

Title: Summary of information on Native American students and computer science

Date: July 2016

Request: Could you provide research on computer science education and Native American students?

Response:

We have prepared the following memo with references on computer science education and Native American students. Citations include a link to a free online version, when available. All citations are accompanied by an abstract, excerpt, or summary written by the author or publisher of the document. We have not done an evaluation of the methodological rigor of these resources, but provide them for your information only.

References

Eglash, R., Gilbert, J. E., Taylor, V. & Geier, S. R. (2013). Culturally responsive computing in urban, after-school contexts: Two approaches. *Urban Education*, September 2013, 48, 629-656.

Abstract: The academic performance and engagement of youth from under-represented ethnic groups (African American, Latino, and Indigenous) in science, technology, engineering, and mathematics (STEM) show statistically large gaps in comparison with their White and Asian peers. Some of these differences can be attributed to the direct impact of economic forces. But cultural factors also play a role. This essay will examine two culturally responsive math education technologies and report on evaluations of the technologies in urban out-of-school settings that suggest both approaches can be effective for integrating math education into urban, after-school contexts.

Kafai, Y., Searle, K., Martinez, C. & Brayboy, B. (2014). Ethnocomputing with electronic textiles: Culturally responsive open design to broaden participation in computing in American Indian youth and communities. Paper presented at SIGCSE '14, March 5-8, 2014, Atlanta, GA. Retrieved on July 11, 2016, from <http://www.ccd.rpi.edu/Eglash/pdi/navajo%20etextiles.pdf>

Abstract: There have been many efforts to increase access and participation of indigenous communities in computer science education using ethnocomputing. In this paper, we extend culturally responsive computing by using electronic textiles that leverage traditional crafting and sewing practices to help students learn about engineering and computing as they also engage with local indigenous knowledges. Electronic textiles include sewable microcontrollers that can be connected to sensors and actuators by stitching circuits with conductive thread. We present findings from a junior high Native Arts class and an academically-oriented summer camp in which

Native American youth ages 12-15 years created individual and collective e-textile designs using the LilyPad Arduino. In our discussion we address how a culturally responsive open design approach to ethnocomputing with e-textile activities can provide a productive but also challenging context for design agency and cultural connections for American Indian youth, and how these findings can inform the design of a broader range of introductory computational activities for all.

Kodaseet, G. G., & Varma, R. (2012). In pursuit of a computing degree: Cultural implications for American Indians. *Journal Of American Indian Education*, 51(1), 67-88. Retrieved on July 11, 2016, from <http://eric.ed.gov/?id=EJ974650>

Abstract: While a number of challenges contribute to the American Indian population's disconnect from information technology (IT), the most glaring is the low number of American Indian students pursuing computer science (CS) studies--a degree essential to IT's entry into and diffusion across communities. Yet, research is scant on factors that contribute to the low number of American Indians pursuing CS. This article employs cultural relevancy theory as a framework for defining the role of culture among the American Indian population and its impact on enrollment, retention, and degree completion in CS. Using data derived from in-depth interviews of 50 American Indian students at six Hispanicserving Institutions (HSIs) and Tribal colleges and universities (TCUs), this article examines these students' experiences in CS programs. It shows slightly more than half of the students experienced different types and levels of conflicts between their culture and a career in CS. This was the case more with American Indian students attending HSIs than TCUs. The study suggests that increasing the number of American Indians attaining a CS degree hinges on (1) the expansion of CS programs at TCUs, (2) HSIs embracing and responding to American Indian cultural knowledge, perspectives and responsibilities, and (3) greater collaboration between TCUs and HSIs.

Nelson-Barber, S., & Trumbull, E. (2015). *The Common Core Initiative, education outcomes, and American Indian/Alaska Native students: Observations and Recommendations* [a report from the Center on Standards & Assessment Implementation (CSAI) at WestEd]. San Francisco: WestEd. Retrieved on July 11, 2016, from https://www.wested.org/wp-content/files_mf/1458229495resourcethecommoncoreinitiativeeducationoutcomesandamericanindianalaskanativestudentsobservationsandrecommendations.pdf

Abstract: Many educators and policymakers in American Indian/Alaska Native (AI/AN) communities are concerned that the Common Core State Standards (CCSS) will fall short of their goal to ensure the preparation of all students for college and/or career. This paper explores how the CCSS could affect AI/AN students, and examines how to best implement the standards to increase the likelihood for college and career success for this group of students. Specifically, the paper describes:

- The importance of understanding the diversity among AI/AN communities
- Why today's education reforms might be viewed as forced assimilation
- How previous education reforms have failed
- What needs to happen for the CCSS to work
- The impact of No Child Left Behind

In addition, the paper includes recommendations for how local and state education agencies, researchers, and policymakers can best proceed to help prepare AI/AN students to succeed in college and/or career.

Searle, K. & Kafai, Y. (2015). *Boys' needlework: Understanding gendered and indigenous perspectives on computing and crafting with electronic textiles*. Proceedings of the eleventh annual International Conference on International Computing Education Research, 31-39. New York: ACM.

Abstract: We draw attention to the intersection of race/ethnicity and gender in computing education by examining the experiences of ten American Indian boys (12-14 years old) who participated in introductory computing activities with electronic textiles. To date, the use of electronic textiles (e-textiles) materials in introductory computing activities have been shown to be particularly appealing to girls and women because they combine craft, circuitry, and computing. We hypothesized that e-textiles would be appealing to American Indian boys because of a strong community-based craft tradition linked to heritage cultural practices. In order to understand boys' perspectives on learning computing through making culturally-relevant e-textiles artifacts, we analyzed boys' completed artifacts as documented in photographs and code screenshots, their design practices as documented in daily field notes and video logs of classroom sessions, and their reflections from interviews guided by the following research questions: (1) How did American Indian boys initially engage with e-textiles materials? (2) How did boys' computational perspectives develop through the process of making and programming their own e-textiles artifacts? Our findings highlight the importance of connecting to larger community value systems as a context for doing computing, the importance of allowing space for youth to make decisions within the constraints of the design task, and the value of tangible e-textiles artifacts in providing linkages between home and school spaces. We connect our work to other efforts to engage racial and ethnic minority students in computing and discuss the implications of our work for computer science educators designing computing curricula for increasingly diverse groups of students, especially as pertains to the emerging field of culturally responsive computing.

Van Cleave, N. (2001). Components of an American Indian computer science transfer degree program. *Journal of Engineering Education*, 90(1), 55-61. Retrieved on July 11, 2016, from http://www.ux1.eiu.edu/~cfnk/Papers/JEE2000_IndianEd.pdf

Abstract: From 1995 to 1997, a culturally relevant transfer degree program was developed at a tribally controlled Community College in Minnesota. Broad traditional values held in common by most indigenous peoples formed the backbone of the project. These values led to the formulation of several significant components of culturally sensitive programs, which were enhanced by classroom practices adopted and distilled during more than two decades of teaching from middle school to the graduate level. Many of these coincided with and reinforced traditional American Indian values. In addition, practical lessons were learned while creating this new model of education. Our conclusion: the core of minority-centered education should be good teaching strategies applied to a specific population but applicable to and effective for all students.

Methods

Keywords and Search Strings Used in the Search

“Native American” and “computer science”

Search of Databases

EBSCO Host, ERIC, PsychInfo, PsychArticle, Google, and Google Scholar

Criteria for Inclusion

When REL West staff review resources, they consider—among other things—four factors:

- **Date of the Publication:** The most current information is included, except in the case of nationally known seminal resources.
- **Source and Funder of the Report/Study/Brief/Article:** Priority is given to IES, nationally funded, and certain other vetted sources known for strict attention to research protocols.
- **Methodology:** Sources include randomized controlled trial studies, surveys, self-assessments, literature reviews, and policy briefs. Priority for inclusion generally is given to randomized controlled trial study findings, but the reader should note at least the following factors when basing decisions on these resources: numbers of participants (Just a few? Thousands?); selection (Did the participants volunteer for the study or were they chosen?); representation (Were findings generalized from a homogeneous or a diverse pool of participants? Was the study sample representative of the population as a whole?).
- **Existing Knowledge Base:** Although we strive to include vetted resources, there are times when the research base is limited or nonexistent. In these cases, we have included the best resources we could find, which may include newspaper articles, interviews with content specialists, organization websites, and other sources.

This memorandum is one in a series of quick-turnaround responses to specific questions posed by educators and policymakers in the West Region (Arizona, California, Nevada, Utah), which is served by the Regional Educational Laboratory West (REL West) at WestEd. This memorandum was prepared by REL West under a contract with the U.S. Department of Education’s Institute of Education Sciences (IES), Contract ED-IES-12-C-0002, administered by WestEd. Its content does not necessarily reflect the views or policies of IES or the U.S. Department of Education nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.