Teaching Statement

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Teaching philosophy

Much of my experience as a teacher is composed of one-on-one interaction either as a tutor, particularly for high school students, or a research advisor for undergraduate students. This has allowed me to see up close and in great detail the different stages of understanding and to have a complete view of how a student transitions from one stage to another. This, I feel, has given me a very solid foundation for classroom teaching.

The common dilemma in learning is that many students will try to take the easy way, often by rote memorization. However, not only is that extremely unhelpful for their further career, it is by no means the easiest way in the long run. This mismatch is often caused by a lack of self-confidence, as the student may feel the concept is beyond their grasp. Of course, most graduates learn that the concepts were completely within their grasp had they simply braven them. I see this subtle encouragement as a key role of an educator, especially in a technical subject such as physics. Gently steering the student toward the barrier in understanding, and then give them the key tools, possibly with a hint or two, to make the breakthrough on their own. No matter how small the final leap, it will often have a significant impact on their self-confidence.

Such a method is naturally less easy to wield in a classroom compared to one-on-one tutoring, advising, or during an office hour, but I believe the concept is still sound. The main challenge will come at finding a pace that will serve both the student that is struggling the most, as well as the one who has already absorbed it all. Thus, I prefer to build understanding of a topic from the ground up, ensuring a strong foundation. This will greatly help with understanding of latter, more advanced topics, as well as give insight to how the layers of understanding have been built through the history. The course content should ideally proceed in a manner where earlier course content will provide both context and mechanical background for later topics.

I prefer that each lecture consists of one main topic, potentially divided into discrete subtopics. Likewise, each topic should be discretized enough to fit in one lecture, if at all possible. Additionally, a lecture might start with a brief, five-minute review of the earlier content pertinent for the topic in question to assist those students who may still lack deep understanding.

In my own learning I have always found it easiest to explore examples that are based on, but more advanced than, earlier topics. Physics, in particular, is almost ideal for this type of learning, given that most topics in physics consist of levels of simplifications. Often, the course starts with basic theories and the simplest possible understanding, and proceeds to investigate what happens when some of these simplifications and assumptions are removed, or how the problems can be solved in more complex geometries.

Eventually, physics education should give the student the knowledge and the tools to apply their skills for real-world problems, whether working in physics or another industry, such as engineering. Basic core concepts such as levers and torque, heat transfer, and kinetic energy and braking can be helpful for everyone, not just those seeking careers as physicists. At the same time, a teacher should be willing and able to keep the advanced, physics-focus students interested and challenged to help them prepare for their individual career objectives. An effective teacher will also be able to have their students learn how to learn, and how to approach problem solving in face of challenging problems.

Role of students in research

I enjoy working with students, and I do my best to help them realize their full potential. I was lucky to be the primary adviser of a student at my previous job in Finland, and at Kansas State University I have advised or co-advised four undergraduate students and a graduate student. I believe undergraduates are often underutilized in research. In my view, what they lack in experience of advanced theories and methods, they usually make up in being extremely motivated, as well as familiar with the newest technologies. Naturally, their projects have to be chosen to match their skill-set and to work around their schedules during the school year, but that is a small price to pay for seeing the excitement in working in research, and the joy and satisfaction in succeeding in it.

I have been very fortunate with students I have worked with, as many of these advisory relationships have been very productive. As an example, we published a paper together with the Finnish student after his project. Additionally, there is another paper currently in final stages of preparation about the work we did with another student, a very bright female physicist who even chose to accept the offer by Kansas State University for her Ph.D. a year after her undergraduate research project. Last, but not least, two of our engineering double-major undergraduate students have been absolutely invaluable in our instrument development project, and it has been extremely pleasant to see them take charge of their respective projects, and constantly exceed my expectations with their work ethic and steady delivery of results.