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Room: PA 311

Proposal id: **51**

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How to use culturally relevant trans-disciplinary activities to improve student attitudes and learning in school mathematics

Abstract

Mathematics is a human activity (Gardiner, 2009) which combines pattern analysis, logical reasoning, creative problem solving and communication. Every human is unique, making sense of mathematics in their own way, thus good teachers incorporate students' existing funds of knowledge (Moll et al, 2001) as well as culturally relevant activities (Ladson-Billings, 1995) and community involvement (Civil, 2006) to improve learning opportunities, experiences and satisfaction for students of all cultural backgrounds. Combining teacher/student and student/student interaction patterns (Mohatt and Erickson, 1981), improving mathematical practice and discourse, as well as finding connections with other disciplines and with social issues (Boaler, 2001) lead to animated classes and a strong student knowledge and cohort base. Thirty years of teaching mathematics to underrepresented students of diverse backgrounds has informed a pedagogy rich with these methods, producing students who feel mathematically confident and empowered. These students have increased life opportunities going forward. Teachers implementing these methods appear to have increased satisfaction. After a brief introduction of background theories, this constructivist, interactive, hands-on, activity-based workshop will model classroom behaviors and methods that lead to positive student and teacher outcomes rich multifaceted mathematical learning.

During this exciting workshop, participants will learn briefly about Indigenous beadwork history and designs in North America. Resources for further study will be provided. Traditional Sami textile designs will also be discussed. I am not an expert in Sami designs, so I will elicit comments from participants. Subsequently, each participant will design his or her own simple beadwork piece with colored pencils on graph paper. Partners will work together to come up with functions, relations, or patterns which could generate their specific designs. Participants will share their work and give each other constructive feedback on their process, comparing symmetries of different design patterns, and exploring the possibilities of color and dimension. If time permits, they will build their own simple, Native American, bead looms to actually create their beadwork pieces with string, cardboard, tape and colorful glass beads provided. Lastly, we will explore the Virtual Bead Loom, designed by Dr. Ron Eglash, and its applications in school mathematics. https://csdt.rpi.edu/culture/legacy/na/loom/index.html

This activity can be simple or advanced. I have used it with students from the middle level, approximately aged ten years, to the advanced level in which we explore university-level graphing, functions, relations, geometry, symmetries, basic group theory, and abstract algebra concepts. Students love this activity, because it empowers their individual creativity, shows them that mathematics abounds in visual designs, encourages them to communicate with each other, and highlights often-overlooked, indigenous, mathematical, reasoning. There are numerous adaptations and extensions for this activity.

I have been teaching mathematics at Oglala Lakota College for 13 years. This is a tribal college, serving indigenous students in North America. 99% of our students are Lakota people, and our college requires that all students learn Lakota history, language, culture, and arts. Instructors at Oglala Lakota College are encouraged to learn as much as possible about Lakota history and culture in order to better serve our

students. I have been taking classes in Lakota arts, language, and psychology since 2011. I am not Lakota myself, but I have found that the more aware an instructor is of the cultural origins of her students, the better she is able to teach them and work with their learning styles. (Ladson-Billings, 1994; Leonard & Guha, 2002; Teaching Tolerance Issue 30, 2006 https://www.tolerance.org/magazine/fall-2006/learning-lakota; Oglala Lakota College School of Education Vision Statement: www.olc.edu/departments/education.htm; Eglash: The fractals at the heart of African designs, https://www.ted.com/speakers/ron_eglash). Research into underperforming and marginalized groups of students in mathematics is showing increasingly that when multiple ways of sense-making in mathematics are valued, students thrive. In my personal experience, the student evaluations of my teaching are consistently excellent. Students in my classes learn the standard mathematics topics required by our curriculum, and also gain a confidence in mathematics that they did not have prior to working with me. I create a supportive, discourse-full, culturally responsive, learning environment that really leads to success.

I grew up in New Jersey, learned to speak French at a young age, was fascinated with and embraced diverse cultures. As an undergraduate at Smith College, I learned about symmetry pattern classifications of three-dimensional crystals and wall pattern designs. I continue to enjoy such explorations. Upon earning my Bachelor's degree in mathematics, I taught middle level mathematics in the Central African Republic for two years at the C.E.G. d'Ippy. It was there that I became interested in the intersection of mathematics, arts, and culture. I learned about the field of Ethnomathematics in the late 1990s, and joined the International Study Group for Ethnomathematics, where I met highly-esteemed scholars such as Ron Eglash, Jerry Lipka (who has done extensive work with the Inuit people of Alaska), and Claudia Zaslavsky. In the autumn semester of 2000, I began incorporating cultural relevance and ethnomathematics in the Mathematics for Educators courses that I taught at Chadron State College. The students gave me very positive feedback about this, and requested that we share our activities with the community preschools and at the Earth Day fair, both of which served children of diverse backgrounds. I gave presentations on our activities at the National Council for Teachers of Mathematics Annual Meetings in 2004 and 2011. I have continued to develop activities, with the help of my students and colleagues. I have been too busy teaching to write extensively on this subject, but I began writing an activity book last summer, and I am currently working on a doctoral degree at the University of Wyoming, which will focus on equity and culture in mathematics education. In my doctoral program, I am gaining proficiency at researching and writing articles, with the goal of improving the mathematics learning and teaching experience for all people.

Remark (by the Organizers): Additional material has already been uploaded on the ESU-8 website.

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