

Timo A. Lähde
Department of Physics,
University of Washington,
Seattle, WA 98195-1560, USA
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TEACHING STATEMENT

The study of physics is of fundamental importance to a large variety of scientific disciplines. As a consequence, the teaching of physics at the undergraduate level is likely to involve a diverse student population with a broad range of prerequisite knowledge. The ambitions of the students are also wide-ranging; it is rarely a foregone conclusion that most participants in a given course are planning to pursue a career as a researcher, or that physics is even the main subject of their curriculum. In my experience, one of the main challenges of the teacher is to provide a properly balanced mixture of topics for each course, while simultaneously giving proper stimulation and attention to those inclined on eventually pursuing a doctoral degree.

The students of physics at the university level face important career-related decisions far earlier than is commonly realized, as the choice of courses taken will eventually have a great impact on their future. As an example, the choice of highly abstract topics such as quantum field theory is well motivated for a student interested in a career as a researcher in theoretical physics, but unlikely to be the best choice for someone aiming for a future in the electronics industry. As preliminary choices in these directions have to be made rather early on, proper input and advice from the teacher can be critical in preventing later frustration and disillusionment. In my experience, it is highly advantageous if the role of the teacher progresses, in the mind of the student, towards that of advisor, mentor and colleague already at this early stage.

When giving lectures and supervising recitation sessions, I have always placed great emphasis on the thorough understanding of physical principles and the applicability of different methods of solution. In this way, homework problems are turned into miniature research assignments in their own right, and the independence of the correct solution on the particulars of the method used is brought out. For me, this often led to highly stimulating discussions with the students, who came to view me as approachable, and as more of a colleague than a superior. I often asked the students who had failed to solve a given problem to present their attempted solutions on the blackboard, so that the difficulties could be addressed through a friendly interaction within the group. I have found that such an approach mimics research at the professional level, and serves to alleviate feelings of inferiority among the less proficient students.

During my time as undergraduate and doctoral student at the University of Helsinki, I was given the opportunity to participate, first as secretary and later as chairman, of a committee planning the courses to be lectured in the Swedish language, according to the requirements and wishes of the students. While originally intended as a means of optimizing the use of limited manpower resources, this gave me a unique opportunity to gain feedback and listen to the concerns of students and teachers alike, and to gain insight into the problems that students face at various

academic levels. As I had already taken most of the courses offered at that time, I also enjoyed sharing my experience in order to support the efforts of the students.

As a postdoctoral researcher, I have often been approached by students wishing to discuss their thesis work, beyond the time constraints of their official advisors. When such opportunities have presented themselves, I have often spent many hours discussing not only the immediate mathematical concerns and problems facing the student, but also giving more general advice on the nature of science, careers in physics, applications for jobs in science, and the philosophy of research. It has often been stated that the perfect researcher "thrives on adversity", and it is certainly true that the open-ended nature of research projects and the minimal guidance in the postdoctoral world favors a certain type of personality. Such stereotypical statements aside, my personal experience is that the sooner the teacher assumes the role of coworker and colleague in the mind of the student, the easier the transition from student into a successful and independent professional will be.

The mentoring of doctoral students and beginning postdocs presents a whole spectrum of challenges in their own right. As the success of a theoretical physicist depends, in the long run, on the ability to extract useful numerical as well as analytical results from complicated calculations, it is of great significance that the student acquires such skills at an early stage. An important task for the advisor is to familiarize the student with such methods, and to guide the efforts of the student towards topics that are likely to attract interest and to be of relevance to the progress of science. With respect to the latter point, the study of recent professional research papers should be encouraged, preferably in a group such as the "Journal club" I participated in during my stay as a postdoc at Lund University. The advanced graduate student and the beginning postdoc should also be encouraged to give frequent oral presentations at conferences and workshops; in this way, their research will be noted and valuable contacts gained for future collaboration.

Although the ability to sustain a concentrated and productive effort in a particular field of study is a valuable asset, the trend of hyper-specialization and fragmentation currently prevalent in many fields of science should be balanced by encouraging the student to start research in a new topic at least once every few years. To facilitate such a process of self-reinvention (which in my opinion is typical of outstanding minds) and also to increase the impact of the student's work on the scientific community, the collaboration with other scientists at the international level should be encouraged already at the postgraduate level. If the student is well networked with established scientists at other institutions, the probability of success during the postdoctoral career stage and beyond is dramatically increased.