Teaching Philosophy

Angela Hanson

University of Kentucky

I enter the classroom, stand at the front, and survey the individuals facing me. They talk among themselves. A small group of students erupts in laughter after hearing about a late night adventure. One student mentions a professor that gave him a panic attack. Another falls asleep after a double shift at work. This time provides a special window into their worlds filled with a variety of goals, stressors, responsibilities, and individual needs. These students are counting on me to learn mathematics, but they are also looking for support and guidance as they learn how to be adults and discover who they are. This inspires me to adapt each class to the needs of those particular students. I leverage my students' interests and aspirations to motivate the mathematical and personal development goals.

1 Learning Objectives

I ultimately want students to leave my class better prepared to enter the next chapter of their lives. This means helping them develop personal and professional skills in addition to technical skills. We focus on critical thinking, communication, and collaboration, each of which fits into the mathematical curriculum and is transferable to other aspects of life.

Problems in mathematics naturally require a level of critical thinking to interpret what is being asked, to determine how to gather the relevant information, and to figure out how to use that information to solve the problem. These skills transfer well beyond my class because they illustrate how people make major decisions and handle the challenges of life. I therefore explicitly address these skills, using math problems as a starting point, and then discussing how to more broadly apply them. In introductory courses like Introduction to Contemporary Mathematics, I assigned scavenger hunt assignments to teach students were to find and evaluate helpful resources. We started each such assignment with a discussion of how this process can also be used to form independent opinions on everything from diet to politics.

Showing work is an important part of solving mathematical problems because it organizes the students' thoughts and identifies points of misunderstanding or confusion. This acts as one form of communication from students to instructors. To expand on this communication, I challenged my students in Calculus and Matrix Algebra to argue their points in words on written homework so that they could deepen their own understanding and work on articulating their thoughts and ideas to others. Ultimately, this transformation from abstract thoughts to concrete words is what prevents misunderstandings and gets ideas heard.

I also have students share ideas with their classmates so that they can see a variety of ways to solve problems. This collaboration is valuable, but many students need more instruction on how to use it effectively. There is a balance between individual contribution and leveraging different perspectives, all complicated by the navigation of interpersonal dynamics. Individuals in the workforce are often put on teams and are expected to produce results, so I help prepare students for this in the safety of the classroom. In College Algebra, I used think-pair-share in every lecture to normalize talking with others about mathematics and asking questions. Later in the term, I

also had occasional group quizzes where students completed problems in teams and presented their work to the other teams for feedback. By the end of the term, students had practice working in groups of all sizes.

2 Motivating Those Objectives

My goal is for every student to be empowered to take ownership of their education. However, many students are not intrinsically motivated to learn mathematics. Math can be uncomfortable or unnatural and may require more commitment than they want to give. This makes external motivation critical, especially when my class is competing with factors like work, extracurricular activities, family responsibilities, and other individual circumstances. Therefore, I address motivation regularly and in two primary ways. First, I invest in each student as a unique person, caring about their circumstances and helping them see a path to succeed through those circumstances. Second, I show students how what we are doing in class will help them achieve their goals, even outside of mathematics.

Before students can focus on new material, they need to tend to their physical and emotional health. Only then can they make room for learning. Therefore, I advocate self-care and facilitate a safe place to learn. This starts with a discussion at the beginning of each semester, partnered with the syllabus, which states what students can expect from me and what I expect from them. I pledge to encourage and respect my students, foster an environment of inclusion, provide a safe place to share concerns, and welcome feedback throughout the semester. I then ask students to be respectful to themselves and others, to use constructive language, and to let me know if something is affecting their ability to learn. This sets the tone for the rest of the term. I remind students regularly that I am a source of support. I also check-in with my class during weeks of multiple exams and follow up with individuals who seem to be struggling. Through mid-semester surveys and individual discussion, I find that students appreciate even the smallest of gestures that make them feel valued and heard. I had one student in Calculus who shared his mental health struggles with me. When he decided to withdraw from the class to take care of his health, he specifically requested to be in my class the following semester because he knew I would be supportive and understanding of his circumstances.

This approach has served me well, not only in the classroom but also as a mentor to one of the undergraduate research teams in the MathLab. The MathLab provides an opportunity for undergraduate students to explore mathematics outside of classes. As a project mentor, I provided mathematical background and insight, but I also helped students navigate the frustration and time management challenges that research can bring. Based on my experiences balancing instructing with mentorship and mental health, I have been asked to lead the First Year Seminar for new graduate students in our department. This seminar is taught by a single senior graduate student each fall with lessons and activities on proof writing, reading mathematics, and building community. In this seminar, I am a primary point of contact. This makes personal investment in each student imperative to help them transition to graduate school.

Many students in college start to challenge the thoughts and beliefs that they were brought up with and begin to develop their own. My role in that process is to highlight the importance of personal development, particularly in an independent course like Introduction to Contemporary Mathematics comprised of predominantly art majors. As they explore relationships, religion, politics, and their general world view, they employ critical thinking to avoid group thought pitfalls and they use information literacy to sift through mountains of data to form their own opinions.

We also discuss how communication and collaboration help fight ignorance and disparity in our society. This perspective of personal growth helps students connect with assignments and engage with the material because they see how it serves a higher purpose.

Students also benefit from hearing how skills apply to their future careers or help market them to employers. Sometimes the mathematical content clearly applies to their area of study and we can discuss how introductory examples generalize to more complex implementation. For example, when I introduce derivatives, we brainstorm when rate of change appears in physics, fluid dynamics, thermodynamics, and other areas of engineering. The real world applications may be less clear at other times. In that case, we talk about how skills like critical thinking, communication, and collaboration appeal to employers and can distinguish students from their peers as they enter the job market. This motivation was particularly helpful when I taught proofs in matrix algebra. We talked about how proofs are arguments used to convince others of the validity of the statement. Regardless of the course, I intentionally point out that skills like critical thinking, communication, and collaboration are transferable to any career path.

3 Delivering on the Objectives

Once the learning objectives are clear and students find their motivation, we are ready to work towards understanding the mathematics and developing those personal and professional skills.

I employ several active learning techniques during class to help my students engage with the material. For instance, I made incomplete note sheets for my college algebra students with a fill-in-the-blank format for definitions and theorems. Examples had space for students to work through them, either with me or in small groups. There were many definitions and procedures, and students appreciated that they did not fall behind in the notes and could focus more on what I was saying rather than what I was writing. This also bought time for additional examples and activities. In matrix algebra, where there are lots of theorems, I used posted notes for the full, detailed statements but used the board to work through examples that clarified the statements. This helped students avoid getting lost in the wording by immediately seeing explicit cases. Students mentioned that this sometimes meant we covered the theorems too quickly. In the future, I plan to adapt this by highlighting or writing the key parts of the theorems rather than reading them to help students have more time to absorb the material and emphasize the key ideas before starting examples.

Introduction to Contemporary Mathematics was a stand-alone, introductory course designed for students who only need one mathematics course for their major. In response, I leaned more heavily on transferable skills to drive the mathematics. I designed a project entirely from scratch to help students work through the stages of critical thinking: forming questions, finding resources, and researching a particular problem. I gave students a list of math problems that were one step generalized from concepts that we covered in class, and they got to pick a subset to take through this process. We spent time in class talking about which topics the problems generalized and where the students might look for resources. I gave instructions that if they got stuck, then they could come to me for guidance or mathematical explanation. Students enjoyed the freedom of this assignment and shared a number of great resources that they found in the process.

To work on communication skills, I use writing assignments. When I taught Matrix Algebra, each writing assignment had two calculation problems and two proof problems. I had students reflect on their process for each problem, and I provided a sample of what a full credit answer looked like to clarify expectations. This was partnered with a specifications-based grading system

so students could submit revisions as they developed their writing skills and adapted to this style of assignment. While these students were more mathematically experienced, I found that they needed more guidance on communication skills. In response, I plan to build the communication skills more gradually by dividing problems into multiple parts with open-ended questions that lead them through why we do each mathematical step.

While some students come to class with a previously formed support network, others lack people to study with. I use think-pair-share regularly in lecture to help students form a community that they can work with on homework. I encourage students to collaborate on homework, and I provide guidance on how to start with their own ideas, discuss them with other students, and then finalize the write-up individually. Some students have had concerns about the relative effort of group members, and my approach is not to fix their problem but to coach them through it. Empowering them to resolve their conflicts has a lasting benefit.

Each class is different because individual students are different. Therefore, as they change, so must I. Through surveys and other communication, I continue to learn from my students and adapt to their needs during and after each semester. My attitude of continued growth has recently led to my nomination for and awarding of the UK College of Arts & Sciences Outstanding TA Award. This honor, coupled with feedback from my students, continues to encourage me:

> *"I think the most impactful part of the year was having you as a professor. I feel like aside from the math lessons helping us in the real world, you taught us a lot of life lessons. You always said the right things when people were having a hard time, and you always made sure everyone was a part of the class."* - Anonymous Student

I am constantly reminded that these practical skills and personal interactions can benefit students just as much as any mathematical concept.