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BOARD # 357: ECR: Core. Identity Intersections of Indigenous Engineers and Computer Scientists

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ECR: Core. Identity Intersections of Indigenous Engineers and Computer Scientists

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Abstract

This paper explores how the identities of Indigenous computer scientists and engineers intersect with their cultural values around their motivations to be in these disciplines and around how they approach their work. This paper draws from a larger study funded by the National Science Foundation and is based on a set of fourteen photo elicitation interviews with Indigenous engineers and computer science students and professionals. Participants shared photographs and reflected on supports, challenges, and motivations due to the lived intersections of their identities as computer scientists and engineers and as Indigenous individuals. We found that the values of giving back and Nation building and the integration of traditional Indigenous knowledge with western disciplinary training are among the main motivators for Indigenous computer scientists and engineers to be in their disciplines. We recommend integrating Indigenous values and knowledges and western training to support the development of positive identities of Indigenous students and professionals in engineering and computing.

Key words

Indigenous, identity, giving back and Nation building, Two-Eyed Seeing

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The current paper explores how the identities of Indigenous computer scientists and engineers intersect with their cultural values both in terms of their motivations to be in these disciplines and in terms of how they approached their work. The study is drawn from a larger study funded by the National Science Foundation (*Native STEM Portraits: A Longitudinal, Mixed-Methods Study of the Intersectional experiences of Native Learners and Professionals in STEM,* NSF/HRD-2000619), which is a collaboration between TERC, AISES – Advancing Indigenous People in STEM, and the University of Georgia. This paper is based on a set of fourteen photo elicitation interviews with Indigenous computer scientists and engineers at the undergraduate, graduate, and professional levels. In the interviews, participants shared photographs and reflected on supports, challenges, and motivations due to the lived intersections of their identities as computer scientists and engineers and as Indigenous individuals.

Theoretical framework

This paper is framed by two Indigenous theories: Giving back and Nation building, and Two-Eyed Seeing. Giving back and Nation building are concepts that encompass helping one's community and working towards a tribe's sovereignty. They are fundamental cultural values in Indigenous communities that direct members to contribute to their communities' wellness, e.g., [1] [2]. These values also support the persistence of Indigenous people in computer science and engineering (CS&E) by providing them with opportunities to employ their CS&E skills for the benefit of their communities [2] [3]. Two-Eyed Seeing emphasizes the need to balance traditional Indigenous knowledge with western disciplinary training [4], which provides opportunities to find strengths in both traditions and can lead to innovation in STEM [5].

Research design and methods

This project was designed as a longitudinal, mixed-method study that includes surveys (276 surveys) and photo elicitation interviews (40 participants) with Indigenous students and professionals in STEM. The main purpose of the overall study was to understand how Indigenous participants' experiences in STEM changed over time, thus we collected surveys and interviews in 2021 (Round 1) and 2023 (Round 2) from the same participants. For this paper, we focused on the photo elicitation interviews of the fourteen participants in CS&E, including five undergraduates, three graduate students, and six professionals. In this group, three were in CS (2 graduate students, 1 professional) and the rest were in engineering (pseudonyms used). Two thirds of participants (9) took part in interviews in both rounds, with the remaining third (5) participating only in the first round. Photo elicitation consists in using photographs to elicit conversation during research interviews [6] [7]. Participants took photographs that responded to the researchers' prompts about the supports and hurdles they experienced in CS&E and the changes they experienced in how they identified as Indigenous individuals in CS&E.

We analyzed interview transcripts with a focus on the identity prompt using a hybrid approach to coding for thematic analysis [8]. We first developed a deductive codebook using concepts from theory and then we developed inductive codes from the data. We consolidated the two sets of codes into a single codebook that we used to code all the transcripts. The study received ethical research overview from TERC's Institutional Review Board.

Findings

Pride in being Indigenous and in CS&E

A recurring theme was the participants' pride in their Indigenous identities and in being in CS&E. As Indigenous computer scientists and engineers, participants understood the power of their representation both for other Indigenous individuals potentially interested in these disciplines, particularly younger generations looking up to them as role models, and for non-Indigenous people who may not know other Indigenous people in CS&E. Flint, a mechanical engineering undergraduate student, stated that being Indigenous and an undergraduate in engineering "*makes me proud 'cuz it's a super small minority. … I'm glad to represent.*"

Figure 1. I am Me by Willow

Other participants like Willow, an environmental engineering professional, and North, a recent doctoral graduate and new faculty in computer science, were interested in signaling to others their presence as Indigenous CS&E professionals. Willow wore her turquoise jewelry in professional settings as a statement to declare: "*I'm sitting at this table, and I have something to say. So, the Indigenous jewelry is one of the best ways to do that."*

North signaled his presence as a CS faculty member by having a sticker about his work in Indigenous issues in CS on his office's door and by having a bookshelf dedicated to Indigenous stories: "*It's just nice to have [the books] there. It's kind of more as a display. … Instead of wanting to hide that at home or anything, I felt very proud and I felt the ability to just bring this into my office, my professional space, where I am as a STEM faculty."*

In addition to the intrinsic pride in their identities as Indigenous individuals in CS&E, participants like Flint, Willow, and North desired to represent their identities for others who may be inspired by their presence.

Giving back and Nation building

We found that the values of giving back and Nation building are among the main motivators for Indigenous computer scientists and engineers to be in their disciplines. Study participants shared

several types of giving back and Nation building that they engaged in, including creating beneficial products, solving tribal problems, and teaching others about Indigenous history and culture. For example, Juniper, a civil engineering professional, asked herself, "*How am I impacting my people? How am I making life better for my people?*" Similarly, Autumn, a graduate student and professional in CS, sought to "*develop things that will positively impact people.*" Other participants took pride in using their skills to support their tribes in their goals to steward the land, such as Richter, a mechanical engineering professional, who said: "*I feel I've turned of late ... having joined this tribal energy team, is my explicit step towards helping tribes with my ability to provide analysis and expertise, and my skills to tribes in their pursuit of their own unique renewable energy goals or clean energy goals."*

Reed, a high school engineering teacher, was motivated to share his knowledge of Indigenous history and culture with his students and other teachers, knowing that they may not learn them otherwise. He shared how he taught a history teacher about residential schools and Indigenous children removal from families in the 1900s and shared his grandmother's adoption experience. Reed recalled, "*That was news to him. ... Once he knew it, then that was something that he could teach, ... so that when he talks about the oppression of the Native American people, it just doesn't end in the 1800s."*

Figure 2. Wanting to Help by Reed

Giving back and Nation building are fundamental cultural values that contribute to shaping Indigenous computer scientists and engineers' identities. Answering how their work is benefiting their communities is foundational to the motivation of the work of participants like Juniper, Autumn, Richter, and Reed, who found a variety of ways to act on this motivation.

Two-Eyed Seeing

Most participants approached CS&E work by finding ways to engage in Two-Eyed Seeing, or bringing together their Indigenous identities and values with their western training. For example, Willow explained that, as an Indigenous person, she had a strong connection with the Earth, and environmental engineering allowed her to bring together her passion for the Earth and for engineering. Similarly, Autumn considered the impact of her CS work beyond the immediate use of a product by applying her Nation's cultural values that "*everyone has value and can contribute to this conversation*" and that the life cycle of things needs to be considered in decision making: "*The idea of equilibrium is something that ... shows up in my discipline in the processes. I go back to the idea of being part of a process and being part of a cycle, and what happens to something after we've developed it, and what are the impacts of it."*

Participants like Willow and Autumn engaged in Two-Eyed Seeing by using the lens of their Indigenous identities to do their work in CS&E, which allowed them to bring together their identities as Indigenous individuals and as professionals in CS&E.

Conclusions

Based on these findings, we conclude that giving back, Nation building, and Two-Eyed Seeing are essential elements for the positive development of the identities of Indigenous individuals in CS&E, providing them with opportunities to use their C&E training and engaging their values to benefit their communities. We recommend integrating Indigenous values like giving back and Nation building and bringing together traditional Indigenous knowledges with western training to strengthen the development of positive identities of Indigenous students and professionals in CS&E and to support their persistence in the field.

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