

UW Research on Gaming and Robotics to Boost Math Learning Supported by NSF Grant

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Can gaming and robotics be used to teach computational thinking skills to middle school students in culturally sensitive ways?



Jacqueline Leonard, director of UW's Science and Mathematics Teaching Center, leads a multidisciplinary team to train teachers to develop mathematical and scientific lessons that are culturally relevant to their students. (UW Photo)

A multidisciplinary University of Wyoming research team will explore that and related questions with the support of a three-year, \$1.2 million grant from the National Science Foundation's (NSF) Innovative Technology Experiences for Students and Teachers (ITEST) program.

UW's project will engage middle schools in at least 10 Wyoming school districts. UW Science and Mathematics Teaching Center (SMTc) Director Jacqueline Leonard has drawn together a multidisciplinary team from the UW Colleges of Education, Engineering, and Arts and Sciences to research a question that has been part of her research agenda for several years.

During the multiphase project, team members will train teachers to develop mathematical and scientific lessons that are culturally relevant to their students. Leonard says they will support educators as they implement those lessons. They will work with the teachers to analyze the impact on students' overall learning. Finally, the research team will work with participants interested in becoming peer trainers, extending the project's reach after the grant period ends.

The path to funding hasn't been an easy one, Leonard says, noting that eight rejected versions, from three different NSF programs, preceded the successful UW proposal.

"It took nine iterations, in all of those different programs, to really flesh those ideas out," Leonard says.

That long path led Leonard to UW and, ultimately, the environment with the biggest potential impact.

"It would not look the way it looks, it would not have the team that it has, it wouldn't be in the place where I think it can make the most difference, if this hadn't been the journey that I took," she says. "I think it's absolutely the right time, the right place and the right people."

Joining Leonard are UW faculty members Jerry Hamann, professor of electrical and computer engineering; Farhad Jafari, professor of mathematics; Ruben Gamboa, associate professor of computer science; and Alan Buss, associate professor of elementary and early childhood education.

Researchers will run a pilot program during the grant's first year. In January, 11 teachers from six school districts will participate in a short course, offered through the UW Outreach School, on the mathematics of gaming and robotics. Participants will receive free enrollment in the class, two hours of graduate credit and a participation stipend.

In April and May, those teachers will implement in- or after-school programs for their students. Half of their programs' focus will be on gaming, while half will emphasize robotics. Activities will be designed to help students see the mathematical principles behind the fun activities. Teachers will embed culturally relevant examples into those projects, to increase their relevance to their students.

"It's not about the robotics and the gaming per se," Leonard explains. "It's also about developing the thinking skills and the processes that we know kids need to have in order to be successful in college if they were to be engineers."

"We want them to see that these visual skills that you have are critical to understanding mathematics and to understanding problem solving," she adds.

In summer 2014, focus will be on data analysis, including reflection by the educators on impacts to their mathematics and science teaching practice and thinking.

During the second year, the program will be expanded to a larger group of teachers and schools. Half of the year-two participant programs will focus on developing gaming lessons and activities, while half will cover robotics.

In year three, at least 40 teachers will join the study and expand the data pool.

"What we're doing is creating a robotics and gaming culture that looks at mathematical and scientific processes as a development process," Leonard says. "It's not just kids putting things together haphazardly, hoping that it will work, but really understanding why."

While teachers in all Wyoming districts will have opportunities to join in the research, several committed early and will form the core participant groups for the pilot and year-two steps. Early participants include schools and teachers from the following districts:

- Albany County School District 1 (Laramie)
- Carbon County School District 1 (Rawlins)
- Fremont County School District 14 (Wyoming Indian Schools)
- Fremont County School District 25 (Riverton)
- Laramie County School District 1 (Cheyenne)
- Natrona County School District (Casper)
- Park County School District 1 (Powell)
- Washakie County School District 1 (Worland)

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