STATEMENT OF TEACHING PHILOSOPHY
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I have always prided myself on my ability to communicate clearly. This is not a natural talent, but an evolving skill that grows and develops with intentional self-assessment and adaptation. My active development makes me a more effective educator, but the reason it persists is that sharing an understanding of the world is how we identify with one another. I personally long to share my perspectives and to understand those of others, because that communication brings me closer to those people in my life. Presenting accurate information does not ensure that the understanding or the magnitude or the implications of the associated ideas have been shared. Thus, without a holistic understanding, the ideas lie sterile and alien to those who observe them.

The importance of developing understanding first became relevant when I was an expedition canoe guide in my early undergraduate years. I would guide young men on month-long whitewater canoe trips into the Canadian shield. The nonprofit that organized these trips nurtured a strong culture of empowerment. I was not hired to lead the trips per se, but to provide guidance when needed. The participants would choose their route, plan their meals, and make daily decisions such as when to navigate through or around rough stretches of river. It was expected that they should be allowed to fail. Although I was only a few years older than the participants, I had a wealth of knowledge and experience in both hard and soft skills that they sorely lacked. The most difficult parts of guiding these trips were then tied to the same problems that we face as educators. In canoeing these questions appear in forms like, “How do I communicate why it is important that we pack up our camp at night?” or “How can I help someone develop confidence when they are struggling with a heavy canoe?” To the first question, just telling them to pack up seems like an artificial rule; something to be observed only when required. To the second, carrying the canoe for them would solve the problem in the short term, but it takes away their agency and fails to address the underlying issue of confidence.

In mathematics we are faced with similar hurdles but they present themselves as, “How do I help students understand why these tools function as advertised?” or “How can I help students that are struggling to develop analytical skills and mathematical intuition?” Just as in the backcountry, I want to guide my students through what our problems are and why we need to address them. I want to let them struggle with their own understanding of mathematics. I want to challenge the ideas that they create until they can defend their positions, and I want to make space for them to confront my presentation of math when it doesn’t agree with their own.

A collaborative, inquiry-based approach to learning has been fundamental to my career in both teaching and research. Colorado State University hosts a weekly math education seminar series, of which I am a regular participant. Topics often focus on the application of active learning, and what a broad range of tactics are included under that umbrella [3]. For some, a flipped classroom implies occasional group worksheets or voluntary boardwork that applies concepts discussed in lecture. On the other extreme, students are encouraged to discover fundamental mathematical concepts by exercises that build up to them, or instructors present the problems that those concepts solve rather than starting with their long known solutions [1]. The benefits of conceptual understanding from active learning seem self-evident, but they come at the expense of speed. In a traditional lecture style it is much easier to move through the progression of material, even when the previously presented material has not been mastered. The assumption is then that students will fill the gaps in their understanding individually through self-study and practice problems.

Most of the classes for which I have been the primary instructor are in the calculus series, and instructors do not have much freedom to experiment with presentation because the exams are standardized across sections. To accommodate the students who want a more conceptual understanding, I have instead turned my office hours into more of a theoretical discussion period than a session for homework help. I guide them through violating assumptions of theorems and seeing how the theorems fail. We discuss ways of answering questions (for which we have formulas) if the formulas were unknown, and conversely how to generalize solutions to specific problems into new formulas.

I think I will always retain a large portion of traditional-style lecture in my teaching because it is a nice starting point for individualized discussions. I like to assume that people I am talking to have infinite potential, but zero background. Starting from that assumption, we can work quickly through concepts that they already do understand until we get to
the edge of what they have internalized and the real discussion can start. However, this approach requires that I be very in tune with what my students are grasping and where my explanations have fallen short. One method that I use to keep my finger on the pulse of the class is 360° feedback. In each of my courses I give the students an opportunity to provide input on my teaching style while it still affects them, usually after the first exam. I try my hardest to adapt to their needs, and the feedback I have received about that effort has been unanimously positive. I also ask them to reflect on their own efforts, learning style, and method of preparation up to that point, and make myself available for perspective or advice if they would like an outside opinion.

My leadership and proficiency in classroom instruction were recognized by the Graduate Director, Professor Jennifer Mueller. She asked me to mentor first and second year Graduate Teaching Assistants, along with three other senior PhD students who have excelled in teaching. The four of us designed instructional materials for the GTAs, organized workshops, and observed the new instructors in their classrooms. For my individual mentees, I provided feedback on classroom management and instruction. I offered to film representative lectures of them so they could observe themselves, and I had them film me in kind. I think that much of the advice that new instructors hear seems self-evident, and it is easy for them to assume that they are following it if they don’t physically see evidence to the contrary. Video self-reviews can help instructors, including myself, gain awareness about what their performance is actually like.

So far I have mostly written on how I feel about teaching. I would also like to include one practical idea that I look forward to implementing in my future classroom. My research area is in Geometric Data Analysis which grows out of applications of linear algebra and differential geometry. It is a young but growing area, but much of its established literature has not yet been incorporated into standard undergraduate texts. I intend to develop curriculum for a course on data analysis with topics such as applications of the singular value decomposition, face recognition, signal processing, dimensionality reduction and clustering, optimization, and introductory Fourier analysis. One of the courses that I have particularly enjoyed teaching at Colorado State is Mathematical Algorithms in MATLAB. It is a one credit course that introduces students, ranging from undeclared freshmen to graduate students in statistics and engineering, to programming in MATLAB. The course has no prerequisites, so I had the freedom to design the course as I saw fit. Thus, I have experience in creating course materials for and teaching basic programming, best practices, and the mathematical concepts underlying various algorithms. I have a good understanding of types of assignments that succeed and how to adapt when I have created work that is too difficult for the class. I think there will be a smooth transition between the work I have put into this course and creating a more mathematical course of my own that is grounded in practical applications and tools that undergraduates will use in their future scientific careers.

In closing, my goal as an educator is to create a taste for mental work in young minds. I think that kind of curiosity lends itself towards far more success than does a mere accumulation of knowledge. The professors that have inspired me the most are the ones that reflect that curiosity in the classroom. They can find intelligence and subtlety in questions that seem off-base on the surface, rather than just sticking to the party line. As John Conway wrote in his forward to Polya’s How to Solve It, “It is a paradoxical truth that to teach mathematics well, one must also know how to misunderstand it at least to the extent one’s students do!” [2]. That statement is centered on 360° communication, and I firmly believe that in order to share the knowledge I have acquired, I need to be able to appreciate the perspective of those with whom I am communicating. If you would like quantitative or qualitative information about students’ evaluations of my teaching, I would be happy to provide it. Thank you for your kind attention.

References


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