Overview

The general objective of my teaching philosophy to mathematics is twofold: first, to help students recognize and appreciate the beauty of math, and second, to equip them with the skills to weave mathematical thinking into their study and future professional endeavors.

Mathematics, which Galileo Galilei called “the alphabet of the universe”, possesses a unique beauty. However, this beauty is only evident to those who can appreciate it. To others, it may seem like an overwhelming jumble of symbols and notations. The dual nature of mathematics - its intrinsic beauty with its abstraction - poses unique teaching challenges, which I will address in the subsequent discussions.

Create motivation

Engaging students’ interest is foundational. Without it, even the most effective teaching strategies can fall short. To spark their interest, I often briefly touch on the related history, anecdotes, real-world applications, and the significance of certain theorems – just enough to provide context and promote motivation.

For example, when instructing Math 320 - Linear Algebra and Differential Equations:

While discussing matrices and eigenvectors, I highlighted their practical relevance by drawing attention to Google’s PageRank algorithm. I emphasized how this algorithm, which underpins one of the world’s most utilized search engines, heavily relies on the principles of eigenvalues and eigenvectors.

When introducing numerical methods for ODEs, I underscored their importance by noting that while many ODEs resist analytical solutions, numerical approximations always offer a pathway. By grounding theoretical concepts in tangible applications, I strive to make abstract ideas resonate more deeply with my students.

Use examples

Math frequently encounters concepts that might seem abstract and elusive. This is why, whenever introducing a new math concept, I emphasize using ample examples to facilitate understanding. I particularly favor examples that are visually intuitive and/or have ties to physics.

For instance, when teaching the non-commutativity of matrix multiplication, I employ visual aids to foster a more intuitive understanding. I ask students to observe the difference between rotating an image then shifting it, versus shifting it and then rotating it. This hands-on approach helps them understand the unique properties of matrix multiplication versus scalar multiplication.

Active thinking

It’s a common human tendency to tune out things they perceive as irrelevant. A one-sided monologue in teaching can make students feel disconnected from the material. Therefore I place a strong emphasis on fostering active thinking.

One method I employ is consistently raising questions to the class, especially the kind of questions students are likely to make mistakes, based on my past observation. This not only keeps them engaged but also helps them in identifying and correcting misconceptions.

Additionally, when time permits, I encourage group discussions. This collaborative approach allows students to learn from each other’s perspectives. During these sessions, I

walk among the groups, listen and interact, to further facilitate learning and engagement.

Being clear and organized

Math is deeply rooted in logic, with its concepts built on one another. A shaky understanding of a math topic, such as linear systems, can impede the comprehension of subsequent topics like matrices and determinants. Therefore, clarity and structured presentation are vital.

For example, at the beginning of each class, I usually provide a brief recap of previous lectures and set the agenda for today's lecture, illustrating the connections between topics. This approach provides students with a roadmap, lest they be overwhelmed by details.

I also invest time in polishing my teaching notes to ensure clarity. When a theorem is pivotal for various examples, I'll either spotlight it as a sidebar or write it down on the blackboard, to make sure students always have the essential tools at hands when tackling example problems.

Being patient and supportive

Given the diverse backgrounds of students and the constraints of time, finding a teaching pace that fits everyone in the class is a challenge. I am committed to supporting students who may be falling behind, believing that being patient and supportive are the key to helping them get back on track.

Students who have a hard time in class may often feel frustrated and lack confidence. They can easily sense any impatience from the teacher, which can diminish their motivation to learn. In my sessions, I consistently encourage my class to ask questions, making it clear that "I expect questions" and that "no question is stupid".

I also consistently remind them of my office hours and encourage them to attend. Office hours offer a valuable opportunity for me to assist students in a more personalized manner, especially for those who are lagging behind. During the office hours, through interactive discussions, I know better my students' challenges so I can tailor my assistance accordingly. For instance, through the several conversations with a student during my office hours, I learned that his main difficulty in keeping up with the course was that he had never learned certain contents that the course assumed the class to know. I therefore helped him review those contents. After several weeks, I observed an obvious improvement in his scores on the quizzes.