Teaching/Mentoring Interests and experience: Abdelghani Laraoui, CHTM-UNM

The opportunity to teach students is one of the main reasons why I seek a career in academia. I view teaching as one of the most exciting challenges of being a professor in the Department of Physics & Astronomy at Texas Tech University. For example, there are a wide variety of students who take physics classes: electrical engineers who take physics courses as part of a well-rounded education, undergraduates whose future profession (for example, nano/biotechnology) will require a fundamental understanding of basic physics principles, undergraduates who plan to pursue a PhD in physics, and graduate students who will one day contribute to the field of physics and engineering in industrial, government, or academic positions. As a professor at TTU I will aim for excellence in all my teaching opportunities.

Teaching Philosophy

As a creative art, teaching relies on establishing effective communication between two minds of varying capabilities and intellects. In a way, I interpret that teaching is a transfer of knowledge from a teacher to students through reciprocal interactions. From this point of view, a well-knit teaching method can leave a long-lasting imprint on a student's mind—the logical flow of information can engage students in learning a subject, irrespective of their previous academic background. Based on my interdisciplinary academic training, I appreciate that classroom teaching can prepare students to apply knowledge and skills, gained from studying a specific subject, to a variety of areas. Importantly, classroom teaching offers a unique and interactive means for motivating students toward a self-teaching process. My teaching and mentoring experiences have made me realize that a key element of an effective teaching method is to steer students to connect their ideas on a topic and to organize their thoughts about a subject. Through interpreting scientific concepts from multiple perspectives, my basic teaching approach, therefore, relies on my constant attempts to draw students' attention, to expand their views and understanding, and to motivate them toward an independent thinking process. Thus, two interlocking focal points of my evolving teaching technique center on my endeavors to balance and refine avenues to engage students in learning and to strengthen their ability to use the acquired skills.

Teaching and Mentoring Experience

As a graduate student at the university of Strasbourg in France, I had the pleasure of being a TA for three physics courses: one course for non-science/engineering majors and two introductory courses for physical science/engineering majors. Drawing from modern physical science education principles related to us through a special course for TA training, I learned the value of using techniques beyond the chalk lecture to keep students actively engaged in the material. These include working through problems in small groups, addressing multiple ways of learning (visual, mathematical, handson, etc.), and creating an environment where students from diverse backgrounds and levels of ability feel safe in interacting. For example, in the course for non majors, I often began my classes with an exciting demo (some of which I had always wanted to try and was performing for the first time) that was in some way related to the material we were covering in class. While not every demo went exactly according to plan, each one was followed by a discussion about the underlying principles which would sometimes evolve into a creative brainstorming session on ways to improve the demo. Above all, I believe my intense enthusiasm for the physical sciences can be infectious and my eagerness to share knowledge with others will draw students to engage in the course material.

During my years in graduate school, I also engaged in numerous outreach activities which gave me the opportunity to think creatively about how to design curricula and share knowledge with a wide audience. I served as an after-school instructor for high-school students in Strasbourg, France. I organized lab visits for these students at the Institute of Physics and Chemistry of Materials of Strasbourg in France and performed basic optics/laser experiments in nonlinear optics. Many of these students decided to follow a career path in science and engineering. Prior to my graduate studies I served as a middle-school teacher of physics for one year in Algeria. My approach to teaching these students was to go beyond merely memorizing "the scientific method" or following a standard experimental protocol. I encouraged students to think and about what constitutes an important problem and then worked with them to design experiments we could test even with our limited resources.

Another element of teaching I believe is extremely important is effective mentorship. As part of my academic training, I served as a mentor for undergraduate students at the University of Strasbourg, University of Kaiserslautern, CCNY-CUNY, and UNM, where I advised students from underrepresented backgrounds about the graduate school process and careers in science and engineering. My PhD and postdoctoral advisors were truly outstanding role models in this regard. During my time in their labs, I had the opportunity to mentor a number of undergraduates, graduate students, and postdocs. Examples include undergraduate Henry Wong (now a grad student at UCLA), master's student Halley Aycock-Rizzo (now a grad student at Syracuse University), graduate student Florin Ciubotaru (now an R&D Senior Researcher at IMEC-Belgium), and postdoc William Knee-Walden (now a research scientist at the University of Toronto). In each case, I helped the trainee design experiments which could be completed in the allotted period of time, would produce valuable insights for our field, and would leverage the students' strongest skills. I also encouraged presentation at conferences, guided trainees through the academic publishing process, and have continued to help with advice on careers in physics/engineering. The most recent example was graduate student Halley Aycock-Rizzo, a physics major from City College of New York and a design engineer in New York City who worked in our lab. Halley had decided he wanted to try out experimental science, but had no experience beyond a general lab course. We designed an experiment based on ideas I had proposed as a postdoc scientist but leveraged Halley's computing and 3D design. By the end of the project Halley was able to operate a state-of-the-art magneto-optical fluorescence microscope integrated with an atomic force microscope on his own. The project culminated a publication in Nature Communications [A. Laraoui, **H. Aycock-Rizzo**, et *al.*, Imaging thermal conductivity with nanoscale resolution using a scanning spin probe", ***Nature Communications*** 6, 8954 (2015)], which has already made an impact on the field of nanoscale thermometry. Watching trainees start from mere interest and almost no experience to accomplished experimentalists is one of my favorite parts of being a scientist.

Teaching Interests: Pathways for evolving teaching approaches

At TTU I wish to teach basic physics courses such as Electricity & Magnetism, Optics, Classical Mechanics, Instrumentation, and specialized or upper-level core courses such Solid State Physics, Nonlinear Optics, and Quantum Mechanics. I am interested in developing a new curriculum that aims to blend various topics of the physical sciences such nanophotonics, quantum optics, nanomaterials engineering, etc. I always tend to adapt and incorporate new ideas since the process of teaching any course requires continuous development and modification. I have recognized that the use of technology can breathe new life into the traditional way of teaching a subject. A web-based source encourages an unrestricted and convenient transfer of information because all of the material remains available without the time limitations of the classroom. Any spontaneous discussion can also be boosted by online discussion forums of course topics using a web-based program such as blackboard, thus helping students to grasp challenging topics that may have not been completely covered in the classroom. The use of interactive and web-based problem solving sources can assist students to digest complicated materials as well. From this viewpoint, a proper and balanced fusion of technology with pedagogy can enrich traditional teaching practice by improving the communication process. As experimentation is an effective way to learn a scientific concept, my approach is to draw on the laboratory courses to complement the discussions in class and underscore applications of the subject taught in the class. Depending on available infrastructure and the level of a laboratory course, I intend to import a flavor of contemporary experimental techniques along with a possible connection with computational methods, and encourage a student's creativity by undertaking an original research and/or a teamwork-based project.

Finally I am interested in exploring ways to encourage greater interest in the physical sciences for students who may not have originally come to Texas Tech University to study physics. I believe one of the keys to attracting more underrepresented minorities is to reach out to more of these students who have raw quantitative and/or experimental skills but do not come to TTU razor-focused on a career in physical sciences. I also expect that my substantial outreach efforts have given me experience in promoting the diverse environment many of us in physical sciences seek.