Teaching Statement

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1 My Teaching Philosophy

From my experience teaching at both universities such as Cornell University, the University of Toronto and Virginia Commonwealth University and secondary schools such as Ithaca High school, I have drawn the following conclusions:

1. People learn more in active learning classes than in traditional lectures.
2. People learn best in an enviroment where they feel safe to make mistakes and ask questions.
3. Focusing on reasoning rather than answers leads to deeper conceptual understanding.

I want my students to develop real mathematical skills and the ability to construct, analyze and critique arguments. I believe the best way of achieving this is to guide students to their own discoveries.

1.1 Active learning

I started as a teaching assistant during the first years of my graduate school. I did not have any prior teaching experience nor any formal training. At the time, I thought that good teaching was just standing in front of students and presenting the material without making mistakes.

After teaching for a couple semesters, it became clear to me that this approach did not work for the majority of my students. I presented correct and careful solutions to standard problems during the tutorials, and I saw how the students who were nodding along could not solve very similar problems on the exams.

I wanted to become a more effective teacher and I started attending the Teaching Seminar at Cornell. One of the topics that we read papers on and discussed was active learning and I came to believe that people don't become experts by watching someone else perform a task. There is solid evidence that *active learning* is more effective than traditional lecture formats [FEM+14].

I have observed that giving students opportunity to express their ideas during class and in office hours allows them to gain independence and confidence in approaching and solving problems. Letting students explore also helps them develop a *growth mindset*.

In active learning environments, students learn more, but often they feel like they learn less [DMM+19]. For this reason, I like to take time to explain my methodology and emphasize the importance of why we go through certain steps rather than just finding the answer.

In my classes, most of the time is spent on students working on problems. I break down questions into small parts so that students can get started and make gradual progress. Students then share their ideas with their peers in small groups or a whole class discussion. I constantly communicate with the class to make sure that everyone is focused on the current task and is following the discussion.

1.2 Creating a safe learning environment

During my career, I have been able to maintain an atmosphere where students feel safe making mistakes and asking questions. The following comments from my recent course evaluations mean a lot to me:

- *"...I've never asked questions during the classes before this class. I normally just waited until office hour and asked. However, he changed my attitude during the class and made me ask questions during class without any fear of feeling stupid and got to participate more. ..."*

- *"I also really liked how patient and kind you were while explaining and answering questions. It made for a very supportive learning environment. Most math professors fall short of what is required not because of a lack of knowledge of their subject material, or because of an inability to articulate an explanation, but because the manner in which they respond to students is impatient. Making people feel stupid is hardly conducive for their learning. It was remarkable that you never once became impatient…"*
- *"…He is really invested in ensuring that his students can understand the material. He is willing to meet with you outside of class regardless of how simple your question and regardless of your performance of the course. However, more importantly, he really and truly cares about the well-being of his students and does not see us as machines who began his class with the same level of knowledge. Professor Balazs understands that his students are human and that the things that are happening around them and at the colleges and dorms/homes can truly affect them. …"*

There is a large amount of research suggesting that *productive failure* and *productive struggle* can lead to more effective and deeper learning ([KB12] [Met17]).

There is often a perception that mathematics is overcompetitive and unwelcoming, where people are made to feel stupid for not being quick or lacking some knowledge. I have found that many students, especially those from underrepresented groups, have already internalized aspects of this culture and do not feel that they belong in mathematics classes. As a result, they lack the confidence to participate and ask questions in class. I make an effort to build a more collaborative and supportive environment.

I emphasize the importance of listening to the explanations and opinions of others, and I set an example for this by not cutting students off, and incorporating their ideas whenever possible. I consistently acknowledge the difficulty of the concepts we are considering and I avoid using words like "trivial" or "clear". I emphasize the role of making mistakes in the learning process, and I try to remove the social cost of being wrong by occasionally soliciting "wrong solutions" from students.

I have also found that an anonymous online discussion board like Piazza or Ed discussions can be an effective tool to let those students participate who would otherwise not do so in person.

1.3 Focusing on reasoning

I believe that the skill to construct and analyze arguments is more important than computing quickly and proficiently. Many students identify mathematics with manipulation of symbols, and focus on the rules and techniques of computation. In first-year Calculus classes, incoming students are often proficient at computing difficult derivatives, but lack the conceptual understanding of what their computations mean.

In a class I taught recently, after working on a problem and discussing a solution, a student came forward with a question that was: *"I understand this solution, I tried to do it differently and got the wrong answer. But I don't understand why my solution is wrong."*. I was extremely happy to walk the whole class through this solution, and to discover the mistake together.

While teaching a linear algebra class developed by Jason Siefken at the University of Toronto, I learned that asking students to find a mistake in an argument can be really beneficial for their learning. To encourage this sort of inquiry, I like to write problems that are phrased as fictional students discussing a question. There will be mistakes in their arguments, and the goal is to find and correct these mistakes. I found that this is an effective way of highlighting and dispelling common misconceptions.

2 Conclusion

I have had the opportunity to teach mathematics at many different levels and institutions, and while each course has required me to adapt to new students and circumstances, I make sure to remain approachable and open to students' prior experience and perception of mathemtatics. I take care to engage my students and encourage them to participate and understand the importance of the process of learning, not just for a particular math class, but in their personal development. I have made a point to learn new methods and course aids to include all students in my courses and I look forward to applying all that I have learned about teaching so far in my career to provide a rewarding and positive learning experience for my future students.

References

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