

The best teachers are not those who know how to stand in front of a class and deliver hour long lectures or solve difficult problems on the blackboard. To be a good teacher means to understand your students, to sense their needs and to convey the joy and excitement of learning which you yourself experienced when first learning the subject. Those who have never felt the high of that moment when something first "clicks", when your perspective on some part of existence is forever changed in an instant, cannot in turn be good teachers. For they cannot convey to the student a feeling which is alien to themselves. And it is the experience of this feeling, of the sheer joy of discovery, which makes learning a truly rewarding experience.

Allow me first to summarize my core beliefs and approach toward teaching, following which I will provide a lengthier discussion of the evolution of these beliefs:

1. **To uplift the weakest:** Teaching should be designed to uplift the weakest of students, rather than to strengthen the skills of those who are already capable. In any type of class-based, collective mode of instruction, there will always be a spread in the capabilities of the students. Nothing pleases the heart of a teacher more than to interact with the smartest kids in class, the ones who are most willing, eager and capable of learning. The opinions of the best students are often used as a barometer to measure the effectiveness of a teacher. However, doing so is a disservice of our position as teachers. The smart kids will manage some way or the other. The curriculum and teaching methods should be targeted to the weakest students. It is those who need the greatest help. If we let them fall behind we betray our fundamental duty as teachers.
2. **To ensure equitable treatment:** In any modern society, students in any institution come from a diversity of social, economic, linguistic and religious backgrounds. Unfortunately technological limitations do not yet allow us to overcome linguistic barriers. There must be a preferred language for instruction. What can be done, is to ensure that every student is given sufficient and adequate opportunity to improve their skills in the language used for instruction. Further, instructors must also be sensitive to the varying religious beliefs and backgrounds of their students. Humour is an essential ingredient for maintaining students' attention in class. While an instructor cannot submit their freedom of expression to the altar of political correctness, one should be careful not to indulge in jokes that unnecessarily denigrate any community or gender. Knowing how to provoke students to think and question their own beliefs without offending them or making them feel targeted, is an important skill for a good teacher.
3. **To encourage the exceptionally talented:** Adhering to the first two points above can have a negative effect on the morale of talented students. While ensuring equity and fairness in education is a worthwhile goal intended for the benefit of the many, such an approach will necessarily lead to dissatisfaction and disenchantment

with the education system in those who are extremely talented. The peculiar talents of exceptional students cannot be neglected. Their talent must be recognized, encouraged and they must be provided with opportunities to learn at a rate more suited to them.

4. **To make learning fun:** "Fun" is often thought of as being inherently contradictory to being a productive worker or to being a good student. This is based on an incorrect assumption about human nature. We are at our most productive when we enjoy the task entrusted to us. This is not to say that the learning process is or can be pure joy. It will necessarily be, in turn, tedious, slow-moving and frustrating. However, at the end of all that tedium and hard work there must lie some promise of excitement and a sense of discovery. It is the teacher's task to generate and to maintain such a hope in students', whether by various means which could include inspirational stories, quotes, videos, hands-on activities, in class demonstrations, class trips to external facilities or inviting external speakers.

I will now provide a glimpse at how my teaching philosophy has evolved over time.

I have been involved in teaching in various capacities since the year 2000. That was the year I joined the undergraduate physics program at the University of Missouri at Rolla (UMR)¹. As a foreign student, I was perennially in need of money and to supplement the financial assistance provided by my parents I quickly joined evening tutoring sessions organised by the University. I was a freshman, but I benefitted greatly from the fact that I had spent much of my high school years in teaching myself the physics and mathematics which is normally considered part of the American college curriculum. Consequently, by the time I started my undergraduate studies, I was in a position to start helping my peers navigate the difficult terrain of introductory physics and calculus.

In 2003, after completing my Bachelor's in physics from UMR/MUST, I joined the physics graduate program at the Pennsylvania State University hoping to do research in the budding field of loop quantum gravity (LQG). There were very few places in the world where one could study LQG at that time and Penn State happened to be on top of that list. Like most other graduate students I was supported by a fellowship which required me to supervise laboratory sessions for undergraduate freshmen taking introductory college physics. Strictly speaking, my job was to instruct the students on how to perform the lab experiments and to grade their lab reports afterwards. In practice I found myself using the first twenty minutes or so of our two hour lab session to provide students with a quick overview of the physics content which they were supposed to have learned during lecture. For whatever reason, the official lectures left most students feeling little better off than if they had not attended the lectures at all. I think much of the blame for this lies in the affliction I call "PowerPoint-itis" which has overtaken much of college teaching in the industrialized world and elsewhere. The net effect was that my lab sessions became mini lecture sessions through which I learned a great deal about how to effectively communicate with students.

¹now known as the Missouri University of Science and Technology (MUST)

In my experience while slide shows are useful in certain classroom situations, there is no substitute for a "chalk talk". When a student sees the instructor take the time and effort to work out the equations in front of the class, rather than simply regurgitating a packaged powerpoint or pdf document, they feel a certain kinship with the instructor. I believe this comes from the most basic principle of leadership that we cannot ask others to do something when we ourselves are not prepared to do it. A student seeing an instructor take the time and invest the effort in working through derivations or problems in class feels far more motivated to repeat those steps than by seeing the instructor flip through a series of slides.

This is not to say that knowledge can only be conveyed via writing equations on a blackboard. I often use animations and videos to illustrate many concepts - for e.g. beat phenomena in waves, length contraction and time dilation in special relativity, non-inertial frames and pseudo-forces in classical mechanics - to great effect. In class demonstrations are also very effective. To demonstrate the effect of a pseudo-force in an accelerating frame of reference, for instance, one can use a piece of chalk placed on top of a smooth surface such as that of a cellphone which is then accelerated briefly and brought to a stop. At the end of this motion we see that the chalk has moved forward, but the surface has moved even further, implying that chalk was moving in a direction opposite to the direction of the applied external force as is expected from a simple analysis of forces and velocities in the lab and moving frames of reference, respectively.

I hope that this statement gives some idea of my teaching philosophy. Of course, teaching is a dynamic process and I am always trying to revise my methods and techniques to better address the changing needs of my students.