A Cultural Impostor? Native American Experiences of Impostor Phenomenon in STEM

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ABSTRACT

Using a framework of colonization in science, technology, engineering, and mathematics (STEM), this U.S.-based study examined how seven Native American PhD students/postdoctoral scholars experienced impostor phenomenon. Participants were identified/contacted at a national conference on minorities in STEM through purposeful sampling. Surveys computed impostor phenomenon scores on a validated scale, while interviews documented how identity and culture contributed to impostor phenomenon in academia. Using a phenomenological approach, interviews were analyzed inductively using a constant comparative method. Surveys scores indicated high to intense impostor phenomenon. Interviews with the same participants further identified the following aspects of impostor phenomenon in relation to their minoritized identity: cultural differences and lack of understanding of Indigenous culture, lack of critical mass and fear of standing out, academic environment, family background and upbringing, and looks and diversity status. Developing a diverse and culturally competent STEM workforce requires a deeper understanding of what deters Native American individuals from pursuing a STEM career. They have the lowest college enrollment and retention rates compared with any race in the United States and could be vulnerable to racial bias and discrimination. Understanding impostor phenomenon through culturally relevant experiences would be crucial to broaden participation in STEM careers.

INTRODUCTION

Impostor phenomenon is a feeling of perceived fraudulence some accomplished people have occasionally or more frequently because they attribute their achievements to luck; others showing them kindness; and factors not related to their own ability, talent, or hard work (Clance and Imes, 1978). This phenomenon was first studied among successful women in the United States (Clance and Imes, 1978) and, since then, among people across disciplines, demographics, career stages, and countries. Although impostor phenomenon is experienced across all genders, some studies suggest that women might be more likely to experience it (Hamood, 2020; Rosenstein *et al.*, 2020; Kimball *et al.*, 2021), especially when marginalized through workplace violence (Chakraverty and Rishi, 2021).

Impostor phenomenon has become a well-researched topic, perhaps due to its pervasiveness among people from different backgrounds and geographic locations. It has been predominantly studied in the United States, and also in Germany (Brauer and Wolf, 2016), Austria (Patzak *et al.*, 2017), South Africa (Nakazwe-Masiya *et al.*, 2017), Russia (Wang *et al.*, 2019), and Israel (Bachem *et al.*, 2020). These studies have documented experiences of students and professionals; for example, undergraduate students (Schubert and Bowker, 2019); graduate students, including PhD students (Chakraverty, 2019, 2020c; Cohen and McConnell, 2019); postdoctoral trainees (Chakraverty, 2020b); faculty (Hutchins, 2015; Sims and Cassidy, 2018); and professionals (Nakazwe-Masiya *et al.*, 2017). Impostor phenomenon could be

correlated to anxiety (Bachem *et al.*, 2020), lack of psychological well-being (Bernard *et al.*, 2020), stress (Levant *et al.*, 2020), maladaptive perfectionism (Cokley *et al.*, 2018; Pannhausen *et al.*, 2020), and certain self-handicapping behaviors (Jensen and Deemer, 2020), among others, in management (Rohrmann *et al.*, 2016); medicine (LaDonna *et al.*, 2018; Levant *et al.*, 2020); and science, technology, engineering, and mathematics (STEM) fields (Tao and Gloria, 2019; Chakraverty, 2020c).

LITERATURE REVIEW

Demographically, impostor phenomenon has been studied across genders and among first-generation higher education students (Haggard, 2019) and certain racial and ethnic minorities (Cokley *et al.*, 2013, 2017), especially Black students (Lige *et al.*, 2017; Bernard *et al.*, 2018, 2020). Few studies have included Native American students as a part of the larger pool of participants (e.g., Gibson-Beverly and Schwartz, 2008; Craddock *et al.*, 2011). However, those studies focused on generic factors and not on student experiences based on racial identity. Yet many studies have found connections between racial and ethnic identity, sense of belonging, and impostor phenomenon among Black students (Ewing *et al.*, 1996; Peteet *et al.*, 2015b; McClain *et al.*, 2016; Lige *et al.*, 2017; Bernard *et al.*, 2018). Particularly, impostor phenomenon could be linked to a lack of belonging in the immediate academic environment or in the field (Chakraverty, 2020b) due to race-based underrepresentation in STEM (Burt *et al.*, 2017; Chakraverty, 2020a) as well as hidden identities that could influence classroom learning experiences among minoritized students (Henning *et al.*, 2019; Binning *et al.*, 2020). Additionally, racial or ethnic identity is a strong predictor of grades (Altschul *et al.*, 2008) and, by extension, one's likelihood of persistence in a field. Based in the United States, the current study examined an understudied area, that is, how Native American individuals in STEM experience impostor phenomenon, especially in relation to their racial identity and background. The research question guiding this study is: "How do Native American PhD students and postdoctoral trainees describe identity-based experiences in relation to impostor phenomenon during academic training in STEM?"

Framework for Understanding Impostor Phenomenon among Native American Individuals

Among the Black, Indigenous, and people of color (BIPOC) community, impostor phenomenon has been studied mostly among Black populations, including undergraduate students (Lige *et al.*, 2017; Bernard *et al.*, 2018; Walker, 2018; Graham and McClain, 2019), graduate students (Craddock *et al.*, 2011; Burt *et al.*, 2017; Stone *et al.*, 2018), and postdoctoral scholars in STEM (Chakraverty, 2020b). These studies examined impostor phenomenon from a race-based perspective including racial identity, race-based othering, and racialized experiences of discrimination. Racialized experiences of impostor phenomenon are deeply embedded in lack of belonging in classrooms, the academic discipline, and the Black community, in general (Burt *et al.*, 2017; Graham and McClain, 2019). One of the contributors to impostor phenomenon among Black students is their historic exclusion from and underrepresentation in STEM fields (Milner, 2004; Butts *et al.*, 2012; Rosa and Mensah, 2016; Burt *et al.*, 2017).

The U.S. Office of Management and Budget defines "American Indian or Alaska Native" as "A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment" (National Institutes of Health, 2015). Students and professionals identifying as American Indian or Alaska Native (also referred to as Native American people in the literature) experience some of the very stressors that Black people do, including their underrepresentation in many fields and academic disciplines. Native American students are particularly an underrepresented minority group in STEM (National Center for Science and Engineering Statistics [NCES], 2019). They represent about 1.6% of the U.S. population but have the lowest college enrollment and retention rates compared with any race in the United States (Jackson *et al.*, 2003; Guillory, 2009), earning only 0.5% and 0.3% of undergraduate degrees in science and engineering, respectively (NCES, 2019). In 2016, Native American people in science and engineering formed only 0.3% of the graduate student population, specifically constituting 0.15% in engineering and 0.38% in the sciences (Bright and Jones, 2020). National Science Foundation (NSF) data from 2018 show that the percentages of Native American people earning master's degrees and PhDs in science and engineering are 0.4 and 0.3, respectively (NCES, 2018).

One of the possible reasons for such underrepresentation could be the disparity or incongruence between cultural beliefs pertaining to communal goals among Native American students (community-based beliefs emphasizing helping and caring for others, working with others, and giving back to the community) and the individualistic goals held by their White, mostly male peers that value individualistic beliefs such as obtaining independence, agency, prestige, and power (also reflective of the predominant culture in STEM), thereby creating a detached sense of belonging in STEM (Smith *et al.*, 2014). This discordance is better understood using a framework of colonization in STEM and by examining the history of colonization of the native people and their land that is the present-day United States, forces that have shaped dominant cultures of knowledge making in STEM. Based on national-level undergraduate enrollment data in the United States, Native American students have a significantly lower likelihood of attaining a STEM degree in five years compared with their White peers (Eagan *et al.*, 2010). One study reported that many Native American students in STEM observe tribal taboos and would feel encouraged to enroll in science classes if the curriculum respected those taboos, as opposed to not opting for a science major if they needed to go against strongly held cultural beliefs to be able to do that (Williams and Shipley, 2018). In this context, the authors defined "taboo" as "a strong cultural warning or prohibition against an action, such that violating a taboo is an act of serious aberrance which can result in feelings of guilt or shame and/or direct or indirect social sanction" (Williams and Shipley, 2018, p. 2). Examples of activities that violated their cultural beliefs included dissecting humans and animals such as certain reptiles, amphibians, and mammals (Williams and Shipley, 2018). Various forms of beliefs and identity (cultural, ethnic, individual, and community identity) held by Native American students and their discordance with the existing STEM curriculum could play a role in whether or not these students envision engaging, acculturating, and thriving in

STEM fields, especially at historically White institutions (Page-Reeves *et al.*, 2017, 2019).

While learning (including learning in STEM) is a cultural process, there is an underlying assumption that science as well as science education is acultural, highlighting the need for supporting community-based, culturally relevant epistemologies for both numerically dominant and nondominant groups (Bang and Medin, 2010). Science can be exclusionary, has a history of invalidating indigenous knowledge, and can perpetuate inequities in terms of who can access science (by virtue of their demographic background) and what constitutes science knowledge (Barron *et al.*, 2021). Yet mindful pedagogical training through "culturally responsive science teaching" could help address inequities based on (and perpetuated by) demographic and cultural differences (Barron *et al.*, 2021). While examining how colonization has shaped teaching and learning of science, knowledge creation, and the perception of what counts as knowledge, it is important to understand the term "frontier," symbolizing the boundary shared between Native American people and colonial settlers; it is as much a metaphorical a term as physical, emphasizing multiple axes across which systemic racism, structural oppression, marginalization, and exclusion have historically occurred (Weaver, 2015). Such divisions could be based on language, culture, race, class, and the perceived superiority one would ascribe to any of these. The notion of a frontier is also closely tied to identity and sense of belonging (Weaver, 2015, p. 27). This helps us understand how educational spaces that are historically White (including STEM fields) have been hierarchical, exclusionary, and marginalizing to those valuing culturally informed pedagogies, curricula, and practices of doing STEM (Page-Reeves *et al.*, 2019; Barron *et al.*, 2021). There is a certain lack of acknowledgment of those who originally inhabited the very lands where historically White institutions of education and knowledge creation now stand and thrive. The experiences of Native American students in STEM, along with their dismal numbers in the field and their experiences of (un)belongingness, are often colored by the positioning of Indigenous knowledge making as disparate, something outside the "frontier" of Western ways of knowing that is considered as mainstream, natural, or normal (Marker, 2016). Such axes of discrimination and inequity in power structures put the burden of not being able to integrate and/or succeed in STEM careers on Native American people whose Indigenous ways diverge or fall outside the realm of Western, positivistic ways of doing STEM (Marker, 2016). This could be seen as a way of determining, with an implied sense of superiority, who ought (not) to belong in STEM and how and why one may identify with the field through a systemic process of STEM identity development that is fractured from one's cultural reality and personal identity (Chakraverty, 2021). The power difference becomes more obvious when the very institutions where Native American students struggle to thrive in the dominant culture, experience their education, and obtain their college/graduate degrees define success through a lens of academic achievement that is disjointed from culturally informed view of success through wayfinding (Howard and Kern, 2019).

Young adolescents can potentially develop science interest even before middle school (Maltese and Tai, 2010) and are more likely to complete an undergraduate degree in science when they have developed early expectations of pursuing a career in science (Tai *et al.*, 2006). Yet Native American students (grades 9–12) are not always able to view themselves as future scientists while holding a Native American identity or easily align native/Indigenous knowledge making and Western science; this may impact how they transition between Native American identity and science identity, also affecting their educational experiences and aspirations for careers as scientists (Laubach *et al.*, 2012).

One of the limitations in our understanding of impostor phenomenon is that it is based on definitions and examples from majorly White-centric studies. As mentioned earlier, the term "impostor phenomenon" was first used from scholarship that emerged after interviewing successful, White women who doubted their success and felt like an impostor or fraud (Clance and Imes, 1978). This eventually led to the development of the Clance Impostor Phenomenon Scale (CIPS; Clance, 1985), a 20-item, five-point Likert scale measuring: 1) luck, chance, or judgment error over ability; 2) feeling fake or self-doubt; and 3) discounting or lack of acknowledgment of one's success or achievement (Clance, 1985; Lee *et al.*, 2020). The current study examines how Native American individuals experience impostor phenomenon in STEM, also closely tied to identity/belonging, through a lens of viewing oneself as an outsider or an impostor in certain learning spaces. It examines how STEM as a space could create these alienating experiences during interactions that happen in the pursuit of knowledge making using ways that are Western and mainstream.

Methodological Considerations in the Current Study

Methodological decisions in this study were made after identifying key knowledge gaps following a thorough literature review on impostor phenomenon. One prominent gap was the lack of research on identity-based experiences of Native American people that could contribute to impostor phenomenon. Due to the sparsity of Native American students in STEM fields, this study was extended across the United States to recruit as many participants as possible. The study used a primarily qualitative, phenomenological approach to understand the experience of impostorness. Data were collected using one-on-one interviews, although some prior data were collected from the same participants through a short survey (please see the *Data Collection* section) as a screening mechanism to ensure that only those who felt like impostors participated. Qualitative studies help develop a deeper understanding of a phenomenon (Kahlke, 2014; Marshall and Rossman, 2014), and an exploratory approach was appropriate due to a lack of theoretical underpinning or robust literature on Native American experiences. This study interviewed PhD students and postdoctoral trainees (together termed as "early-career researchers") to understand their journeys during their training (Laudel and Gläser, 2008). Native American participation in STEM fields is disproportionately smaller compared with their already small proportion in the U.S. population. This study aimed to identify possible factors contributing to the underrepresentation of Native American individuals pursuing research in STEM.

METHODS

Data Collection

The current research followed a qualitative, phenomenological approach (Marshall and Rossman, 2006) and is a part of a

larger study examining impostor phenomenon among a diverse group of students and professionals in STEM fields in the United States. Following institutional review board approval from Washington State University (a large, research-focused, public, land-grant univeristy, 16156-001), the author conducted one-time, in-depth interviews with individuals who agreed to participate. Eligibility to participate in the study included identifying as American Indian/Alaska Native/Native American and currently training as a PhD student or a postdoctoral scholar in a STEM field at a U.S. university.

To ensure that interviewees were aware of impostor phenomenon and had personally experienced it at least once, they filled out a short survey (5 minutes) before the interview. The survey had demographic questions, 20 five-point Likert-scale items from the CIPS (1 = not at all, 2 = rarely, 3 = sometimes, 4 = often, 5 = very true) examining the construct of the phenomenon, as well as an open-ended question asking whether participants could describe an instance when they felt like an impostor. Those interested in being interviewed provided their email addresses at the end of the survey. All questions other than items from the CIPS were optional. The survey was hosted on the author's institutional webpage, which also had the definition and an explanation of impostor phenomenon (Clance and Imes, 1978) as well as more background information about the study. Participants who had questions about the study could email the author. Anyone eligible could participate irrespective of age, sex, generation status, or location. Overall, the study used a "multi-mode, multi-step data collection process" (Creswell and Clark, 2017; Chakraverty, 2020a, p. 439).

Following the same approach for prior published research based on the larger study in which impostor phenomenon among Black participants was examined (Chakraverty, 2020a, p. 439), participants were identified from a national conference the author attended in Baltimore, MD, in 2018 that focused on "broadening participation and encouraging minorities to pursue research-based science careers." The author distributed business cards with information about the study and a link to the survey to those who attended the conference, including faculty principal investigators, postdoctoral researchers, and PhD

students. Those interested took the survey followed by the optional interview; the author did not know them professionally or personally. In other words, the author did not recruit participants, but the participants self-selected themselves to participate in the study if they had experienced impostor phenomenon and wanted to share their experiences.

Interviews
One-on-one interviews were conducted with those who completed the survey and consented to be contacted, clarifying that they have experienced impostor phenomenon, verified both through the CIPS scores and the open-ended survey question for which they described an experience of impostor phenomenon. The interviews probed further into their understanding of impostor phenomenon through situations when they experienced it. Interview questions were not based on the survey findings. Instead, everyone was asked a list of questions (Table 1; also see Chakraverty, 2020a, for examples of questions asked to Black participants) developed by the author based on literature gaps. Questions 5 and 6 in Table 1 focused on addressing the lack of studies focused on Native American identity and impostor experiences during training in STEM. Additional follow-up questions were asked based on participant responses to initial questions following a semistructured pattern. For example, if an individual described mentors and advisors contributing to impostor phenomenon, the author asked questions about the mentoring and advising received at different stages of training. The interviews were about 45 minutes long and were transcribed by a professional company. Participants received no monetary or other incentive for their time.

Data Analysis
The survey scores were computed by individually adding up all the item scores for a total of 100 to classify participants based on CIPS (Clance, 1985) as experiencing low (<40), moderate (41–60), high (61–80), or intense (81–100) impostor phenomenon (Table 2). Simultaneously, interviews were analyzed examining the phenomenon through life experiences (Moustakas, 1994; Kvale and Brinkmann, 2009; Patton, 2014)

TABLE 1. Interview questions

1. How did you hear about the study? What motivated you to participate in the study?
2. Could you give me a brief summary of your academic background, and what is it that you are currently doing?
3. Have you ever felt like an impostor? What were some of the events around the first time you felt like an impostor?
4. What does it mean to feel like an impostor? How does it feel?
5. How did your identity as a Native American shape your impostor experiences? Do you hold other identities that make you feel like an impostor?
6. What are some of the situational or environmental factors during STEM training contributing to impostor phenomenon? Could you talk about the academic environment that might trigger impostor feelings?
7. Are there personal factors that make you feel like an impostor? Specifically, do you think family plays a role in your experience of impostor phenomenon?
8. Is there anything about your workplace interactions that make you feel like an impostor?
9. How does the phenomenon manifest in your day-to-day life?
10. Do you talk about your impostor feelings? [With whom?] Or do you mostly keep them to yourself?
11. What could happen differently that you will not feel like an impostor?
12. Is there anything else you would like to share that we haven't discussed? Do you have any questions for me?

[I thank the participants for their time.]

TABLE 2. Participant characteristics

Pseudonym	Sex	CIPS score
Michelle	Female	95 (Intense)
Rosalynn	Female	93 (Intense)
James	Male	90 (Intense)
Abigail	Female	85 (Intense)
Julia	Female	77 (High)
Anna	Female	75 (High)
Caroline	Female	62 (High)

based on their Native American identity, both during and outside STEM training (Giorgi and Giorgi, 2003; Marshall and Rossman, 2006; Connelly, 2010). Given the dearth of research on impostor phenomenon examining Native American perspectives, in-depth interviews allowed making meaning of rich descriptions of experiences and further categorizing those experiences based on the development of certain themes (Creswell, 2012; Castleberry and Nolen, 2018).

The author and a research assistant coded the interviews using a set of initial codes the author developed after a first read of the transcripts. Initial codes included "identity," "belonging," "marginalizing experiences," "minority status," "STEM environment," and "other identity." These codes represented impostor phenomenon not just as an internal feeling of lack or insecurity, but also framed it around external cues rooted in colonial, structural, and racialized oppression. Additional codes were constructed as the researchers coded each line and paragraph in the transcript. Each coder read and coded all the transcripts separately, then met and discussed the final list of codes, resolving any disagreements through mutual conversation. Examples of new codes included "culture," "critical mass," "fear," "family," and "external appearances." The codes were compiled into themes and exemplified with quotes through constant comparison and an inductive analysis (Glaser, 1965; Pope *et al.*, 2000; Thomas, 2006). Themes constructed for each participant are presented in Table 3.

Additional measures were taken to strengthen the rigor and trustworthiness of the study. Other than reflexivity and researcher positionality (discussed in the following section), the following were carefully considered: 1) Interview questionnaire: The author asked simple, easy to understand questions (Table 1) and follow-up questions to collect rich, thick descriptions. 2) Consultation: The author sought feedback from a colleague during the formulation of the study design, interview

questionnaire development, data collection, and data analysis. The colleague has several years of experiencing working with Native American high school students from various tribes in the northwestern United States, studying their interest and future intention to participate in STEM fields. 3) Member checking: Following transcription, interviews were de-identified and shared with the participants, who could add reflections or delete anything they did not want on record in addition to determining the accuracy of the transcription. This was to improve the trustworthiness of the data as well as ensure that the participants had agency in what was shared about their experiences (Birt *et al.*, 2016). 4) Mindfulness: At the beginning of each interview, the author shared with the participants that they could stop the interview any time they wished to, temporarily or otherwise, if they experienced discomfort in sharing sensitive experiences. All the questions asked were optional; participants could refuse to answer any question that made them uncomfortable. The author emailed each participant after the interview by the end of that day or the next day to ensure that participants did not experience post-interview distress. None of the participants expressed concerns or distress following the interview.

Reflexivity/Researcher Positionality

The author documented how her beliefs and worldviews as an early-career researcher from India and a woman of color with a background and graduate training in environmental sciences, public health, and science education could influence how she conceptualized the study (Antin *et al.*, 2015). The author practiced reflexive journaling and memo writing during the study. She was mindful of how she experienced and succeeded in education models (both in India and the United States) that are considered dominant or mainstream by Western standards, largely shaped by Western colonization, in a nonnative language (English), replacing Indigenous ways of doing science education. Interviews were conducted in English, a language not native to some of the participants either. This is important, considering language shapes the way we think, exist, and perceive the world around us (Boroditsky, 2011). The author worked with a researcher (Coder 2) who is second-generation American of Asian origin, identifying as a woman in a STEM field at a public, land-grant university. Yet neither of the researchers are experts in ways of knowing and understanding the world using an Indigenous lens. The author wrote memos at the end of each interview, highlighting the key points discussed during the interview. She specifically remembered her role as an

TABLE 3. Thematic examples of impostor phenomenon shared by participants

Pseudonym	Cultural differences and lack of understanding of Indigenous culture	Lack of critical mass and fear of standing out	Academic environment	Family background and upbringing	Looks and diversity status
Rosalynn				X	X
Abigail		X	X		X
James		X			
Michelle	X	X	X	X	X
Julia			X	X	X
Anna	X	X		X	
Caroline		X	X	X	

immigrant, English-speaking faculty in the United States at the time of the study, her role as a social science researcher making meaning of the experiences of people in STEM, and her lack of familiarity with certain words to describe cultural practices or ways of being during interviews (pow-wow, sweat lodge, etc.), making a note of these learnings that provided an audit trail during data interpretation.

FINDINGS

Overall, four PhD students and three postdoctoral researchers ($N = 7$) identifying as Native American participated in the study (survey and interview). They were at historically White institutions and from the following STEM fields: nursing, biochemistry, biomedical science, bioengineering, genetics, and chemical engineering. Each of them has a pseudonym. Their survey scores (Table 2) indicated that they experienced high to intense impostor phenomenon (62–95) at the time of the study. Their training status (PhD student/postdoctoral researcher) and field of study are excluded so that they are not easily identifiable due to their smaller presence in STEM. The interviews examined in detail experiences related to their identity and training in STEM (Table 3). All participants attributed their impostor feelings to lack of belonging and identifying as a minority, sometimes of mixed heritage. Their sense of feeling minoritized, marginalized, and excluded was nuanced. Participants viewed themselves as numeric minorities in several ways: as women, Native American people, and/or both in STEM. They also felt marginalized and excluded knowing that their ways of being and knowing the world did not always adhere to ways in which their training shaped their ways of knowing and doing science. In the following sections, selected quotes illustrate how some participants felt they had the social capital, but of a different nature than what their (White) peers had, which also brought a feeling of exclusion.

For Abigail, feeling like an impostor meant "I don't belong here [in the PhD program]. I just barely got through, I shouldn't be here," while for James, it meant "that despite any successes, even though people say, 'Yes, you deserve this success, you worked, you burned the midnight oil to get here,' I feel like I don't belong." He further described feeling "the least accepted, … I'm definitely a sheep in wolf's clothing." Caroline was one among the few Native American people at her institution. This added to her sense of not belonging, as if "somebody's gonna find out that I'm not good enough, and there's been a mistake that I made. Maybe I didn't deserve to get to where I'm at as an impostor. Like I snuck in or something under the radar." For Anna, being Native American meant that she had social capital of a different nature compared with her White peers that made her feel like she did not belong and was an impostor. "We have social capital of a kind, but not the kind that gets you very far in the social part of academics. When it comes to interacting with other academics, that's where I don't feel like I belong." Perceiving oneself as being different or "the other" could contribute to impostor phenomenon, possibly also linked to a lack of belonging in the academy, which Anna navigated with a different kind of social capital (as she explained), that could have roots in the history of colonialism and structural oppression experienced by Native Americans. This made her aware of cultural differences as well as lack of understanding of Indigenous culture on the part of dominant groups in academia; as we see

in the first theme, *Cultural Differences and Lack of Understanding of Indigenous Culture*, she felt that she had to assimilate into a culture and process/way of knowledge making that was different from her own identity and background.

Participants expressed feelings of being an impostor in relation to their minority identity, describing the following: 1) cultural differences and lack of understanding of Indigenous culture, 2) lack of critical mass and fear of standing out, 3) academic environment, 4) family background and upbringing, and, 5) looks and diversity status. Each theme is described in detail along with illustrative quotes from the interviews.

Cultural Differences and Lack of Understanding of Indigenous Culture

Cultural differences and the pressure to assimilate into a predominantly Western way of knowledge making made participants feel like impostors. Anna, who described herself as from the Choctaw tribe, presented examples of cultural differences in academia where:

> This institution, the science, the policies, the infrastructure, none of it was built for people like me. I have to navigate between learning the rules of this context and losing myself. I constantly think that I have academic Stockholm syndrome, where people get kidnapped, they identify with their kidnappers. Because if I don't internalize these views, these values, then I will be ejected from the system.

Anna believed she had to embrace academic values that felt foreign to avoid being removed from the academic system. "There is a large pressure to assimilate to academic viewpoints that are Western science, a very calcified view of science that's not necessarily always consistent with an Indigenous worldview," she added. For example, seeing a forest as a natural resource that could be exploited was a hierarchical assumption that put humans at the center of importance, the center of knowledge and understanding compared with other species. This was, according to Anna, "in conflict or strongly contrast[ing] with Indigenous worldview." Such worldviews added to her lack of belonging in academia as a Native American student.

Anna discussed her knowledge of historical work in genetics with Indigenous subjects that was ethically problematic and objectionable. There were classical research papers in genetics "done on these Indigenous populations that probably did not give informed consent." She felt that people from Indigenous backgrounds did not participate in scientific studies due to lack of transparency or trust and "because of the biases of the researchers, what the data will be used against. First, we're statistically infrequent, and secondly, there's a lot of historical reasons for a reluctance to participate in any kind of research." During group discussions, lab members were apathetic and did not acknowledge her whenever she brought up the ethical issues around publishing genetics papers with data from Indigenous people without their consent. "People really don't wanna hear about that. You feel that you need to acknowledge this, but people get very uncomfortable." Anna feared that people saw her as a difficult, confrontational person, making her question her place in academia.

During field visits for her research, Anna "took the time to establish relationships with the Indigenous people around my field site, … picking up languages of the Indigenous people like Anishinaabe, Choctaw, and Wampanoag to make those connections." She developed personal relationships "because you can't go to an Indigenous population and be like, 'I'm going to help you with this thing.'" Yet her advisor (who was not Native American) did not approve of developing personal relationships with her research participants. "That's been difficult to explain about why I have to take the time and build relationships [with participants] that don't necessarily result in a product. That's difficult."

Michelle shared examples of cultural differences that made her feel alienated and like an impostor. She said, "I talk differently. I speak more slowly and quietly and that comes more from Native American culture." She added:

> I don't make eye contact. I've been told on evaluations that I came off as being rude because I didn't make enough eye contact. In Native American culture if you make eye contact with someone who is your superior, it's actually very intimidating and threatening. Looking just directly over someone's shoulder is actually the most respectful thing to do.

Michelle also felt like an impostor when academics around her made no effort to understand her culture, assuming that "the Native American culture is not as present anymore. People think of it as more a historical thing rather than something that people still abide by and follow. It's just frustrating to me." In her program, she was asked if she was related to a Cherokee princess. "That's not how the tribal structure works. There was never any royalty so that's absolutely not something that happens at all," she shared. Reflecting on explaining to someone that she is Cherokee and having that person respond, "Oh, I'm 1/64th Cherokee," she added:

> Well, I was raised in the culture. I'm half Cherokee. I am very much a part of my community. I try to go to pow-wows and learn the language and know the songs and participate. It just seems invalidating to my identity when people will say things like that. It seems people don't want to believe me or don't want to learn, but rather want to draw parallels.

Michelle remembered some students asking her if she could make them a pair of moccasins or if they could accompany her to a sweat lodge,

> which is a really spiritual experience and not something that you want to just bring people to as though they're tourists. It's supposed to be religious and a celebration of nature and mother earth, a lot more serious than people want to take it. I've had people say derogatory things to me, call me a "squaw," ask me if I put on war paint.

She added, "A lot of it comes from ignorance and people wanting to learn, but they do so in a way that just wears you down after a while." As a result, Michelle thinks it is hard for her not to feel like an impostor.

> It's so intrinsic to who I am. … Would I feel more comfortable if I completely conformed? … No, because even if I changed my physical appearance, my life experiences are still so atypical [as a Native American person] that I don't think that I would feel like I really fit in.

She felt like an impostor when unable to freely express herself and be accepted based on her identity without any pressure. She wanted to heal and help people and spoke about the dichotomy between traditional and Western medicine that made her wonder how she could truly espouse a Western way of practicing science. "In Cherokee, the word 'health' is the same word as 'peace.' I want to spread healing and peace and love. That seems to get so lost in Western medicine." Her understanding of "health," based on her background, was not always what was practiced in Western medicine. She was also concerned about how the health of Native American people was ignored.

> Everyone is just shipped off to an Indian health clinic and are given a cheap pair of eyeglasses. A lot of their health problems are ignored because they're not being treated by other Native Americans. They're being treated by White people who don't understand the community and don't necessarily want to.

She frequently saw her White colleagues disparage herbal medicine and commented:

> My roots led me to medicine and who I am and who my family is. … Herbal medicine needs to be better understood. My classmates disparage anyone ever thinking about taking an herbal supplement. That's so much of the basis of medicine that I grew up knowing and learning and practicing.

Both Anna and Michelle felt the pressure to conform and assimilate into a different value system vis-à-vis a Western way of doing science. This made integration into their fields or universities challenging.

Lack of Critical Mass and Fear of Standing Out

Lack of belonging during early-career academic training came from a lack of community for participants at their respective universities. Although James loved pursuing research, his impostor phenomenon came from the lack of Native American people in his field. His field as well as the conferences he attended were a "Caucasian majority," that made him feel like an outsider. Similarly, while Abigail met a few minoritized students during PhD training, they were not Native American, which was discouraging in terms of "finding role models, finding someone who comes from your background and cares about the perspective." As a Native American, she was consistently singled out by colleagues in academia and "judged more on a group basis than an individual basis, not only as myself, but as a Native American." The low number of Native American people in her field made her feel like an impostor. She was troubled by the realization "that I'm going to be a minority no matter where I go in the world. There isn't a country anywhere in which Native Americans are in the majority." She felt isolated "because there's just no one. I don't know any other Native American who is in science here." This made her doubt herself. "I don't start in a place of confidence. I start in a place of, 'Well, I don't see anyone like me. Am I doing something wrong?' The numbers for Native Americans in grad school is [sic] extremely low."

Caroline was unable to develop a feeling of belongingness in the department. She occasionally skipped going to work "just because I don't feel like I wanna be in that space or I belong in that space, and so I lose that day of productivity." Seeing more people of color in STEM could help.

> Having more people in academia who look like me and have similar experiences that I have had would make me feel less like an impostor. Just knowing that there's somebody, regardless of who or what they are, as an ally and a resource.

Although many experienced impostor phenomenon and self-doubt, such as "Why am I here? Why am I doing this?," during training, there was not as much focus on understanding impostor phenomenon. Caroline wants to become a faculty because

> I never had anybody who looked like me in my whole ten years of higher education. That's why I wanted to get in higher education, because I'm a person of color, and that's a powerful message that can be sent if you're in a position where people see you and interact with you in an education setting.

When Anna failed her PhD preliminary examinations, she was told by her advisor that perhaps academia was not for her. Yet she stayed in academia so that she could encourage people from the Native American community to get into higher education. Her advisor (who was not from the Native American community) did not share her values. So instead of seeking support while retaking the preliminary examination, "I let that sense of failure just overwhelm me and define me for years." Her continuing in academia is a story of resilience and reclamation. Pushing back against colonial forces means being the voice that affirms and amplifies when marginalized students reclaim their rightful position. As the only Native American, Anna felt like an impostor and struggled to talk about it "because there's no one else to acknowledge it." She sought community support outside the department, through membership from groups such as the American Indian Science and Engineering Society and the Alaskan Native Science and Engineering Program. These groups met weekly, which helped her feel more connected to the people of her tribe and less like an impostor.

Michelle felt that lack of critical mass in a field brought a fear of being stereotyped or singled out. She has always wanted to attend a national holiday of the Cherokee nation when everyone gets together: "It's a giant pow-wow. It's a bunch of competitions with marbles and dancing and singing and something that I've wanted to go to for years." However, she is afraid to ask for time off, because "I don't want people to think that I'm making provisions based on my identity. I don't wanna be seen as though I need to take more time off because of who I am." She did not want to be someone always sharing her own experiences as a Native American.

> I've had a lot of experiences that are different from other people and a lot of times, situations will arise in which we're talking about something in school that I feel like I could contribute to because I've had these different experiences, but I don't want to because I don't want to be singled out, so I just keep quiet.

For example, when people talked about disease prevalence in different groups, they were referring to disease prevalence for "White, African-American, Asian, Hispanic and 'other.' I was like, well, I guess I'm the 'other.' They do arise quite often." This made her feel "invisible." She wishes to feel "more comfortable expressing who I am and not feeling pressured by my identity, feeling like I either don't say something or have to say something because of who I am."

Academic Environment

The competitive, less-collaborative academic environment as well as comments from colleagues that participants heard also contributed to their impostor phenomenon. Julia felt that the academic environment was hierarchical and particularly hostile and unfriendly toward minorities. Whenever she received external recognition, she felt like she was in the spotlight and could no longer fade into the background. While applying for the NSF Graduate Research Fellowship Program, she spent a lot of time incorporating feedback from past NSF reviewers and mentors. Yet a mentor told her that he did not expect her to get the fellowship because it was very competitive. When she did, she thought, "They gave it to me because I fulfilled a diversity quota." Her mentor doubting her made her doubt her own abilities. She added, "We need a more collaborative and less authoritative atmosphere that would help with the impostor syndrome, of not feeling like I'm not an expert or I don't know what I'm talking about because so-and-so is in the room."

Caroline started her PhD training after receiving competitive, merit-based scholarships. Yet people questioned her place as a person of color in the program. Her peers made comments such as "Oh, you just got in because of the scholarship" and "Affirmative Action is working for you." Abigail also talked about a chilly academic climate, lack of social networks in PhD training, and the cues she got from her peers in the PhD program due to which, "I don't feel as socially connected with the students." She felt a lack of commonality with the other students in the program based on identity, because of which, she was reluctant:

> to spend enough time with somebody of the dominant academic paradigm; I don't have enough in common with other people to even strike up a conversation about doing a project together. That's just not part of a group I belong to.

She felt like she should "quit apologizing and start negotiating more. I'm learning to recognize when students are asking for inappropriate things when I'm serving as a TA [teaching assistant] and get[ting] better about saying no."

Due to the low number of Indigenous people in her field, Michelle felt like "I'm the oddball. I don't always conform." This led to "anxiety or worry of failing a test or dropping out of school altogether due to feeling singled out as a Native American, feeling odd in other people's eyes because I don't fit their stereotypes and so therefore it's not legitimate in their eyes." She panicked during many tests, feeling like she did not study or work hard, "that I don't know anything, despite having worked so hard on knowing the information. I can't learn as well as my classmates do. I'm just gonna fail this exam." She feared being judged as an underachiever by her peers, "worried that I don't know everything and because I express

that, they must think that I don't work hard, that I don't achieve.

As discussed previously, Anna described historical research in genetics that was not conducted ethically, possibly without the consent of Indigenous subjects. Yet her lab did not encourage these discussions. "People really don't wanna hear about that. You feel that you need to acknowledge this, but people get very uncomfortable."

Although Anna felt obligated to have such difficult conversations and acknowledge that science has often progressed through unethical practices, profiting out of the marginalized, she also feared being perceived as someone difficult to work with. "People will say, 'Oh, does she quote-unquote, fit?'" Part of the challenge was also to fit into the dominant crowd and hence not saying or doing anything that would make others uncomfortable.

Family Background and Upbringing

The role of family was described under contexts such as being first generation, lack of social capital, and family identity conflicting with academic identity. Participants who were first-generation college students lacked the know-how about getting into college or a PhD program. Anna felt a disconnect when comparing family backgrounds and family histories between herself and her graduate school peers. Anna's grandmother, whom she was close to, did not go to high school and worked as cleaning staff at the university she attended for her PhD. "This is not where we come from [an educated family]," Anna explained, feeling a disconnect when a peer told her, "'Oh, my grandmother gave birth three days after defending her PhD' and she replied saying, 'Oh! My grandmother had been homeless!'" While some of her peers were third-generation PhDs, she was a first-generation student and her family (including her siblings) did not have exposure to academia. This brought in a lack of belonging for Anna, contributing to impostor phenomenon, which increased when she first left for college, because "most Indigenous people are very rooted to their home community," she explained. While moving for better career prospects was the norm for many White students, especially White men, it meant being away from her community support system for Anna. She described this as "cultural dualism, not feeling at home when I'm with my family because I ask questions, don't accept anything on faith, but in academic settings, I'm also not at home, … stuck in between these paradigms [family and academics]."

Anna further explained that because of the way she was raised, she was not aware of anything "other than the paradigm of you get married, have babies, and go to church. It's really an absence of the social capital that people with academic pursuits in college and graduate school have." This also contributed to impostor feelings while pursuing higher education. Rosalynn, like Anna, talked about a "dualism of culture in which we live in as someone who is part of an academic Caucasian culture and being raised yet in a culture where academia is too far out of reach." She felt like a "cultural impostor," raised in a large, multicultural family of Native American and Hispanic people who did not focus on education. A first-generation college student in her entire family, she "certainly will be the only person in my family for many generations that'll have a PhD. I think that contributes a fair amount [to impostor phenomenon]." As a cul-

tural impostor, she did not fit "in the world of my family of origin, and yet that [her family background] significantly influences who I am as a person in academia. When I'm in academia, the history that I carry with me is very apparent."

Michelle was also a first-generation college student on a merit-based scholarship who felt that she would fail because no one in her family went to college. Michelle stated, "This line of thinking often makes me panic and underperform on exams." She added, "My family grew up pretty poor, and so I have a different background in a lot of different ways from my classmates and I feel like there's a lot of pressure to conform and be like everyone else and I just feel different."

Michelle lacked the family support network that her peers had, not knowing how to apply to schools and what to expect, "missing out on information that other people had, and that's how it [impostor phenomenon] all started." In fact, her family expected her to find "someone rich to marry instead of achieving something for myself. There was a complete lack of parental pressure for me to achieve." Family background differences also brought cultural differences; her peers in the PhD program "exuded a sense of having grown up well and they dress that way, they act in certain ways." Her peers shared stories of going skiing while growing up. However, Michelle has never been skiing because her family could not afford it. She saw this as not just racial differences but also class differences. "It's not just White culture. I would say that it's White upper middle class. … I think class might even have more of a role than ethnicity [in experiencing impostor phenomenon]," she added. This example points to intersections of racial identities and class disparities, also a form of structural oppression as a result of racism, classism, and colonialism.

Caroline shared similar life experiences to those of Michelle. Her parents did not believe in her interest in pursuing engineering and made her "take an aptitude test to confirm that I was heading in a good direction. The high school-administered career test recommended I become a social worker." She felt that she did not deserve to pursue a PhD in engineering and she was not intelligent enough to persist because her parents did not believe in her, adding to her impostor phenomenon. Julia explained that the complexities of one's identity was based on how or where one grew up and where one was from. Growing up in a small town, she never texted or used a smartphone, yet living in a large city, "everybody expected me to be able to send and receive text messages. Sometimes, I feel like I'm backwards, and the rest of everybody, they're just moving forward."

Looks and Diversity Status

The way one looked or one's diversity status also contributed to feeling like an impostor. Both Abigail and Rosalynn shared that because of their unconventional looks, people did not realize that they are Native American. Abigail identified "most strongly with my Anishinaabe, otherwise known as Chippewa roots," while Rosalynn described not looking like a Native American: "My ethnicity is very culturally ambiguous. … I'm very light skinned and I have features outside the norm or the group's mean." As a result, Rosalynn felt she did not belong in academia or in the Native American community, making her feel like an impostor. She faced "a lot of anxiety, wanting to make everyone happy, to fulfill perceived expectations." If she failed at something, she always attributed it to her lack of hard work, whereas

she attributed her successes to others being kind to her. Michelle's colleagues in academia often questioned her nontraditional looks and commented that she did not look Native American enough. While people from the Cherokee tribe were light skinned, she looked "more bronze than what a lot of people generally think of, which is southwestern Native American tribes rather than southeastern Native American tribes." She found it "frustrating for people to just tell us that we're not Native American enough." She also felt pressured to conform to social standards, unable to dress as nicely or expensively as her PhD peers. She added, "I feel like I look different and then I have bad teeth because we couldn't afford braces when I was younger. I feel like I stand out physically. I know that I'm a complicated case."

During the interview, Julia called herself a "pseudo-minority," struggling to place herself in a minority category because of her multicultural heritage. As someone of mixed race, she did not feel like she belonged in any particular group.

> I am multiracial, and I appear White, so I've had a lot of difficulty navigating race and ethnicity in my training. I feel like I wanna honestly report my background, but also feel like if I do that, I'm fulfilling a quota for diversity and inclusion, so maybe the reason why I got the NSF [fellowship] was because they needed more racial and ethnic minorities and because I checked a box.

Her diversity status brought a lack of belonging. She stated, "Everybody else looked like they belonged, but I didn't. I never know if I got opportunities because I was actually competitive enough to get them or just because they looked at what I checked off in the boxes," adding, "the meaning of URM [underrepresented minority] is different. It's not a yes or no answer anymore." When offered a diversity scholarship during PhD training, she felt guilty and wanted to offer it to someone else, not feeling like she belonged as a diverse candidate, because she "looked like the White girl in a class of diverse people. I don't know if people judge me for that." She did not consider herself "enough of a minority to deserve some of the opportunities."

DISCUSSION

The current study examined impostor phenomenon experienced by seven Native American PhD students and postdoctoral trainees in STEM. The study was conceived keeping in mind the dearth of literature on Native American identity in relation to impostor phenomenon. Thus, an in-depth interview study was appropriate as a conversational mode of data collection to understand several nuances of what made participants feel like an impostor. A prior survey using CIPS found that the seven participants experienced high to intense levels of impostor phenomenon at the time of the study. Interviews with the same participants further revealed reasons that participants experienced impostor phenomenon. All the themes were linked to a poor sense of belonging in the academy and in STEM. One reason could be a lack of family background in STEM fields that was related to a poor understanding and/or appreciation on the part of the family members of what it takes to persist in STEM. The role of a sense of belonging in one's identity development, persistence, and academic success in STEM have been discussed

in prior research, especially when examining the experiences of women of color (Carlone and Johnson, 2007) and members of the BIPOC community (Strayhorn, 2011, 2018; O'Meara et al., 2017). Findings provide a lens for understanding how those experiencing (cultural) impostor phenomenon may not fully develop a sense of belonging in the academic spaces they cohabit, including research teams, classrooms, departments, universities, and STEM fields.

Prior findings that are a part of the larger study conducted an in-depth examination of the reasons why Black trainees in STEM felt like an impostor (Chakraverty, 2020a). Some of the reasons uncovered included being the only Black person in a larger professional group, lack of belonging, stereotyping, microaggressions, judgment based on external appearances, feeling like the "diversity enhancers," and other factors based on one's membership to a particular racial group. Interestingly, the current study constructed themes, some of which were similar to experiences of Black individuals, such as lack of critical mass and fear of standing out, a chilly academic environment, and one's looks and diversity status. However, some of the themes unique to the Native American participants also include cultural differences and lack of understanding of Indigenous culture as well as a cultural dualism or a dichotomy of personal and professional identities based on family factors such as background, culture, and upbringing.

The first theme related to cultural differences and lack of understanding of Indigenous culture from those with whom participants interacted in the academy. Historically, the term "impostor phenomenon" was first conceptualized in a study documenting the experiences of successful, White women in the United States (Clance and Imes, 1978) and was applied in subsequent research studies mostly focused on the experiences of White people. Studying impostor phenomenon across cross-cultural contexts is fairly recent, and as a result, culturally informed models of understanding impostor phenomenon are largely underexplored or sparsely explored among Black people (Stone et al., 2018).

Within the BIPOC community, about a dozen studies have focused exclusively on the experiences of Black people. Our understanding of the phenomenon based on Indigenous cultures is largely lacking. All study participants were currently training in largely White research institutions where racialized marginalization and dehumanization of students of color have occurred historically (Milner, 2004). Cech and colleagues (2017) demonstrated that epistemological dominance and imperialism could contribute to structural and cultural disadvantages for Native American people in science, engineering, and health. It delegitimizes Indigenous ways of knowing and being, marginalizing those from such backgrounds and values, even in pedagogical practices that challenge culture-based knowledge making, ultimately devaluing and dehumanizing native ways of knowing. Foundational work by Smith (2013) has critiqued Western paradigms of knowledge making and discourses around research while looking at Indigenous cultures, and especially the need to decolonize such ways of unidimensional meaning making. Some of the experiences that Anna shared, for example, a human-centric approach to exploiting natural resources, speak of the dichotomy and conflict of living with Native American values while struggling to navigate a field (STEM) where knowledge making is essentially influenced by

different, Western, predominantly White values. This conflict of one's identity with science identity was acknowledged in other themes as well, especially when participants found their identity invalidated by others who lacked an understanding of Indigenous culture and made seemingly harmless but insensitive comments about Indigenous ways of being.

The second theme described how lack of critical mass of Native American people in STEM and fear of standing out made some experience impostor phenomenon. Prior research shows that being a numerical minority among a larger group could contribute to a lack of belonging and feeling like an impostor for Black students in STEM (Chakraverty, 2020a). Being minoritized and lack of critical mass could stymie access to mentors from the same background or holding similar identities and beliefs (Chakraverty, 2013). For example, an Indigenous mentoring program for Native American students, trainees, and faculty in STEM could include developing relationships organically by connecting and sharing, cultural humility, and incorporating Indigenous mentoring activities and worldviews along with providing culturally attuned resources and support systems (Windchief *et al.*, 2018, p. 329). Institutions with predominantly White faculty and student bodies need to focus even more on cross-cultural mentoring that acknowledges and celebrates cultural differences as well as cultural pluralism rather than assimilating underrepresented minorities into the dominant academic culture and ways of understanding science (Davidson and Foster-Johnson, 2001). This could help lessen cultural isolation that many Native American people face in STEM.

The third theme illustrated how the academic environment could contribute to impostor phenomenon. Windchief *et al.* (2018), p. 508 also found that Native American students in STEM feel "unwelcomed, isolated, misunderstood, and marginalized." To improve the academic environment, mentorship and coaching could be effective ways of helping individuals manage feeling like an impostor, improve self-efficacy, and reduce negative evaluation fears (Zanchetta *et al.*, 2020). Impostor phenomenon disproportionately affects women and the BIPOC community; mentors need to have cultural competency, being mindful of the cultural differences and inherent biases that minoritized individuals risk facing (Hinton *et al.*, 2020). Prior research shows that lack of cultural competence can be addressed to some extent when mentors and mentees share common attributes, for example, MD–PhD mentees being mentored by MD–PhD faculty (compared with MD faculty and/or PhD faculty) (Chakraverty *et al.*, 2018a, 2020). Following a thorough review of literature, Windchief and Brown (2017) recommended a "culturally congruent mentorship program" for Native American PhDs in STEM through a bicultural paradigm (as opposed to a solely Western paradigm) by amalgamating traditional mentoring techniques with culturally relevant Indigenous values. Such mentoring programs could include components of cultural humility and values (Windchief *et al.*, 2018). Overall, culturally sensitive mentoring, modeling, and advising for BIPOC trainees could alleviate some of the psychological distress that marginalized STEM trainees experience in addition to isolation and loneliness that could be related to feeling like an impostor.

The fourth theme discussed family background and upbringing in terms of being a first-generation learner, lacking the social capital that their White peers did, and a conflict between family identity and academic identity. Family interest and involvement in science could facilitate children in developing an early interest in science (Dabney *et al.*, 2013), and an early development of science identity has been examined using a funds of knowledge framework (Chakraverty *et al.*, 2018b). In prior research, several physicists and chemists spoke about an informal or more formalized family environment in which talking about and doing science were encouraged (Chakraverty, 2018b). While the roles of parents, siblings, family, and extended social networks have been documented in supporting an early interest in science, not everyone described having these experiences of family support. In fact, in some cases, choosing a STEM field came with more skepticism than support from family members, which could contribute to one feeling like an impostor.

The fifth theme detailed ways in which one's looks and diversity status could contribute to impostor phenomenon through the process of "othering" (Peteet *et al.*, 2015a), with power differences between White people (considered the dominant group) and Native American people (considered as others). One of the ways of othering could be due to the ethno-racial biases and disadvantages that Native American students experience regularly at predominantly White institutions (Cech *et al.*, 2019). These cultural disadvantages could be in the form of exclusionary practices such as "derogatory stereotyping, exoticized othering, delegitimization, and assimilation pressures related to cultural hegemony" along with a lack of understanding of Indigenous knowledge and traditions (Cech *et al.*, 2019, p. 355; Barron *et al.*, 2021). Prior research examining Black students in STEM shows that othering by self and someone else could contribute to impostor phenomenon, which occurred in the current study when participants experienced cultural differences and lack of understanding of Indigenous culture (theme 1); lack of critical mass and fear of standing out (theme 2); and a chilly, competitive, and less collaborative academic environment (theme 3). Black participants also experience othering due to their fewer numbers and race-based microaggression, stereotyping, and judgment (Chakraverty, 2020a).

Strengths and Limitations

This study included Native American voices connecting cultural identity and impostor phenomenon during STEM training. To the author's knowledge, Native American voices have not been specifically included in the examination of impostor phenomenon, especially among PhD students and postdoctoral scholars, and are an often overlooked group of individuals in STEM. Participants shared in-depth narratives of aspects of their training that were related to feeling like an impostor. Participants were from six different STEM fields and seven different research universities across the United States compared with prior studies in which Native American people were a part of a larger sample (e.g., Gibson-Beverly and Schwartz, 2008; Craddock *et al.*, 2011). The construction of themes through a qualitative analysis of semistructured interviews is something that surveys could not have uncovered. It gave a deeper, more nuanced understanding of factors that could contribute to Native American people in STEM experiencing impostor phenomenon due to how their cultural and racial identities are marginalized in STEM.

Despite efforts made by the author, it was challenging to find Native American scholars in STEM willing to participate in the study. The individuals were self-selected; selection bias was due to purposeful sampling (Smith and Noble, 2014). Six out of seven participants identified as female; male participants were underrepresented in the study. This is a cross-sectional study in which participants were interviewed once (compared with a longitudinal examination of impostor phenomenon). Although prior research using phenomenology has used one interview per participant (e.g., Liu and van Schalkwyk, 2021; also recommended by Alase, 2017; Hycner, 1985), it may not fully capture the depth of the phenomenon being studied (Holroyd, 2001; Padgett, 2009). This remains a limitation of the current study and was addressed with in-depth interviews of about 45 minutes per participant. Additionally, only those still in STEM were included compared with those who may have left STEM training due to impostor phenomenon or for other reasons.

CONCLUSION

Although largely seen as an internal (and internalized) experience, impostor phenomenon can be traced to both internal and external factors, including deeply embedded identity-based beliefs that could determine academic socialization (Kong *et al.*, 2013; Chakraverty, 2021). Particularly, academic transitions could be challenging without adequate support. It is at these transition points that some trainees are vulnerable to impostor phenomenon, even making them consider leaving their training (Dabney *et al.*, 2016; Chakraverty *et al.*, 2018a, 2020). Impostor phenomenon is a perception about oneself based on certain environmental cues that could lead to a largely distorted view of one's abilities and potential. Faculty, administrators, and universities could create safe spaces for conversations around perceived failures, mental health challenges, and achieving a balanced outlook toward work and productivity. They should note that members of the BIPOC community (as well as other underrepresented groups) are especially adversely affected by stress, burnout, isolation, alienation, and challenges in integrating into mainstream academic groups, paving the way for disparities (Clark and Hurd, 2020). They need psychosocial and career support during STEM training (Curtin *et al.*, 2016). Additionally, we need to decolonize STEM through our teaching (Dessent *et al.*, 2021; Shahjahan *et al.*, 2021) and research practices (Smith, 2013; Anthony-Stevens and Matsaw, 2019), such as through "culturally responsive science teaching," as mentioned earlier (Barron *et al.*, 2021).

This study expanded our understanding of culturally relevant aspects of impostor phenomenon among Native American people, connecting their impostor experiences to structural inequality in STEM with its Eurocentric, exclusionary ideologies (Cech *et al.*, 2017; McGee, 2020). In conclusion, by supporting those already in STEM fields but experiencing poor sense of belonging and impostor phenomenon, the overall persistence and demographic diversity could vastly improve.

Recommendations for Future Research

Measures to improve doctoral training in terms of being more diverse as well as inclusive in relation to various identities and demographic attributes are recommended. Future research could examine experiences from other marginalized groups to improve equity and inclusivity in STEM. Through a longitudinal design, one could understand how impostor phenomenon may evolve over time. Research on cross-cultural mentoring that could mitigate impostor phenomenon would be helpful. Future research could also examine a wider demography of how faculty, staff, and administrators experience impostor phenomenon. Overall, our understanding of impostor phenomenon has improved, particularly in the last decade, with an increasing number of research studies with participants from different demographic groups. We need to continue to undertake research that examines experiences of impostor phenomenon among the BIPOC community. We also need more research exploring how colonialism and structural racism may contribute to impostor phenomenon in the BIPOC student population.

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