

Statement on Teaching

Operating through the medium of mathematics

There are strong links between beliefs, thoughts, actions, and outcomes. In the following sections, I will describe beliefs and thoughts I hold as an educator and represent the theme of my actions in teaching through an example. There are some comments from students regarding their evaluation of my driving along the road of education.

Beliefs

I believe in the infinitude of a functional and active hope (where any usage of hope below will be of this sort). The placement of one's hopes, or the lack thereof, influences what current-day decisions seem advantageous, possible, and appropriate. The hopeful educator is able to and should agitate the certainty of societal outcomes[1] espoused as the natural order (very explicitly: White supremacy and accompanying Western Imperialistic ideals), bridge present realities to re-imagined futures, and engage the mind with the heart for the creation and application of further hope. Thus I teach people mathematics in order to demonstrate the affective-pragmatic duality of both hope and mathematics: No matter the positive real number r , the repeated sum of r tends towards positive infinity; and, any partial sum will be greater than the one before it—because not everyone begins daring towards the infinite. In the mathematics of hope, and vice versa, we can grasp the endless, bringing a compactness to hope. As a mathematics instructor, I welcome the infinite and become a safety net for students to enjoy the wonder of the primes, the utility of formal power series, formal Laurent series, or Puiseux series, and the ubiquity of (complex) polynomials, one of my favorite infinite-dimensional vector spaces. Likewise, I encourage students to dream and hope and mold paths that we make more tangible and useful as we do with the mathematical objects just mentioned.

Exploring mathematics with students as a hopeful educator, including teaching in new areas, is then a way to model and to express deliberately the process of confidence building, to celebrate unapologetically, to encourage optimism after facing defeat, and to promote agency with respect for community. Essentially, this is an opportunity to measure hope[2] drawn from cultivating knowledge. As well, hope invites conversations on planning, persistence, and resiliency in developing quantitative reasoning skills and defining internal and external success.

It must be emphasized that hope is personal as well as collective. Hope is about people and so is doing mathematics—for one, who is doing the mathematics but people. In the spirit of [3], the list below is crucial for me to transform a hope believed into the exercise of thought which fuels the actions I take to serve and to center students, undergraduate and graduate, as an educator and practitioner of mathematics.

Inspired by *People Over Math*

- (i) I am not the arbiter of my students' hopes as long as the humanity of others is non-negotiable

- (ii) I am a Black, straight, non-disabled, cis man regarded as a professional mathematician: I commit to advising and teaching with a growing awareness of my positionality and with the intentionality to go beyond my experience to promote positive mathematical outcomes.
- (iii) I have the structural and personal power to reduce uncertainty and exemplify grace.
- (iv) I honor the privilege of communing with people by contributing responsively to our space while being proactive in the protection of students.
- (v) I do not own mathematics any more than my students do: I acknowledge the power to do harm and be a gatekeeper with my words and actions—even my thoughts matter in the practice of centering students.

Thoughts

The beliefs above influence my thoughts on what makes a good mathematics teacher. I envision myself as moving towards the “quality teacher” described in [4]:

“This great teacher was a great person operating thru the medium of subject matter.”

What a joy that my primary subject matter is mathematics! A more ideal state is when each student sees me as a great person operating through mathematics. Indeed, I know times when I was neither a great person nor operating through mathematics effectively. In failure, my communities and I demanded that I change. This continual reflection helps me develop personally and professionally. I have had to re-think where I situate in the educational road, in the story of any one person. From this reflection I have developed a general method to frame my presentation of mathematics and to guide students who are on this road with me.

State Hear Observe Write Explain Read

SHOWER mathematics in its challenging wonders and connective insights.

Student feedback 1: “Which attributes of the course and/or the professor helped you learn the material?”

I was able to learn new concepts through SHOWER, which I haven't heard of before this course.

I liked his SHOWER methodology (Speak linear algebra, hear linear algebra, observe linear algebra, write linear algebra,...). He also was a great help during his office hours.

These verbs intersect in a variety of ways and have various meanings to the array of students I have taught and will teach. I have taught students with whom I did not share a common speaking language, and others utilized assistance in their writing or

in seeing certain distances. Since the usage of the mnemonic is to remind students to engage any and all senses one can in the learning process, and doing so communally, it requires updates so that my beliefs about students and my actions towards them are aligned in thought, too. One update includes the change from "speak" to "state" as my pedagogical motivation is to have students invest in making statements and analyzing those statements for veracity, utility, and classroom empathy.

Actions

During my PhD program, my first five semesters teaching placed me in a situation to teach a new course each time. Preparation heavily involved researching past courses through online resources and learning from other instructors. I began courses with an email assignment for the purposes of gauging digital access and learning about the community I was to guide. Each email told me about a mathematical hope, mathematical fear, and a goal for the semester. Students often dropped the mathematical part, but any response was information about the person I was teaching and interacting with: *People over Math*.

Student feedback 2: "Which attributes of the course and/or the professor helped you learn the material?"

He makes sure everyone understands a topic and does his best to get everyone involved. Very passionate about math which makes class interesting.

Although at first a little skeptical, the teaching style used in this course did help me learn in this course. The use of examples in class helped immensely.

As a postdoc, I did not have a teaching assignment. To hone in on my skills in the classroom, I took on assignments outside the classroom. I led K-20 STEM educators in statewide and national webinars on equity, and as an active learner, I attended professional development sessions with K-12 teachers from across the country. I also took time to mentor undergraduates, postbacs, and graduate students through seminars and in research. All these accounts continue to provide reflective moments on teaching in the classroom.

Example: S-H-O-W-E-R Linear Algebra

I taught Linear Algebra in a classroom that had the dimensions of a bowling alley lane and densely packed chairs to fit the 70 students. I was intentional in developing an environment in which students would feel empowered to utilize the boards spanning the walls—the saving grace of the space. This foresight was rewarded when a student asked about a non-classical example of a zero vector, something not a number or column of zeros. I had a plan! Group work! Board space! Let's go! It would rely on us **S**tating the properties of the zero vector, **H**earing and **O**bserving the reasoning behind each group's work, **W**riting out the necessary computations, **E**xplaining why we could reduce our computation, and (re-)**R**eading a previous example on finite fields. They were

in overwhelming agreement to write out 35 sums (up to commutativity) on the power set of $\{\blacksquare, \blacktriangle, \bullet\}$ with symmetric difference as addition, leaving me to compute $\emptyset + \emptyset$. Then we formed a vector space over the field $\{0, 1\}$, with our class having the ability to review an already-explored example of $\{0, 1\}$ as a set with associative binary operations.

In this example, and throughout the semester, definitions became more concrete through guided student explorations. It worked well for some students to contribute from their desks (especially individuals I knew would be adversely affected by an overload of stimuli), while rotations of the working groups provided opportunities for students to observe and explain to each other our collective results. Students explained that the empty set matched the description of the zero vector of a vector space. More generally, an introduction to finite vector spaces, not just finite-dimensional ones, gave background to applications of linear algebra in the design of algorithms, coding theory, scheduling, and encryption. Belief in my students as willing and capable learners, communicating the importance of SHOWERing from the beginning of the course to the current inquiry and onward, and the action to engage a challenging topic with them—they knew I would be there to support them as their instructor and a researcher in algebra—built up our class confidence as we demonstrated a shared hope in understanding the abstract in a concrete fashion.

Future

Over the past seven years, I have held the role of an adjunct instructor with a 3–2 teaching load, a graduate instructor leading a pilot course and another four distinct courses, and a postdoc designing virtual spaces. I have taught undergraduates at an HBCU in the South, instructed undergraduates and graduate students at an HSI in the Southwest, led seminars in the Midwest for postbacs and graduate students, and engaged mathematicians and STEM educators around the globe. These experiences, and the relationships derived from them, continue to mature my beliefs, shape my thoughts, and compel me to act to center students. This means I will continue embrace opportunities to grow as an educator, journeying hopefully and preparing diligently, operating through the medium of mathematics.

References

- [1] J. Baldwin. “The Negro Child—His Self-Image”. *The Saturday Review* 21 (1963).
- [2] S. F. Farmer. “Hope in Confinement: Towards a Pedagogy of Restorative Hope”. PhD thesis. Emory University, 2016.
- [3] R. Garcia et al. “People Over Math: A Co-created Principle for Successful Research Communities”. *MAA Focus* 42.3 (2022), pp. 26–31.
- [4] S. E. Kelly, C. Shinnars, and K. Zoroufy. “Euphemia Lofton Haynes: Bringing Education Closer to the ”Goal of Perfection””. *Notices of the American Mathematical Society* 64.09 (Oct. 2017), pp. 995–1003. ISSN: 0002-9920, 1088-9477. DOI: [10.1090/noti1579](https://doi.org/10.1090/noti1579).