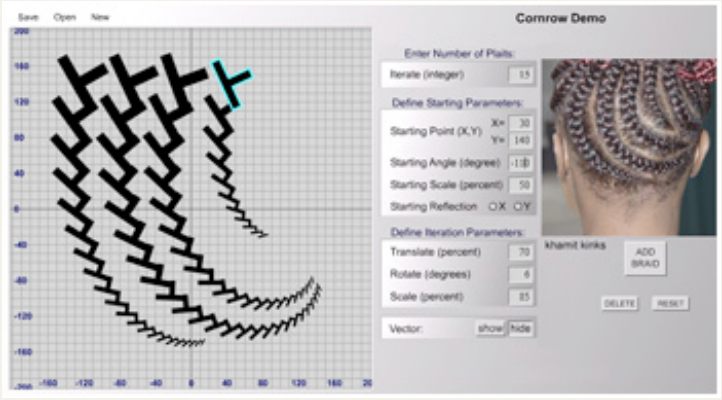
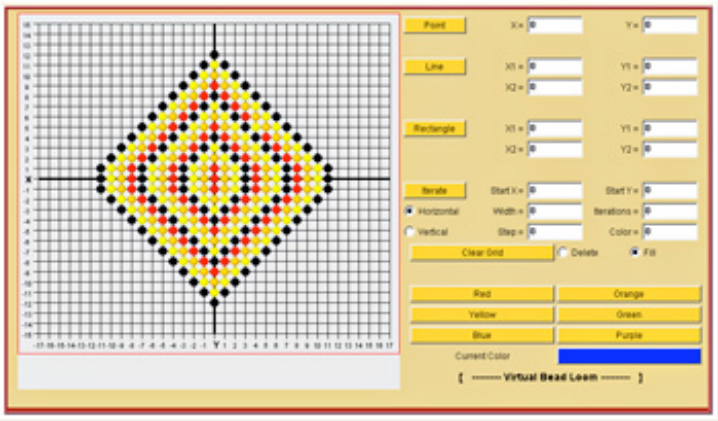
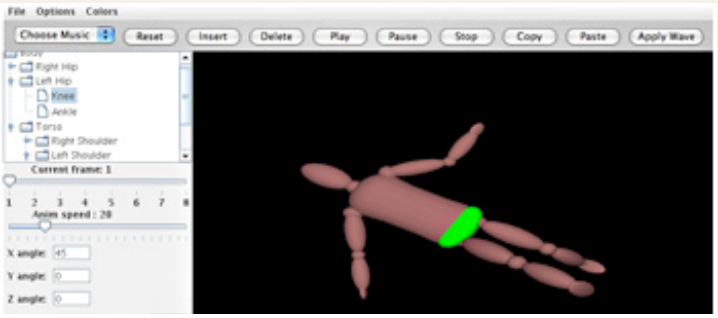
Campus.News for the Week of February 5, 2007

Web-Based Programs Designed To Bolster Student Interest in Computing







Using a series of interactive computer programs that focus on the mathematics embedded in various cultural designs, students from across the country in grades 4-12 have shown a statistically significant increase in their math achievement scores. Now a new National Science Foundation (NSF) grant in excess of $300,000 will help the Rensselaer researcher who developed these programs extend their use to help engage underrepresented minority students in the subject of computing.

Over the last six years, Ron Eglash, associate professor of science and technology studies, has created a suite of 11 Web-based applets that focus on individual facets of African American, Native American, or Latin American culture where math plays a role in design. Called "culturally situated design tools" (CSDTs), the programs educate students about the mathematic principles used to design cornrow hairstyles, Mangbetu art, Navajo rugs, Yupik parka patterns, pre-Columbian pyramids, and Latin music, among others.

Working with Mukkai Krishnamoorthy, associate professor of computer science at Rensselaer, and Hilmi Yildirim, a doctoral student in computer science, Eglash is currently developing a new user interface for the tools. While the earlier math-based programs challenged users to simulate cultural designs by using concepts such as transformational geometry, Cartesian coordinates, and fractions, the new tools will require students to create the designs by entering "pseudocode," thus shifting the learning content emphasis to computer programming.

By the end of their three-year grant, Eglash and Krishnamoorthy hope to offer a new collection of "programmable" CSDTs that will allow students anywhere in the world to invent new design tools of their own creation.

"Over the last six years we have received requests for design tools from places all over the world, including New Guinea, Argentina, and South Africa," said Eglash, principal

investigator on the research. "At the end of this research project we'll be able to offer Web-based resources to allow anyone, anywhere to design their own culturally situated design tools."

From top to bottom, "Cornrow Curves," "Beadwork," and "Virtual Breakdancer" are three culturally situated design tools that will be modified to teach users the basics of computer programming.

Beyond creating new computing-focused and customizable CSDTs, the researchers say the primary purpose of the grant is to use the revamped tools with undergraduate students involved in the Student Leadership Corps (SLC) of the NSF-sponsored Students & Technology in Academia, Research, and Service (STARS) Alliance. After being trained in how to use the programs, students in the SLC will be deployed into middle and high schools, where they'll use the hands-on, educational tools to teach computing skills to students in grades 7-12.

The STARS Alliance seeks to increase the participation of women, underrepresented minorities, and persons with disabilities in computing disciplines through multifaceted interventions focused on the influx and progression of students from middle school through graduate school in programs that lead to computing careers. The group's SLC is composed of underrepresented groups of college-level students who study computing, engage in both research and outreach projects, and act as role models for their younger peers.

Participating SLC mentors — hailing from universities in North Carolina, Georgia, Alabama, and Florida — will visit area schools weekly to work with students as they use the CSDTs to learn basic computer programming skills. Surveys will be administered to the students prior to and following their use of the CSDTs in the classroom, in order to measure the impact of the tools on students' attitudes toward careers in computing.

In conjunction with their outreach programs, SLC mentors will have the opportunity to create new CSDTs, following a design protocol that ensures respectful use of cultural materials by a participatory process involving local members of educational and cultural communities.

"Making real-world connections — especially connections that tie in students' heritage cultures — in computing instruction has been recognized as increasingly important by educators. Culturally situated design tools will provide a flexible space to do that, allowing students to reconfigure their relationship between culture, computer programming, and technology," Eglash said. "Use of these educational resources has the possibility to improve students' mindset toward computing, and the greater potential to foster in them a lifelong love of computing."

All of Ron Eglash's culturally situated design tools can be found and used — free of charge — on his Web site: www.rpi.edu/~eglash/csdt.html. Each CSDT program includes a tutorial and a cultural background section explaining the social context of the practice as well as its underlying mathematics. Testing materials, ideas for assignment and student evaluation, and examples of student work also accompany each design tool.

Eglash's initial CSDT research was funded by three federal grants: a U.S. Housing and Urban Development Community Outreach Partnership Centers grant, a Department of Education Fund for the Improvement of Postsecondary Education grant, and a National Science Foundation IT Workforce grant.

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