Teaching Statement

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As a mathematician, I enjoy working a good math problem for both the challenge and the pure joy of finding the solution. Many of today’s capable students have not been encouraged by their teachers to struggle with a difficult problem and then to experience the exuberance of having solved it. Through my work mentoring middle school teachers, I have seen that some teachers fear beautiful mathematics themselves. Instead of trying to understand the concepts, they have blindly followed examples in their textbooks and have encouraged their students to do the same. Then, when students encounter mathematics outside of the context of their textbook, they may not be able to interpret the mathematics correctly. We as math teachers, need to make students more active in the learning process. If the students don’t personally connect with mathematics, they will struggle to recall what they have learned. As a math educator, I have seen that effective questions asked of the students during class have encouraged more students to become active mathematics learners.

As teachers, it is important that we also engage in the learning process. I have gained much insight from my students through various experiments that I have done with course work in my classes. When teaching combinatorics, I asked my students to give group presentations. They all prepared beautiful and poignant power point "shows", some almost like game shows. This inspired me to develop game shows for my summer Survey of Calculus class which is geared toward students who tend to have a lower self esteem about their own mathematical ability. Twice a week, we would break mid-class for a game show. The students became contestants in my power point game shows. They competed for extra credit in the shows by solving problems in front of their classmates. The show was such a success; I had over one third of my students in my office hours working with me and their classmates to understand calculus in order to win the chance for bonus points in the game show. Through the game show the students engaged in the course and enjoyed learning calculus.

Five years ago I had the opportunity to work on improving the traditional calculus teaching at the University of Arkansas. In my experience teaching calculus, I had seen the need for more extensive student involvement in the course. I called on students regularly to come to the board to solve problems or to summarize what they had read in the book for homework. Also, in addition to in class exams, students were allowed to come by my office for oral exams to make up for some of the points they missed on the exams. These opportunities allowed the students to understand calculus as a teacher does. They saw that just writing floating mathematical expressions on the board could not help their fellow students to grasp the concepts. They needed to think through their answers and explain them carefully. I also had problem sessions where students could work together on some challenging problems in additions to their collected daily homework. Not all students participated in class or in the problem sessions, but those who did saw tremendous increases in their skill level by the end of the course. In fact, compared to the other calculus sections, my students received more A’s and B’s.
In transition courses like discrete mathematics, linear algebra or introduction to abstract algebra, keeping the students interested in the mathematical rigor rather than pure problem solving is extremely important. Some of the students who have been quite capable in calculus, struggle with their first proofs. Doing a proof is like solving a puzzle; the puzzle pieces are the definitions, propositions and theorems and key examples learned in class. Keeping the students fluent in class vocabulary is a must. It is difficult for students to prove that a map between groups is a homomorphism if they don’t know what a homomorphism is. I start every class with a short quiz, which checks whether they know the concepts from our last class. The students look forward to these quizzes and they keep the students on top of the material. In these classes, I also ease the students into their first proofs. Sometimes, I will write out the proof sentence by sentence, then cut it up and let the students put the sentences together to make a proof. Other times, I will give them an outline of a proof and have them get together in groups to flesh the proof out. The first proofs are usually short, connecting a few true statements together. As the students become fluent in proof techniques they gain a deeper understanding of the theory and some of them become exhilarated by the challenge of proving more complex statements.

We need to keep mathematical thinking alive in our students and the students of future generations. After seeing so many mathematically unprepared students in my University courses, I decided I needed to become more involved with K-12 teachers and students. I joined a team of Math Educators and Math Specialists in Northwest Arkansas and we wrote and received a grant called the Math Mentor Partnership Program to assist middle school math teachers in improving their teaching. Two summers ago, I designed a course to boost the content knowledge of the teachers who were not deemed highly qualified. We did lots of hands on activities which helped them gain a deeper understanding into geometry, measurement, proportional reasoning, algebraic thinking, number systems and statistical reasoning.

My last year in Arkansas, I visited schools weekly to work with teachers in designing more effective lessons. In each school, we used the lesson study model detailed in The Teaching Gap by Stigler and Hiebert [SH]. Each meeting, we designed a student centered lesson on a mathematical strand where their students have not performed well on standardized exams. Then one of the team of teachers and specialists taught the lesson to a class. The rest of the team observed the students actively learning. After the lesson, we discussed the pros and cons of the lesson and how it would play out with a different student population. Working together, the teachers began to better understand when the students learn the most from a lesson, what effective questions aid in the students’ understanding and other valuable insights that they otherwise may have missed if they were teaching the lesson on their own.

In addition to teaching courses at the University and in the middle schools, I feel it is important to keep teaching alive outside the classroom. As advisor of Pi Mu Epsilon, I interacted with students who enjoy mathematics on a biweekly basis. I enjoyed keeping their interest aflame with fun mathematics. After the club had been in hibernation for three years, we resurrected the club and won a University award for most improved Registered Student Organization. Pi Mu Epsilon offered many university students subtle mathematics learning opportunities such as solving our problem of the week, building polyhedra and dodecahedral bamboo structures, learning game theory through game day, playing with math toys in toy day and showing off their love of math in sidewalk chalk day. The club services a growing niche of students on campus that enjoy math.

I liken teaching math to putting together a collection of gigantic free form jigsaw puzzles all at once. Prior to a course, each student has learned various mathematical concepts and formed some connections among these ideas. Conceptually, each student comes into a course
with some pieces of his or her puzzle pre-assembled. During regular class meetings, I will introduce new mathematical ideas and methods for proofs and solving problems; pointing out puzzle pieces to the students. I will justify proofs and give sufficient examples for the students to make connections to their amassed mathematical knowledge; giving the students a plan to put their pieces together. The students are assigned homework to master the material in the course; the students try to join their jigsaw pieces together. To be effective, I collect and grade course work in order to give the students feedback; allowing the students to affirm their piece placement. At the end of the course, I hope to have added to each student’s collected mathematical insight, reshaping each student’s puzzle. Since the process of learning never ends, the student will hopefully continue his or her puzzle in other math classes.

References