STATEMENT OF TEACHING PHILOSOPHY

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Below I have listed five principles important to my philosophy of education. My hope is that they give the reader an impression of me as an educator both inside and outside of the classroom. In the text that follows each principle, I give a brief explanation of why it is important and/or an example of how it has influenced my teaching.

1. My most valuable resource is the experience and wisdom of other educators.

My most successful application of this principle has been the adoption of a team-based partially flipped linear algebra teaching model developed by two professors at the Colorado School of Mines and another professor at the University of Denver [3]. Students watch short 5-10 minute lecture videos before coming to class which prepare them for a group activity that comprises the first 20-25 minutes of a 50 minute class. The group activity is used to introduce students to concepts that will be covered during the lecture. Over the past three years, instructors adopting the model have coordinated their courses and shared group activities, worksheets, lecture notes, videos and a common Blackboard for all sections using the model. Kelley Tantangelo and I will be giving a presentation at the 2017 Joint Mathematics Meetings in Atlanta about the adoption this model for teaching linear algebra [8].

It is also important that educators reach out and connect with other instructors in their own regional areas and across the country. Most recently, I have attended the 2016 Joint Mathematics Meetings, the Joint Meeting of the 2016 Intermountain and Rocky Mountain Sections of the MAA and the Front Range Mathematics Education Seminar. At these meetings, I am most interested in adopting or being introduced to new ideas that have been based on research data from people working in the area of mathematics education and the scholarship of teaching and learning.

I often consult other instructors and educators when designing content, lesson plans, exams and anything else related to teaching. During my time at Texas State University I regularly attended the math education seminar. This seminar has provided me with some of my most effective tools as a teacher. Discussing difficulties and problems with other instructors often leads to simple solutions and good advice as they have often encountered the same problems. Furthermore, it helps establish a culture and community within a department which values experience and time-tested teaching methods.

2. The best educators spread their enthusiasm to their students.

The best educators are well versed and enthusiastic about the content they are teaching. Recent evidence [1] shows that "teacher enthusiasm is an unexplored interpersonal factor which could effectively prevent academic cheating." Without a keen, competent instructor students are often left unmotivated and unchallenged. The following comments come from the course evaluation forms of a calculus class which I taught.

- "The instructor was very intelligent and enthusiastic. Honestly, it was my favorite course this quarter."
- "The instructor was wonderful. He made calculus extremely enjoyable."
- "Tim was a great teacher because he is so enthusiastic about calculus. This made the class a million times more engaging than it would have been otherwise."

However, even the most passionate educators can be ineffective teachers. Successful teaching requires attention to detail and a variety of well-tested student centered teaching methods.

3. Courses should be designed around learning objectives and not topics.

Many mathematics courses are often designed around a list of topics. For example, a precalculus course covers polynomials, trigonometric functions, exponential functions, ... However, experts in instructional design [5] encourage courses to be designed around learning objectives, which are statements that lay out what students should be able to do after completing the course. For example, one of the learning objectives for the calculus course I am currently teaching is "communicate written mathematical arguments and statements that (a) use standard notation and terminology (mechanics and vocabulary), (b) are logically ordered (structure), (c) are clear and complete (style, appropriate detail)." Following this principle means constructing learning objectives and outcomes first, then developing assessment and teaching strategies that align with these outcomes and objectives.

Constructing good learning objectives and outcomes requires time, skill and effort. It is typically a simple task to list all of the topics a course will cover. It can also be tempting at times to simply convert topics directly to objectives. For example in a precalculus class, we could adopt the objective "student should be able to preform polynomial long division." However, this is essentially the same as listing polynomial long division as a course topic. Instead, I try to construct objectives that align with the goals of the institution, department and students involved in the course. One of my favorite tools for constructing stronger learning objectives is Bloom's taxonomy of learning objectives [2]. Many variations on the taxonomy exist but they all partition the language of learning objectives into a hierarchy with objectives related to evaluation, synthesis and analysis near the top of the hierarchy. It is important to have a rich collection of outcomes and objectives that reach all levels of the taxonomy since it very difficult for students to achieve objectives at the higher levels of the taxonomy without first becoming proficient with the objectives from the lower levels of the taxonomy.

Course objectives should strongly reflect student, department and institution goals. On a course evaluation of one of my classes a student described one of the strengths of the course and instructor as the following: "The [instructor] tailored the class to fit our needs as students..." This comment gives evidence that students respond best to instruction where learning goals and outcomes are in line with student objectives. Similar comments hold true at the department and institutional levels. Unaligned goals and outcomes can waste student time and lead to possibly different learning outcomes.

Assessment should be concretely aligned with learning objectives. According to [7], "the best assessments are those whose results are used to improve teaching and learning and inform planning decisions." The more closely we align our assessments with our learning objectives and outcomes, the more confident we will be that our decisions based on those results are accurate. Moreover, assessments which are unaligned with learning outcomes and objectives give students an inaccurate portrait of their progress in achieving the goals and outcomes of the course.

4. Instruction should vary in both its methods and cognitive levels.

As a proponent of Howard Gardner's theory of multiple intelligences [4], I believe that students deserve to be assessed in a variety of forms. Some examples include using group work and group projects to assess at the interpersonal level, using presentations and class discussions for assessment in the visual/spatial axis and written reports for assessing progress through linguistic intelligence. Varying learning activities and assignments along axes of multiple intelligences helps keep the methods of assessment and grade assignment unbiased and informative.

I also vary my assignments and classroom activities so that they reach all levels of Bloom's taxonomy of learning objectives [2], especially the levels of evaluation, synthesis and analysis. (Examples of objectives and subgoals at these levels include but are not limited to objectives containing the verbs: deconstructs, differentiates, generates, modifies, organizes, interprets, justifies, relates, summarizes and supports.)

5. Technology can be a powerful tool for increasing the effectiveness of learning.

The current student body has grown up with technology throughout their lives and has become very effective at managing and utilizing technology and media. At the same time, media and technology have rapidly become reliable and widely available. The benefits of appropriately implemented technology in the classroom have been well-researched [6].

One of the most user-friendly and effective two-dimensional graphing utilities is Desmos. The system is very easy to use and loads on any web browser. For illustrating graphs and geometric concepts in the classroom, I almost always rely on Desmos. The system has a built-in projector mode and allows for the introduction of functions and parameters (which can be controlled by sliders). This allows me to introduce topics in the classroom in a dynamic way.

I have effectively used online homework submission systems such as Webassign and MyMathLab in my courses to allow students to receive instant feedback on homework and retry difficult problems. These systems have been particularly useful for helping my students achieve proficiency in the lower levels of Bloom's Taxonomy [2]: remembering, understanding and applying. In my classroom the biggest advantage of implementing these systems is the freeing up of classroom time to engage students in active learning environments targeted at higher levels of Bloom's Taxonomy.

At Colorado School of Mines I taught a large section of differential equations with 120 students. With so many students it is difficult to have guided discussions and get informal assessment of student learning outcomes. One way I was able to get feedback was by introducing the use of iClickers during lectures. I would embed questions into slides and poll students during lecture. This allowed me to get the informal feedback that I needed to determine if the class needed more time on a topic or if we could all move on to other concepts and examples.

Partially flipped classrooms are becoming more and more prevalent at the university level and require the use of a variety of technologies. I have been involved in three different partially flipped classrooms. The first was as a TA for Business Calculus at the University of Denver and the other two were as a Linear Algebra instructor at Colorado School of Mines. In terms of technology, there was one major difference between the courses, in the Linear Algebra classes we used Google Forms to ask students a couple of short multiple choice questions related to the video before coming to class. The addition of these video response questions to the Linear Algebra classes helped me assess whether or not the students understood the video before coming to class and generally lead to more adequately prepared students.

Using these principles and others it possible to produce learning goals, learning outcomes and methods of assessment which are challenging unbiased and concretely aligned with one another. Notwithstanding, some methods work well with certain classes while failing to be engaging for others. My first experience with this phenomena occurred fulfilling the requirements for a minor in education during my undergraduate studies. I taught both a 9^{th} grade algebra class and a honors 9^{th} grade geometry class at the local high school. The differences in these classes taught me that the methods and practices one uses in a course should be fluid and reflect the culture and demographics of the students in the course.

References

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