

Contributions to Effective Teaching

The audience of mathematics courses, particularly at the introductory level, is composed of diverse and sometimes reluctant learners. Given this audience, effective teaching communicates more than the course material by transmitting the beauty of mathematics. An elegant mathematical argument speaks to individual students as a function of their experience and interest level. Accordingly, these diverse interest levels ensure that effective teaching is an exercise in differentiated instruction. By tailoring my teaching approach to the interest and experience level of my audience, I foster an inclusive learning environment where each student receives the amount of instruction necessary to support their learning. In practice, I approach teaching as a conversation during which the students and I actively engage with the processes leading to mathematical results. This interactive approach exemplifies the reality that mathematics is an active process, offers individually guided practice in this skill, and includes a variety of student viewpoints in each class.

I implemented my teaching philosophy approach during my experience as a teaching assistant for integral calculus at McGill University. I was responsible for 2 tutorials and 3 office hours per week. I began each tutorial with a brief review of the material to be covered and divided the exercises for each topic into three sections. For the first, I detailed a complete solution while explicitly describing my thought processes emphasizing how and why I was applying each concept. Next, by soliciting student input, we completed a second problem on the board. I found that students were encouraged to make suggestions during this second example after I explicitly verbalized my thoughts during the first section. Finally, I allowed students time to work through a new problem while I circulated through the class and offered individualized instruction. By scaffolding each topic in this way, students first observed the steps leading to a complete solution, contributed to the development of a solution, and finally independently solved problems with my differentiated guidance. Students appreciated this course design and made explicit mention of it in my teaching evaluations.

Integral calculus is required for most McGill science degrees so the audience enters with varied academic backgrounds and interests. To connect and engaging with these students, I used a range of individualized approaches. My ability to do so was recognized with the Teaching Assistant Award in 2017 and 2018 while my calculus students gave me an average rating of 4.9/5 for “Overall, the performance of this TA was excellent” with no ratings lower than 4/5. I also lectured portions of third-year *Honours Ordinary Differential Equations* and *Honours Introduction to Dynamical Systems* courses at McGill. While these courses required more direct lecturing than a tutorial, I explicitly structured each class to emphasize student interaction and participation; the students quickly learned that their participation is a crucial aspect of the course and of their learning.

My postdoctoral and industrial experience is focused on research with no teaching opportunities. However, teaching is an integral part of being a mathematician that I have dearly missed. Therefore, I searched for opportunities to teach during my postdoctoral experience and organized a day-long workshop as part of the CRM-CAMBAM Mini-workshop series. The workshop offered a graduate-level introduction to the use of structured equations in mathematical biology and was attended by approximately 60 participants. This online workshop illustrated the difficulty in eliciting student participation and the importance of adaptability during remote learning. As a result, I envision moving away from the synchronous lecture format for remote learning, and instead pre-recording lectures and scheduling small virtual meetings to allow for personalized feedback.

Mathematical teaching also includes student mentorship and I have thus far mentored three undergraduate researchers. In an interdisciplinary field such as mathematical biology, fostering an interactive and collaborative atmosphere through frequent (at least weekly) meetings is critical. During these meetings, I emphasize the collaborative nature of mentorship, with students learning to pose research questions and take initiative in their work.

Contributions to Diversity, Equity, and Inclusion

Mathematics is a human endeavor that benefits when mathematicians bring their whole selves to the discipline. My colleagues and students bring their own experiences, identities, and sense of value and belonging to every class, meeting, and interaction. As a white man in a white male-dominated field, I am dedicated to listening to and learning from my under-represented colleagues and students. However, listening is not enough.

Therefore, I am committed to using my position and privilege to remove barriers to diversity, inclusion, and equity in mathematics and academia. Ultimately, I aim to create a learning environment where students and colleagues of all identities feel appreciated, welcome, safe, and able to contribute.

As an educator, I create an inclusive classroom by using inclusive language and treating all students with respect and as unique individuals with diverse needs, experiences, and identities. To do so, I explicitly learn and use their names and preferred pronouns during interactions. To create an inclusive classroom, I approach teaching with the goal of creating a learning community and explicitly state this goal at the beginning of each semester. As a faculty member, I will encode the expectation of an inclusive, respectful, and welcoming classroom in my syllabi. I will explicitly state my zero tolerance policy on discrimination of any type, and will seek training and professional development on how to improve my inclusive teaching practices.

The under-representation of minorities in mathematics leads to a lack of role models for students from these communities and acts as a structural impediment towards increasing representation in mathematics—and deprives mathematics of valuable contributors. To combat this, I highlight contributions from individuals from marginalized communities in mathematics, am deliberate in encouraging minority students to consider themselves mathematicians and scientists and will recruit these students for research, industrial internships, and leadership programs. Along these lines, I am a member of the DEI committee at Pfizer and I have participated in the “Letters to a Pre-Scientist” program since 2015. This program aims to increase representation of minorities in science for students in low-income schools. I have been matched with 6 middle school students and have worked to humanize and demystify “mathematician” as a possible career pathway. In my interactions with “pre-scientists”, students, colleagues, or the general public, I actively seek to portray mathematics as a human activity that benefits from the full humanity of all mathematicians. In support of creating an inclusive environment for mathematicians to be their whole selves, I have been a member of Spectra and on the “allylist” since 2017.

According to the American Mathematical Society, 40% of undergraduate and 30% of doctoral mathematics students are women, with women comprising a smaller proportion (20%) of faculty at doctoral granting institutions, while similar data is not available for other under-represented minorities. This extremely “leaky pipeline” indicates the need for diverse strategies to increase student retention at each stage of the career pathway. To this end, I deliberately encourage students from under-represented communities to continue in mathematics classes, seek out research or industrial opportunities, and to perceive themselves as mathematicians. Further, I will recruit under-represented students for opportunities such as summer research programs, final year research projects, and offer sustained support and advocacy throughout their training. During my PhD, I mentored a female undergraduate summer researcher, and we have since published a paper together. As a faculty member, I will recruit a diverse research group by explicitly targeting underrepresented groups when advertising positions, and will include regular inclusivity training for my students and research group following the *Being Human in STEM Initiative* curricula with my research trainees to create an anti-racist environment.

Ultimately, as a mentor and scientist, I am deeply committed to issues of diversity, equity, and inclusion. I am committed to the recruitment of undergraduate researchers from under-represented groups, such as women or people of colour; to the creation of an inclusive, supportive and respectful group atmosphere; and to explicitly seeking opportunities to listen and learn about issues of diversity, equity, and inclusion. I am dedicated to addressing issues of diversity, inclusion, and equity throughout my professional and personal life. I will continue to seek opportunities to educate myself on issues of diversity, inclusion, and equity, to listen to my students and colleagues, and to do the work necessary to ensure that mathematics is a place where all are welcome, can contribute and flourish, and importantly, belong.