

DIVERSITY STATEMENT

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I strive to change the world, one student at a time, through teaching. *How to change the world one student at a time* depends highly on the individual student; I will describe some of the dimensions of diversity and how I address them in my classroom and beyond. I will discuss *personal identity* in great detail, describing how I approach race, gender, sex, sexual orientation, age, and disability in the classroom and beyond.

First, though, I will describe three other aspects of diversity, which are unmistakably correlated with personal identity, but aren't *only* about personal identity. Students bring a diversity of *attitudes* to the classroom; a principal aim of mine in any classroom is to nourish a *growth mindset* in my students. Differences among students' backgrounds often translate to different levels of *preparedness*; one of the ways I try to foster success for students from all backgrounds is by addressing these gaps through planning, outreach, empathy, and flexibility. Tragic and traumatic *life events* can impact an individual student's classroom experience more than anything; my personal experience with grief, loss, and healing governs the support I offer students responding to such events.

Attitude. The most important *inward* cultural norm in my classroom is the *growth mindset*. What you *can learn, will learn,* and are *learning* are far more important than what you *currently know* or don't know. Anyone can succeed with the right attitude and hard work. (Appropriate support often helps too.)

Most cultures understand that this truth applies at least as well in math as in any other context. Yet, American culture promotes the peculiar notion that some of us just "aren't math people." Sometimes American culture even *celebrates* not-knowing, especially around mathematics, thereby encouraging Americans to claim "not a math person" as a dimension of their *identity*. Some dimensions of identity, including race, sex, gender, and sexual orientation, are congenital dimensions of the body or soul. But this dimension of identity is volitional, governed by one's *choice* between a deficit mindset or a *growth mindset*; this dimension of identity is fundamentally a choice of attitude.

At its rotten root, the notion of "not a math person" isn't about numbers or shapes; rather, it's the antithesis of *mathematikos*, the lifelong drive to learn. A student with a fixed mindset is prisoner to a structure of the mind, and my job is help them free themselves from this prison by experiencing the joy of learning. At the beginning of the College Algebra and Elementary Functions classes I taught at Iowa, I tried to open students' minds and hearts to the possibility of experiencing this joy by having them write a "love letter to math." This is one of several classroom practices I have adopted from my sister Jessie [5].

When I taught high school math in Mississippi, I thought (as I always do) about the ways that the lessons from my classroom might influence my students' lives in the years ahead. In several cases, it turns out, my students have applied the math *itself* to better their lives, e.g. when they went on to study engineering in college, or work in a bank, or pass college algebra and/or calculus en route to a college degree. Overall, though, there are two primary ways that I hoped influence *all* of their lives. First, I sought to foster their inquisitive spark and thus help them claim the skills and inclination to nourish lifelong learning as a component of their identity. Second, through such nourishment, I hoped to help them positively influence future generations in the same way. Growth mindset, like any attitude, is contagious. Many of my students' next encounter with Algebra 2 will be when *their children* (broadly understood) take the class. My principal

aim for these students was for them to *experience the joy* of learning, to repeat this experience, to *witness* this joy and internalize it as an element of their identity, so that when their children encounter a challenge they, as parents, can *testify* to the joy that lies on the other side of the challenge and to the possibility of reaching that other side. My goal was to promote the growth mindset as a lasting cultural value for my students and their communities.

Although college classrooms differ starkly from my classroom in Mississippi, and from one another, the tension between growth and deficit mindsets is constant. Even though math majors and engineering students, e.g., have often established habits of *mathematikos* long before enrolling in my course, and graduate students even more so, the growth mindset is like a muscle that requires exercise or a tree that requires sunlight. By promoting this norm in my classroom, I hope to help my students cultivate this practice in themselves, make it their own, and share it with their communities for the rest of their lives.

Preparedness. With a growth mindset, anything is possible. Yet, it helps to be prepared: college algebra students need arithmetic skills, calculus students need algebra skills, and homotopy students need point-set topology skills. Yet, students often arrive without having mastered certain prerequisite skills. The growth mindset is the most important tool in light of this reality: no need for judgment, let's work on improving some skills we'll need. (Sometimes a different course offering is advisable.) Still, while "deficit" is a destructive psychological notion, it is sometimes descriptively accurate, and scaffolding success for students who arrive in a class with a deficit in prerequisite skills requires more than the cultivation of a healthy attitude. It requires planning, outreach, empathy, and flexibility.

I try to plan my courses in a way that *anticipates* preparedness issues before the semester starts, e.g. by talking with veteran colleagues. Some skills will demand remediation. For example, a college algebra student of mine at Iowa hadn't mastered their multiplication tables, so I brought them a deck of flash cards to borrow for the semester. This skill was absolutely necessary for success in the class and it was realistic to expect the student to master this skill with targeted practice, which they did. Other prerequisite skills are less foundational to the course content. When there is a gap in preparedness regarding these skills, I design problems to minimize the impact, keeping the focus on the core material. For example, I try to minimize the amount of messy algebra required in calculus problems; even in linear algebra, I try to design problems that use relatively few fractions.

It's best to have these contingencies in place at the start of the semester. At the start of calculus, e.g., I list some of the skills students will need, and resources students can use to improve those skills on their own. I also encourage students to meet with me, in office hours or by appointment. In my experience, most students never visit office hours if it's entirely up to their initiative, so I often require each student to visit my office during the first two weeks of the semester. Once I started doing this, I found that more students returned for office hours across the semester. This also allows me to ask each student questions that they might hesitate to answer honestly in a public setting, increasing the possibility that the student and I can intervene *in anticipation* of, and not just in response to, prerequisite skills which require improvement.

Often, though, such intervention comes mid-semester, which is less ideal but fine, especially if our classroom culture has developed a level of trust where my outreach comes across without any sense of judgment. Three ways that I try to cultivate this trust are by emphasizing how important *their success* is to me, by advertising my availability to meet with them (in and outside of office hours), and by listening actively. When we do intervene, students are in a vulnerable position, psychologically; a healthy classroom baseline of trust is helpful, but now the individual student and I need to deepen that trust. The best thing I can do is listen and empathize. When the student hears that *I hear them*, then we can really get to work.

Finally, implementing these interventions requires some measure of flexibility, e.g. regarding deadlines, in the architecture of the course. Next, I will describe further vital reasons for such flexibility.

Tragic and traumatic life events. Sometimes, a math classroom can become a sanctuary, an ecosystem in itself, an arena in which to contend with friendly challengers visiting from the world of ideas, free from corporeal distraction, unburdened from the cruelties of man and nature. Yet, there can be times in one's life when these cruelties inflict pain so acute that suffering seems to engulf the whole world. Nothing impacts an individual student's classroom experience more than the loss or grave illness or injury of a friend or family member, or sexual assault.

While all my experiences as a student inform my teaching, this is true most deeply when it comes to grief, trauma, loss, and healing. Everyone has different needs in such a situation. Some students appreciate a compassionate person to listen to them, while others just need space. Some students need time off to grieve acutely. Sometimes, they then need clear structure to help them start living with the grief that remains. Some students need this structure almost right away. Some students are unable to return to class. Still, all students suffering from grief have this in common: they need me to listen compassionately when they have something to share, and they *never* need anyone's judgment, let alone mine!

Personal identity. Before delving deeply into my thinking around issues of personal identity, and how this thinking informs my approach to the classroom, I would like to describe a few practices that make my classroom a more welcoming, inclusive, and equitable environment for students from all backgrounds.

In my research, teaching, and service, I pay careful attention to diversity issues in representation. Besides being central to the *human context* of my work, questions of representation also offer feedback on the equitability of my approaches. For example, in each of my first two years leading UNL's Putnam Seminar, none of the 3-5 regular participants were female. Why was this [4]? How could we do better? The first change I made this year, informed in part by advice from my sister Audrey, was to change some of the language in our advertisement in the student bulletin:

The annual Putnam Exam ... is a nation-wide mathematical competition.... Freshmen and sophomores are especially encouraged to enter the competition.

became

Give yourself a mathematical treat! The annual Putnam Exam... is a nation-wide mathematical challenge.... Female and minority students are especially encouraged to participate; first- and second-year students are especially encouraged to participate.

I repeated this emphasis when soliciting the UNL faculty's help in recruiting for the Putnam. Roughly half of this year's participants are female. Secondly, I'm modifying the tone and structure of the Putnam seminar, in a way suggested by the change in tone of the announcement: Putnam is a challenging Friday treat.

We all carry implicit biases. Limited life experiences are partly responsible, as are disparities in representation. So too are patterns of language. In particular, *blackness* tends to have negative connotations and symbolic meanings, *whiteness* positive ones. When I finished drafting my recent paper, *A geometric proof of the flyping theorem*, I realized that, by following recent mathematical convention, I may have unwittingly furthered this practice. Conventionally, one colors the two chessboard surfaces from a knot diagram black and white, and Greene had recently proved that when the diagram is alternating and connected, certain pairings associated with these surfaces were definite of opposite signs. Based on how I usually drew my figures (highlighting the black surface), I had established the convention that the pairing on the black surface was negative-definite. Before posting to the arXiv, I spent a few hours transforming my figures and reversing the signs in my equations in order to reverse this convention. Now, anyone who reads my paper will practice associating blackness with positivity.

Uri Treisman describes how differences among students' backgrounds often express themselves in the formation of groups and in the dynamics within those groups [8]. In an inquiry-oriented setting with daily group work, I like to assign students to a different group every class, in a way that is (ideally visibly) random. Remotely, Zoom makes this seamless. In-person settings require more student buy-in, and so the key seems to be establishing a before-class routine for visibly random group formation on the first day of the semester (e.g. as they enter class, each student selects a card from a euchre deck—9's through aces—in order to form six groups of four). This random rotating structure invites students to build community at the level of the entire classroom, and I have been delighted at how well this has gone even in this semester's remote setting. As students work in groups, I rotate among them, taking a comfortable amount of time with each. Surprisingly, Zoom has improved this dynamic, perhaps because in each breakout room, students know that I'm all theirs. There is no external audience. We can take our time, or I can pass right through and stop longer next time; it's up to them. When we dialog, though, I pay careful attention to make sure every single member engages, not to put them on the spot, but rather to open up space explicitly for *their* voice.

Many people love math but feel like they don't have psychological ownership of math. Often, this disparity stems from stereotypes that they've internalized, as a student's image of a mathematician does not align with who they are: female, Black, Latinx, farmer. The issue is *stereotype threat* [1, 2]. (In fact, even a "positively stereotyped social identity" can negatively impact student performance [3].) Research shows that one can address stereotype threat in an effective, simple, and direct way: name it, describe it, expose the blatant falsehood of the stereotype. When the risk is heightened, such as at the beginning of a test or quiz [7], I help students *center their minds on the relevant part of their identity* by having them write down the following mantra, "I am a successful, hardworking college student."

I was born into tremendous privilege, a straight upper-middle class White American male with a law professor and a high school math teacher as parents. This privilege delimits my capacity to identify with the realities of those whose experiences are different than mine. Therefore, I must develop tools for empathy by listening, reading, engaging, and imagining.

My personal experiences are useful to this endeavor only through a type of analogy, which, in a structural way is similar to the way I try to "visualize" handle decompositions of 4-dimensional manifolds. My mind's eye pictures a handle decomposition of a 3-manifold, while my inner voice constantly reminds me of the ways that this picture differs from the truth it seeks to convey. The approach improves, but does not perfect, my understanding of the 4-manifold.

Here is a concrete example. A few years ago, I spent six weeks in Ethiopia, where my sisters, who are White, were born. I gained the benefit of experiencing the culture at a profoundly personal level by connecting with family friends in their homes in Addis Ababa and the town of Asela, and by meeting new friends at the University of Addis Ababa and in a network of orphanages.

Despite the overwhelmingly positive nature of this experience, I also learned an uncomfortable lesson. These visits gave me *some* experience being the only person who looks the way I do. I always felt conspicuous. It grew exhausting. Sometimes, especially in public, it felt as though people saw my skin color and no further. Yet, this is completely different from what women, people with disabilities, transgender people, and people of color experience when they're the only person in a room who looks the way they do. One difference was the limited duration of my stay, and the fact that I was there by choice as a visitor. The more profound difference, however, is that my whiteness signifies privilege, whereas their outward difference evokes something else.

To empathize, by definition, requires understanding how another feels. Perfect understanding of this kind is an impossible ideal. Instead, one must introspect, in order to appreciate the current limits of one's empathetic capacity, and then strive to expand these limits. Reading fiction (or similarly, biography) enables one, in a

disembodied way, to inhabit the mind and skin of those from different backgrounds, potentially opening up vast new capacity for empathetic imagination. Nonfiction provides contexts and conceptual frameworks for such imaginative work, among other things. The best way to expand one's empathetic capacity is to meet folks from backgrounds different from one's own and engage with them in meaningful ways. Through such engagement, by loving one another and listening, one can transform disembodied frameworks and capacities into knowledge of the heart. And yet this knowledge always has its limits; it's as important to appreciate these limits as it is to build this knowledge.

Next, I will describe some experiences from my time teaching high school which inform my thinking on this subject.

My first year teaching high school was at the Charles School, a public charter school in Columbus, Ohio in its second year of existence. I taught three classes: two pre-algebras and one remedial fundamentals of math. I remember the latter most distinctly. All nine students in the class were Black, and four came from Columbus' Somali-American population. All nine had fallen far behind in previous math classes. For the Somali students, this was most likely due to a language barrier; for the other students, it seemed tied in different ways to attention-seeking behavior and/or difficulty concentrating. In short, each student in that class needed individual attention, and with such a small class, I was sometimes able to give them this attention. We began with addition and subtraction of positive and negative integers. For some of the students, this was far too advanced, and we started more basic: addition and subtraction of 1- and 2-digit numbers, and multiplication tables. Overall, that semester, we made progress; yet, there were also many days when math seemed out of the question, due to forces that felt out of my control. You might say the issue was classroom management, but naming a thing is different than understanding it.

The next summer, I joined the Mississippi Teachers Corps. The students in my school were rural, generally poor or working class, roughly 60% White and 40% Black, reflecting the small-town community in which the school was located. I also taught three Latinx students at Potts Camp, at least one of whom I have since learned is a Dreamer. (During my last year in Mississippi, I played in a weekly soccer league on a team with one of these students and his uncle; the vast majority of the players in the league were Latino, and every week there was a police cruiser parked at the fields, for no discernible law enforcement or public safety reason.)

The students generally appeared to enjoy the structure and rhythm of math class, especially when they understood the material well enough to engage with it. In the face of challenges, some students coped well, pinpointing their confusion and asking about it. Several students, though, while they enjoyed tasks that they understood, often reacted to challenges in less productive ways, intentionally disrupting the flow of class for everyone. Connecting with these students was perhaps the most exhausting, and most rewarding, aspect of my time at Potts Camp. The most important thing was to build a shared rapport, then trust, and eventually that good *agape* love that MLK preached about [6]. This mutual respect, trust, and love enabled us to work together as they sought to improve resilience, self-discipline, and altruistic respect, while I expanded my equanimity, affability, and empathy.

More rarely, some students came to class determined to sow chaos, with no intention to learn. A stark example involved a pair of twins during my first year at Potts Camp, in my last class of the day, geometry. When I turned my back to write on the board, they would make sounds like birdcalls, or throw things—a baby rattle, a condom, spitballs, a rock. I sat them on opposite sides of the classroom so that I could triangulate the source of any outbursts, but then they enlisted the help of several classmates. Three of these students were sophomores at the time and went on to take four classes with me, culminating with AP Calculus. During that time, we grew close, building shared trust, admiration, and *agape* love [6].

During my second year at Potts Camp, I had another student who was very far behind in terms of his math skills. This student tried very hard to compose himself during class if he got frustrated, but he frequently acted out in ways that disrupted the rest of the class, and so he and I had frequent conversations with the principal and vice principal. He kept asking why I seemed to have it out for him, and I always tried to explain that I had nothing against him, but his behavior needed to be more respectful of our classroom's shared expectations. Later that year, he was arrested and convicted of a serious violent crime outside of school. He had acted with callous recklessness, shooting into a trailer, taking a human life. The situation was even more charged because this student is Black, the victim White and female. His mother taught at the school, and I always asked her how he was doing in prison. She later told me that he was surprised to know that, of all people, I was the one who cared. It's hard to know what lesson to take from this experience, except to keep trying to connect compassionately with my students, and to remain humble about my assumptions regarding the contents of other people's hearts.

My experiences and reflections inform my teaching in two ways above all: through humility regarding my understanding of others' internal processes, and through increased cognizance of some of the situations in which people from different backgrounds *might* experience a situation differently. My principal objective is to treat all students equitably, creating conditions for their learning process to thrive, and adapting existing structures to accommodate their needs. As a baseline, I establish the same architecture for everyone, with uniform expectations and standard contingencies. My increased cognizance around diversity interests informs this design, and humility regarding my empathetic capacity necessitates a certain degree of flexibility in these contingencies. From this baseline, I treat everyone as the individual they are. Here, too, the same cognizance and humility govern my approach. I never *assume* that anything in particular has to do with race or gender or other aspects of identity; rather, considering these aspects of identity helps me try to anticipate trouble—or opportunity—before it presents itself, and to recognize it if and when it arises.

I will conclude with an extended example of this, from my time teaching at UNL. The end of my rings-first proofs course in modern algebra last fall featured a project, called Being Them, in which each student learned in some depth about a historical mathematician—in this case, from algebra or number theory—and came to class “as” that mathematician. The students/mathematicians then rotated through “cafe-style” 3-4 person conversations, speaking in the first person *as* the mathematician they had *become*. I think this activity was really great in some ways, especially the way that the use of the first-person voice narrowed the distance that students, especially female students, saw between themselves and historical mathematicians and their discoveries. The project led to deeper senses of psychological ownership.

As I drafted the assignment, I grappled at length with questions of representation: due to the history we were exploring, most—but not nearly all—of the mathematicians represented would be (dead European) White men. The class discussed this shameful and sad disparity before and during the project.

When the project commenced, there was only one student who hadn't chosen a mathematician: the only Black woman in the course. When she arrived in class, it was clear in person that *something* was weighing heavily on this student; her stress was palpable. Had I triggered this student through the design of the assignment or by inadequately reckoning with the exclusionary legacies of mathematical history? Or maybe something else was going on, something having nothing to do with the class.

I reached out. No response. I reached out again. The first time, I hadn't brought up race or gender. Experience has taught me that most of the time when a student suddenly starts having a tough time in class, there are usually external factors behind this change. I figured, as I generally do, that if I were in her position, I would prefer that my professor not assume immediately that a given problem has anything to do with race or gender.

When the student didn't respond, though, I responded by acknowledging these factors and offering her several paths forward. I wanted to put her first and help her meet course expectations. The student didn't respond and showed up to the first day of cafe style meetings completely unprepared. She radiated anxiety. Yet, she found a way to engage that day: she joined a conversation that included one of her friends, who was "being" Marie Sophie-Germain, and listened. Then the student "became" Sophie-Germain for the remainder of the class. Her resiliency impressed me.

At the end of class, I asked her what I could do for her in terms of adapting the project. She told me that something completely external to our class was creating tremendous stress for her, and she expressed in tacit but clear terms that she didn't want to discuss the details with me. Thus, I didn't press. After class, I sent an email encouraging her to choose a mathematician that no one else had chosen. The student responded by choosing Lejeune Dirichlet, changing her mind to Adebisi Agboola, coming to class as Sophie-Germain, and finally writing about Dirichlet.

This student's experience highlights the extra emotional risk, for female students and students of color, and especially for female students of color, involved in grappling with our history, whose ugly aspects persist to this day. Still, such grappling is vital work, in part *because* of this uneven distribution of emotional risk. I still believe that the curriculum of this rings-first "introduction to modern algebra" course naturally invites an exploration of historical context, and that Being Them is a great way to explore that context.

Several lessons from this experience apply more broadly. It is important to optimize diverse representation, and to acknowledge when representation is inadequately diverse, doing so in a way that invites continual dialog on this topic. It is vital, particularly in contexts where inadequately diverse representation is conspicuous, to pay extra close attention to the individual responses of women, students of color, members of other underrepresented groups, and especially those at the intersection of two or more of these identities.

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