Teaching Statement

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My primary reason for teaching mathematics is a selfish one – I enjoy teaching. I enjoy the thrill of simplifying complex and abstract ideas into smaller parts in a way that helps my students appreciate the beauty of mathematics.

Experience

Calculus series · Over the years, as a Teaching Assistant at the University of Illinois, I have had the opportunity to lead discussion sections for Calculus 1–3 (Math 221, 231 and 241). In the current semester, I am leading a section on Introduction to Differential Equations, Math 285.

Merit teaching · I have taught each of the calculus courses as part of the Merit program, which is an initiative at the University of Illinois aimed at emergent scholars from traditionally underrepresented populations in mathematics. As part of Merit I get to work with smaller groups of students for longer periods time. This leads to focused group-study sessions in the classroom and lets me prioritize concepts over problem-solving tricks.

SIM camp · In the summer of 2017, I taught a four day course titled *Classical constructions* at the Summer Illinois Math Camp. This was a course aimed at middle school students that taught them how to build a mechanical calculator using simple tools – a compass and a straightedge. I viewed this as a chance to influence young minds and change their attitudes towards math for the better. Working with the restriction of using only these two tools allowed my class to engage in modular learning – we built simple skills based on concepts we understood and then combined these to grapple with incrementally complicated and subtle ideas.

Indian and American systems · My experiences with teaching in different formats and working with varied age groups has made me look at the bigger picture of what my teaching goals are and how I wish to achieve them. This is augmented by the differences in my own education. I completed my undergraduate degree in India and I now teach classes in America. The two systems vary in many subtle and interesting ways and I have benefited from the insight this gave me into instructional practices. I enjoy being able to implement and integrate the best methods from both systems.

Content creation

Worksheets and group activities · In my opinion, success in classroom teaching is primarily dependent on the instructor's level of preparation before they enter the class. For this reason, I carefully script my teaching sessions in as much detail as possible and I try to be aware of exactly what I will be speaking about. This includes knowing beforehand the examples I wish to use in class and the problems the students themselves will be solving. When creating worksheets, I try to design problems in my own style. I like having my students work in groups as it lets me use the group's knowledge as a buffer against each individual not remembering some part of the subject – a person on their own might get stuck but the group as a whole is more likely to figure things out correctly. Hence, I purposefully design problems with several small parts – each part easy to solve on its own but the larger problem leading towards deeper insight. This makes working in groups unavoidable as well as rewarding for the students.

Developing a new course · I am currently developing content for a Math 490 course that will be taught in Spring 2019. The course aims to expose to undergraduates the computational and programmable sides of traditionally pure branches of math like group theory, graph theory and number theory. This is giving me the opportunity to develop a laboratory-style course. It is interactive by design as the best way to teach someone programming is to let them

write programs of their own to figure out what they understood and what parts they can improve.

In the classroom

As an instructor, I view myself as responsible for more than just teaching new math. In the classroom my role is to also actively work toward ridding students of false notions like "math is hard", "some people are born with math-talent" and "math is about number-crunching". I do this by exposing students to different techniques and varying approaches to the same problem. For example, some students might like to think geometrically while others might have more algebraic mindsets. A successful instructor should encourage students to use the viewpoint that comes more naturally to their students, while also exposing them to new possibilities. Students need to be reminded that math comes in many flavors and they need to discover their own style of engaging with the subject.

This is especially relevant to students who belong to traditionally underrepresented demographics in the mathematical community. It is important that these cycles of prejudice and bias be broken so as to create an equal and friendly environment where students can experiment and make mistakes without fearing failure and judgment. As an instructor, I strive to create that environment. Every new day in the classroom, I keep in mind a simple goal – it is sufficient if I successfully deliver just one new concept to *all* my students. The emphasis here should be in inclusion so that no student gets left behind.

Computers in math education

Geogebra · Being a firm believer in the utility of technology to improve teaching, I never shy from using software in the classroom. During my SIM camp course on Classical Constructions, I used the Geometry and Algebra visualization software called GeoGebra to demonstrate various constructions in a fun and interactive way. Due to this, I had several students express an interest in learning the software and experimenting with constructions on their own.

LaTeX · In Fall 2018, I have been conducting an experiment in class where I actively encourage my students to maintain a cloud-shared LaTeXdocument containing helpful notes and examples from our courses on Introduction to Differential Equations. While initially the students seemed intimidated by the syntax of the software, I encouraged them to give it a try and not worry about making mistakes. I am currently receiving regular contributions from students and my own role has been to curate their notes and check for any errors. The shared document was set up so that they can all contribute constructively to it but the contributions are anonymous. This has created a safe environment as mentioned previously where the students can hone their skills at writing with accurate mathematical notation and distilling key ideas from any topic while not worrying about mistakes and judgment from other. It is giving my students experience with using the typesetting software which has become a staple in the sciences and engineering, while also giving them a set of complete notes to refer to as the course progresses.

Python and SageMath · I think programming itself is an essential tool for future scientists, mathematicians and engineers. Knowing how to program using a language like Python is a quick and easy way to actualize ideas and programming abstract math using a software like SageMath is very helpful for gaining a deeper understanding of mathematical structures. I think their optimal use is in 400-level math courses where traditionally one hears students complaining about things being too abstract. In these situations, programming can be used to make things more concrete and give students a way to construct instances of the objects they are studying, be it in Group theory, Linear algebra, Graph theory, or Differential manifolds.

Conclusion

Reiterating what I said earlier, my primary reason for teaching mathematics is a selfish one – I enjoy teaching. But teaching well is also hard. It is a delicate balance between illuminating the way while also fostering independence, between creating equal opportunities while also letting them get their hands dirty playing with concrete instances. It is this balance that is a joy to navigate and it is the feedback from my students that keeps me pushing new boundaries, wanting to forever improve my pedagogical methods.