Teaching Statement

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Six years of experience teaching diverse groups of learners and designing relevant curriculum have equipped me with an example-driven teaching philosophy and an inclusive, interactive teaching style. Many years involved in the national laboratory system and in the technical divisions of the American Nuclear Society (ANS) have also afforded me an overview of the national nuclear engineering research landscape that will be essential to advising students in their research at Fancy University.

Teaching Experience

There is an unmet need for software development training in nuclear engineering [1, 2]. In graduate school, I responded to that need by establishing a student organization (The Hacker Within (THW)), creating curriculum, and teaching workshops. As a postdoc, I wrote a book [3] and chaired the steering committee of the Software Carpentry Foundation (SCF), an international non-profit devoted to scientific computing education [4, 5].

In nuclear engineering guest lectures, I have taught and developed curriculum for numerous undergraduate and graduate-level classrooms. However, the bulk of my teaching has been in a workshop setting. With THW and the SCF, I have designed and taught scientific computing curriculum in seventeen workshops to total of approximately six hundred students.

These workshops varied from two to ten hours per day and from two days to two weeks in length, addressing topics such as the UNIX Shell, version control, databases, Python, C++, unit testing, and mathematical, scientific, and plotting libraries. During these workshops, I had the opportunity to teach very heterogeneous groups of students. Typical workshop demographics included students at the undergraduate, graduate, and faculty level and traversed disciplines from physics to limnology [2].

Teaching Philosophy

Through experimentation with instructional design and teaching style as well as direct feedback from learners [2, 4], my teaching philosophy has come to emphasize inclusive student engagement as well as example-driven, interactive curriculum.

In both classrooms and workshops, I try to avoid lengthy soliloquy by interjecting short, relevant, interactive exercises into the lesson. In the workshops, for example, conceptual explanations a few minutes in length are followed by similarly short problem solving sprints. During these sprints, both I and my students actively engage the task. This requires that each student be seated at a computer and ready to actively participate. Combined with targeted strategies to reduce stereotype threat and overt bias in the classroom [6, 7], such hands-on engagement in a supportive classroom environment can be extremely effective at engaging students across skill levels and backgrounds [8].

However, this interactivity is only effective when concepts are also introduced in a well-ordered manner. Ideally, a student should form a clear mental map of concepts and ideas and gradually become prepared to link concepts and categorize ideas when confronting a new challenge. Such a map can only be conveyed with instructional design that reflects the well organized concept map of the instructor [9].

Teaching Interests

My physics and nuclear engineering background have prepared me to confidently teach a number of classes in the department at Fancy University. New courses that I might bring to the department would build primarily upon my research and teaching experience in modeling and simulation, fuel cycle analysis, waste management, and nuclear energy policy and analysis.

For example, I am prepared to fundamental nuclear engineering courses already offered in the Department of Engineering Fanciness and Nuclear Engineering such as NE111, NE222, and NE333. Also my research in computational nuclear fuel cycle and repository analysis have amply prepared me to teach courses offered in nuclear fuel cycle analysis (i.e. NE121 and NE232) and nuclear waste disposal modeling (i.e. NE666). The highly computational nature of my current work, some graduate coursework in radiation transport methods, and my experience teaching scientific computation are a good foundation on which to instruct numerical modeling courses such as NE555 and NE556 . Also, my research experiences in experimental accelerator and telescope physics have prepared me to teach a number of additional fundamental courses having to do with accelerator and detector physics (i.e. NE434).

In addition to supporting the department by teaching existing courses, I am prepared to expand the curriculum in three primary areas of my expertise: computational methods for nuclear engineering, waste disposal modeling, and energy systems analysis in the context of nuclear energy.

A course on 'Computational Tools for Nuclear Engineering,' for example, could address the need for software development training that has driven my teaching thus far, but would be tailored to a nuclear engineering skill set. Focused on nuclear engineering modeling and simulation, this project-driven semester would motivate use of a suite of software development practices emphasized in my book, Effective Computation in Physics [3], which was designed to accompany such a course.

I would be particularly delighted to develop a pair of courses in the area of fuel cycle policy and analysis. The first, 'Fuel Cycle Modeling and Analysis,' could cover fuel cycle metrics development and computational modeling techniques for analyzing the impacts of potential technology and policy choices. I envision using Cyclus as a learning tool for homework exercises that drive toward an analysis capstone project. In this capstone project, groups of students would synthesize lessons of the course into a relevant Cyclus module development or simulation and report.

Another class introducing 'Nuclear Energy Economics and Governance' could cover important economic considerations of nuclear energy as well as relative roles of public utility commissions on the local scale, the Department of Energy (DOE) and Nuclear Regulatory Commission (NRC) on the national scale and the International Atomic Energy Agency (IAEA) on the global scale. Such a course would draw on my research interests in the impacts of energy policy, as well as a suite of coursework I took in the Energy Analysis and Policy program at the University of Wisconsin as a graduate student.

Finally, a more advanced course on 'Computational Modeling of Environmental Impacts' might follow your current course on waste management, NE666. Such a course could cover computational modeling methods for analyzing the environmental impact of used fuel storage and disposal, contaminants, and effluents from an array of nuclear power generation processes.

References

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