

Sarah Hagen
Oregon State University
February 18th, 2020

Teaching Statement

“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 wanted to be a good teacher so bad. My own experience with high school mathematics left me with no love of the subject. Indeed, I did not take a single math class as an undergraduate. It was only when I was in my mid-twenties that I discovered, through volunteer work in an after-school program, the beauty and excitement inherent in mathematics. I subsequently oriented my entire adult life around exploring and sharing the wonder of mathematics. A major part of that reorientation involved earning a master's degree in Mathematics for Teaching — a program in which I learned much of the history and conceptual development of elementary mathematics, where I was introduced to lesson plans designed to reinforce fundamental concepts, and where, as part of my capstone project, I researched so-called math learning disabilities. How wonderful! By the time I began my PhD program I was sure that I had all the knowledge and drive necessary to be an excellent teacher. I was wrong.

I put everything I had into my first term as an instructor. I was enthusiastic in the classroom and generous with my time outside of class; I was transparent about the reasoning behind every decision in the course; I carefully planned my board work; I made sure never to speak more than 7 minutes at a time without giving the students a problem to work on; I created interesting and well-scaffolded weekly activities; I constantly reminded the class of the bigger picture. My students were engaged and we had an excellent class rapport. However, I was thoroughly humbled when I saw that the average grades for my class on the midterms and final exams (common across all sections of the course) were *exactly* the same as the averages for all the instructors. Did my students have a positive experience of mathematics in my classroom as a direct result of my time and effort? Of course! Did they learn more mathematics by having me as their teacher. No! This last fact is what I struggled to understand.

The problem, I realize now, is that although I may have effectively laid the groundwork for student learning, I didn't let my students take advantage of that hard work since I still lectured for most of the class time. My crisis of confidence after that first term led me to reevaluate my role as an instructor and to seek advice. Under the mentorship of Dr. David Pengelley, I became familiar with much of the research on the effectiveness of active learning for transferring knowledge and

expertise to students. My subsequent transition to teaching with active learning was so positive, so profound, that I count it as one of the most transformative experiences of my graduate career.

My Classroom

The coursework in my classes follows a 3-step structure adapted from the ABC pedagogy method developed by David Pengelley. The first step in this method involves scaffolded reading and exercises to be completed *before* each class session. This means that students can introduce themselves to a topic at their own pace and there is never a concept encountered in class that they come at completely cold. Each class period begins with a discussion of the preassigned readings and exercises, where any related questions are answered. The bulk of the class time is spent with students working in groups on more interesting problems and presenting solutions on the board. When the students are working in groups my role is to guide them in their problem solving and highlight the subtleties in their reasoning. When problems wrap-up my role is to place the content just covered in a broader context, point out common difficulties, and give insight into “expert” problem solving strategies. In the final step the students have one or two more challenging problems to complete for homework.

Beliefs and Teaching Goals

I believe that anyone can become competent, or even great, at mathematics with a sufficient amount of effort paired with thoughtful guidance. I do not believe that mathematical ability is a fixed quantity. I have seen incredible amounts of growth in my students in my time at OSU. I have seen a young man who entered college unable to add fractions become a successful engineering major. I have seen students who claim to be “bad at math” begin to provide sophisticated justification for subtle steps of reasoning. Just last term I had a young woman who entered my class (MTH 103 Algebraic Reasoning - the lowest level math class at OSU) with one of the lowest placement scores in the class. Through her own effort both in and out of class she ended up with the highest score on the final exam - besting several students who had taken much higher level math classes before ever coming to college. I believe that any student who puts the appropriate effort into a well-structured course can achieve relative mastery of that subject. I have yet to be proven wrong.

I believe that mathematics is inherently worth studying, even without the enormous usefulness of its applications. In this way I feel as though mathematics is akin to the humanities. It is joyful and philosophically rich, and its truths are worth pursuing for their own sake. We are lucky as mathematicians that this subject also happens to be the sharpest tool we have for understanding the universe and ourselves.

When teaching a particular subject, my immediate goal is to convey expert thinking and help students generate enough competency that if they encounter a related topic that wasn't

covered they have the tools and confidence to learn it on their own. Equally as important for me, however, is to help students see how math can empower them to understand the world and their own lives better. This is something that I take time in my classroom to emphasize, and it is a motivating factor in much of my mathematics outreach, especially to underserved communities (see curriculum vitae and cover letter).

History of Mathematics

Whenever possible I tie the history of mathematics into the curriculum. I have even taught certain topics entirely using primary historical sources (taking advantage of the wonderful NSF-funded TRIUMPHS primary source projects). Seeing modern mathematics through a historical lens is invaluable for helping students understand the reasons behind why we study what we study and why subjects come in the forms that they do. Teaching with the history of math is also wonderful for giving students a sense that mathematics is a human endeavor. There is a story to be told and understood. In the right context, modern decisions and formulations make perfect sense. This can replace much of the frustration students feel surrounding choices in the curriculum (“Why are we even doing this?”) with a sense of satisfaction and even ownership over the topics. It is a dream of mine to one day be able to teach history of mathematics classes similar to those I enjoyed when earning my Master’s degree.

Conclusion

After assessing student learning through both student discussions and exam scores, it is clear to me that teaching with active learning has had an extremely positive impact on my students. However, the impact on me has been even greater. I used to enjoy lecturing, but I can never go back. I have never been so satisfied, so confident, and so excited by my role in the classroom. I was honored to receive the William F. Burger Graduate Teaching Award in the spring in recognition of the impact of my undergraduate teaching.

On the first day of class each term I write on the board the quote, commonly attributed to Antoine de Saint Exupery, that I opened this teaching statement with. Early in my teaching career I would have said that it encompassed everything I believed about teaching. Now I know that it is just the beginning. Inspirational teaching can open the door to deep learning, but teaching with best practices is what allows students to walk through it.