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Codeveloping and Implementing an Indigenous Mentoring Program for Native American Faculty in Science, Technology, Engineering, and Mathematics

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Mentoring programs for Native American faculty in science, technology, engineering, and mathematics (STEM) fields are critical toward developing, recruiting, and retaining Native American members of the professoriate. This article describes the development and implementation of an Indigenous Mentoring program for Native American faculty in STEM. Indigenous research methodology and method approaches were used to cogenerate the Indigenous mentoring program, and qualitative description and interpretive focus group methods were applied. Interviews were conducted with 23 Native American faculty—STEM to inform positive mentoring practices to increase their retention and success in STEM fields. A content analysis of the interview data identified common themes, and eight Native American faculty—STEM (program fellows) participated in an interpretive focus group to review data and findings and to codevelop the components and content of the Indigenous mentoring program. Based on these findings, the Indigenous mentoring program included four components: (a) informal, peer-to-peer gatherings; (b) formal group gatherings; (c) attendance at a scientific meeting; and (d) development of a formalized mentoring relationship. Process and outcome evaluations were completed. Program fellows (N = 8) were from two tribal colleges and universities (TCUs) and one predominantly White institution. The Indigenous mentoring program was 9 months in duration, with eight informal, peer-to-peer gatherings, and three formal group mentoring sessions. Findings indicate the program fellows found the Indigenous mentoring program to be useful and meaningful for the career advancement and success of Native American faculty and instructors in STEM fields. The program can serve as an effective platform for improving mentoring, retention, and success of Native American faculty—STEM and increase their numbers in STEM disciplines.

Keywords: Native American; faculty development and retention; mentoring; multiple methods; science, technology, engineering, and mathematics

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continued

Mentoring is the most frequently cited strategy to assist faculty members in achieving professional advancement and success in higher education. It is perceived to be especially important for faculty from groups that have been historically excluded from the academy (Beech et al., 2013; Martinez et al., 2018; Zambrana et al., 2015). Limited opportunities for professional advancement, underrepresentation in leadership or administrative positions, lack of mentoring and role models, discrimination, ethnic or racial bias, undeserved scrutiny, pressure, and an environment of cultural homogeneity (Nivet et al., 2008; Price et al., 2005; Wong et al., 2001) are among the challenges and issues faculty from historically excluded groups face in academe. Research shows many such faculty leave academe because of systematic segregation, discrimination, harmful traditions such as mascots, a competitive culture and elitism (Brown et al., 2024; Fryberg et al., 2008; Gamble, 2000; Nivet et al., 2008; Walters et al., 2019).

During the past 2 decades, some academic institutions and medical schools developed and implemented mentoring programs to advance careers of faculty from historically excluded groups (Bean et al., 2014; Beech et al., 2013; Sorcinelli & Yun, 2010; Tran, 2022; Williams et al., 2020; Yun et al., 2016), especially Indigenous populations (Brown et al., 2024; Walters et al., 2019). The National Institutes of Health (NIH) and the National Science Foundation (NSF) recognized mentoring as a critical tool for fostering a vibrant and competitive workforce in the STEM fields (Guessous, 2015; Peterson et al., 2020), and biomedical, behavioral, clinical, and social sciences (Sorkness et al., 2017). Existing Indigenous-focused efforts include a grouping of NIH-funded programs through University of Washington's Indigenous Wellness Research Institute, which focus on HIV-related, substance use, and health disparities research and training among Indigenous predoctoral and early career scholars and retention of Indigenous faculty in biomedical research (Walters et al., 2009, 2016; Walters & Simoni, 2009), and the Indigenous Faculty Forum, delivered through the Oregon Health & Science University's Northwest Native American Center and University of Hawai'i's Native Hawaiian Center of Excellence, which provides a 1-day structured course for Indigenous faculty in academic medical centers (Brodt et al., 2019). These mentoring programs show progress in efforts to increase the overall size, quality, diversity, and research productivity of the Indigenous faculty. However, to our knowledge, there are no mentoring programs reported in the literature that focused broadly on retention and professional enhancement of Native American faculty in STEM fields within academia. Thus, our study focused on Native American faculty, which is applied as a term inclusive for American Indian and Alaska Native, Native Hawaiian, First Nations, and Indigenous from other countries faculty with academic positions located in the United States.

Two recent studies exploring the lived, personal, and relational experiences and mentoring connections of Native American faculty at research universities (Walters et al., 2019) and in STEM fields (Brown et al., 2024) revealed that Native American faculty often face unique challenges for professional advancement and career success. These challenges include, but are not limited to, institutional

recognition and support of Indigenous values, the relevance of research conducted in partnership with Native American (NA) communities, fostering relationships amongst NA faculty, responsibility to serve/mentor NA students, academic work/life balance centered on Indigenous values and NA community obligations, and participation in cultural activities (Brown et al., 2024). Additionally, studies have revealed barriers to Native American faculty career advancement include cultural taxation, which is the extra, uncompensated, and institutionally unrewarded work that is disproportionately placed upon NA faculty (Brown et al., 2024; Jaime & Rios, 2006; Walters et al., 2019). This problem also undermines faculty from other minoritized groups where faculty are tasked to address diversity-related departmental and institutional affairs, to serve on numerous committees, mentoring students, grant writing, teaching, and mentoring other faculty of color (Joseph & Hirshfield, 2011; Padilla, 1994; Shavers et al., 2014; Trejo, 2020). Another obstacle facing Native American faculty is securing funding for Native-led research from large external granting agencies such as the NSF or the NIH. This is a requirement at most academic institutions that faculty gain large external funding in order to be granted tenure or full professorships. NA faculty are consistently underfunded compared to their White colleagues in STEM. Recent studies have found systemic racial inequality in funding for all historically excluded groups including NA groups (Chen et al., 2022; Eaton et al., 2022). In 2019 alone, NSF received 20,400 research proposal submissions; only 99 of them came from self-identified NA researchers (.3%; Chen et al., 2022). While a relatively high percentage of NA research proposals were funded in 2019 ($n = 33$, 33.3%) compared to the overall funding rate of 27.4%, Chen and colleagues explain that the surplus of awards for NA ($n = 6$) is significantly less than those of White researchers ($n = 798$; Chen et al., 2022). More recently in 2022, the NIH funded only 153 research grants that had either had a principal investigator or coprincipal investigators that identified as Native American ($n = 119$) or Native Hawaiian ($n = 34$). This represents only .004% of the total number ($n = 41,631$) of funded research projects for this funding source (<https://report.nih.gov/nihdatabook/report/306>; NIH Data Book—Report 306: Number of NIH Principal Investigators Funded by Grant Mechanism and Race). Other studies have highlighted that funding agencies have different conceptions of what constitutes fundable research, which leads to lack of funding as mentioned above (Eaton et al., 2022; Parker et al., 2018; Smith, 2021). Questions such as: What constitutes legitimate research? or who is considered a serious contributor to the academy? are part of the narrative that keeps the institutional and academic gatekeeping alive. As Parker et al. (2018) point out, the gatekeeping surrounding funding is a key mechanism for the continuation of “traditional” knowledge systems within the academy. These obstacles inhibit NA faculty retention within academia, which creates a trickle-down effect on NA early career, graduate students, and undergraduates.

In codeveloping our Indigenous mentoring program for Native American faculty in STEM, it was important to address those identified and expressed aspects that created institutional barriers

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to their professional advancement and career success. Furthermore, it was also important to consider the multiple formats of Indigenous mentoring, including those that are place-based (Barnhardt & Kawagley, 2005; Davidson-Hunt & O'Flaherty, 2007; Semken, 2005), institutional setting influences and mentor positionality (Cobb et al., 2003; Mutua & Swadener, 2004), and attentiveness to faculty identity location (Dei, 2000).

The importance of Indigenous values in the implementation of a mentorship program for Native American faculty—STEM cannot be overemphasized. These values are stated succinctly for the context of higher education by several authors (Ball, 2004; Harris & Wasilewski, 2004; Kawagley & Barnhardt, 1998), and include the Four Rs, respect, relevance, reciprocity, and responsibility (Kirkness & Barnhardt, 2001). Respect refers to the customary, oral, and Indigenous knowledge held by the whole community; relevance refers to adopting a posture that promotes Indigenous knowledge and skills at the institutional level; reciprocity refers to the efforts non-Native American faculty make to understand and build upon the cultural background of NA faculty members, who are able to gain access to the inner workings of the institution to which the NA faculty—STEM member is being introduced; responsibility refers to requiring institutional commitment to create a more hospitable climate for Native American faculty (Kirkness & Barnhardt, 2001). The Four Rs call for examining the interaction between Indigenous values and higher education while considering culturally congruent modalities. Aspects of mentoring and Indigenous values related to higher education were considered during the development and implementation of an Indigenous mentoring program for NA faculty—STEM.

Purpose of the Study

The purpose of this study is to describe the codevelopment, implementation, and evaluation of an Indigenous mentoring program, developed for NA faculty—STEM. The guiding questions were: (1) What are the recommended components and content of an Indigenous mentoring program? And (2) how can a codeveloped Indigenous mentoring program support the success among Native American faculty in STEM? Findings will inform additional efforts to develop, tailor, and deliver effective mentoring programs to support the success of NA faculty and instructors in STEM.

Positionality of the Coauthors

The 21-member coauthorship team includes Native American faculty (NAF) and non-NAF and researchers who are situated at tribal colleges and universities or predominantly White institutions. Eighteen of the coauthors are NA. Of these, 14 are STEM faculty or instructors who were interviewed for the study; five are faculty, program directors, or student researchers on the project team. Three of the coauthors are non-NA, of these, two are faculty members and one is a postdoctoral fellow on the project team. The diverse research team shared a common desire to improve understanding of the collective values and experiences of NAs working within tribal colleges and universities and predominantly White institutions. The intent is to apply this information to develop a tailored mentoring program. As with our recent publications on this project, our varying points of view and positionalities intentionally decolonize traditional research processes and authorship protocols and contribute to a

replicable method that others can adopt and adapt (Brown et al., 2024; Tsosie et al., 2022).

The diverse range of backgrounds of the coauthors include being the first person in their family to earn a high school or doctoral degree while others have family members who attained college degrees. Some of the coauthors are of mixed background with one parent being NA and the other parent being Caucasian. Some of the coauthors grew up in a household where there was an ever-constant flow of knowledge, stories, strength and understandings of place-based, cyclical, evolving, adaptable life approaches which honored the past with consideration of future generations, language, and land. In contrast, some of the coauthors grew up disconnected from their tribe, restricted to cultural activities due to a heavy Christian influence in their family and boarding school-imposed restrictions that created a disconnect from understanding the strength that cultural knowledge provides, and an introduction to knowledge that was heavily influenced by a colonial understanding of the world—domination, competition, and separation.

These experiences impact how many of the coauthors approach research and their subjectivities related to mentoring and STEM. For example, one coauthor stated, "Being a first-generation high school graduate, for all known maternal and paternal generations, I have woven our storytelling, traditional ecological knowledges, original instructions, and love into my daily research, practices and life." A coauthor who implements a 10-day STEM camp for middle school students from schools that are on or near Montana Tribal reservations said, "It is my hope that my interactions inspire at least one young Native child to Indigenize their education and college." Many of the coauthors are involved in efforts to recruit and retain Indigenous students in STEM fields, health-related areas and curriculum design.

These varying coauthor positionalities decolonize traditional research and authorship protocols. For example, one coauthor views the research and inclusive authorship protocols used in this study as an opportunity to insert Indigenous epistemologies, values, and acknowledgment of everyone who has contributed to the work. Coauthors work under the guidance of cooperation and connectedness to accurately share the experiences of Indigenous scholars and the impact that shifting research expectations can make in our understanding of knowledge. Another coauthor views decolonizing traditional research methods beginning with an awareness of and reflection on language, how things are said, what words are used, and how these ideas change attitudes, how they are or may be translated and how they can ultimately be changed to honor the intent—the intent of our ancestors and communities and answer questions on why we are involved in the sciences/research to begin with. Another coauthor prefers to align with an Indigenizing process because "it allows one to build or add to an already established process versus a decolonizing process that can be an immensely subtractive frame of mind."

Some of the coauthors commented on how their dual status as researcher/participant impacted the study. One coauthor said, "Having dual status resulted in a more holistic, all-encompassing perspective." Another coauthor said, "Having the participants collaborate on the interpretation of the data and in crafting of the manuscript can help provide further and deeper insights to the work. It also impacts the participant; this work provides an avenue to authentically voice many of the issues that we experience in academia and has the potential to inform efforts to make academia a better, more welcoming space." Another coauthor said,

Being a researcher/participant in the study is a result of the current situation that we aim to improve in the future through bringing to light successful approaches helping Indigenous students. Obviously, the NA faculty population is small and for seminal research, it's not unexpected that we will be the researcher and the participant.

Method

Project Background

In 2017, the National Science Foundation Alliances for Graduate Education and the Professoriate Transformation-funded University of Montana, Sitting Bull College, and Salish Kootenai College to create a multicomponent model to enhance the retention and professional success of NA faculty—STEM. The three components developed for this model were an Indigenous mentoring program, research publication and grant preparation professional development, and an institutional support program focused on faculty retention. Other components of the project included social science research and external evaluation activities. This article will detail the Indigenous mentoring program component.

Codevelopment and Indigenous Research Methods

Codevelopment was the core conceptual underpinning that guided the process for the project, while Indigenous research methodologies and methods informed the methods at each step. Codevelopment was applied here as a process through which different forms of knowledge (e.g., across research disciplines and nonresearcher ways of understanding) are applied to real-life challenges related to systemic injustices. The concept of codevelopment, like coconstruction or coproduction, is rooted in the recognition that there are different ways of understanding and knowing the world and the belief that bringing these together may provide more holistic solutions that are more suited to addressing real-world systemic challenges (Godemann, 2008). In this project, codevelopment was applied as a decolonizing strategy to address power relations stemming from colonial interactions that persist to obscure and marginalize Indigenous peoples' knowledge and practices (Smith, 2021) within the academic professoriate setting. Indigenous research methods harmonized with the codevelopment structure; the 4 Rs of respect, relevance, reciprocity, and responsibility (Kirkness & Barnhardt, 2001) were applied in the selection of methods for data collection, analysis and interpretation, functioning to facilitate and highlight Indigenous ways of knowing and equitable participation in research processes (Kovach, 2009; Smith, Tuck & Yang, 2018).

As such, the project methods required deep engagement with Native American faculty—STEM at each step of the research process—from conception to publication—to uplift knowledge, values, practices, and experiences in academia and to develop the structure and content of the Indigenous mentoring program. The project applied codevelopment through iteratively integrating knowledge and perspectives of the National Science Foundation Alliances for Graduate Education and the Professoriate Transformation research team (which consisted of six NA and four non-NA members representing two tribal colleges and one predominantly White institution); a five-person advisory board consisting of two NA faculty in STEM, two NA and one non-NA academic representing two tribal colleges and one predominantly White institution; and a group of eight NA faculty in STEM (the program fellows, described below), who engaged in the process at

each step from start to finish. Additionally, all nonprogram fellow interview participants (NA faculty in STEM), were invited to engage as coauthors in the conception and writing of an article describing interview findings (Brown et al., 2024) and this article (11 accepted and participated). Advisory Board members reviewed, revised, and approved findings and plans at each stage. The inclusive practices and iterative engagement helped to create relationships throughout the entirety of the research and dissemination process.

Native American Faculty in STEM Program Fellows

During the proposal development phase, NA faculty—STEM at the three institutions were identified and invited to participate in the project once the grant became funded. Eight NA faculty—STEM from the three partner institutions agreed to participate in the project as program fellows (a term selected by the group). Each program fellow signed a formal agreement which established a mutual understanding of expectations for participation and external evaluation activities and compensation for the academic year. Annual compensation for participation included 1-month summer salary or one course buyout during the academic year, proportional to a fellow's participation, and a \$1,200 stipend for technology support (e.g., laptop computers, lab equipment to support research). Full participation in all the project components and activities was required to receive full compensation.

All research activities were approved by the Institutional Review Boards representing the predominantly White institution ($N = 1$) and tribal college ($N = 2$) research partners. The Advisory Board B provided oversight and review of all research activities.

Codevelopment of the Indigenous Mentoring Program

Step 1: Interviews

Semistructured qualitative interviews were conducted among a national sample of NA faculty in STEM (Table 1). This was the

Table 1
Semi-Structured Interview Guide

Interview question
1. What activities have you been involved with at your institution that help you feel supported by and connected to your professional community?
2. What activities have you been involved with at your institution that help you feel supported by and connected to your campus community?
3. Describe an ideal Indigenous mentoring program that enhances your career and professional goals.
a. What are some of the key components of this program?
b. Are there any specific topics/areas you would like mentorship about?
c. How is this program delivered?
d. Is it individual, group, or a combination? Explain why.
e. Describe your ideal mentor for professional development (position, experience, etc.)
f. Recognizing your multiple commitments—both professional and otherwise, how often could you participate in an Indigenous mentoring program during the school year?
g. What incentives would motivate you to participate in an Indigenous mentoring program during the school year?
4. What else do we need to know as we move forward on developing this program?

Table 2
Interview Participant Characteristics

Demographic	Range or % and (n)
Age range (years)	28–59
Female	64% (n = 14)
Professional title	
Instructor	22% (n = 5)
Assistant professor	35% (n = 8)
Associate professor	30% (n = 7)
Postdoctoral fellow	4% (n = 1)
Other	9% (n = 2)
Institutional affiliation	
Tribal college or university	30% (n = 7)
Predominantly White 4-year institution	65% (n = 15)
Other academic setting	4% (n = 1)
STEM area	
Science	52% (n = 12)
Engineering	17% (n = 4)
Mathematics	4% (n = 1)
STEM-related fields	26% (n = 6)

Note. STEM = science, technology, engineering, and mathematics.

first step in the codevelopment process to generate potential content and structure for the Indigenous mentoring program. The interview guide featured open-ended questions to accommodate principles of NA oral traditions, including respect for each participant's story and allowing each participant greater control over what they wished to share (Kovach, 2009). It was developed based on principles of Indigenous research methodology and method and informed by existing literature and career enhancement and/or mentoring programs (Kosoko-Lasaki et al., 2006). The interview guide featured questions about support, connection, community in professional and institutional settings, and programmatic aspects of an ideal mentoring program for NAF-STEM (Table 2). Interview questions for this study represent qualitative descriptive design, which is a method of inquiry that seeks to yield pragmatic information to improve understanding of activities and processes experienced by the population of study (Sandelowski, 2000). Qualitative descriptive design can be applied to assess, develop, and refine culturally responsive programming among Indigenous populations (Burnette et al., 2014; Sullivan-Bolyai et al., 2005).

Recruitment for interviews included active and passive strategies with snowball and convenience sampling, through targeted national listserv distribution, and recruitment via tabling and flyers at tribal colleges and predominantly White institutions primarily in the Pacific-Northwest/Plains region and at national conferences. Individuals were eligible if they self-identified as being NA, and were faculty, postdoctoral trainee, or tribal college employee in STEM or related disciplines. The eight program fellows were included as participants. Participants completed an informed consent process and demographic survey. The qualitative research study team (from hereinafter referred to as "the study team") consisted of one NA (JH) and two non-NA (MP, BB) researchers trained in qualitative methods.

Interviews were digitally recorded, and audio files were transcribed verbatim by a professional audio transcription service. The transcripts were the foundation for data analysis. The study team used content analysis, which is a low-inference analysis strategy that pairs well with qualitative descriptive design (Sullivan-Bolyai

et al., 2005). The study team systematically analyzed transcripts to identify patterns, emphasizing developing themes that directly represented the terms used by participants (Sandelowski, 2000). NVivo 10 (QSR International Pty, 2010) was used for data organization and management. Additional details, including interview procedures and member checking processes, are described elsewhere (Brown et al., 2024).

Interview Participants. Detailed interview participant data are provided in Table 2. Twenty-three NAF and instructors and a postdoctoral trainee in STEM fields at U.S.-based tribal colleges and predominantly White institutions participated in the interviews. Of these participants, eight were the program fellows who ultimately participated in the Indigenous mentoring program.

Step 2: Interpretive Focus Group

Program fellows, each of whom had also participated as an interviewee, engaged in an interpretive focus group. The method functioned to provide additional interpretation of interview data and critical feedback and elaboration on preliminary themes identified by the study team and Advisory Board, then refine and construct the Indigenous mentoring program components and content.

The interpretive focus group is a participatory and power-sharing approach to focus group facilitation, where groups of people who share similar characteristics (e.g., socioeconomic setting, cultural backgrounds) are brought together for their specific knowledge or experience to analyze data generated by others (or in this case, their own data and that of others) who share similar characteristics (Redman-MacLaren et al., 2014). This method functioned to align with the 4R's to add to the relevancy and relationality (i.e., does the research assist the community and can the community make sense of the research?) in the structure and content of the Indigenous mentoring program.

The facilitator's guide included 17 questions and was developed to be semistructured and conversational. The guide included themes and specific concepts derived from the interview data to generate group discussion and consensus on Indigenous mentoring program details such as structure, location, frequency, format, delivery, and topics for content. The de-identified interview data, organized by code, were available for interpretation and for reference to expand on preliminary themes. Focus group facilitators included one NA who was experienced in the development of Indigenous mentoring programs and was a consultant to the project and one non-NA member of the qualitative research study team (BB). Documentation was obtained through field notes taken by facilitators and the two additional members of the qualitative research study team (MP, JH). At the end of the focus group, facilitators reviewed notes and conclusions with the program fellows for member checking and to enhance the trustworthiness of the findings (Dodson et al., 2007). The qualitative research study team, guided directly by the findings from the focus group, finalized the Indigenous mentoring program components and content (Figure 1).

Step 3: Program Development, Implementation, and Evaluation

The implementation team consisted of two program coordinators, one NA (AG) and one non-NA (BB). The implementation team facilitated all components of the Indigenous mentoring program,

Figure 1
Indigenous Mentoring Program Development and Implementation Timeline

Year	2017		2018			2019				
Quarter	3	4	1	2	3	4	1	2	3	4
Interviews with NAF-STEM										
Interview data analysis										
Interpretive Focus Group with NAF-STEM Program Fellows										
IMP development										
IMP implementation with NAF-STEM Program Fellows										
IMP evaluation										

Note. NAF-STEM = Native American faculty in STEM; IMP = Indigenous mentoring program; Quarter 1 (Q1) = January–March; Q2 = April–June; Q3 = July–September; Q4 = October–December; STEM = science, technology, engineering, and mathematics.

including development of the platform for delivery (Slack), evaluation (Qualtrics), and planning and scheduling of mentoring sessions.

To extend codevelopment into the implementation phase, the implementation process was evaluated using either (a) a survey to assess participation, format, and topic or type or (b) through email exchanges with individual program fellows reporting on their individual participation (i.e., an email requesting participation in one of the component opportunities such as attendance at a conference, and the follow-up emails reporting on which conference was attended and when). A postprogram evaluation was conducted at the conclusion of the Indigenous mentoring program using two strategies:

1. A listening session with the program fellows, facilitated by the implementation team in a group setting with an open, conversational tone. The implementation team took field notes during this session and developed detailed summary notes to inform evaluation.
2. A one-on-one exit interview, where each program fellow met with two professional program external evaluators. These evaluators were contracted by the project to perform evaluations of all the grant components, and had not been involved in the interview, focus group, or implementation stages of research. The evaluators took notes during each one-on-one interview and provided a summarized evaluation of participant experiences.

Results

Focus Group

The eight program fellows participated in the interpretive focus group. The length was approximately 2 hr, with snacks, coffee, and tea provided. Program fellows discussed and shared perspectives and experiences related to interview data and findings. The group provided specific recommendations to design the Indigenous mentoring program components and content (see Table 3). A list of content topics for mentoring sessions were generated from recurring themes in the interview data and were presented to the program

fellows to discuss, interpret for relevance and appropriateness, and generate a consolidated list of topics for the program. The final list of suggested content topics included:

1. Strategies to confront and mitigate racism and sexism in academia (workplace and classroom)
2. Navigating the competitive academic systems in your own way
3. Developing STEM research and applications that are meaningful to Indigenous communities
4. Embracing your strengths and leadership style as an Indigenous scientist/scholar
5. Goal setting for (your definition of) success and career advancement
6. Feedback on grant applications, manuscripts for peer review, abstracts for presentations, and other deliverables
7. Navigating the tenure process
8. Exploring ways to navigate and overcome imposter syndrome
9. Uplifting Native identity while acknowledging challenges (i.e., imposter syndrome, isolation)
10. Opportunities to protect time through planning and communication
11. Avenues for institutional change and advocacy

Indigenous Mentoring Program Content and Structure

Overall themes represent synthesized findings from the interviews and interpretive focus group. Themes focused broadly on two areas: (a) opportunities for support and connection in professional and institutional settings and (b) programmatic factors of an ideal Indigenous mentoring program. These are further described below.

Table 3
Recommendations for Indigenous Mentoring Content and Components

Theme	Subtheme	Example	Recommendation for Indigenous mentoring program
Opportunities for support, connection, community	Professional	Field-related conferences Grant writing workshops Writing and publication workshops	Funding provided to travel to these conferences/workshops Establish formal (or informal) institutional workshops specific to Native faculty
	Campus-based	Faculty, staff, student gatherings	Provide space and funding for gatherings (formal and informal) to take place
	National level	SACNAS, AISES, others	Funding to travel to these national conferences
	Formal structure	Meet with a designated mentor Convene a mentor/expert panel	Provide opportunities for structured mentoring sessions with an assigned mentor or mentoring panel
	Informal structure	Peer-to-peer mentoring session Conversations over coffee or a meal	Provide opportunities for more conversational/spontaneous mentoring with peers, near peers, elders, and tribal community members
	In-person format	Meeting with a designated mentor in-person (on-campus or at a scientific conference)	Both in-person and online mentoring opportunities are important, given the value of in-person interaction, and the reality of busy schedules
	Online format	Virtual meeting with a designated mentor Virtual peer mentoring group	
Programmatic factors	Frequent meetings	Every other week	Offer frequent informal mentoring opportunities (e.g., 1x/month), in addition to less frequent, formal mentoring opportunities (e.g., 1x/semester)
	Infrequent meetings	Once per quarter or once per semester	

Note. SACNAS = Society for the Advancement of Chicanos/Hispanics and Native Americans in Science; AISES = American Indian Sciences and Engineering Society.

Opportunities for Support and Connection

Participants described professional, campus-based, and national forms of support and connection along their academic career pathway (Table 3).

Professional Support. This area emphasized attending conferences or training networks to connect with others in the same field or research area. Benefits of attending national conferences with others in similar professional areas included meeting future collaborators or mentors, becoming energized by a larger community of NA faculty—STEM who do similar work, and overall encouragement. One participant described this type of support when attending the American Indian Sciences and Engineering Society (AISES) annual conference:

Yeah, so within the AISES family, there are a handful of people that I. ... I don't know them well and I only know them through AISES National Conferences or the Leadership Summits, but AISES uses the words, "AISES Family" and I really feel that when I go to meetings. These are maybe people that I only see once or twice a year, but they know who I am and I know who they are. And, we'll have the one 30-min conversation over the course of the conference, but those are valuable interactions as well. And, I'll describe one. This is a person who is, I would consider her an AISES elder, even though she's not one of the official AISES elders. She's an AISES member who is my elder. And, she was an academic and always checks in on me at AISES Conferences or whenever I see her at other professional meetings because she has also been in the same area of science. And so, she checks in on me and almost is like another mom to me. But, she knows kind of what I'm going through professionally. And, wants to make

sure that, is your institution treating you fairly? How are things going with promotion and tenure back when I was up for tenure.

Other forms of professional support were reported to include funding for course buyouts or teaching support so NA faculty—STEM could focus on writing, publishing, or research; funding for equipment and classroom technology; didactic opportunities such as grant writing workshops, writing, and publication workshops or support groups; and interdisciplinary brown bags or seminars to learn about ongoing local research projects and potential collaborators. In general, participants described strict institutional rules regarding funding and scarce resources for stated professional development opportunities. Many participants expressed the perspective that their institutions undervalued such professional development activities.

Campus-Based Support. Opportunities for support and connection included campus-wide committees or councils to support NA student, staff, and faculty success. Such groups would gather at frequent intervals (e.g., monthly) to share information on campus-based projects, services, and events. Another purpose of these committees or councils was to "elevate" academic programs founded by NA faculty and the research and work done on-campus by NA faculty. One common issue voiced on this topic was the emphasis on faculty-to-student relationships rather than faculty-to-faculty relationships, representing a missed opportunity to build connection with other, on-campus NA faculty. Informal gatherings, such as social events hosted by a department where faculty, students, and their families could gather for meals and engage in games or activities were described as valuable for learning more about coworkers and peers and building a sense of connection. One participant described it this way,

I just, I guess, they tend to be not formal, but informal gatherings where I feel that kind of support and where I feel like I can talk about what's going on or hear about what's going on with (*peers*). Activity-wise they tend to be things like, 'Oh, we had a speaker invited, so we all went out to the Chair's house and had a social gathering,' or we have. ... I mean, they tend to be social, not formal, events ... Even at the retreats, that we plan, it's a good day, but I think that's not where I feel the support and connection, as much as it is in the more informal day to. ... Usually there's something each month where, if we go to dinner together, or just something informal.

Some participants described regular, informal gatherings of NAF from across disciplines, whether in an Indigenous-only space (such as a building designated for NA students) or meeting-up at a broader campus event, to share meals and talk about personal topics rather than academic or professional topics.

National Level Support. Academic societies and networks were described as a pathway toward professional support and connection. The AISES and Society for the Advancement of Chicanos/Hispanics and Native Americans in Science were the most frequently mentioned societies and annual conferences. Describing the opportunity to feel a broader sense of connection through National level support, one participant said,

Well, I think the number one thing of course is, going to conferences. ... There are not that many Native Americans who are in STEM fields. There are definitely not that many Native Americans who are in [*field of study*]. If you're the only one that's at an institution, then when you're thinking about who are your colleagues in terms of what you do, there may be people interested in what you're doing, but they're not in your university ... Being able to network with other people who are doing something similar to what you're doing and, or maybe Indigenous. Or in my case, I go to SACNAS, which is the Society for the Advancement of Chicanos and Native Americans in Science. It's kind of a larger community of both the Latino and Native American communities that you meet a lot of people who are doing work like yourselves. Or who are interested in work that you're doing. Conferences are a big deal.

Noting that most activities are student-oriented at these conferences, participants suggested the addition of faculty-focused activities and mentoring opportunities at annual conferences.

Programmatic Factors

Overall, interview participants expressed a need for mentoring programs for NA faculty—STEM and identified programmatic recommendations (Table 3). When asked about the structure and content of an ideal mentoring program, participants identified a program that incorporated both formal and informal interactions in a hybrid format (online and in-person) for opportunities for connection and inclusiveness. Participants also described a desire to meet up with other mentees at conferences and to listen to and learn from Native American elders and community members, and other guest speakers, or assigned readings.

Indigenous Mentoring Program Implementation and Evaluation

The Indigenous mentoring program was implemented for one academic year (September 2018–May 2019). Eight NA faculty—STEM program fellows participated, representing the predominantly White institution ($N = 4$) and the tribal colleges ($N = 4$). Fifty

percent of the participants were female. The program consisted of four components:

1. Informal peer-to-peer mentoring gatherings
2. Formal mentoring gatherings
3. Attendance at scientific conferences or meetings
4. Development of formalized mentoring relationship(s)

For each individual component, the implementation process and data are presented, and postprogram evaluation by program fellows is reported.

Indigenous Mentoring Program Component 1: Informal Peer-to-Peer Mentoring Gatherings

At the onset of the program, the implementation team developed a Slack page to facilitate communication among the Program Fellows. This page served the purposes of (a) providing program information, featuring a resource page with a description of the component; (b) a communication platform between the program fellows and the implementation team; and (c) a communication platform among the program fellows. The informal peer-to-peer mentoring gatherings were scheduled and arranged by the program fellows; following each gathering, a designated program fellow would report the occurrence, and the implementation team would send a link to an online survey to document the date, duration, number of participants, and mentoring content topics discussed.

Eight informal gatherings occurred throughout the academic year, approximately once per month. Email correspondence between program fellows and the Indigenous mentoring program implementation team indicates that participants may have met more frequently, but some gatherings were not reported/documented. Each gathering lasted approximately 90 min, and a range of 2–6 program fellows attended each meeting. The most frequently discussed topics at the informal sessions were "Goal setting for (your definition of) success and career advancement" and "Embracing your strengths and leadership style as an Indigenous scientist/scholar." Topics are presented by the number of sessions each topic was discussed (Table 4).

Component 1: Evaluation

Overall, the program fellows described the informal peer mentoring sessions as very helpful. Comments on this component centered on structure, delivery, and program fellow context. Given the informal, peer relationship building focus of this component, consensus during the participatory focus group had been to allow program fellows to arrange and participate in these gatherings based on need and ability. However, results indicated that this strategy for scheduling (i.e., no predetermined schedule at the outset of the program, program fellows worked within one another to schedule each meeting) was onerous and left many program fellows feeling as if they were unable to participate as often as they had wished due to lack of ability to protect scheduled time in advance.

Gatherings were planned and scheduled using Slack, and although there were no predetermined limitations on where or how the meetings would take place (i.e., in-person vs. online), all reported gatherings took place online using Zoom. Results indicated varying

Table 4

Topics Discussed at Informal Peer-to-Peer NA Faculty-STEM Mentoring Gatherings

Topic	No. of session
Goal setting for (your definition of) success and career advancement	7
Embracing your strengths and leadership style as an Indigenous scientist/scholar	3
Navigating the competitive academic systems in your own way	2
Developing rigorous science that is translatable and meaningful to Indigenous communities	2
Navigating the tenure process	2
Feedback on grant applications, manuscripts for peer review, abstracts for presentations, and other deliverables	2
Uplifting Native identity while acknowledging challenges	1
Strategies to confront and mitigate racism and sexism in academia	1
Avenues for institutional change and advocacy	1
Opportunities to protect time through planning and communication	0
Exploring ways to navigate and overcome imposter syndrome	0

Note. NA = Native American; STEM = science, technology, engineering, and mathematics.

familiarity with Slack; some program fellows had not previously used this platform and were uncomfortable using it, which was a barrier to participation. Some participants recommended using a more ubiquitous platform, such as a private Facebook group, in the future.

Program fellows reported differences in immediate mentoring needs across institution type (tribal colleges vs. predominantly White institutions) and career stage. While participants described the value of peer or near-peer mentoring for sharing experiences and perspectives, some recommended establishing a baseline of individual context within their institution, workplace circumstances, and career stage. This learning and sharing within the group would make clearer the needs of each program fellow and establish a useful framework for peers to provide more tailored mentoring to one another.

Indigenous Mentoring Program Component 2: Formal Group Gatherings

Three formal group gatherings were held throughout the academic year. The first session occurred in September 2018 and was an introductory session to provide information on the program components, timeline, and procedures. This session was facilitated by a non-Native member of the implementation team and focused on information to describe the delivery format for the components, planning, opportunities for questions and discussion, and relationship building among the program fellows cohort (attendance rate = 88%). The second formal gathering occurred in January 2019. This gathering focused on the topics of racism and microaggressions and was delivered by a NA faculty from an external predominantly White institution (attendance rate = 75%). The third session

occurred in April 2019 and explored the topic of creating a healthy work–life balance; this session was facilitated by a NA faculty—STEM from an external predominantly White institution (attendance rate = 75%). All presentations were recorded and made available to program fellows.

Component 2: Evaluation

Program fellows described the importance and relevance of the formal mentoring gatherings, and identified, as with the informal peer mentoring, that attendance would have been higher had the sessions been scheduled at the onset of the Indigenous mentoring program. Regarding content, while some reported deep value and appreciation of the topics presented, others wished for more “applied” or “practical” topics, such as specific resources to support research and teaching. Additional recommendations for speakers included tribal elders and members of tribal councils. The group suggested that each program fellow could facilitate one formal mentoring gathering, as they all had something important to share with the group and could learn from one another in this way. Program fellows who missed one or more gatherings described the importance of access to the recorded sessions so they could participate despite lack of attendance.

Another salient issue brought up by program fellows was the overall function of the informal peer mentoring groups (namely, moral support) in contrast to the significant institutional or workplace barriers faced by some of the program fellows. Although the supportive environment within the peer mentoring groups was appreciated, the inability of the group to adequately address or resolve current work-related issues or situations was a frustration.

Indigenous Mentoring Program Component 3: Attendance at Scientific Conferences or Meetings

This component included the opportunity to attend a national scientific conference or meeting. The process for acquiring the available funding support included submitting a request (title and location of meeting, budget) to the program coordinator, followed by a brief report after the conference. The request process was for information and tracking purposes, and all requests for support were approved.

Component 3: Evaluation

Three program fellows engaged in this component, and all reported experiencing critical professional development opportunities through these experiences, including meeting with peers and mentors to explore new or continued research and scholarship collaborations. For example, one program fellow attended an exploratory roundtable in their field; the meeting brought people from both private and governmental sectors together and facilitated new network connections and several new research collaborations. Another program fellow attended a national meeting in their field of study where they participated in a luncheon for Indigenous scholars and developed new relationships with Indigenous elders, students, and emerging scholars.

Indigenous Mentoring Program Component 4: Development of Formalized Mentoring Relationship(s)

Program fellows were encouraged to individually identify and develop a formalized mentoring relationship with one or more individuals. There were no limitations on institutional affiliation or field of study, and the program provided a \$1,000 honorarium to the mentor for this purpose. This component was designed to be flexible to meet the needs and preferences of each individual program fellow.

Component 4: Evaluation

Three program fellows participated in this component. One program fellow used the honorarium to bring their mentor to their academic institution for meetings and guest presentations. The second program fellow corresponded virtually with one mentor, traveled to the academic institution of a second mentor, and collaborated with a third program fellow to participate in a series of meetings and join a panel with another mentor during an Indigenous research center colloquium. Their discussions focused on bridging gaps between Indigenous communities and Western scientists, on professional development and on environmental leadership strategies in the workplace. The three program fellows who participated in this component appreciated the support in developing a formalized relationship with a trusted mentor. They expressed gratitude for the relationship-building and for the mentors.

Overall Program Evaluation

Overall, program fellows felt the Indigenous mentoring program could be a model for how to support NA faculty—STEM. One major topic discussed across the group listening session and individual exit interviews with the Program Fellows was participation; specifically, barriers to participating in the program and how these barriers might vary by institution. Participation in program components was impacted by professional obligations (e.g., invited presentations, administrative duties, teaching duties), and personal obligations (e.g., funerals for family/community members). Despite lower participation, program fellows expressed sincere interest in the project and wanted to be accountable for their participation. Several program fellows described the importance of recognition by the implementation team of these competing priorities and wished there had been more acknowledgment that such tensions arise and may impact attendance and participation in the Indigenous mentoring program.

Finally, program fellows described differences in participation barriers across institutions. For example, those working at tribal colleges felt the demands of their positions regarding teaching and student support often took precedence and prevented their participation. Program fellows recommended that in future iterations of Indigenous mentoring, programming specifically recognizes these barriers and provides support to assist program fellows with negotiating these types of tensions.

Discussion

Recruitment and retention of Native American (NA) faculty—STEM is critical to the development of the future professoriate and recruiting and retaining NA students (Ortiz-Walters & Gilson,

2005). Diverse faculty benefit institutional teaching, research and service missions (Daley et al., 2006; Milem, 2003). Specifically, more NA faculty—STEM are needed to convey their scientific knowledge of the natural world and conduct, participate in, and drive critical research on NA issues (Smith, 2013; Walters et al., 2020; Wilson, 2008) including health disparities, climate change, violence against Indigenous women, poverty, unemployment, and housing conditions. Mentoring programs for NA faculty—STEM situated in academic settings can help recruit and retain these faculty (Brown et al., 2024). In addition, federal and state funding agencies and foundations are recognizing the importance of diversity, equity, and inclusion (DEI) work in higher education. NA faculty—STEM are in a unique position to incorporate scientific and STEM education research with a focus on DEI opportunities within their work. Finally, NA faculty—STEM are able to influence a shift in culture in relation to DEI within a department, college/school, and even an entire institution (Walters et al., 2019).

To our knowledge, no other studies reported in the literature have codeveloped, implemented, and assessed a mentorship program to enhance the retention and success of NA faculty-STEM. However, there are studies highlighting mentorship programs for non-NA underrepresented minority faculty. These studies have demonstrated positive impacts on mentees learning about institutional cultures, promotion and tenure processes, pertinent career advice (Tran, 2022), research and scholarship activities, such as successful grant proposals and publications (Yun et al., 2016) and peer review of internal and external proposals (Guessous, 2015). A further benefit is the creation of networks of supportive colleagues (Peterson et al., 2020; Williams et al., 2020; Yun et al., 2016) and gaining empowerment skills, enabling them to handle conflicts that arise at work and better negotiate for their workplace needs (Peterson et al., 2020). Faculty mentoring programs developed for historically excluded racial and ethnic groups have used several mentoring structures. For instance, two programs paired senior mentors with junior mentees (Tran, 2022; Williams et al., 2020); one program implemented “Mutual Mentoring” where mentees developed their own context-sensitive mentoring relationships and activities within a campus-wide programmatic structure (Yun et al., 2016); and two mentoring programs where women in STEM (Peterson et al., 2020) or early career STEM faculty from historically excluded groups (Guessous, 2015) participated in one-on-one, peer-to-peer and group mentoring activities. The configuration of our Indigenous mentoring program is like these two latter programs. Four components formed the framework for the program, which were informal mentoring gatherings (e.g., peer-to-peer mentoring activities), formal mentoring gatherings and attendance at scientific conferences or meetings (e.g., group mentoring activities) and the development of formalized mentoring relationships (e.g., one-on-one activities).

Evaluation of our mentoring program indicated that the program fellows thought the program could be a model for how to support NA faculty—STEM. The program fellows built meaningful relationships with each other during the program which helped create an informal faculty support network and learning community. Fellows thought it was helpful to have a network of supportive NA faculty—STEM colleagues and be part of a peer group who understands issues that people from diverse backgrounds experience in academia. These findings are like a virtual mentoring program for women from historically excluded groups in STEM (Peterson et al., 2020). Even though many of the program fellows codesigned

the program to serve their interests, professional and personal obligations impacted their ability to participate in the program. Program fellows asked for more acknowledgment and revising the programming to specifically recognize these barriers. The WISE@OU mentoring program for early career STEM faculty addressed some of these participation challenges by videotaping their workshops and posting them on their website, to have the resource available and add to the library of wisdom that faculty could tap into (Guessous, 2015). Similarly, our Indigenous mentoring program sessions could be video-taped and posted to the program website so that faculty can view them when time permits. Our program used an in-person format for the formal and informal mentoring sessions and meetings. Revising the format to a more virtual program may reduce barriers to participation. For example, if a faculty member needs to travel to their home community or to a conference, they could participate in the virtual mentoring sessions via Zoom. A cross-institutional mutual mentoring program for underrepresented women in STEM implemented biweekly Zoom meetings for 2 years. Evaluation of this program did not report any barriers to participation; however, some participants thought an annual in-person meeting would benefit group cohesion and sustainability (Peterson et al., 2020). If the Indigenous mentoring program was virtually delivered an annual or biannual gathering for the participants could be included.

Although we did not assess faculty social support, research shows that early career STEM faculty program fellows felt there were advantages and disadvantages of combining a faculty from a predominantly White institution and faculty from a tribal college together in a mentoring program, given institutional differences (e.g., teaching and service loads), and career practices and career stages (e.g., existence or nonexistence of promotion and tenure institutional practices) (Brown et al., 2024). One advantage of having faculty from different institutions in the mentoring program was seeing the challenges to NA faculty-STEM career success at other institutions and how they were addressed. Another advantage is that each group of faculty are serving Indian Country and will likely have professional overlap. Oftentimes, NA faculty from university and tribal colleges work in the same NA community and collectively address and support teaching and research needs. A challenge of combining NA faculty—STEM from both tribal colleges and predominantly White institutions in one mentoring program was balancing discussions of tensions unique to program fellows versus the need for applied/practical resources to address needs in publication, teaching, and grant writing specific to the institutional context. For example, NA faculty—STEM instructors at a tribal college may teach 27–33 credits per year and need to bring in extramural support to fund their academic positions while NA faculty—STEM at a predominantly White institution may teach 3–15 credits per year and seek funding to support their research and strengthen performance records to achieve promotion and tenure.

The implementation team identified a tension of not wanting to burden the program fellows with the requirement of participating in the various components of the program while allowing for autonomy in building relationships. For example, encouraging the program fellows, instead of the implementation team, to schedule the informal mentoring/gathering sessions might have helped protect time for busy fellows. Additionally, requiring a proactive approach to identifying a mentor and using the honorarium might

have helped meet project spending deadlines and assist the fellows to take full advantage of the Indigenous mentoring components that were offered. Another suggestion from the program fellows was to include explicit recognition of potential barriers facing the program fellows in participating in the various components of the program. For example, future Indigenous mentoring programs could include a mechanism that sends a motivational message to program participants when they miss a session. This could help increase feelings of inclusion and belonging, which have been shown in the literature to be useful (Guessous, 2015). Future evaluation efforts could assess reasons for program participants missing sessions to better characterize the barriers.

Recommendations for the Future

Suggestions for future iterations of the Indigenous mentoring program included additional structure and planning by the implementation team to schedule informal peer mentoring gatherings for the entire academic year at the onset of the program to allow the program fellows to protect the designated times, and to provide multiple meeting reminders. Program fellows also requested enhanced guidance on discussion topics, such as a loose schedule of “assigned” topics for each gathering. An additional recommendation was to have arranged sessions with institutional officials, or specific senior, institution-based individuals who could help address real entrenched academic issues that were brought-up in the informal or peer mentoring meetings to assist in developing strategies for change-making or improving conditions. These suggestions underscore the need for institutions to support and deliver programs and activities that enhance NA faculty-STEM professional development and for administrators to strengthen institutional support to improve NA faculty-STEM success.

Furthermore, the use of Indigenous research methodologies and methods to codevelop the program was essential to the inclusion of valued, meaningful, and relevant structures and components of the Indigenous mentoring program; future iterations of the program will benefit from the use of IRM to adapt to the specific context, participants, and setting.

Strengths and Limitations

These data are limited by the voluntary nature of the participants, potential selection bias, inclusion criteria that included a postdoctoral researcher, and the 23% of participants who represented STEM-related fields (e.g., public health) in the interviews that contributed to the program development. With only one of the 23 interview participants being a postdoctoral researcher, and the majority of participants representing core STEM fields, potential to skew the results is minimized. These data are also limited to the low number of NA faculty—STEM faculty who participated in the program. We acknowledge that U.S. NA populations are not homogenous: worldview, beliefs, and customs vary by Native American community, geography, urban or rural identity, academic appointment at an institution, limiting broad generalizability of findings (Brown et al., 2024). Results were limited in several ways. Despite repeated efforts by the implementation team to collect evaluations of the formal group gatherings via Slack and Qualtrics, no information was reported by the program fellows. Program evaluation data were limited to detailed summary reports only, which prevented members

of the research team from opportunities to review transcripts and include direct quotes and perspectives of individual program fellows. Additionally, no pre-post assessments were conducted to determine the effect of the Indigenous mentoring program activities on academic constructs such as research and publication productivity, networking and collaboration, discrimination, career development, political and institutional issues, and dealing with multiple demands. Nonetheless, the authors used established approaches to recruit an appropriate number of participants to the interviews that helped develop the Indigenous mentoring program, and to identify theme saturation (Glaser & Strauss, 1967), and determined reliability of findings (Birt et al., 2016; O'Connor & Joffe, 2020). We collected implementation process data and conducted postprogram evaluation conversations with the program fellows, drawing on two sources of information (listening sessions and one-on-one exit interviews) for results. We encourage those who are implementing future iterations of Indigenous mentoring programs for NA faculty—STEM to embed additional quantitative and qualitative evaluation approaches in the program, including transcribed qualitative data for inclusion of participant voice in the findings, and follow-up measures to advance understanding of the long-term impact of participation.

Conclusion

Although this was a pilot mentoring program, the favorable evaluations indicated the Indigenous mentoring program may improve NA faculty-STEM career success. However, the program relied on self-reported and qualitative evaluative data which limits our ability to draw any causal connections to the actual impact of the program on NA faculty-STEM career success related to mentoring practices.

Nonetheless, the findings from the initial mentoring program have implications for similar programs seeking to enhance the success of NA faculty—STEM. Program fellows became familiar with each other during the program which helped create an informal faculty support network and learning community. There was enthusiasm for a mentoring program that contains formal and informal components. Overall, the feedback was positive for having predominantly White institutions and tribal college faculty participate in the mentoring program. A benefit of a multi-institutional mentoring model is that best practices could be disseminated across institutions. Future iterations of the program would benefit from incorporating institutional administrators and officers into some of the gatherings. This could strengthen institutional support and create decolonizing environments that enhance the recruitment, retention, and professional achievement of NA faculty—STEM.

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