New Tools Spark Student Interest, Achievement in Mathematics

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- *From*: Roger Bagula <rlbagula@xxxxxxxxxxxxx>
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New Tools Spark Student Interest, Achievement in Mathematics
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Description
A researcher at Rensselaer has uncovered mathematics embedded in the designs of various aspects of native and contemporary culture, from traditional beadwork and basket weaving to modern hairstyles and music. Using the discovery, he s developed a series of interactive, Web−based teaching tools that are capturing the interest and imagination of students in math classes across the country.

Rensselaer/Eglash
Ron Eglash's first culturally situated design tool, "Cornrow Curves," allows students to learn transformational geometry and iteration while they create simulated cornrow designs on the computer.
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Newswise A researcher at Rensselaer Polytechnic Institute has uncovered mathematics embedded in the designs of various aspects of native and contemporary culture, from traditional beadwork and basket weaving to modern hairstyles and music. Using the discovery, he s developed a series of interactive, Web−based teaching tools that are capturing the interest and imagination of students in math classes across the country.

Ron Eglash, associate professor of science and technology studies at Rensselaer, has created a suite of 11 computer software programs 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 mathematics principles used to design cornrow hairstyles, Mangbetu art, Navajo rugs, Yupik parka patterns, Pre−Columbian pyramids, and Latin music, among others.

New research reported in the June 2006 issue of American Anthropologist suggests that use of CSDTs can raise math achievement and may improve technological career aspirations for ethnic minority students.

Preliminary surveys of students 83 percent of which were under−represented minorities who used the design tools for two hours per day over a two−week period displayed a statistically significant increase in their attitudes toward computers, compared to 175 randomly selected students who had not used a CSDT. The statistical upsurge in the first group of students may indicate an increase in positive attitudes toward IT careers for students exposed to CSDTs, according to Eglash, lead author on the paper.

Two qualitative evaluations conducted by teachers of predominately Latin American students found a statistically significant improvement in the mathematics performance scores of students using the CSDTs, compared to the achievement of students in classes where the tools were not used as a teaching aid.

Making real−world connections especially connections that tie in students heritage cultures in math instruction has been recognized as increasingly important by educators. Culturally situated design tools provide a flexible space to do that, allowing students to reconfigure their relationship between culture, mathematics, and technology, said Eglash. By challenging students to recreate a set of goal images or to construct their own shapes and designs, the tools give them a hands−on opportunity to explore and manipulate standard curriculum math concepts such as transformational geometry, scaling, Cartesian coordinates, and fractions, while connecting those concepts to their heritage as well as contemporary culture.

The Fractal Factor

In 1999, Eglash discovered that fractal geometry the geometry of similar shapes repeated on ever−shrinking scales is apparent in the designs of many cultures on the continent of Africa, revealing that traditional African mathematics may be much more complicated than previously thought. He documented fractal patterns in cornrow hairstyles, weavings, and the architecture of villages, as well as many forms of African art.

Working with math teachers on ways to use this discovery to get African American students interested in the subject of math, Eglash began focusing on the geometry of cornrow hairstyles as a way to connect with popular culture. He developed his first CSDT, Cornrow Curves, which allows student to learn transformational geometry and iteration while they create simulated cornrow designs on the computer.

Cornrow Curves was followed by a CSDT that focused on scaling iteration in the traditional ivory sculptures of Africa s Mangbetu people.

After students completed the Cornrow Curves and Mangbetu software experience, we asked them why they thought they were able to use iterative scaling for both simulations, said Eglash. They quickly answered that it was because both designs were derived from African origins, an indication that math and computers have now become a potential bridge to their cultural heritage, rather than a barrier against it for these students.

Additional CSDTs include Virtual Bead Loom (one of six programs focused on Native American culture), based on the geometric patterns present in Shosone−Bannock beadwork, and Rhythm Wheels (one of two Latin American−geared programs), which focuses on the concept of identifying the least common denominator between fractions.

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 research was funded by three federal grants: a U.S. Housing and Urban Development (HUD) Community Outreach Partnership Centers (COPC) grant, a Department of Education Fund for the Improvement of Postsecondary Education (FIPSE) grant, and a National Science Foundation (NSF) IT Workforce (ITWF) grant.

The paper, titled Culturally Situated Design Tools: Ethnocomputing from Field Site to Classroom, can be found on pages 347−362 in Volume 108, Issue 2, of American Anthropologist.

About Rensselaer

Rensselaer Polytechnic Institute, founded in 1824, is the nation s oldest technological university. The university offers bachelor s, master s, and doctoral degrees in engineering, the sciences, information technology, architecture, management, and the humanities and social sciences. Institute programs serve

undergraduates, graduate students, and working professionals around the world. Rensselaer faculty are known for pre−eminence in research conducted in a wide range of fields, with particular emphasis in biotechnology, nanotechnology, information technology, and the media arts and technology. The Institute is well known for its success in the transfer of technology from the laboratory to the marketplace so that new discoveries and inventions benefit human life, protect the environment, and strengthen economic development.

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