

Brandt Kronholm - *Teaching Statement*

In October of this year, I interrupted my morning Vector Calculus lecture at St. Mary's College of Maryland to share with my class a bit of elementary number theory that was troubling me. This eight minute detour prompted more student questions than the previous thirty minute lesson on the tangent, normal, and binormal vectors. Even the students who are usually reserved in class had something to say. Our short discussion ended with a question mark and we were easily back on track with our Vector Calculus lesson. After class, one student approached me with her calculator to share some numerical evidence hinting that the earlier question mark could be a conjecture.

The point is not that I made this detour and got a positive response from my class. The point is that my teaching of mathematics is steeped in my own enthusiasm for the subject. Perhaps it is my own inquisitive personality or perhaps it is that I came to mathematics in an unusual way. I have a Master's Degree in Literature and I often view mathematics through a writer's lens of communication. No matter the case, this contagious perspective of curiosity and communication motivates not just my teaching but also my student's learning. It also allows me to make such occasional fun mini mathematical excursions.

I will confess that one of my detours completely disrupted a recent Math for Teachers class. Math for Teachers is a course for those students who wish to enter into K-6 education. In a welcome departure from the usual lecture format, class time is usually composed of group work and cooperative learning. Two or three students share a table whose surfaces are made of white-board material and they collaborate with one another using colored markers and erasers! While brainstorming for mathematical projects appropriate for a class of fourth graders who would soon be visiting, I suggested torus tic-tac-toe to my students. Once they saw how it was played, they could not and would not let it go. Even before they really knew how to make three-in-a-row on the torus, they stubbornly kept at it until they understood. At this point no one noticed that we had missed our half-way break. So, adding fuel to the fire, I told them there was a winning strategy for the game. For the next forty minutes torus tic-tac-toe was played and studied. Many students independently began taking notes on their games until they got the winning strategy. Though my lesson plans were scrapped, the detour prompted a healthy session of creative thinking and data collecting. It also came back to haunt them a few weeks later as a really good test question.

While the standard lecture format is typically how I present material to my students, my classroom is energetic and dynamic. I write neatly and often on the board using complete sentences whenever I can. Sometimes I will pause my lecture and tell my students to put down their pencils and to stop taking notes. Though I think the class enjoys hearing a teacher tell them to "take a break," this sideline is anything other than that. A temporary suspension of note taking allows me to interact and communicate with the students on a new learning wavelength. I use this time to illuminate a big idea or illustrate a concept at the board. Though it may be unusual to have an open discussion of mathematics in a first or second year class, I find that it works for both me and my students. Active participation allows me to pace the lesson and calibrate homework assignments. It may be a big picture or a tiny detail that we focus on and it gets all eyes on me instead of darting between chalkboard and notebook. What follows is a meaningful discussion of a fundamental concept. For example, the discussion of limits of multi-variable functions and disks of small radius instead of the usual "limit from above or below" was a big hit in my vector calculus class recently. The idea that a one dimensional sphere

is a line segment and a deeper understanding of absolute value vs. distance prompted quiet exclamations of “Oh” and “I get it.” It was the stuff of a great lesson, full of good questions from and for the students.

I often quote Paul Halmos’ take on homework as he said “...to learn mathematics is to do mathematics” and so I assign lots of homework, not too much, but just enough. I encourage my students to treat their math homework in the same way they would treat a writing assignment. In other words, it’s about communication and don’t hand in a rough draft. It may take several goes to fully complete an exercise. Once complete, then all of the steps and arguments needed to communicate the mathematics should be neatly rewritten on a new sheet of paper to be handed in. This treatment of math homework as a writing exercise is enormously helpful in several ways. Pragmatically, it allows me to grade with ease. Pedagogically, a neatly written homework reveals not just the student’s learning but also my teaching.

I advocate rehearsing homework exercises, especially when preparing for a quiz or test. Doing a problem just one time correctly may not be enough. My tests and quizzes are always partial credit and never multiple choice. Moreover, they include always a full page of definitions and theorems and a few bonus questions. Definitions and theorems are often a shock to young math students and I tell them that we cannot communicate our mathematics if we do not respect and adhere to definitions. Again I find opportunity to relate to my students that mathematics is just like writing - it *is* communication.

Though the majority of my mathematical teaching experience has been at Penn State and the University at Albany, my time at St. Mary’s College of Maryland, having a student population of roughly 2000, has convinced me of what I have long suspected: I enjoy the community of the small school. On Saturday I can walk to the Women’s Soccer game and be invited by my students to join them in the stands. Tuesday I might see another student playing intramural dodge ball at the gym - and ask him why he wasn’t in class that day. Students will flag me down at the student center to ask me about their Linear Algebra homework. My senior research project advisee can (and has) found me outside of our usual meeting time to ask questions about generating functions. These events enhance classroom and office hour time as they foster a friendlier, more human student-teacher relationship full of communication.