missed 75% of the classes and consequently failed the first exam. At this point, I sent an email expressing my concern to which the student apologized for laziness and said things would change. With my simple support, this student become one of the best in the class. As in many facets of life, it is meaningful to know that someone notices and cares.

While my research focuses on theoretical math, I am interested in problems that have real-world applications. I believe that students crave these connections and I try to make them evident whenever I can. One semester while teaching Vector Calculus, I attended a master's thesis defense on image smoothing: increasing picture resolution and smoothing a picture drawn from connected data points. Partial derivatives were heavily utilized in the procedures. The next class, I excitedly shared these techniques with my students who were starting to study partial derivatives. This spiked their interest as they could immediately see the usefulness of what they were learning.

I stay involved in a number of local outreach opportunities. As my professors took the time to introduce me to the various aspects of faculty life, I want to spend time mentoring the next generation. Consequently, I worked with the university's Women's Mentoring Program last year. At the meetings of our local math club and Pi Mu Epsilon chapter, I enjoy interacting with the undergraduate math majors, answering their questions about graduate school or mathematics in general. Annually, the department hosts a High School Mathematics Competition for schools across the state. I have committed several Saturdays to proctor these exams. This fall, during a research visit to Hungary, I was invited to a local high school to present on research in mathematics. I enjoyed sharing my love of mathematics with others and sparking their interest in my research.

My primary research interest, discrete mathematics, lends itself to undergraduate research quite naturally. It has a wealth of open problems which can easily be understood with minimal prior knowledge in the subject. While the solutions are not always so simple, an undergraduate may make worthwhile contributions by investigating smaller cases. This is a setting where they can deepen their understanding of various mathematical structures, search for patterns, and exercise creativity. Unlike coursework, research has an element of uncertainty. In a class, the way to solve a problem often comes from the last chapter, and the student knows that the problem is solvable. A research problem does not have these nice guarantees. While there are often new struggles and frustrations, research problems also provide a heightened sense of satisfaction. I look forward to walking alongside an undergraduate as they take the first steps in research, showing them the beauty of the exploration process and the excitement it can bring.

This fall, I was invited to speak at the Carolina Math Seminar, an afternoon conference focused on undergraduate research. I presented my work on the zero-forcing model of disease spread. After the presentation, a number of undergraduates approached me to express their interest in the topic. It is an easy model for undergraduates to understand and is open for further exploration. There are many restricted classes of graphs on which an undergraduate can obtain new bounds. Starting small, this type of research can lead to a larger project that could be pursued in graduate school.

As I plan lessons, interact with students, and monitoring learning, I strive to meet students on their level, engage them in the learning process, provide support as needed, introduce them to mathematical research, and instill a love for mathematics. More than a passing grade in my course, I want the students to end the semester with an expanded collection of mathematical tools and a clear development of their reasoning skills. I want to enable my students to be life-long learners.