

# Teaching Philosophy

Michael Kolios

Teaching is a very challenging endeavour. In fact, I would agree with one of the scientists I have admired the most, an amazing teacher and mentor to many, the late Richard Feynman: "I don't know how to do it". Feynman was astonished by the fact that his son and daughter would learn in totally different ways. What would work brilliantly for one would fail for the other. One can imagine that if there was such a difference in understanding between two students with so much in common, including their teacher, environment, upbringing, etc., then when one considers students from various environments, backgrounds and phases of their development, it may seem impossibly difficult to ensure that each and every student understands what it is you are trying to explain. Teaching is indeed a very, very difficult challenge. There are however a set of guiding principles to which I adhere to overcome the challenge.

Before I explain these guiding principles, I would like to talk a little more about Feynman. His published lectures (The Feynman Lectures on Physics) were a pleasure for me as I read them in preparing for my first year physics lectures when I initially came to Ryerson. He himself was a very talented pedagogue of a topic that makes many people cringe at the mere mention: "physics". His first year class lectures are legendary: he is known as the "Great Explainer". It is said that he took great care when explaining topics to his students to ensure that the topic was not arcane, but instead readily accessible to his students. This has been a guiding principle of my philosophy while teaching at Ryerson for the past ten years: you have to always think of the intended audience, determine what you want them to understand, treat them with respect and provide a series of lectures which are very well organized, clear, to the point and accessible. I have taught physics to a variety of audiences indeed: to general arts students, to science students and to engineering students. I have taught both undergraduate and graduate students. It is really interesting to see how they respond to the lectures and what it is that motivates them.

The principles I follow are:

1. Have a clear understanding of the intended audience, why they are taking the course and what you want them to know by the end of the course. This is critical, as common pitfalls in teaching physics are either the presentation of material beyond the students' comprehension or the offering of material that is irrelevant to their training program. Physics is an abstract topic that is difficult to understand even when well presented; teaching at an inappropriate level or lecturing on material for which the students do not see the relevance to their program will make the experience frustrating to both student and teacher alike. Therefore, I always include many examples of physics applications in the biomedical field for our science students, engineering examples for our engineering students and explanations of everyday phenomena for our arts students. This relevancy is important, as it facilitates their understanding and motivates them.
2. Be well prepared and organized. This is something that should be obvious: it is difficult enough to understand a topic when first presented (especially physics!); having it presented in an unorganized manner will lead to confusion and inhibit learning. I have cringed at reports that have been written by students (or, for that matter, by professors submitting papers or grant applications) at the last minute and for which I spend an inordinate amount of time and effort trying to understand what they mean. I anticipate that the experience would be much worse for a student being presented material in a disorderly fashion. Moreover, a mastery of the subject presented is a prerequisite to good teaching. One must be able to answer the students' questions, and try to explain any abstract concepts in many different ways. If I do not know the answer to a question, I say so. Then in the next lecture I give the answer, and explain how I arrived at it.
3. Make sure the lectures are accessible to the students. The material must be of the appropriate level, and one must do research to find out how well prepared the students are. This is a very difficult task, but richly rewarding when done properly. Also, I try to use humour in the classroom when appropriate, in cases of long solutions or derivations. When discussing wave motion for example, I talk of "making the wave" during a Blue Jays game and what happens when the wave encounters fans that perhaps imbibed too much alcohol. Engaging the students in this way is very productive.
4. Be interactive in the classroom. This perhaps is one of the most difficult goals to achieve in contemporary undergraduate lectures that have potentially hundreds of students, but it is very important. Therefore, I always ask questions during a lecture, and in fact I must ask a minimum of

2 or 3 questions every ten minutes. I try to use the Socratic approach, as it truly engages the students. When time permits, I include class demonstrations. I have brought mirrors to demonstrate the laws of reflection (to the horror of some of my students sitting in the first rows of my class), tuning forks and gum to demonstrate resonance and beats, long Slinkies for standing waves, and invite students to participate in all such demonstrations. In a recent class last week, I had a student actually write a solution on my tablet computer (which is displayed so that the entire class can see) and then I politely explained, while drawing on top of his solution, where he may have erred.

5. Treat students with respect, but seek to earn their respect also. The students should be treated as you would treat a colleague. This is paramount, as it is particularly damaging to the learning experience to have a relation with the students in which they perceive themselves as being treated arbitrarily or unfairly. The old saying "Do unto others as you would wish them do unto you" comes to my mind. In turn, the student must also have clear knowledge of what the expectations are and that deadlines are deadlines. Respect from the students must also be earned, not only inside but also outside of the classroom to have a richer learning environment.

In summary, even though teaching is a difficult endeavour, I have found that following the above principles has yielded an excellent rapport between me and my many undergraduate and graduate students. These interactions have been very satisfying and fulfilling. Many of these principles are a matter of common sense, yet one must be vigilant in adhering to them. I really do love teaching undergraduate and graduate courses, and I am grateful that my students realize this and have told me how motivated they are by my enthusiasm.