

Department of Physics & Astronomy

PHYSICS NEWS FLASH

New Faculty Member Specializes in Physics Education Research

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By Serena Dai

New physics instructor Dr. Debra Krause Dandaneau is the first faculty member specifically hired to conduct physics education research within the Department of Physics and Astronomy at the university.

“Science education research was traditionally conducted through Colleges of Education . . . now it is more widely recognized that individual science departments have a very important role in researching how to teach their subject matter effectively,” Dandaneau says.

She is currently working on the department’s initiative to restructure the physics curriculum to include intermediate level physics courses for general track majors. These students plan on using their degrees as background for fields such as education, law, medicine or journalism. She calls the sequence “Postmodern Physics” in part to draw attention to the courses and in part because for many students, they will follow the Modern Physics course taught by Professor Marianne Breinig.

“Science progresses in paradigms; the curriculum is broken up,” Dandaneau says. “[The new classes] will blend traditionally separated sub-disciplines of physics... to help majors learn the underlying concepts.”

At Oregon State University, the only other university Dandaneau knows of with a similar program (Paradigms in Physics), enrollment of physics majors increased by 140 percent after restructuring the standard curriculum. Dandaneau strives to do just as well here, especially with Tennessee’s need for more qualified physics teachers.

Dandaneau’s unique background explains her interest in physics education research. After receiving a bachelor’s in physics from the University of Dayton, she taught high school for two years while completing the coursework for a master’s in education from Wright State University. She left teaching to become a research engineer for Wright-Patterson Air Force Research Laboratory, which financed her master’s in electro-optics at the University of Dayton. Later, she went to get her Ph.D. in physics at the University of Colorado, where Nobel Laureate and faculty member Carl Weiman was establishing a physics education research group.

Although Dandaneau did not work with the group, she became interested in the subject; after she received her Ph.D. in experimental condensed matter physics, she switched to physics education research.

“Now that I’m teaching for UT and working on physics education projects, I am able to try

research-based teaching techniques I'd read about and develop my own ideas ...I feel like I'm more creative than I ever was in the lab," she says.

Dandaneau also plays a role in the new experimental high school for gifted science and math students, the [Tennessee Governor's Academy \(TGA\)](#). She is helping to develop the curriculum and is designing ways to monitor the students' progress. She also will be conducting some of the students' on-campus learning, including laboratories.

"I want students to do labs, projects, and even make demonstration equipment...using a hands-on approach," she says. "The more I can get them to do, the better."

Even in her lecture-based classes, Dandaneau strives for interactive learning. For the "How Things Work" class she is teaching in fall, she will assign lab-based group-homework in addition to having her students answer questions during class.

"I have these 'clickers,'" she says, holding up a stack of index cards labeled with letters and colorful Post-It Notes. "I give multiple choice concept questions during class, and they hold up the color for what they think the answer is."

Because of the cards' success, Dandaneau plans to implement more expensive "real clickers" in the fall. Eric Mazur, a physics professor at Harvard who has researched the effective use of clickers, is even expected to visit campus next spring.

The TGA begins in August, and Dandaneau teaches "How Things Work I" and "Elements of Physics I" this fall. "Postmodern Physics" (officially called "Intermediate Physics") will start in the spring.