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Remote controlled learning: MSU computer engineering labs going online as part of pilot program

July 17, 2009 -- By Michael Becker, MSU News Service

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BOZEMAN -- Montana State University computer engineering students will soon have the ability to control real laboratory equipment from the convenience and comfort of their home computers, thanks to a \$148,000 grant from the National Science Foundation.

The two-year grant will help the MSU College of Engineering determine whether students learn from Web-based laboratory courses as effectively as they do from hands-on courses, said the grant's principal investigator, [computer engineering](#) assistant professor Brock LaMeres.

In addition, LaMeres' research could one day lead to more distance learning options for students at other Montana colleges and even high schools by providing remote access to advanced scientific equipment.

"All of our engineering classes have a major laboratory component to reinforce the classroom concepts," he said. "But now students are wanting more online classes."

Online courses tend to be more convenient for students, more popular and less expensive to operate, [LaMeres](#) said. But engineering has struggled to deliver online offerings because so much of the field requires hands-on work with machines and other instruments.

Engineering programs across the country have tried to overcome this difficulty by distributing "lab kits" or making computer simulations available for online courses. MSU is one of the first universities in the country to make it possible for students to control real equipment remotely using their computers, LaMeres said.

"In theory, it's the same experience, but you're not physically located in front of the instrument," he said.

LaMeres will use the grant money to buy four to eight devices called logic analyzers -- instruments that allow students to see and measure data moving between a computer microprocessor and memory chips. The devices cost about \$10,000 each and can be controlled remotely using Web-based software.

Then, over the course of two academic years, LaMeres will modify an existing microprocessor course and assess how well his students learn using the logic analyzers both in-person and online.

"One of the results might be that they don't understand the material if the equipment is not right there in front of them, and we need to know that," he said.

Comparing a hands-on version of a course with an online version is fairly unique, said Carolyn Plumb, director of educational innovation and strategic projects for the College of Engineering. Plumb is co-principal investigator on the NSF grant and will help assess student learning in LaMeres' microprocessor course.

"The College of Engineering would like to provide some quality educational experiences for students at a distance," she said. "Any research that can compare the distance learning experience with the face-to-face experience is going to be helpful."

While student demand is the main motivation for the pilot courses, LaMeres said another reason for the research is to eventually help students at other Montana schools.

LaMeres envisions that students at community colleges or high schools could arrange Web access to the equipment at MSU. That would provide those students with valuable laboratory experience and save the schools travel money.

Plus, being able to keep pace with MSU courses will help students seeking to transfer into MSU engineering programs, he said.

LaMeres noted that online is not an option for all engineering courses and that the Web will never completely replace hands-on experiments.

"It's well-suited for what we're trying to do: digital electronics," he said. "But if it's successful, we're hoping we could deploy this throughout our curriculum."

The grant, which was awarded July 1, comes from the NSF's [Course Curriculum and Laboratory Improvement program](#). The program helps improve undergraduate education by creating and spreading learning materials and teaching strategies that reflect scientific advances and modern theories about teaching and learning.

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ELECTRICAL AND COMPUTER ENGINEERING

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Prof. LaMeres receives NSF curriculum development funding

Dr. [Brock J. LaMeres](#), Assistant Professor in the Electrical and Computer Engineering Department, and Dr. Carolyn Plumb, Director of Educational Innovation in the College of Engineering, were recently awarded a \$150,000 grant from the National Science Foundation (NSF) to study how student learning is impacted by incorporating measurement-based, online laboratory experiments into engineering courses. Congratulations, Prof. LaMeres!

This important project was selected based on peer review by NSF's highly competitive Course, Curriculum, and Laboratory Improvement program.

Over the past decade, technology has enabled wide spread adoption of online course delivery. While online education is attractive from a cost and convenience point of view, engineering courses are often unable to offer this method of course delivery due to their heavy reliance on hands-on laboratory experiments. Prof. LaMeres and Dr. Plumb will develop a set of measurement-based, online laboratory experiments that will be used in a junior level microprocessor course. Prof. LaMeres is hopeful that the results will lead to expanded online course offerings without sacrificing the importance of hands-on lab work.



Brock LaMeres (right) works with ECE student Boe Jensen in the Tektronix Digital Systems Lab