

TEACHING PHILOSOPHY

BRENDAN BURNS HEALY

Many instructors treat classroom hours as a time exclusively to stand at a board and lecture. It is true, of course, that the face-to-face component of a course is an important chance to disseminate information relevant to the class. However, there is potential for *so much more*. Engaging students in an effort to promote critical thinking is an essential part of education and development and it is most effectively done in the classroom. Part of this engagement as well is the mission of inviting all students to be part of the discourse, no matter their background. A crucial piece of this mission is being particularly mindful of students who may not traditionally think of themselves as belonging in mathematics, which is a discipline that is constantly evolving to be more inclusive and representative.

1. MODERN TEACHING METHODS

In an era of pre-recorded lectures hosted online and vast amounts of supplemental material available from many sources, it is the case that the raw facts are available at students' fingertips at all hours. This means that class time is not just to go over statements, definitions, and theorems, but to carefully work through examples and engage students in exploring concepts. Just as important to a math class as its stated objectives in the syllabus is developing the ability to work through problems with a mathematical mindset.

To this end, I have engaged in classroom practices that promote mathematical thinking skills. In this semester I am recording all of my lectures to be available to students to review later. This helps students stay engaged during class without the stress of feeling like they will 'miss something'. Instead of scrambling to copy down every single symbol marked on the board, they are freed up to begin the process of understanding what is being said in real time. As a result, I have found that student engagement, in the form of answering questions and asking their own, has increased in my classes several times over.

Inquiry-based learning is another technique I have used successfully with students. Usually appropriate for higher level courses, this pedagogical method allows the students to practice their mathematical communication skills by presenting their proofs or ideas to the class. The students are then constructively critiqued by their fellow classmates to move the class forward to more comprehensive understanding of the material. In addition to the benefit received by the presenter getting feedback, the rest of the class engages in an activity rarely experienced in a lecture-based class - they think critically about what is being told to them. If an idea is presented by an instructor, very rarely do students have an internal monologue where they ask questions such as "Does this actually make sense?" or "Can it really work this way?" Instead all is taken as fiat. In an inquiry-based class, they are encouraged strongly to challenge ideas, allowing them to engage with the mathematics in a way that can be much more authentic and productive. Most recently I taught an introduction to proofs class using an inquiry-based learning approach, but I keep these principles in mind for all of my classes.

When I was a fellow at the Tufts University Graduate Institute for Teaching (GIFT) there was a moment that has stuck with me ever since and continues to inform the way I teach. During the program, we had a panel of veteran academics and teachers who mentioned their best practices in the field of pedagogy, and one of them made a very simple analogy. He said that these methods I have described, which are often called “active-learning” methods, are statistically proven to be so effective that if they were used in a drug trial, the trial would be halted and the drugs would be administered to the control group because it would be immoral to deprive them of treatment that was so effective. I believe that it is currently our duty as both practitioners and instructors of mathematics to teach students in ways that both challenge their preconceptions and ultimately benefit their mathematical understanding.

2. MATHEMATICS AS SERVICE

It is important to recognize, however, that not all students are motivated by the intrinsic study of mathematics. A common feature of math courses, especially at the lower level, is fulfilling the computational needs of fields like engineering, physics, and other sciences. Recognition of this reality should inform the way such a class is run. I have had the opportunity to teach an applied calculus course, which taught me some valuable lessons. Adding an extra hour to the weekly meeting time meant we were able to do in-depth projects alongside the textbooks’ more rudimentary examples. For what I felt like was the first time in these students’ academic careers, they were truly getting an idea of *how* mathematics would be used in their respective disciplines - we were able to spend multiple days on ideas from chemistry, biology, and even geography. This experience left me with an incredible amount of additional vocabulary to use in the classroom to get across the concepts the students would be learning and how they might be asked to think about them in the future.

One can take this a thinking step further and consider disciplines outside the sciences proper. All of the institutions at which I have taught have required, as a condition of receiving a degree, that every student pass at least one mathematics course. Along with this requirement comes the creation of courses that are meant to fulfill it. In particular, these are classes where the students are often ‘math phobic’. These can be the most difficult situations to navigate for the instructor, due to the tendency of students to shut down when challenged or set back. What I found in these classes is that we were actually able to do surprisingly robust mathematics, including complicated combinatorics and linear programming in a finite mathematics class. It turned out that what mattered most was the attitude and language of the instructor and less the actual difficulty or perceived difficulty of the material. This is a lesson I have brought to bear on every level of class since, all the way from these service courses up to my current topology class.

3. DIVERSITY AND INCLUSION

In my time teaching, both at a small liberal arts school like Tufts as well as a large public institution like the University of Wisconsin-Milwaukee, creating and maintaining an inclusive classroom is something I have worked very hard at and has been a point of pride for me. This effort comes in many forms. It is easy to believe that a simple lack of comments to the contrary indicates that one is keeping course discussion inviting, but it is not that simple. It is the responsibility of a caring instructor to *actively* maintain an inclusive environment by choosing language carefully and finding creative ways to encourage all students to participate. This is especially important for students who are traditionally underrepresented

in mathematics. The subject matter of mathematics can be imposing when viewed through the lens of a student who believes that they cannot, or should not, study mathematics. I strive towards making the discipline more approachable to students from all backgrounds and identities.

Tufts and the University of Wisconsin-Milwaukee offered resources for instructors to learn about diversity and inclusion in the classroom and on a multicultural campus. For example, Tufts hosted a series of workshops aimed for instructors where we could practice the language and communication skills that would be both inviting and sensitive to the needs of all students. As a participant in these workshops, I was made more aware of how an instructor's "blind spots" can impede a student's learning and engagement in the course content. Further, I was able to see my classes through an equity and inclusion lens that helped me appreciate the diverse life experiences, demographic characteristics, and multiple group memberships. Honoring my students' identities and experiences, which can be far different than mine, is an important step in cultivating a respectful and inclusive learning space.

My training at Tufts, through workshop participation and certification completion, prepared me well for the start of my academic career at the University of Wisconsin-Milwaukee. The student body is very diverse culturally, socio-economically, and in terms of protected classes like veterans. Many of my students work full-time jobs in addition to being in school. For this reason, I work hard to both maximize the effectiveness of in-class time, but also to develop intelligently designed assignments and projects that allow students to get the maximum benefit for each hour they are able to dedicate.

4. TEACHING IN A POST-PANDEMIC WORLD

It would be disingenuous to say that the Spring of 2020 did not change the world of higher education in a permanent way. While it was always the long term trend that teaching would shift towards utilizing online resources, the COVID-19 pandemic accelerated this transition in an unprecedented way. Instructors who had never used a Learning Management System before were quickly and frantically attempting to update their skills with Canvas, Blackboard, D2L, or another similar tool.

I was fortunate enough to be already prepared with familiarity of Canvas (my current institution's LMS). In part due to my prior efforts to leverage the power of technology in my courses, I was already used to setting up various online resources, including videos, online homework and quizzes, and other interactive pedagogical tools. Moving forward, experience with these techniques will become ever more important, as will using textbooks that offer PDF versions or online supplemental materials. On this last point, I am personally hoping that one lasting effect from this global emergency is a shift towards open source textbooks, which have been something I advocate openly for to my colleagues. There is plenty of free and comprehensive mathematics material available to college students. Because other costs of education become increasingly burdensome to students (in part due to recent economic downturns), it is even more important for us as educators to help reduce students out-of-pocket expenses.

With the benefit of being prepared for an online semester this time, I have made significant adjustments to my use of classtime this semester (Fall 2020). In particular, I post short (no

longer than 15 or 20 minutes) videos for students to consume asynchronously and at their own pace, while I use scheduled class time as part office hours and part problem session. Because I record these class sessions, my courses offer immense flexibility in timing to students who may have other obligations including work or caring for older relatives. These students generally take me up on individual video meetings in order to ask questions they were not able to ask during the recorded classes. What I have found is that my engagement in the class remains very high, despite the lack of in-person interaction. I attribute this in no small part to the versatility in modalities I build into my courses.

All of the aforementioned themes coalesce into a central tenet of my pedagogy – I shape my teaching to encourage and scaffold student engagement. I do this with effective communication, clear enthusiasm, carefully chosen language, and an inviting demeanor, as well as efficient use of modern technology.