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## Using Indigenous Research Frameworks in the Multiple Contexts of Research, Teaching, Mentoring, and Leading

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### Abstract

Indigenous research frameworks can be used to effectively engage Indigenous communities and students in Western modern science through transparent and respectful communication. Currently, much of the academic research taking place within Indigenous communities marginalizes Indigenous Knowledge, does not promote long-term accountability to Indigenous communities and their relations, and withholds respect for the spiritual values that many Indigenous communities embrace. Indigenous research frameworks address these concerns within the academic research process by promoting values such as: relationality, multilogicality, and the centralization of Indigenous perspectives. Indigenous research frameworks provide a framework that can be used in multiple contexts within higher education to bring equitable practices to research, teaching, mentoring, and organizational leadership. In this article, as a researcher who uses Indigenous research frameworks, I utilize autoethnography to engage in critical, reflexive thinking about how my perspective as an Indigenous researcher has developed over time. The purpose of this autoethnography is to reveal how Indigenous research frameworks may enhance higher education, especially for Indigenous students.

### Keywords

Indigenous Research Frameworks, Mentoring, Indigenous, Teaching, Autoethnography, Indigenous Knowledge

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### Acknowledgements

I would like to gratefully acknowledge my own Indigenous communities and those communities where I've conducted research for instilling in me the passion to uphold respectful communication as a primary value in all aspects of life. I acknowledge the work of the many other Indigenous scholars that have prepared a space for Indigenous Knowledge to become respected within the academic community. I also acknowledge my mentors, mentees, and students whose perspectives have helped me to develop these practical applications for Indigenous research frameworks. Finally, I would like to acknowledge the sources of support that have made the experiences described in this research possible: The National Science Foundation (GeoConnections, Award Number: 1712378), The Geological Society of America (Graduate Research Award, 2015), Purdue Center for Intercultural Learning, Mentorship, Assessment, and

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*Indigenous research frameworks can be used to effectively engage Indigenous communities and students in Western modern science through transparent and respectful communication. Currently, much of the academic research taking place within Indigenous communities marginalizes Indigenous Knowledge, does not promote long-term accountability to Indigenous communities and their relations, and withholds respect for the spiritual values that many Indigenous communities embrace. Indigenous research frameworks address these concerns within the academic research process by promoting values such as: relationality, multilogicality, and the centralization of Indigenous perspectives. Indigenous research frameworks provide a framework that can be used in multiple contexts within higher education to bring equitable practices to research, teaching, mentoring, and organizational leadership. In this article, as a researcher who uses Indigenous research frameworks, I utilize autoethnography to engage in critical, reflexive thinking about how my perspective as an Indigenous researcher has developed over time. The purpose of this autoethnography is to reveal how Indigenous research frameworks may enhance higher education, especially for Indigenous students. Keywords: Indigenous Research Frameworks, Mentoring, Indigenous, Teaching, Autoethnography, Indigenous Knowledge*

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## Introduction

Indigenous research frameworks (IRFs) have been presented as an approach to conducting academic research that authentically respects and supports the values of Indigenous communities (Brayboy, 2005; David-Chavez & Gavin, 2018; Smith, 1999; Wilson, 2008). However, research implemented within Indigenous communities does not always involve direct collaboration with Indigenous community knowledge holders, does not authentically engage Indigenous Knowledge held within Indigenous communities, undervalues long-standing traditional systems of knowledge perpetuation, and does not incorporate long-term benefits to the community (Canadian Institutes of Health Research [CIHR] et al., 2018; David-Chavez & Gavin, 2018). Some of the tension in these relationships lies within the fact that while many researchers cite examples of IRFs and the research projects in which they are used, many non-Indigenous researchers do not have adept experience working directly with Indigenous communities. In order to reflexively understand this phenomenon from my current perspective (an Acoma geologist straddling the boundaries between Indun Country, science, and education), I am analyzing practical examples of my own research, teaching, mentoring, and managing practices. The examples discussed in this writing evolved from an honest approach to materializing Indigenous research frameworks and the theoretical values they uphold into tangible interventions I have led during the past several years of entrenchment within higher education institutions. I use autoethnography (Hughes & Pennington, 2017) as

a way to centralize my voice both as a member of the Indigenous community and as a researcher of Western modern science (WMS).

Indigenous ontological and epistemological approaches to research and education require a nuanced understanding of how intercultural exchanges of information should be handled (Brayboy & Castagno, 2008; Smith et al., 2016). While some educators and researchers are able to communicate with underrepresented students effortlessly (Ladson-Billings, 2009), more often, Indigenous scholars and Indigenous communities share stories about how their cultural values have been disrupted by individuals who refuse to discern their appropriate relationships within Indigenous communities, especially as they conduct research (David-Chavez & Gavin, 2018; Jacob, 2013; Smith, 1999).

Adopting Indigenous research methodologies thus requires practitioners (both Indigenous and non-Indigenous) to hold themselves to a higher standard (Kincheloe & Steinberg, 2008; Smith, 1999). For example, Indigenous researchers who use IRFs within their own communities must acknowledge their long-term social positioning within the Indigenous community context while also being a representative of WMS during the research process. This may create tension for the Indigenous researcher who wishes to ethically explore culturally sensitive Indigenous Knowledge because they must follow their community's cultural protocols (i.e., seeking permission from Elders, Indigenous Knowledge holders, and governing officials of the community) before undertaking their research. Similarly, non-Indigenous researchers using IRFs must present themselves as outsiders to the community in respectful, often humbling, ways which divests power from WMS in the research process and empowers Indigenous perspectives. In addition, non-Indigenous researchers should make efforts to learn the historical interactions between the Indigenous community and outsiders so they are more adequately prepared to communicate effectively with the community and respect the environment in which the research will be conducted.

Explicitly recognizing the purposes, motivations, and utility of research conducted within Indigenous communities is often dismissed within WMS research designs (Smith et al., 2016). In effect, many WMS researchers are unwilling to invest the time (e.g., time spent away from other research projects, time necessary to build cultural competence, preference for the siren call of a ticking tenure clock) necessary to authentically engage with Indigenous communities. It is also an unusual proposition to WMS researchers to be asked to proffer academic positionality (e.g., perception of research utilizing IRFs as less than scholarly, offering co-authorship to Indigenous Knowledge holders, citing Indigenous Knowledge; David-Chavez & Gavin, 2018). Researchers who adopt IRFs might also expect academic colleagues to question their work on the premise that research framed using IRFs does not align with WMS positivistic practices (Barrett, 2013). Some WMS researchers have competing political interests which may preclude them from participating in research projects founded on Indigenous research frameworks. Collectively, these barriers have historically led to a decreased number of WMS researchers who are authentically able to utilize IRFs within their research practices.

### **Indigenous Research Frameworks**

In my own research, I also rely heavily upon the work of Wilson (2008) because he has usefully juxtaposed Western scientific research principles (e.g., axiology, ontology, epistemology, methodology) with those of IRFs. In his work, Wilson (2008) attempts to show the interrelatedness of these principles by creating a circular figure that encompasses all of these principles and describing his representation: "The entire circle is an Indigenous research paradigm. Its entities are inseparable and blend from one into the next. The whole of the paradigm is greater than the sum of its parts" (Wilson, 2008, p. 70). His work has impacted

my own because I realized that although these two ways of knowing can have very similar goals (e.g., enhanced learning of students), there is also value in the relationships that are created during the research process. Reframing my thinking as a geoscientist to incorporate my Indigenous worldview required me to reflexively consider how my research methodologies incorporated: respect for Indigenous Knowledge (i.e., epistemologies), accountability to the communities I was working in (i.e., axiology), and a willingness to consider the relationships between Indigenous Knowledge and WMS (i.e., ontology).

Indigenous research frameworks developed out of a need for Indigenous scholars to find ways of doing science that did not depend on them betraying their cultural values (Masta, 2018; Wilson, 2008). For many Indigenous communities, these cultural values are sustained through daily practice and connection to their community; this is true even after they develop their skills as WMS research practitioners. Some researchers refer to this comingling of identities as “two-eyed seeing” (Bartlett, Marshall, & Marshall, 2012) or “life in the borderlands” (Anzaldúa, 1987).

Indigenous Knowledge is widely held as place-based knowledge built upon the needs of Indigenous communities that have maintained their status for hundreds of years (Cajete, 1994; David-Chavez & Gavin, 2018; Garcia, 2018; Hikuroa, Morgan, Durie, Henare, & Robust, 2011; Smith, 1999; Snively & Corsiglia, 2001). Indigenous Knowledge is thus immersed within the cultural and spiritual values of the Indigenous community from which it is derived. Often, Indigenous Knowledge has utility and performs a necessary function for the perpetuation of an Indigenous Knowledge system.

### **Shared Values of Indigenous Research Frameworks**

There are many examples of IRFs which have been presented in academic literature (Brayboy, 2005; Grande, 2008; Jacob, 2013; Kovach, 2014; Little Bear, 2000; Masta, 2018; Wilson, 2008). This article is not meant to summarize all of the intricacies of Indigenous research frameworks but is instead focused on some of the shared values of IRFs that resonate with me and have influenced my experiences in higher education. I will use the following characteristics of IRFs to structure reflections on my experiences:

- **Holistic** approaches that emphasize the interrelatedness between Indigenous communities, their local environment (e.g., place-based education), their political agendas (e.g., multiculturalism, social justice, diversity efforts), and outsider perspectives of Indigenous Knowledge and its uses (e.g., efforts to integrate Indigenous Knowledge and WMS; Brayboy & Castagno, 2008; Cajete, 2000; CIHR et al., 2018; Henderson, 2000; Jacob, 2013; Smith et al., 2016; TallBear, 2015; Te Aho, 2018).
- **Relationality** (relationships between both human beings and human beings and their environment) as a core tenet for how Indigenous Knowledge is produced and legitimated outside of the academy (Cajete, 1994, 2008; CIHR et al., 2018; Jacob, 2013; Little Bear, 2000; Smith et al., 2016; TallBear, 2015; Te Aho, 2018). This is, in effect, the incorporation of an Indigenous sociocultural frame of reference or way of knowing (Cajete, 2000).
- Acknowledgement and **centralization of Indigenous perspectives** of stakeholders and conductors of research, who are impacting Indigenous communities, into all aspects of the research process (Brayboy, 2005; Cajete,

2000; David-Chavez & Gavin, 2018; Jacob, 2013; Masta, 2018; Te Aho, 2018; Zywicki, 2013)

- Continual evaluation (e.g., formative feedback) of how the research being conducted **serves the interest(s) of Indigenous communities**, including the quest for sovereignty and other sociopolitical interests found within Indigenous communities (CIHR et al., 2018; David-Chavez & Gavin, 2018; Jacob, 2013; Masta, 2018; Smith et al, 2016).
- Acknowledgement of **multiple ways of knowing** (multilogicality), which allows “science” to be critiqued as a culturally-grounded construct and also allows Indigenous Knowledge to be broadly legitimated as well as critiqued (Bartlett et al., 2012; Brayboy, 2005; Brayboy & Castagno, 2008; Cajete, 2000; Dunbar, 2008; Jacob, 2013; Smith, 1999; Te Aho, 2018).
- Acknowledgment of the importance of a “**spirituality component**” to Indigenous research. This facet is primarily a reflection of how many Indigenous communities incorporate their spiritual behaviors into their everyday lives (Brayboy, 2005; Cajete, 2000, 2008; Jacob, 2013; Smith et al., 2016). It is assuredly different depending upon one’s community and family (Brayboy & Castagno, 2008; Cajete, 2008; CIHR et al., 2018; Jacob, 2013; Little Bear, 2000; Masta, 2018; Te Aho, 2018).

These shared values of IRFs are important because they show how Indigenous communities “think alike” (David-Chavez & Gavin, 2018; Hikuroa et al., 2011) and why they are able to come to a base consensus of how inter-communications should be emplaced even with stark differences between Indigenous communities.

### **Multilogicality of Indigenous Research Frameworks**

While there are shared values among IRFs, there are also values that Indigenous scholars and WMS researchers contend with (Smith et al., 2016). Kincheloe and Steinberg (2008) argue Indigenous communities should seek allies from outside of their community to bolster resistance against neocolonialism and allow for transformational change to happen at a broader scale. This struck a chord for me because in my own specific culture—Acoma Pueblo—there is an unspoken sense of distrust for all outsiders, but most especially when they are proposing Western scientific research that could impact our community (Cajete, 2008). This places a burden on Indigenous researchers to embrace the sharing of Indigenous Knowledge outside of the Indigenous community. While some Indigenous communities are open to sharing this type of information (Morton & Gawboy, 2000; Wall & Masayesva, 2004), other Indigenous cultures limit access to Indigenous Knowledge (Battiste, 2008). Additionally, some Indigenous community members might view this aspect of a “generalized” Indigenous approach to research as a requirement for the community to justify their Traditional epistemologies to outsiders (Wilson, 2008). Indigenous data sovereignty refutes this requirement by acknowledging that Indigenous peoples should have the right to maintain their epistemological foundations within their local community (Battiste, 2008; First Nations Information Governance Centre [FNIGC], 2014, 2020; Rainie et al., 2017). The Indigenous research frameworks I use centralize Indigenous perspectives but also allow for divergent viewpoints to be recognized, accepted, and respected.

Another contested aspect of IRFs involve the way that researchers satisfy the component of “serving the interests of Indigenous people and their communities.” This statement can mislead non-Indigenous people, particularly academic researchers, into believing that *all* Indigenous communities, and individuals, align preternaturally in terms of their political interests, societal needs, and Indigenous worldviews. As mentioned previously, Indigenous communities can have drastically different approaches to interacting with non-Indigenous entities, especially when it comes to communicating sensitive Indigenous Knowledge that can be misused. This creates a contradiction because some researchers (Grande, 2008; Kincheloe & Steinberg, 2008; Kovach, 2014) mention avoidance and/or denial of essentialism within their perspective of IRFs due to its detrimental effects on Indigenous communities and individuals. However, *articulating* an Indigenous approach to incorporating Indigenous Knowledge requires, at the very least, an essentialized wording (that erases specific histories of uncountable Indigenous communities) while creating an inclusive statement that “works” for all Indigenous communities.

My own approach has been to not attempt to include all Indigenous communities into a single Indigenous research framework. Instead, in most of my work, I combine IRFs with socioTransformative constructivism (sTc; Rodriguez, 1998) which allows a generalized approach to research and teaching to be contextualized through the use of IRFs for specific Indigenous communities. There should be a purpose in grouping Indigenous communities together and this could be based on similar political goals, similar environmental contexts, similar historical (albeit separate) contexts (Smith, 1999). My purpose in this article is to develop an understanding of how IRFs can be wielded in faculty activities beyond research.

A third criticism of IRFs is related to the aspect of spirituality and its consideration as a necessary component of Indigenous approaches to research and education (Brayboy 2005; Cajete, 2008; Smith, 1999). I cannot disregard the role that spirituality holds within Indigenous worldviews, but I practice prudence when trying to accurately describe what is (and what is not) deemed “spiritual.” Grande (2000, p. 355) writes that Indigenous approaches should have “Earth as its spiritual center.” Other Indigenous researchers (Cajete, 2008; Smith, 1999) use generalized wording that is not specific to any particular Indigenous community, but reflects Indigenous insights that spirituality is directly tied to Indigenous Knowledge production. It can be difficult for non-Indigenous researchers to recognize how the epistemological underpinnings of their science influences research they conduct within Indigenous communities. While I support the notion that Indigenous spirituality does not need to be validated by non-Indigenous individuals/communities, I still grapple with my identities as an Indigenous person, who sees great value in acknowledging phenomena beyond what WMS can explain, and a geoscientist whose formal training did not include acknowledgement of the value of Indigenous perspectives. If spirituality is explicitly named within an Indigenous research framework, that could require that the Indigenous community involved in research be open to discussions of Indigenous spirituality. These discussions can quickly become problematic if Indigenous perspectives are not at the forefront and in a respected position. There is value in lived experience (Dunbar, 2008), and my own lived experience tells me that there is no direct consensus of which aspects of Indigenous spirituality are open to critique by non-Indigenous parties.

### **Theoretical Perspective and Methodology**

The theoretical perspective I am using is Tribal Critical Race Theory (Brayboy, 2005). This framework centralizes Indigenous perspectives and demands context in situations where Indigenous communities will be involved in research. This is important because the history of negative interactions (i.e., colonization, racism, loss of data sovereignty collected through



WMS research) between many Indigenous communities and outsiders to those communities has resulted in distrust of WMS (CIHR et al., 2018; First Nations Information Governance Centre [FNGC], 2014; Smith, 1999). The research projects discussed in this article were completed in accordance with Purdue University IRB (Studies: 1602017136, 1701018726, 1701018727) with secondary approval from Heritage University IRB. Approval for publishing this article was requested and provided by the Acoma Pueblo Tribal Council and the Yakama Nation Tribal Council.

Autoethnography was chosen for its usefulness in valuing alternative perspectives that seem to run counter to WMS positivism as well as a way to engage in critical, reflexive thinking about how practical knowledge gained from lived experiences can enhance understanding of scientists' positionality during the scientific process (Dunbar, 2008; Hughes & Pennington, 2017; Masta, 2018; Tomaselli et al., 2008). This allows a transformative approach to creating educational environments within higher education from a comprehensive understanding of social dynamics (e.g., a researcher's relationship to participants in a research project) and traditional WMS empirical data (e.g., results/analysis from a research project). Non-qualitative researchers often mistake autoethnography for storytelling without a connection to theory or research. Hughes and Pennington (2017) offer three distinct patterns of autoethnography that enable researchers to legitimate their research and offer new perspectives (e.g., Indigenous) that will transform the disciplines of WMS. The approach used for this article is to claim links to existing qualitative constructs (Hughes & Pennington, 2017) which requires careful attention to fairness, ontological authenticity, catalytic authenticity, educative authenticity, tactical authenticity, methodological rigor, and aesthetic rigor. These terms and their contexts within this autoethnography are discussed in the following paragraphs.

Fairness in this context is dependent on whether different social constructions of reality are explicitly identified during the writing process. I have spent many years within the WMS academic system, separated from my family with only a few visits each year for at least half of that time. My familiarity with WMS and my identity as a scientist expose me as a representative of WMS to my home communities. It was not until I was introduced to the research of other Indigenous scholars (Brayboy, 2005; Wilson, 2008; Zywicki, 2013) that I was able to understand why I was constantly reinterpreting the knowledge I was learning in the WMS classroom into a more personal, culturally congruent (i.e., Acoma) understanding of those WMS concepts (Gay, 2010). In this way, I have stakes in both the promotion of Indigenous Knowledge as a valid source of information as well as the continuation of WMS efforts to mitigate natural hazards and enhance the overall health of the global Indigenous community.

Writing this article has required me to reflect deeply on my own positionality. I realize now that my positionality is necessarily one focused on inclusion because of the marginalization I have experienced as a gay, Native American in my daily life as well as within WMS educational settings. This critical self-reflection has helped me understand my personal values for diversity, equity, and inclusion especially within research contexts involving Indigenous communities. Ontological authority describes this critical self-reflection that examines whether a researcher's values and social constructions of reality are improved by virtue of having more evidence-based information (Hughes & Pennington, 2017).

The research projects I have led have truly changed the way I think WMS research can be conducted. I always listened closely when professors explained that one of the reasons they enjoyed their career was because of the freedom to choose the direction of their research. As I resolved to use IRFs in my own research I knew that I would be a driver of change within WMS that would result in long-term benefits for Indigenous communities. Catalytic authenticity (Hughes & Pennington, 2017) indicates new, transformative ways of thinking that

are apparent after self-evaluation. The transformative aspect of this article is to bring the values of IRFs into other aspects of higher education (e.g., mentoring and teaching) beyond research.

I began writing this article with the intention that Indigenous educators would be able to use it to reflexively integrate Indigenous values within a holistic approach to creating higher education spaces. However, I now realize that whether I choose to write for them or not, people beyond my intended audience will be reading this article. However, this is a reciprocal process in that both the researcher (e.g., an Indigenous researcher) and the audience (e.g., a non-Indigenous researcher) reflexively integrate their understandings of social constructions described by others (e.g., the social experiences described in this article) with their own experiences. Educative authenticity represents the degree to which this sense of appreciation for entities outside of one's own affinity groups is enhanced, and their social constructions are respected.

The mobilization of the transformative practices recognized within catalytic authenticity is referred to as tactical authenticity (Hughes & Pennington, 2017). This active component of autoethnography aligns with IRFs because it ensures that theory is not the ultimate end of the scholarship described within the autoethnography. It is important to not only explicitly recognize theoretical constructs that are evidenced by personal experiences but to transform this knowledge into something useful that will benefit future generations of scholars, researchers, and communities.

The methodological rigor for this article is more concerned with why the use of IRFs is successful in these particular instances as opposed to finding some universal indicator that implies the justification and need for using IRFs in higher education settings. Methodological rigor refers to the standards being used for interpretive and constructivist inquiry in contrast to the standards of WMS which include validity, reliability, and generalizability (Brayboy & Castagno, 2008; Hughes & Pennington, 2017; Smith et al., 2016). In the context of this autoethnography, the purpose of this article is not to generalize my experience as something that all underrepresented students will face (Smith et al., 2016). Rather, the purpose of this autoethnography is to reveal WMS institutional values that are supportive of the use of IRFs to enhance higher education (Brayboy & Castagno, 2008).

The aesthetic rigor of this article spans multiple disciplines within the physical and social sciences. Aesthetic rigor is the level of acquiescence to accepted standards for literary quality, i.e. reflexively connecting personal experiences to scholarly research (Hughes & Pennington, 2017). Contextually, this clarification is extremely important when working with Indigenous peoples, Indigenous communities, and Indigenous Knowledge. Indigenous data sovereignty as well as other research focused on the intersection between Indigenous communities and academia has revealed that although Indigenous research may enhance WMS through connections to non-Indigenous theory, Indigenous Knowledge remains under the stewardship of Indigenous communities (Battiste, 2008; David-Chavez & Gavin, 2018; Rainie et al., 2017).

Together, these criteria form a foundation upon which the personal experiences of researchers can be integrated to form a more holistic, contextualized perspective of the research experience. In my context, the use of autoethnography has led to research that seeks to answer the questions of how Indigenous ways of knowing survive within geoscience departments embedded within WMS higher education institutions and how to identify the pragmatic applicability of Indigenous Knowledge within WMS traditional geoscience pedagogies. To this end, the theoretical perspective I am using is equally important as the research method.

I used a self-interview technique in order to expand my thoughts into a reflexive exercise that would connect my personal experiences to broader bodies of literature in science education, critical theory, and Indigenous Knowledge (Hughes & Pennington, 2017). Self-interview and other reflexive techniques are especially important within Indigenous contexts

because they allow for the explicit recognition of positionality's influence on the research process (Tomaselli et al., 2008). I developed a set of seven questions related to my experiences teaching undergraduate students, mentoring undergraduate and graduate students, as well as leading Indigenous student organizations while using Indigenous research frameworks to guide my styles of pedagogy and communication. Another Indigenous qualitative researcher administered the self-interview and was allowed to exert some influence on the wording and order that the questions were asked. Additionally, the external interviewer included follow-up questions that helped broaden my understanding of the connections between the different contexts in which I have used IRFs. The interview lasted about 90 minutes and included a debriefing session after the interview was completed to reestablish regular communication between the external interviewer and myself. The self-interview data is used primarily to preface the multiple contexts in which I have used IRFs and is also included in the discussion section in order to clarify different relationships among my experiences using IRFs.

### **Development of Darryl Reano's WMS Identity**

The following section is an excerpt from the self-interview. It is meant to serve as a way for readers to understand my relatively recent introduction to Indigenous research frameworks and how I began to use them in conjunction with geology/geoscience.

*The undergrad that I went to--the classes were pretty much straightforward typical geology classes, lots of field components. In a way, geology is almost more focused on experiential learning rather than theoretical learning. You're out in the field trying to describe minerals that you can look at and actually point out and see rather than ideas that are abstract. When I came to graduate school, it was a different kind of thinking, because I was exposed to geology literature. I started [learning] how you lay out a research problem, how you go about [collecting data and analyzing it], and also [the importance of] connecting [your findings] to the broader literature.*

*One of the first classes that I took [as a PhD student] was about mixed-methods in engineering education. It was really interesting for me because it explained how quantitative research is much more useful for explaining "what" was happening, whereas qualitative research can help you understand "why" certain things were happening. That class was also the first time I started hearing about theoretical frameworks. That was when I started realizing that all of the science that I have been doing has a theoretical framework, but it's never **explicitly** mentioned. There is this assumption that the [geoscience community of researchers] agrees on a common theoretical framework being used. It was interesting to find out that there are other frameworks.*

*I learned about social justice frameworks that were focused on equity and [using these frameworks] not just at the end of a research project but from the very beginning! How you can come up with a research question that meets the needs of the community by talking to communities throughout the research process and [maintaining] long-term accountability to those communities. All of that was powerful for me because I didn't think that was something scientists or researchers cared about. I know people care about it on a personal level but they don't typically bring it into their work that I've seen, especially in geology.*

*I also learned about Indigenous research frameworks. In many of these Indigenous research frameworks, [Indigenous researchers] are writing for other Indigenous communities. However, one of my goals, as an Indigenous researcher, is to show [non-Indigenous] scientists why they should value Indigenous Knowledge and Indigenous research frameworks. I think that getting buy-in from the broader [academic] community is difficult because they haven't*

*seen examples of [research informed by Indigenous research frameworks] in practice, especially in my discipline.*

*What I'm trying to do [with my research] is show examples of ways that we can glean geological knowledge from the global [Indigenous] community [ethically]. I think that Western modern science has a lot of growing to do in terms of how they treat people and how they attack issues before [research] can be done respectfully. A lot of times, Western scientific values are similar to Indigenous values in the sense that people want to be happy and comfortable. The [tension] is more a product of **how** the different groups achieve that. [Non-Indigenous] scientists feel justified coming into [Indigenous] communities, doing research, leaving, even maybe devastating the community, because they learned something [that enhances Western modern science]. I don't think that's a very [ethical] approach if you're thinking about the entire [global] community as a whole rather than just a select few groups within the community that benefit the most.*

*Giving Western scientists access to Indigenous Knowledge is contentious among Indigenous scholars and Indigenous communities--there's disagreement about what that level of access should be. What I try to do in my research is focus on the geological aspects, nothing more than that. Things that you actually see walking around [physical environments] and censoring some of the more sensitive [cultural] information and allowing the community to be the arbiters of that. For the papers that I write, I'll put down some things and then I'll send it back to them [community Officials] to have them look at it to make sure that if there's something they don't like or they don't want in there, they can take it out. That way, it's not just my own personal opinion of what should and should not be shared, but it's actually a group of people [from the community] making that decision.*

*I have started learning about Indigenous communities in Canada that are setting up Indigenous IRBs essentially where they [Western researchers] go through gatekeepers within the community anytime research is being done within or about these communities. I think that's one thing to look for in the future for Indigenous communities in the United States. I think you'll see more of that as more Indigenous scholars are becoming aware of all the different processes we have to go through for other communities, so why should we not have those same protections at Home?*

*What I think Indigenous research frameworks bring to the academic research process is this relational aspect. How interpersonal relationships and communication impact the research process. There are often more respectful attitudes among people when you are considering their opinions, their values, [and] their cultural beliefs. I think that's really important for growing the higher education community because a lot of our [academic] work depends on opening ourselves up to new ideas and finding new ways to solve problems. Indigenous research frameworks can help bring a greater diversity of students that feel welcome in that [academic] environment so that we can have people from different backgrounds learning about the same material together. Their unique life experiences will influence the research that they do and how we approach different research questions and even which research questions we decide to approach.*

*Darryl Reano Self-Interview, 2019,  
brackets, bolding, and rewording for clarity were added post-interview*

### **Indigenous Research Frameworks Within Multiple Contexts**

The following sections of this article will highlight several experiences from my time as a graduate student working to complete my doctoral degree requirements. The teaching components were culled from the various teaching experiences I held as a graduate student, including teaching assistantships for introductory geology courses and co-teaching an

introductory environmental science course. The mentoring section is founded on my experiences mentoring Indigenous and non-Indigenous students in both formal and informal settings. The context of “leading” refers to my time spent as President of the Purdue American Indian Science and Engineering Society (Purdue-AISES). All of these contexts were happening concurrently and at a time when IRFs were beginning to become a major facet of my professional disposition. Each section will begin with a brief explanation of the context of the experiences, followed by an excerpt from the self-interview that describes the relevancy of the context (i.e., mentoring, teaching, leading), and will be completed with an analysis of the connections between the multiple contexts and the shared values of IRFs (e.g., holism, relationality, spirituality) described earlier in this text.

### ***Using IRFs for Teaching***

During graduate school, I taught introductory level geology courses (mostly non-majors) and upper-level lab courses for geoscience majors. I also had the privilege of teaching undergraduate students through “GeoConnections.” GeoConnections was an NSF-funded project (Award # 1712378), focused on creating culturally relevant geoscience education modules for Indigenous undergraduate students. These modules integrated aspects of IRFs into the development of each module. During the implementation of these three modules (a total of 15 class hours) I was also present on a university campus, situated within an Indigenous community, in the state of Washington.

Using IRFs for teaching requires a holistic approach. For me, this means that teaching does not stop immediately when class is over. There were numerous times when students approached me as I was walking around campus to converse about the scientific topics we were covering in class. These interactions were often focused on contextualization—students wanted to voice connections between Western scientific content and their daily lives.

*It's not easy. It takes time to develop relationships with people that aren't directly benefiting you [or from you]. From what I've seen, the expectations for a teaching assistant in our department would be: you give this lecture, answer any questions that students have about their assignment, enter [the grade] into the gradebook, and then next week do the same thing. That's the extent of the relationship that is expected between a teaching assistant and students at many universities. But what I've seen is that you'll have different levels of engagement from different students from the very start of the class. Where some people are interested, they're happy to be there, and they want to learn the material. Often, you'll have other students that are just completely disconnected.*

*I think that traditional educational environments foster impersonal teaching. “If you don't want to be here, you're going to get an ‘F’. If you're not trying, I'm not going to help you [and] you're not going to pass the class.” If you use Indigenous research frameworks in that same space, it's much more focused on the students, and it's a reciprocal relationship. I see it as this relational aspect of IRFs—it's asking me to find out what the student's perspective is, figure out their level of engagement, and if they're not engaged, finding different ways to engage them. Which means talking to them about things beyond the science, beyond the concepts we're learning in that class because a lot of them are from different majors besides geoscience and so they're trained within their departments to be thinking towards their own careers. I think finding ways to connect the geoscience concepts to their goals and to their values is really important for increasing their engagement. I think IRFs are a natural way to do that. It just **creates a better communication flow** between the teacher and the student.*

*It doesn't happen immediately. In your first class, you're like “Let's just open up the floor and everyone tell me how you feel about geology.” That doesn't really work because*

*there's a level of trust that has to be developed first. That requires vulnerability on both parties' accounts, so you're not going to immediately have that sense of trust from the beginning of a relationship. That's something we've learned about working with Indigenous communities and why these Indigenous research frameworks include that as a component is because we've seen this over and over again. If you're not considering the needs and perspectives of the people you're working with, then the communication just is not as good as it could be.*

*One of the first things that I wanted to talk to the students about was transparency. Then I went on to explain: "You should really be considering who I am as a teacher. Why am I teaching you this material? Why are we sharing these ideas with you? What are you going to use this knowledge for? Why have they arranged the information in this way? What underlying goals do [the authors] have for you after having read this book? What's the next step?" That was really eye-opening for a lot of the students. They were fascinated by this idea that they were being molded without realizing it. But I was being explicit about it. That was one [IRF] aspect, this transparency aspect [acknowledging] who I am, what the knowledge is for, and what we are training them to do.*

*Darryl Reano Self-Interview, 2019*

**Holistic.** GeoConnections, implemented at a small private university in the state of Washington, reflected the holistic nature of IRFs through the different relationships we highlighted during the development of course materials between the Yakama people and local geologic features such as the Yakima River and the Columbia River basalts. In the climate change report, the Yakama people distinctly identify cultural resources as impacted by climate change. This is a disruption to the WMS science idea that only physical natural resources (ones that can be economized/sold for profit) are worthy of inventory or engagement (Brayboy, 2005; Little Bear, 2000; Smith, 1999). Another inclusive/holistic aspect was how we structured the stakeholders in the modules. Stakeholders we included in our activity were local business owners, Indigenous communities, Yakama First Foods (i.e., sacred foods; Montag et al., 2014; Yakama Nation, 2016), scientists, local community members, and students. Therefore, even though we privileged Indigenous perspectives, this did not mean that we excluded the dominant perspective from the discussion. Additionally, students were encouraged to continually add new stakeholders as the discussion progressed and new interests and needs of unmentioned stakeholders became evident.

The lab environment also included holistic aspects evidenced by the fact that we sometimes had children with us in the classroom during lab times. In this particular small university setting, careful attention is paid to the various barriers that may prevent students from wholly participating in class activities and assignments. The children present during lab did not disrupt the lab activities we were doing, but instead allowed all of us to have an intergenerational educational experience. During this lab period, parents were able to expose their children to current practices of college students and model the behavior of a successful student. This experiential aspect of perpetuating Indigenous Knowledge is invaluable. In this case, we were also perpetuating Western modern scientific knowledge in the same space, which showed the younger participants that these two knowledge systems are not incompatible in practice.

Indigenous community members were also invited into the classroom in an effort to expose the class to unfiltered Indigenous perspectives. In actuality, the community members who came were older students or had graduated already but maintained a connection with the Indigenous students on campus, the instructor of the course, and/or other faculty at the university where GeoConnections was implemented. During the modules, I did not pretend to have extended knowledge about the First Foods of the Yakama people; instead, I deferred to

those community members who had much greater expertise than I do as a visitor to the area and outsider to the Yakama culture.

**Relational.** In GeoConnections, we implemented an activity involving E-Colors, “a personality diversity indicator” (Equilibria, 2019), that has been used in training new employees at major energy corporations. This activity was designed to alert individuals to intercommunication skills that may need to be developed in addition to potentially “inherent” communication styles. In industry settings, lack of development of these skills can pose significant threats. For our purposes, we were more interested in having students develop a reflexive mindset (Rodriguez, 1998) that would allow them to interpret their individual educational experiences during the GeoConnections project within a broader context (e.g., within Toppenish county, Washington State, the United States, the global community). However, to begin this pattern of reflexive thinking, we asked students to consider their relationships with other people in the classroom as well as people within their communities. This was a preemptive approach to having the students begin planning a community-based action project that would allow them to directly address climate change tasks dictated by the Yakama Nation climate adaptation plan (Yakama Nation, 2016).

**Centralization of Indigenous Perspectives.** In GeoConnections, as part of the “Yakima River Module,” we also emphasized the First Foods of the Yakama nation as having a voice and respected position within the ecosystem (Montag et al., 2014; Yakama Nation 2016). For the Yakima River Module, this meant that the survival and sustainability of First Foods for future generations (Jacob, 2013; Montag et al., 2014; Yakama Nation, 2016) was of prime importance as we considered Indigenous perspectives, specifically those of the Confederated Bands and Tribes of the Yakama Nation. This was especially important because this module was implemented on the lands of the Confederated Bands and Tribes of the Yakama Nation. This Yakima River Module is an example of developing relationality between human and non-human entities (Te Aho, 2018) within the Yakama ecological landscape (Jacob, 2013; Montag et al., 2014; Yakama Nation, 2016). By putting the needs of non-humans (e.g., First Foods) as paramount, we were able to discuss sustainable approaches that would incorporate multiple perspectives (i.e., Indigenous and non-Indigenous) when trying to mitigate climate change impacts (Brierly et al., 2018; Little Bear, 2000; Tallbear, 2015).

**Serving Indigenous Community Interests.** In the “Policy and Communication Module” for GeoConnections, we addressed climate change concerns coming directly from the Confederated Bands and Tribes of the Yakama Nation (Yakama Nation, 2016) by dedicating a major portion of lab time during this module to address task items set forth in the adaptation plan. This included the identification of key local community stakeholders through a power-mapping exercise developed from materials created by the Earth Science Women’s Network (Glessmer et al., 2015). We asked the students to not stop at finding names of important people in the community they thought should be involved, but we also asked them to find direct contact information to make it more apparent that the next step would be to actually contact the people who were in positions of power in order to begin a collaboration. Students were then invited to implement their proposals with the instructors of the course explicitly offering to help materialize the action plans of the students. However, students, at the end of the semester, were reluctant to pursue the promulgation of their planned initiatives. Many of the students indicated verbally that their academic workload would not allow them to pursue time-intensive extracurricular activities. Thus, while our module was poised to serve the Indigenous community directly, none of the action plans developed within the module have yet been put into effect.

**Multilogicality.** In all of the GeoConnections modules, respect for both Indigenous Knowledge and WMS as valid sources of knowledge was a prime objective. Neither knowledge system was elevated above the other intentionally. However, the GeoConnections modules were implemented within a WMS institution of higher education. Although this institution is on the lands of the Confederated Tribes and Bands of the Yakama Nation, WMS values often overshadow and take priority over the cultural values of Indigenous communities. Therefore, the structural arrangement and presentation of the GeoConnections modules may have emphasized how different our approach for GeoConnections (i.e., privileging Indigenous perspectives) was in comparison to other classes taught from a WMS perspective.

During GeoConnections, respect for Indigenous Knowledge and WMS was developed during classroom discussions which explicitly asked students to share how WMS impacted their daily lives. These discussions allowed all students, Indigenous and non-Indigenous alike, to bring their unique cultural identities into the classroom. Additionally, the main instructor for the course had a nuanced understanding, developed over multiple years, of the academic and personal backgrounds of the students enrolled in the course. Based on interview data collected during the GeoConnections project, students felt that WMS knowledge was inherent to all of their classes, but that the GeoConnections modules offered a contextualized approach to understanding the WMS concepts presented.

**Spirituality.** In the GeoConnections modules, we did not dictate what was spiritually significant from anyone's perspective. Instead, we allowed the climate change adaptation plan (Yakama Nation, 2016) to speak directly from the public Yakama perspective. Even though not all of the students in the class were members of the Yakama Nation, their understanding of the Yakama perspective was encouraged through reading excerpts from the climate change adaptation plan (Yakama Nation, 2016) about significant cultural resources. Additionally, their perceptions of Indigenous perspectives were elevated, moving from mere understanding to respect for other cultures and insights to how environmental changes are intertwined with the spiritual values of Indigenous communities:

*I haven't really been exposed to that, except for this class, so I don't know a lot about that. Taking this class, I see that **it means a lot to the people that live around the rivers and how some of these things are disappearing. It's affecting their culture and things are changing.***

**-Student X**

### Using IRFs for Mentoring

Mentoring was an integral part of my graduate student experience at Purdue University. I was first given the opportunity to formally mentor as part of the "Minority Education Through Traveling and Learning in the Sciences" program and the "Sharing the Land" program (Maygarden et al., 2012; Riggs et al., 2007). These programs allowed me to teach geology to underrepresented high school students in the field along with several other geologists (other graduate students and faculty members) during summers, in different parts of the United States. I was also affiliated with the "Alliance for Graduate Education through the Professoriate" (AGEP) program at Purdue University. This program pairs experienced graduate students with undergraduate students, usually part of the "Louis Stokes Alliance for Minority Participation" (LSAMP) program, as well as first-year graduate students. I was also a mentor for Indigenous undergraduate students through the "Indigenous iNtegration of Aquatic science and Traditional-Ecological-Knowledge for Undergraduate culturally Responsive Education" (i-NATURE; NSF Award # 1612186). Informal mentoring has also been a natural extension of



these activities because I realized that people within my own science department who were not part of formal mentoring programs were seeking mentors as well.

All of these experiences, collectively, have shaped my understanding of what it takes to mentor students from various academic and social backgrounds. As mentioned earlier, these experiences were taking place during my own progression through graduate school and as I was searching for my own mentors. Reading literature about IRFs encouraged me to take an active, reflexive approach to my mentoring style and the types of mentors I sought. Developing agency through familiarity with IRFs took me to a crossroads: I could become selfish and relegate myself to siloed thinking patterns as I saw many of the graduate students in my department do, or I could engage with these potential mentees and bring them onto the path that I was traveling on through higher education. With great tension, I chose to help as many individuals as possible. However, as many mentors soon realize, I could not help everyone. Sometimes this was because of time constraints in my schedule but more often it was because I simply was not the best mentor for some students. As I became more experienced at mentoring, I learned how to use my academic network to refer students to better-suited mentors.

*I think mentoring is a lot harder than teaching. The reason why I say that is because it feels like I make deeper connections with the students [I mentor]. When I'm teaching to a class, I say things in a generalized sense so that everyone can understand and everyone feels comfortable voicing their opinion. When I'm working with an individual student it's very specific because they're a unique individual. I think finding that person's unique way of communicating is a lot harder than trying to communicate with a group.*

*Also, [academic] topics are not [always] the focus of [mentor-mentee] relationships. [Mentees would tell me], "Yeah- I'm in school, I'm taking classes, and I have a high workload this semester. But what I really want to talk about is the stress I'm having when talking to my advisor." I've had numerous mentees that told me, "I need to leave my lab and switch to a different lab" and they didn't know how to do that. At that point, I am not helping them understand geology concepts, it's more about **interpersonal relationships**. They've never been trained or taught explicitly **the communication styles of academia**.*

*I think also [mentoring is] different with mentees from underrepresented backgrounds compared to majority students. I've had both, but often the majority students are really focused on their futures. They're really interested in learning how to prepare themselves now for what position they would like in the future, either a career or their next major, class, or job. A lot of the underrepresented students I talk to--our conversations focus more on the day-to-day interactions we have with people. Things such as experiences with racism or microaggressions, problems talking to advisors, competitive atmospheres in different lab settings, and emotional feelings about their level of work ethic and/or level of expertise in a field. Not feeling like they know enough compared to the rest of the department is another common topic. I think underrepresented students feel more comfortable discussing these more emotional issues than the majority students I've mentored.*

**Darryl Reano Self-Interview, 2019**

**Holistic.** One of my Indigenous mentees suggested they might be interested in the Sloan Program, a program designed to offer support for Indigenous students entering graduate school. As a graduate student, I participated in the Sloan Indigenous Graduate Program (SIGP), a "program that provides funds for the creation and operation of four regional centers that aim to foster welcoming and supportive environments that cater to the needs of indigenous students" (Sloan Indigenous Graduate Partnership, n.d.). The SIGP is only implemented at certain schools around the United States, which would have entailed the mentee moving and leaving

their cultural place. They had been told that this would be a logical next step after finishing their undergraduate degree. However, the mentee expressed some concern over leaving their home and living amongst strangers. After careful consideration with themselves, the mentee later came to me and told me that they would not be applying to the SIGP after all.

While many mentors would have gauged their “resistance” to applying for the Sloan Program as a barrier that needed to be overcome, I saw it as a conscious decision my mentee was making for their spiritual health. For many Indigenous community members, it is impossible to leave our cultural homes and expect to remain deeply connected to our Indigenous values and customs. Although, we are able to retain our identity, there is a definite loss of community when we are not able to visit our family, take part in community ceremonies, or hear our Indigenous languages on a daily basis. From that point on, our mentor/mentee conversations were redirected by the mentee towards how they could give back to their community, both as a participant in spiritual gatherings but also as a student-researcher within the higher education community. Many of our discussions began with typical mentor/mentee question-answer dialogues (e.g., deadlines, progress reports, anticipated workloads), but these discussions often morphed into the personal dynamics of how their cultural obligations were somewhat at odds with their academic responsibilities. In this sense, my own similar cultural background as opposed to my academic background was more important in order for me to be an appropriate and useful mentor for this mentee (Blake-Beard et al., 2011).

**Relational.** Human cross-cultural communication is inherent to mentoring within WMS institutions of higher education (Blake-Beard et al., 2011). However, authentic communication relies on trust between communicators to develop meaningful relationships that allow both mentor and mentee to vulnerably share their inner thoughts and concerns, especially within Indigenous communities (Rodriguez, 1998; Smith, 1999). Often, in Indigenous communities, you develop several relationships with interrelated individuals concurrently as you are being introduced into the society. This helps ensure that different perspectives can converge on the same focal point, which is the outsider’s intent, motivation, and potential benefits for being associated with the community and its members.

For many of my Indigenous mentees, this necessitated meeting with their other advisors and mentors on campus. Sometimes they were current instructors of the mentees but other times they were informally connected to them through summer research projects and cultural community connections. In this way, I was simply an additional member to their academic and cultural communities. Within many Indigenous communities it is understood that everyone brings value to a relationship (i.e., mentoring relationships) and that our individual strengths are not necessarily shared between one another, necessitating the community as a broad group of people who, collectively, are better able to advise us. To truly take advantage of the strengths within our support networks, it is necessary to reflect on our relationships with these individuals and learn to cohesively situate the advice we are offered. With my mentees, I focus on identifying key people who have provided me with meaningful mentoring relationships, explaining how I identified them and brought them into my support network. For many of my Indigenous mentees, they know what their own needs are but are hesitant to request explicit help because it places a burden on others.

**Centralization of Indigenous Perspectives.** One of my mentees was able to introduce me to the Yakama Tribal Council. This was important for my mentee (and myself) because there was a cultural obligation to introduce me to their broader (i.e., non-academic) community, especially because I was helping them with their research. During this meeting, I explained who I am (my identities as an Indigenous person, as a WMS researcher, and previous research I have been involved with implementing), my different roles in the local community (as an

instructor at a local university during implementation of the GeoConnections modules, mentoring students, including Yakama community members, and also as a researcher from Purdue University), and the expected outcomes from those roles. This allowed me to acknowledge my position as a researcher in the local community was subject to the cultural advice of the Council. I asked them to tell me if I was doing something wrong at any point or to notify me if they did not want me to be present in the community anymore. In this context, even with a shared Indigenous identity, I was respectful of the place I was in, the home of the Yakama Nation, and so I deferred all “control” to them over the research taking place under my supervision as well as my own personal affiliation(s) within the community.

**Serving Indigenous Community Interests.** While working with Indigenous mentees, it is important to me that students develop a sense of how their technical geoscientific knowledge may be incorporated into their Indigenous worldviews. Most often, this occurs when mentees are able to make connections between the technical geoscience knowledge they’ve acquired and the needs of their own home communities. However, since I am not from the same Indigenous communities as most of my mentees, it is imperative that I do not overstep my boundaries with other Indigenous and non-Indigenous communities. By creating agency (Rodriguez, 1998) and fostering a reflexive mindset amongst my mentees, they are able to articulate for themselves what they perceive the needs of their communities to be. Sometimes service to Indigenous communities is direct (e.g., working within the science offices of their community’s government after graduating) but other times it is less direct (e.g., inspiring the younger generation to pursue academic interests or maintaining status as an intermediary between academia and their Indigenous community). All of these potentialities are equally valid and require a certain level of personal sacrifice. For my part, I choose not to value one pathway over the other, but I do encourage my mentees to think critically about how the career choices they make will impact themselves, their families, their communities, as well as how all these impacts fit into the sociohistorical and political contexts of our world (Brayboy, 2005; Rodriguez, 1998).

**Multilogicality.** During meetings with many of my Indigenous mentees, we have talked about how our Indigenous Knowledge systems are such integral parts of our identity that we cannot forget about them even while we were in participating in WMS activities such as classes, field trip, and professional meetings. In addition, a lot of the WMS knowledge that we are exposed to in the classroom is taken home and shared with our families to see what their thoughts are and whether there is disagreement. In this way, the WMS knowledge shared within institutions of higher education are filtered through multiple ways of knowing.

While it was useful for each of us, individually, to reconcile our cultural worldviews with the perspective presented in the academic classroom, we had to make those connections ourselves. Amongst my Indigenous mentees, there are differences in how they felt the cultural aspects of their educational experiences could be better respected by outsiders to their culture. Some mentees mentioned that the administration at their institutions did not make enough concession to Indigenous interests (e.g., Indigenous-controlled spaces on campus, funding for Indigenous student organizations to travel) which led to a loss of pride and engagement with their institution. Other mentees described key allies within their institution’s administration who were empathetic with their concerns and who would stand up for them to other members of the administration to ensure that Indigenous concerns and interests were addressed substantially (e.g., becoming faculty sponsor for Indigenous student organizations, offering culturally relevant support through their professional networks).

Working with non-Indigenous mentees has given me different insights into how multilogicality plays an important role in mentoring relationships. Many of the non-Indigenous

mentees I have worked with are apprehensive about offending me, especially when culture and Indigenous people are the topic of discussion. I make it an emphatic part of the early part of any mentoring relationship to tell mentees that I understand we are from different backgrounds and that I will not take immediate offense to anything they are willing to share. Instead, I will listen to them and allow them to explain their reasoning for their behaviors, perceptions, and attitudes about certain topics. Creating this dialogic conversational space allows for different worldviews to come together and for us to learn from each other, but without one perspective automatically attributed more power (Rodriguez, 1998). This process is intended to allow opportunities for the mentees to develop a more complete understanding of their own needs and how to communicate with others to meet those needs, reinforcing the transformative aspect of agency (Rodriguez, 1998).

**Spirituality.** One semester, an Indigenous student I was mentoring was having a very difficult time. They could not concentrate and they were told by their own cultural advisors that they needed to reconnect with their environment. Their cultural advisors suggested going on hikes and walks into the mountains so that they could reflect on their circumstances. After hearing them recount this experience during one of our mentor-mentee meetings, I offered my own adaptation of how to implement the advice within an institution of higher education. I began by explaining a similar piece of advice that I was offered by my own cultural advisors when I was younger: to respect the non-human life around me, including plants, animals, and geomorphic features (e.g., rivers, mountains). By taking this advice, I was able to find a relationship with “nature” close by me at all times, even on the campus of higher educational institutions. I was able to access everyday experiences that maintained relationships with the non-human world while living my day to day life at a university. This day to day reaffirmation of Indigenous spirituality is key to maintaining Indigenous cultural identities, especially when we are displaced from the specific culturally significant places in which we usually affirm our Indigenous identities.

### **Using IRFs for Leading**

I have had many experiences supervising people from younger generations. However, some of the most meaningful experiences I have experienced in higher education happened when I was president of the Purdue chapter of the American Indian Science and Engineering Society (Purdue-AISES). The mission of Purdue-AISES, according to the student organization constitution and bylaws, is “to nurture building of community by bridging science and technology with traditional Native values. Through its educational programs, AISES provides opportunities for American Indians and Alaska Natives to pursue studies in science, engineering, business, and other academic areas. The trained professionals then become technologically informed leaders within the Indian community. AISES’ ultimate goal is to be a catalyst for the advancement of American Indians as they seek to become self-reliant and self-determined members of society.” During graduate school, as I reflected on my involvement with the organization, I realized that I personally did not feel like Purdue-AISES was meeting my needs to become “self-reliant” and a “self-determined member of society.” After talking with the membership as a group and approaching each member individually, I found that many Purdue-AISES members also desired more culturally relevant programming rather than opportunities for professional development that duplicated opportunities in their home departments. Another issue that was identified through direct communication with the membership was the lack of interpersonal engagement with the cultural identities represented in the Purdue-AISES membership. We were all part of Purdue-AISES because of our interest in Indigenous cultures (membership was open to all Purdue University students) but there were

few opportunities to actively learn about each other's cultures since many of our meetings were focused on professional development such as technical seminars, Western science and engineering research activities, and rote outreach activities that did not require integration of our cultural backgrounds.

With such a small active membership (about 10 regularly active members), I was able to take the time to communicate with each member directly and to consolidate our ideas for what we desired from Purdue-AISES into grant proposals. Student organizations at Purdue University are eligible for internal funds meant to encourage enrichment activities and planning for the student body of Purdue University. We identified two sources of funding: the "Graduate Student Organization Grant Allocation" board (GSOGA) as well as the "Student Fee Advisory Board" (SFAB). GSOGA is a source of funding for small projects, events, and materials that are typically less than \$5,000. Our GSOGA grant proposal was focused on creating a podcast about Purdue-AISES's research accomplishments but communicated in a way that is accessible to non-academic communities. Additionally, to address the Purdue-AISES membership's need to locate each other culturally, we decided that part of the podcast programming would include introductions to each other's cultures. The SFAB grant proposal is a larger source of funding for bigger events on campus (>\$15,000). For this proposal, we decided that we wanted to plan the inaugural Indigenous ArtsFest at Purdue University. The purpose of this ArtsFest was to highlight contemporary perspectives of Indigenous identities. We invited several Indigenous DJs, an Indigenous activist/songwriter, as well as a First Nations drag queen to perform at our event, which was open to the entire Purdue University/West Lafayette, Indiana community. The purpose of this event was to create a culturally-inclusive space for the entire Purdue community where we could share and learn about each other. Purdue-AISES envisioned an event where science, the arts (broadly), and culture intersected in meaningful and respectful ways that benefited all of the attendees. Our goal with this project was to increase intercultural competency related to *contemporary* Indigenous communities among the Purdue community as a measurable goal in alignment with Purdue University's Diversity and Inclusion initiatives.

**Holistic.** As leader of the Purdue-AISES organization, I began the academic year with an individualized assessment of what the current membership wanted in terms of cultural events, professional development, and outreach to the non-academic community. I did not rely on group meetings, a common form of communication among academic researchers, because it was clear that the members had many ideas that they were only willing to express in confidence among trusted individuals. As president, I felt it was my obligation to provide the space and time for these informal modes of communication to occur. Once members were able to express their needs from the Purdue-AISES student organization, I was astounded at how many people desired interdisciplinary engagement. More specifically, while all of the members were from various science, technology, engineering, and mathematics (STEM) disciplines, there was an expressed need to develop collaborations with the liberal arts (e.g., writers, musicians) community of Purdue University. While this might seem out of line with an organization designed to meet the needs of scientists and engineers, it is certainly not misaligned with Indigenous cultural values. Since the needs of our membership lie at this intersection of cultural and academic identities, it was necessary to mold our student organization to address these needs. The result of this line of thinking was that we began to write the grant proposal to fund the Indigenous ArtsFest.

**Relational.** In the Purdue-AISES student organization, we emphasized the importance of intergenerational contributions. In terms of our programming, this meant that new students were emphatically situated within the Indigenous community at Purdue University so that their perspective was incorporated into the goals for the academic year. For many of the students,

an open forum was not the place to voice their perspective and so it fell on me, as the leader, to meet with individuals to acquire individualized perspectives that were more authentic by creating opportunities for dialogic conversation where power structures were de-emphasized. In order to do this, we had group meetings scheduled when only students (undergraduate and graduate) were allowed to attend, without faculty interference. This is reflective, I think, of the importance of informal communication (Brayboy & Castagno, 2008) within Indigenous communities. This allows individuals to express their ideas within a dialogic conversational space where ideas are both respected and challenged (Rodriguez, 1998). These understandings of how interpersonal dynamics influenced the power structures of our organization were only possible through reflexive exercises undertaken by the Purdue-AISES leadership.

**Centralization of Indigenous Perspectives.** During planning for the Indigenous ArtsFest, I met with several of the other cultural centers on the Purdue University campus to see if they would be interested in partially funding some of our proposed performers. While the cultural centers were happy to help, it seemed to come at a cost. Some entities were willing to invest funding into the Indigenous ArtsFest but with the caveat that they would be able to add a performer of their choice to the Indigenous ArtsFest lineup. While this sounds collaborative in theory, one of the main things I had gathered during informal and formal conversations with AISES members was that they were excited that the list of performers for the ArtsFest were all student-generated: these were performers that spoke to the identities of our membership on a personal level. The performers that the campus entities wanted to invite served their interests but did not necessarily serve the interests of student members of Purdue-AISES. Reciprocity is a valued component of relationships with Indigenous communities and their members (Cajete, 2000; Masta, 2018; Smith, 1999). After more discussion about the purpose behind choosing the ArtsFest performers, the other campus entities agreed that it was more important for the Indigenous student body to have the final say on who was invited to perform during the ArtsFest.

**Serving Indigenous Community Interests.** Our original purpose in putting on the ArtsFest was to deliver “a diverse and inclusive event designed to highlight interactions between contemporary Indigenous communities and American culture.” This project allowed Indigenous graduate students to facilitate a major cultural event that aligned with the Purdue University institutional goals of creating immersive diversity opportunities for the Purdue University community. The Indigenous ArtsFest included performances by Indigenous artists but workshops were also to be held to encourage discussions between the local community and the invited performers who represented various cultural groups from different parts of the United States and Canada. These discussions were designed using IRFs that involve respectful discourse in a setting that acknowledges freedom of speech while maintaining Purdue’s commitment to professionalism and even-handedness. Many of the topics presented by the invited guests were to cover mainstream media topics but in relation to various communities outside of the Midwest. Research has shown that exposure to diverse perspectives encourages open-mindedness and increases cultural competency (Deardroff, 2006), which in turn makes students more employable on the global job market. However, half a year after the proposal was funded and with much discussion of how to format the ArtsFest event, we decided that we needed to more directly focus on Indigenous perspectives and the needs of the Indigenous student body. We chose to do this by no longer focusing on interactions between Indigenous cultures and mainstream (e.g., US Midwest) cultures but to focus on contemporary Indigenous identities in an effort to reinforce the Indigenous student body’s efforts to situate our cultural and academic values within contemporary society, especially the academic community of Purdue University. We felt that this created a space where all of the Purdue-AISES membership

felt comfortable, accepted, and excited for sharing some of our interests interwoven within the theme of contemporary Indigenous identity.

**Multilogicality.** The AISES membership at Purdue University represents many diverse Indigenous cultures that are not necessarily aligned in terms of their sociopolitical worldviews. The term Indigenous is an inclusive term that is the current English representational word being used by some Indigenous scholars to reference the many groups around the globe who have maintained place-based knowledge for millennia (David-Chavez & Gavin, 2018). However, this essentialization can also be detrimental because not all groups considered to be Indigenous share the same worldview and values. This is also true of the membership of Purdue-AISES, because many of us were the only person from our community attending Purdue University. As a group, we used the grants we were allocated for Purdue-AISES initiatives to explore our worldviews and their unique traits that influence the shared space created for the Purdue-AISES student organization on campus. We neglected the traditional power structures of academia in favor of creating a space that allowed all Purdue-AISES members to have decision-making abilities that dictated the future directions of the student organization.

**Spirituality.** While we had no formal spiritual leaders on campus, the Purdue-AISES advisor, who was also the director of the Native American Educational and Cultural Center (NAECC) regularly invited Indigenous Elders from around the global Indigenous community to bless many of our gatherings, to meet with students (as a group and individually), and to share their perspectives on the importance of education and its relationship to Indigenous identity. As a student organization, we also maintained the importance of spirituality as we planned our events for the year, including the Indigenous ArtsFest. While in discussion with one of the ArtsFest performers, it was suggested that an Elder lead an opening ceremony for the ArtsFest. This entailed our organization funding the travel for the Elder to perform the ceremony. From our perspective, this was a respectful decision, but also one that we were ready to support not only in discussion, but also financially. This was a key factor for showing respect for the cultural norms of many of the invited performers as well as to show reciprocity for the amount of engagement we were requesting of the performers. Additionally, the presence of an Indigenous Elder would have created an intergenerational space for promoting Indigenous cultural values (i.e., spirituality).

## Discussion

Indigenous research frameworks provide powerful ways for academic researchers and scientists to understand and interact with Indigenous Knowledge systems. There are many variations of IRFs, but some shared values among IRFs include holism, relationality, multilogicality, serving Indigenous communities' interests, centralizing Indigenous perspectives, and also respecting spirituality as an essential part of Indigenous community members' identities that cannot be disregarded. The ultimate effect of enacting IRFs appropriately ensures the production of inclusive dialogue, with great transparency that supports effective communication. Communication is a key factor for the production of knowledge, the promulgation of knowledge, and the efficient storing of knowledge in both Indigenous Knowledge systems and WMS.

Through critical, reflexive practices I have found many opportunities to connect Indigenous Knowledge systems and WMS using Indigenous research frameworks. These opportunities span beyond traditional academic research practices—utilizing a holistic approach to center students' experiences with mentoring and participating in student organizations within higher education institutions. However, it is important to me to also

understand what the goals are in bringing Indigenous Knowledge into non-Indigenous spaces. Was my goal related to Indigenizing academia? Protecting Traditional (i.e., Indigenous) ways of life? There should be a purpose to connecting the two knowledge systems so that it is clear and transparent. Many scholars, Indigenous and non-Indigenous, would argue that “it depends on the context” but I think this would be avoiding the pressing issue at hand: WMS marginalizes Indigenous Knowledge (Little Bear, 2000; Masta, 2018). This is problematic because at the “objective” level of WMS, there is no incentive for Western scientists and researchers to connect with/to/from Indigenous Knowledge systems. Defining the purpose of reaching out to each other, allows for both perspectives to be given the opportunity to decide whether the connection is something they benefit from or if the burden is too great to be taken on. Relating the experiences in the previous sections of the article, I believe that using Indigenous research frameworks in higher education institutions has allowed me to create inclusive spaces, that value diverse cultural ways of being—this is my purpose. These findings echo previous understandings of how multicultural education and culturally relevant pedagogies benefit underrepresented students (Gay, 2010; Sleeter & McLaren, 1995), but this article offers unique insight for how these inclusive approaches (i.e. IRFs) can be wielded in research, mentoring, and managing contexts, particularly with Indigenous students.

Currently, there are both formal and informal protocols and frameworks for guiding how IRFs should be used, especially by non-Indigenous people (Battiste, 2008; CIHR et al., 2018; Carroll et al., 2019; First Nations Information Governance Centre [FNIGC], 2014; First Nations Information Governance Centre [FNIGC], 2020). One specific example is the Ethics Eskinuapimk (Battiste, 2008), also known as the Mi’kmaw Ethics Watch, created in 1999 to “ensure that Mi’kmaw people and knowledge are protected within Mi’kma’ki territory to the degree that research processes can ensure this capacity” (Battiste, 2008, p. 506). This power structure, which privileges Indigenous perspectives, allows the Indigenous community to become more involved in all stages (e.g., planning, implementing, and evaluation) of the research process (FNIGC, 2014; FNIGC, 2020; Smith, 1999).

IRFs provide a basis, centered on the perspective of historically marginalized groups, to bring equitable practices to research, teaching, mentoring, and leading groups of people. As more of us Indigenous scholars continue to use IRFs to conduct research, we should not overlook the usefulness of IRFs to create better communication amongst smaller groups such as mentor/mentee relationships, classroom environments, and also organizational groups that are localized to specific interests (e.g., student organizations, corporate special interest groups, community-focused groups). However, more research is needed beyond the reflexive understandings I have presented in this article. This article is not meant to generate a checklist that can be used to create inclusive spaces for Indigenous students. Instead, the experiences detailed here should hopefully spark an understanding of how IRF values were contextualized for specific experiences between myself and the students I interacted with. A detailed understanding of how non-Indigenous students perceive educational environments informed by IRFs would further bolster claims that holistic, inclusive educational practices do indeed create benefits for all students, including Indigenous students enrolled in physical science degree programs.

My experiences focus predominantly on Indigenous students because these contexts were where I often gravitated to during graduate school. My experiences teaching at a predominantly white institution using IRFs were also fruitful, but I decided to centralize Indigenous perspectives in this article. One of the more surprising experiences I had when teaching non-Indigenous students using IRFs included student conceptualizations of Indigenous Knowledge. Perhaps due to a lack of cultural experiences, some of the non-Indigenous students attempted to lay claim to Indigenous Knowledge. This experience heightened my apprehension regarding the danger for appropriation of Indigenous Knowledge



by non-Indigenous entities and required me to revise aspects of the curricula for GeoConnections.

A responsible, authentic approach to using IRFs would also require longer-term opportunities for students, educators, and community members to voice their own opinions on how IRFs may impact the educational experience of their family members and themselves. In that way of thinking, I see these reflexive understandings as beginning steps towards a lifelong connection with the Indigenous students and communities that I have connected with over the past several years.

IRFs provide a framework that can be used in these multiple contexts for transparent, effective communication. As the population of students in institutions of higher education continues to diversify, it is to the benefit of academia at large to make use of opportunities to include multiple perspectives to advance Western science. Creating better communication among members of our societies will create transparency, which can not only effectively highlight new ways that disparate groups can align objectives, but also create action plans that benefit multiple interest groups. As a potential future faculty member myself, I am amongst the next generation of Indigenous scholars who will continue to strive for respecting multiple ways of knowing as the first step to the new generation of science, a science that respects Indigenous Knowledge and Western scientific knowledge together.

### References

- Anzaldúa, G. (1987). *Borderlands/La frontera: The new mestiza*. Aunt Lute Book Company.
- Bartlett, C., Marshall, M., Marshall, A. (2012). Two-eyed seeing and other lessons learned within a co-learning journey of bringing together Indigenous and mainstream knowledges and ways of knowing. *Journal of Environmental Studies and Sciences*, 2, 331-340. DOI: 10.1007/s13412-012-0086-8
- Barret, M. J. (2013). Enabling hybrid space: epistemological diversity in socio-ecological problem solving. *Policy Sciences*, 46, 179-197. DOI: 10.1007/s11077-013-9178-x
- Battiste, M. (2008). Research ethics for protecting Indigenous knowledge and heritage: Institutional and researcher responsibilities. In N. K. Denzin, Y. S. Lincoln, & L. T., Smith (Eds.), *Handbook of critical and indigenous methodologies* (pp. 497-510). Sage Publications.
- Blake-Beard, S., Bayne, M. L., Crosby, F. J., & Muller, C. B. (2011). Matching by race and gender in mentoring relationships: Keeping our eyes on the prize. *Journal of Social Issues*, 67(3), 622-643.
- Brayboy, B. M. J. (2005). Toward a tribal critical race theory in education. *The Urban Review*, 37(5), 425-446. DOI: 10.1007/s11256-005-0018-y
- Brayboy, B. M. J., & Castagno, A. (2008). How might Native science inform “informal science learning”? *Cultural Studies of Science Education*, 3, 731-750. DOI: 10.1007/s11422-008-9125-x
- Brierly, G., Tadaki, M., Hikuroa, D., Blue, B., Sunde, C., Tunnicliffe, J., & Salmond, A. (2018). A geomorphic perspective on the rights of the river in Aotearoa New Zealand. *River Research and Applications*, Special Issue Paper, 1-12. DOI: 10.1002/rra.3343
- Cajete, G. (1994). *Look to the mountain: An ecology of Indigenous education*. Kivakí Press.
- Cajete, G. (2000). Indigenous knowledge: The Pueblo metaphor of indigenous education. In M. Battiste (Ed.), *Reclaiming indigenous voice and vision* (pp. 181-191). UBC Press.
- Cajete, G. (2008). Seven orientations for the development of Indigenous science education. In N. K. Denzin, Y. S. Lincoln, & L. T., Smith (Eds.), *Handbook of critical and indigenous methodologies* (pp. 487-496). Sage Publications.
- Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council

- of Canada, & Social Sciences and Humanities Research Council (2018, December). *Tri-Council policy statement: Ethical conduct for research involving humans*. Author.
- Carroll, S. R., Rodriguez-Lonebear, D., & Martinez, A. (2019). Indigenous data governance: Strategies from United States Native Nations. *Data Science Journal*, 18(31), 1-15. DOI: 10.5334/dsj-2019-031
- David-Chavez, D. M., & Gavin, M. C. (2018). A global assessment of Indigenous community engagement in climate research. *Environmental Research Letters*, 13(12), December 2018, 123005. DOI: <https://www.doi.org/10.1088/1748-9326/aaf300>
- Deardroff, D. K. (2006). Identification and assessment of intercultural competence as a student outcome of internationalization. *Journal of Studies in International Education*, 10(3), Fall 2006, 241-266. DOI: 10.1177/1028315306287002
- Dunbar, C., Jr. (2008). Critical race theory and Indigenous methodologies. In N. K. Denzin, Y. S. Lincoln, & L. T., Smith (Eds.), *Handbook of critical and indigenous methodologies* (pp. 85-100). Sage Publications.
- Equilibria. (2019). *Personality diversity indicator*. Retrieved from <https://equilibria.com/PDI-home>
- First Nations Information Governance Centre. (2014). *Ownership, control, access and possession (OCAP™): The path to First Nations information governance*. Retrieved from: <https://fnigc.inlibro.net/>
- First Nations Information Governance Centre. (2020). *A First Nations data governance strategy*. Retrieved from: <https://fnigc.inlibro.net/cgi-bin/koha/opac-retrieve-file.pl?id=9c677f3dcf8adbf18fcda96c6244c459>
- Garcia, A. (2018). *A study of ethnogeological knowledge and other traditional scientific knowledge in Puerto Rico and Dominican Republic* (Doctoral dissertation). Retrieved from ProQuest: 10981584.
- Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice*. Teachers College Press.
- Glessmer, M., Adams, A., Hastings, M. G., & Barnes, R. T. (2015). Taking ownership of your mentoring: Lessons learned from participating in the earth science women's network. In G. Wright (Contributor), *The mentoring continuum: From graduate school through tenure* (pp. 113-132). The Graduate School Press, Syracuse University.
- Grande, S. (2000). American Indian identity and intellectualism: the quest for a new red pedagogy. *International Journal of Qualitative Studies in Education*, 13(4), 343-359.
- Grande S. (2008). Red pedagogy: The un-methodology. In N. K. Denzin, Y. S. Lincoln, & L. T. Smith (Eds.), *Handbook of critical and indigenous methodologies* (pp. 233-254). Sage Publications.
- Henderson, J. (S.) Y. (2000). The context of the state of nature. In M. Battiste (Ed.), *Reclaiming indigenous voice and vision* (pp. 11-38). UBC Press.
- Hikuroa, D., Morgan, K., Durie, M., Henare, M., & Robust, T. T. (2011). Integration of Indigenous knowledge and science. *The International Journal of Science in Society*, 2, 105-114.
- Hughes, S. A., & Pennington, J. L. (2017). *Autoethnography: Process, product, and possibility for critical social research*. Sage Publications.
- Jacob, M. M. (2013). *Yakama rising: Indigenous cultural revitalization, activism, and healing*. University of Arizona Press.
- Kincheloe, J. L., & Steinberg, S. R. (2008). Indigenous knowledge in education: Complexities, dangers, and profound benefits. In N. K. Denzin, Y.S. Lincoln, & L. T. Smith (Eds.), *Handbook of critical and indigenous methodologies* (pp. 135-156). Sage Publications.
- Kovach, M. (2014). Thinking through theory: Contemplating indigenous situated research and policy. In N. Denzin & D. Giardina (Eds.). *Qualitative research outside the academy*

- (pp. 92-106). Left Coast Press.
- Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American children*. Jossey-Bass.
- Little Bear, L. (2000). Jagged worldviews colliding. In M. Battiste (Ed.), *Reclaiming indigenous voice and vision* (pp. 77-85). UBC Press.
- Masta, S. (2018). What the grandfathers taught me: Lessons for an Indian country researcher. *The Qualitative Report*, 23(4), 841-852. <https://nsuworks.nova.edu/tqr/vol23/iss4/9>
- Maygarden, D. F., Egger, H. L., & Gill, I. P. (2012). Summer geoscience field trips for minority high school students—Successes and challenges in Louisiana and beyond. *Gulf Coast Association of Geological Societies Transactions*, 62, 585-588.
- Montag, J. M., Swan, K., Jenni, K., Nieman, T., Hatten, J., Mesa, M., Graves, D., Voss, F., Mastin, M., Hardiman, J., & Maule, A. (2014). Climate change and Yakama Nation tribal well-being. *Climatic Change*, 124, 385-398.
- Morton, R., & Gawboy, C. (2000). *Talking rocks: Geology and 10,000 years of Native American tradition in the Lake Superior region*. Pfeifer-Hamilton Publishers.
- Rainie, S. C., Rodriguez-Lonebear, D., & Martinez, A. (2017). *Policy brief: Indigenous data sovereignty in the United States*. Native Nations Institute, University of Arizona.
- Riggs, E. M., Robbins, E., & Darner, R. (2007). Sharing the land: Attracting Native American students to the geosciences. *Journal of Geoscience Education*, 55(6), 478-485. DOI: 10.5408/1089-9995-55.6.478
- Rodriguez, A. J. (1998). Strategies for counterresistance: Toward sociotransformative constructivism and learning to teach science for diversity and for understanding. *Journal of Research in Science Teaching*, 36(6), 589-622.
- Sleeter, C., & McLaren, P. (Eds.). (1995). *Multicultural education, critical pedagogy, and the politics of difference*. State University of New York Press.
- Sloan Indigenous Graduate Partnership. (n.d.). Retrieved from <https://sloan.org/programs/higher-education/education-underrepresented-groups/sloan-indigenous-graduate-partnership#strategy>
- Smith, L. T. (1999). *Decolonizing methodologies: Research and Indigenous peoples* (2<sup>nd</sup> ed.). Zed Books.
- Smith, L. T., Maxwell, T. K., Puke, H., & Temara, P. (2016). Indigenous knowledge, methodology and mayhem: What is the role of methodology in producing Indigenous insights? A discussion from Maturanga Maori. *Knowledge Cultures*, 4(3), 131-156.
- Snively, G. & Corsiglia, J. (2001). Discovering indigenous science: Implications for science education. *Science Education*, 85, 6-34.
- TallBear, K. (2015). An Indigenous reflection on working beyond the human/not human. *GLQ: A Journal of Lesbian and Gay Studies*, 21(2-3), 230-235.
- Te Aho, L. (2018). Te mana o te wai: An indigenous perspective on rivers and river management. *River Research and Applications*. Special Issue Paper, 1-7. DOI: 10.1002/rra.3365
- Tomaselli, K. G., Dyll, L., & Francis, M. (2008). “Self” and “Other”: Auto-reflexive and Indigenous ethnography. In N. K. Denzin, Y. S. Lincoln, & L. T., Smith (Eds.), *Handbook of critical and indigenous methodologies* (pp. 347-372). Sage Publications.
- Wall, D., & Masayeva, V. (2004). People of the corn: Teachings in Hopi Traditional agriculture, spirituality, and sustainability. *American Indian Quarterly*, 28(3/4), 435-453.
- Wilson, S. (2008). *Research is ceremony: Indigenous research methods*. Fernwood Publishing.
- Yakama Nation. (2016). *Climate adaptation plan for the territories of the Yakama Nation Version 1*. Retrieved from: <https://www.critfc.org/fish-and-watersheds/climate/>

Zywicki, S. M. (2013). "There's nothing not complicated about being Indian": American Indian student experiences in a mainstream middle school. *Graduate Theses and Dissertations*, paper 13030. Retrieved from <https://lib.dr.iastate.edu/etd/13030>

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