Teaching Statement

Subhadip Chowdhury

I consider teaching and communicating math to be an integral part of my life. To me, 'learning' math means being able to justify logical implications, being capable of making connections between seemingly different interpretations of the same problem, and being able to communicate complex ideas in a way that demonstrates a clear understanding of any underlying subtler nuances. Unfortunately, quite often, Mathematics is misunderstood as the subject about formulas and symbolic mindless computations. To rectify this misconception, my teaching philosophy has always been to focus on concepts and processes and how they relate, reinforce, and illuminate each other, over listing facts and answers. Another prevalent issue in Mathematics as a STEM field has always been the harmful fixed mindset, the self-belief that math is somehow the domain of the innately talented and privileged; inadvertently leading to under-representation from women and other minorities. In this statement, I explain what strategies I have employed to address and advocate against these issues and the rationale behind my methods.

Teaching and Learning in the 21st Century. The rapid technological advances of modern science, brought in focus due to the recent pandemic, has made it clear to students that an abundance of learning material is available to them online for free. As such, I believe one of my *primary* goals as an educator is not to deliver content, but rather to help students develop their critical thinking skills so that they can become self-regulated learners with the ability to discern useful information from fraudulent, imprecise, or irrelevant ones. At the same time, the evolution of newer and more felicitous subject areas (e.g. Data Science, Climate Change) requires that we prepare students to ask and explore questions in contexts that perhaps do not yet exist. To ensure the independence and inquisitiveness I wish to foster in students, I have strived to make my classroom an environment that provides them with the means to acquire these skills.

Active Learning with Formative Assessment. Like any other skill worth mastering, getting good at mathematics requires regular and active engagement with the subject on the part of the students. I teach most of my mid-to-higher-level math classes in a hybrid *flipped inquiry-based learning* format. Before each session, I start by crafting a rigorous in-class worksheet that curates the study material (including videos and references encouraging additional explorations) and requires students to make necessary efforts to discuss, analyze, and discover the relevant results and examples themselves first during class, before we discuss it together in the next class. This always involves working in small groups, guided with directed questions and prompts, designed as *transparently* as possible, with clarification on different aspects of the theory. Significant effort is made to ensure that students can explain and justify their reasoning at every single step on the way to the end result. Student collaboration is also encouraged for a large portion of their homework to help them learn from each others' strengths and weaknesses. For introductory-level courses (e.g. Calculus I), regular lectures are thoroughly interspersed with students working on *Think-Pair-Share* exercises with weekly sessions dedicated group work. Students are regularly given short *just-in-time* exercises such as reading quizzes or no-stake warm-up clicker questions, which gives both the students and me prompt feedback regarding whether we are on track and creates opportunities to adjust their thinking process if needed. The active nature of the classroom allows me to engage with every student personally, understand their needs, and modify the instructions on the spot accordingly.

Diverse Content in an Inclusive Classroom. Throughout the semester, I make sure that students get to work with different partners to avoid any stagnant social dynamics, as I constantly monitor the classroom to ensure that no one feels isolated and that I pay equal attention and provide honest helpful guidance to both the capable and the less experienced students. To ensure that all students learn equitably during team activities, they are not only required to be civil and constructive with their criticisms but also actively recast negative ones, which empowers them to see any feedback as opportunities for advancement, not evidence of personal failure. In a complementary direction, I have found that early and regular social interaction through an online forum (e.g. on MS Teams or Moodle) where students *optionally* share their backgrounds and interests, significantly lowered the barrier of intimidation and has helped students become more comfortable and inclusive in the classroom.

A diverse student population has different needs, faces distinct challenges, and confronts different fears in their journey to academic success. So it is important to me that each student is treated as an individual, that multiple perspectives, experiences, and identities are valued and promoted, and that each one of them is allowed reasonable academic freedom to pursue the study material at their own pace. This has meant creating different ways of delivering content – visually via slide presentations, graphically via math software and web applets, and

practically via online video examples that highlight applications of abstract ideas. It has also included spending extra time with students with disabilities or English language learners, creating examples in-class notes and worksheets that are more heterogeneous in nature, that relate to the personal experiences of students, and using online LMS such as Moodle to organize the syllabi and give a concrete structure to courses. Finally, it has meant being mindful of my language and rhetoric so that it portrays my spirit of open-mindedness and goodwill. More details on my DEI efforts and commitments can be found in my *Diversity Statement* (also available in my *Teaching Portfolio*).

Practical and Contemporary Assignments. To make sure that my students are capable of applying their textbook knowledge to relevant and practical situations, each of my courses involves one or more projects or case studies that act as an extension to their assignments. Examples are chosen from various STEM fields (e.g. Google's page rank algorithm, autocatalytic oscillating chemical reaction, hysteresis in population, propulsion engines, etc.) that incorporate *Mathematica, Octave, or Python* labs into my curriculum. These projects have helped students visualize abstract ideas more easily, observe simulated experiments, understand how to implement the theoretical algorithms in a practical time-efficient way, and explore the limitations of computing technologies at the same time. In advanced pure math courses, such as Topology, students are asked to write or present an expository paper on a contemporary topic of their choosing from advanced math to demonstrate their math communication skills. Some students have used words like *'quest'* and *'adventure'* to describe these projects in their feedback and found the experience satisfying and enjoyable.

Mentoring Students beyond Classroom. Over the past years, I have supervised several independent study projects, senior Bachelor's theses, and summer research projects, both in pure and applied math, and also in related areas of economics, statistics, and computer science. A detailed list of these is available in my CV. When mentoring students outside the regular classroom, I am always careful to allow them as much agency as possible in the task of acquiring the knowledge and validating their ideas themselves - only stepping in to guide when they stray too far from the end goal. In each case, I also help students learn mathematical writing, coach them on their presentation skills, and help them focus and reflect on their career goals. Students have regularly praised my availability, enthusiasm, and willingness to help them both in and outside the classroom: *"[he] goes out of his way to explain things, and even beyond his role as an instructor, he cares about his students."*

Grading for Growth. In order to properly assess and reward the overall academic growth of students over the semester, I have transitioned to alternate grading methods such as *Specification Based* and *Mastery-Based Grading* in most of my classes. Instead of a handful of raw examination scores or partial credits on incomplete works, students are graded based on how many learning targets they can demonstrate continual fluency over throughout the semester. Students are provided multiple chances to showcase their growth and understanding (through weekly quizzes, online homework, applied projects), and are allowed to reassess any missed learning target during office hours after they revise their initial work based on my feedback. In higher-level courses, students' proof portfolios, final papers, or presentations also go through a peer review and revision process. I have found that this constant feedback and reassessment loop makes students feel more comfortable in taking risks, respond more frequently to questions, and cultivate a growth mindset that encourages perseverance through productive failure. It also gives me a better metric to determine their knowledge retention; I have found that the average student performance has gone up when I allow them to demonstrate their abilities in a less constrained environment. Equally important, collecting regular *anonymous student feedback* (open throughout, but specifically requested at mid and end-semester) has helped me keep track of the classroom climate and continually improve myself based on students' suggestions.

Professional Development and Future Goals. Throughout my career, improving my pedagogy has been and always will be an ongoing learning process for me. Through various mentoring cohorts and teaching communities, I have gained valuable insights into best practices in the scholarship of teaching and learning from my colleagues. Attending teaching seminars and other pedagogical workshops through the *Five Colleges of Ohio* consortium, the *MAA mentoring network*, completing online DEI training about handling classroom incivility, etc. have taught me in-the-moment strategies for handling unexpected situations in the classroom. At my most recent institution, I was fairly successful in my goal (as evident from student feedback) to incorporate discovery-based learning through my Intro to Proof class, as I continue to improve upon it, and have been learning how to completely flip the introductory courses. My continuing goals include incorporating technology in my teaching in new ways to innovate and transform STEM instruction with new forms of representations and experiment with bolder pedagogical ideas. Finally, by bringing in a wide variety of perspectives, I hope to impact and get support from my peers in designing approaches towards broader, more widely applicable, and more memorable learning.