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# Go With the Flow: Indigenous Science in the Language Classroom

*Stephany RunningHawk Johnson and Sequoia Dance-Leighton*

The Confederated Tribes of Warm Springs, the Confederated Tribes of the Colville Reservation, and the Coeur d'Alene Tribe are located in what we now call Washington, Oregon, and Idaho in the Pacific Northwest of the United States. Paula Groves Price, Zoe Higheagle Strong, and T. Francene Watson are three professors in the College of Education at Washington State University (WSU) who have dedicated time and energy to cultivate and nurture relationships with educational leaders, Elders, and teachers within these Indigenous communities. Through these relationships and previous projects, as well as a memorandum of understanding (MOU) agreement between WSU and the tribal entities, they envisioned a project to work together on centering Indigenous knowledges and cultures while teaching science and language. Dr. Groves Price, Dr. Higheagle Strong, and Dr. Watson worked closely with contacts at the Paschal Sherman Indian School, the Nespelem Elementary School, the Warm Springs K-8 Academy, and the Coeur d'Alene Tribal School to shape a project that would include cultural and language aspects into the science curriculum desired by the tribes. This project was a collaborative effort that would not have happened without the generous time, energy, and knowledge contributions of the tribal peoples we, researchers and writers, worked with and learned so much from.

In 2017, the team from the three tribes and from the College of Education at WSU received a grant from the National Science Foundation to work on the project they called Culturally Responsive Indigenous Science (CRIS). The three main goals of the CRIS project were to 1) develop and implement culturally responsive Indigenous Science, Technology, Engineering, and Mathematics (ISTEM) curriculum modules that integrate Indigenous knowledge, culture, and language with western science and technology, 2) conduct culturally responsive professional development for teachers to effectively integrate ISTEM curriculum and technology into classroom instruction and assessment, and 3) provide supplemental hands-on enrichment programs for Native American students to engage with ISTEM projects and experiments outside of the traditional school environment and on the WSU campus.

The CRIS project began in Fall 2017 with a focus on building relationships between participants from the Confederated Tribes of Warm Springs, the Confederated Tribes of the Colville Reservation, the Coeur d'Alene Tribe, and WSU. Participants included mostly teachers from the tribal schools and professors and students from WSU, but community members and Elders were also in attendance to provide guidance and advice. Each tribal entity has different languages and different cultural practices and beliefs. However, Elders and community leaders felt they could learn from each other while keeping their curriculum true to their ways of knowing and being.

In the first year of the CRIS project, there was a strong focus on creating classroom curriculum that taught science concepts and skills along with traditional cultural practices and language. Some were designed to be taught in science classes and others in Indigenous language classes. The focus on developing and revising curriculum ran throughout the entire project, as the curriculum is always changing, along with the teachers and the students interacting with it. What we found, and perhaps should have known at the beginning, is that a curriculum is not a static document that is ever "finished." Our tribal partners reminded us of this, and it is a lesson that we continue to reflect on.

Table 1 summarizes the main activities from the CRIS project and the outcomes of those activities. A focus on relationship-building and curriculum development carries on throughout the entire project.

We were forced, as was the rest of the world, to adapt during project years three and four, when most activities were put on pause because of COVID-19. Despite being unable to hold in-person events, we continued working on curriculum through Zoom meetings. In Summer 2021, we began slowly, and with utmost care, to meet in small groups to finalize curriculum and plan implementation. In the fifth and final year, 2021-22, we brought students to WSU’s campus in small groups, met with each of our tribal partners individually, and piloted curriculum implementation in schools.

<b>Year</b>	<b>Activities</b>	<b>Outcomes</b>
2017-18	WSU visits to Colville, Warm Springs, and Coeur d’Alene tribes	Relationship-building
	Two meetings of all partners	Relationship-building, curriculum development
	Student field trip to WSU	Student exposure to STEM and higher education institution
	Teacher summer institute at WSU	Curriculum development, assessment of teacher needs and wants
2018-19	WSU visits to Colville, Warm Springs, and Coeur d’Alene tribes	Relationship-building, curriculum development, and revision
	Third meeting of all partners	Relationship-building, curriculum development, exploration of co-teaching and curriculum sharing
	Two student field trips to WSU	Student exposure to STEM and higher education institution
	Teacher summer institute at WSU	Curriculum development and revision, assessment of teacher needs and wants
2019-20	WSU visits Colville, Warm Springs, and Coeur d’Alene tribes (before COVID)	Relationship-building, curriculum development, and revision
	COVID protocols put in place	Project on temporary hold
2020-21	Online meetings with all partners	Curriculum development and revision, project moving slowly
2021-22	Two WSU visits to Colville and Warm Springs	Relationship-building, curriculum development, and revision, curriculum implementation
	Bi-weekly visits with James Whistocken LaSarte at Coeur d’Alene	Curriculum implementation and reflections
	Student field trip to WSU	Student exposure to STEM and higher education institution, conversations with teachers about future goals and plans

Table 1. CRIS Project Activities, 2017-22

## A FOCUS ON COEUR D'ALENE

In this essay, we explore a small piece of the CRIS project with our Coeur d'Alene (Cd'A) partners. We detail the lessons learned and contemplate further work and learning from this project and the collaborations and relationships we have developed and continue to nurture. Paula Groves Price was the initial Principle Investigator for the CRIS project at WSU. When, in 2020 she took the opportunity to move to a different institution, she asked Stephany RunningHawk Johnson to work on the project. While there are many collaborators and contributors on this project, the story of this piece of the CRIS project work is written and shared by Sequoia Dance and Dr. RunningHawk Johnson. Sequoia is Shoshone-Bannock from Fort Hall, Idaho, a PhD student in Cultural Studies and Social Thought at WSU and an Indigenous Wellness Advocate. Stephany is Oglala Lakota, an assistant professor of Cultural Studies and Social Thought at WSU, a former middle school math and science teacher, an Indigenous feminist scholar, a mother and partner. We both identify as Indigenous women *and* as guests in the communities represented in this project. We, along with our other WSU team members, have taken great care in developing and fostering relationships with community partners, and Sequoia in particular had developed relationships with the Coeur d'Alene community from prior work with WSU, as well as community events such as powwows and wellness/youth events.

During the 2021-2022 school year, we—Sequoia and Stephany—worked with James Whistocken LaSarte, language teacher at the Coeur d'Alene Tribal School, to implement science curriculum in his snchitsu'umshtsn language class. James has been part of the CRIS project from its inception and has participated in all stages of relationship-building, student visits, teacher professional development, curriculum development, and curriculum implementation. Many times during our work with James, we would ask his opinion, and more often than not he replied, "I just go with the flow," and the saying stuck. We have taken it as the motto for this project in multiple ways: the changes in the curriculum, the changes in personnel, the COVID protocols that interrupted so much of daily life, and the title of our paper. James started as the language teacher at the Cd'A tribal school the same year we began work on the CRIS project, but he had been working with youth for a long time in informal settings as a coach, mentor, and employee at their community center. The curriculum developed by and with James and other Coeur d'Alene language department folks is a living document acting as a guide to help James, and us as researchers and teacher educators, think about ways we can assist non-tribal science teachers to incorporate culture into their lessons.

## INTEGRATING INDIGENOUS WAYS OF KNOWING WITH WESTERN SCIENCE

The CRIS project focused on teaching western science and centering Indigenous culture and language simultaneously. To hold these two concepts in tandem, we must remember that "underrepresentation in science will never be remedied by better schools, better curricula, better teachers, and all other betters that leave science itself as pure and beyond examination. We are arguing that science learning and participation in science are relational in nature" (Medin & Bang, 2014, p. 240). Teaching science based on tribal cultural values "requires us to ground our pedagogy and curriculum in a sense of relatedness and reciprocity to and with all living beings... the focus must be brought back to connections and the relatedness of all beings, as well as include an expanded understanding of who counts as a member of the community" (RunningHawk Johnson, 2018, p. 89). Indigenous knowledges put science and students in relation with each other in powerful and important ways.

Indigenous knowledges are powerful and ancient as well as contemporary and compelling. Robin Wall Kimmerer (2017) tells us that "In English, we never refer to a member of our family, or indeed to any person, as *it*. That would be a profound act of disrespect. It robs a person of selfhood and kinship, reducing a person to a mere thing. So, it is that in Potawatomi and most other Indigenous languages, we

use the same words to address the living world as we use for our family. Because they are our family” (p. 131). Kimmerer highlights the importance of relationships and the differences between Indigenous and western ways of knowing.

We use the phrase “go with the flow” purposefully because it captures the informative, nuanced, and reflective ways that “storying” as research centers Indigenous ways of knowing, teaching, and learning and highlights “how our communities work” (Brayboy, 2006). We remind our readers of the ever-present tensions inherent in teaching western science to Indigenous students; western science is often analytical and reductionist whereas Indigenous knowledges are intuitive, holistic, and passed through oral traditions. As Mazzochhi (2006) writes, it is “exceedingly difficult to analyse one form of knowledge using the criteria of another tradition” (p. 463). Perhaps, by moving within and through these tensions, non-Indigenous teachers working with Indigenous students can better understand why and how they need to honor and center the culture and language of their students.

While it is certainly imperfect, we hope to confront and illuminate the CRIS project as an example of a transformative praxis, an empowering tool for Indigenous education, and as an “ideological and implementation space” (Hornberger, 2002; Hornberger & Swinehart, 2012) to do decolonizing work within and for communities. Our intention is to create spaces in which students, community members, Elders, and teachers are empowered to reclaim and reassert Indigenous knowledge and lived experience as central to their curriculum and pedagogical considerations, allowing the values of relationality and reciprocity to lead.

Education is, and has always been, important to Indigenous communities. In our current institutions and systems, some education is achieved through schooling, and we choose to work within the school-based curricular structure that is in place. Our tribal partners asked us, as “education experts,” to help them create a curriculum they could use to do this work. The Elders and community members guiding and advising the CRIS project expressed their belief that curriculum created through the CRIS project could do decolonizing, and perhaps even Indigenizing, work in their communities. They provide the language and cultural knowledge; we provide the curricular structure and other school-based supports. We feel both honored and obligated to take on this work at their request.

From our reflections as authors and as a larger WSU research team, the experiences we had with all the project participants, and the voices of our tribal co-researchers, three important themes emerged. As we sat down and talked through notes, team conversation transcripts, interview and focus group transcripts, and observational data, there were three topics that we kept returning to again and again: the challenges of using the curriculum template that we developed, the complexities of teaching science in the language classroom, and the skill with which James used Indigenous teaching and learning methods with his students.

## THE 7E CURRICULUM TEMPLATE

The 5E instructional model (Bybee, 2015) is commonly used by science teachers to structure their lessons in ways that center students and encourage them to explore in order to better understand science concepts and develop their problem-solving skills. This is very much a western construct and is commonly taught to pre-service teachers for use in their classrooms. For the CRIS project, this model was adapted to make it more applicable and relevant for students in tribal schools, the majority of whom are tribal members.

The five E’s are: engage, explore, explain, elaborate, and evaluate. The partners liked these elements of curriculum planning but felt that for Indigenous students, an additional two E’s would help make the template more culturally relevant, as well as allow for the creation of curriculum specific to each cultural

context. Elders and Indigenous teachers were crucial to the discussion surrounding the importance of the inclusion of the two additions, which are: environment<sup>1</sup> and Elders. The 7E template (Table 2) is set up to show traditional ecological knowledge learning, western science learning, and language learning outcomes simultaneously. Note that “environment” has been combined with the “explore” E.

Teacher: \_\_\_\_\_ Subject: \_\_\_\_\_ Grade Level: \_\_\_\_\_ Week of: \_\_\_\_\_  
 Unit Title: \_\_\_\_\_ Unit Length: \_\_\_\_\_ Class Period Length \_\_\_\_\_

<b>CRIS Cultural Values:</b>			
<b>Traditional Ecological Knowledge learning outcomes:</b>	<b>Nature of Western science learning outcomes:</b>	<b>Language learning outcomes</b>	<b>Technical and practical learning outcomes:</b>
Students will understand and appreciate: •	Students will understand and appreciate: •	Students will be able to: •	Students will be able to: •
<b>Assessment(s):</b> •			

<b>Lesson 1:</b>						
<b>Micro-Tasks (iPad or on website):</b>				<b>Key student outcomes:</b>		
1.1				•		
1.2				•		
1.3				•		
<b>Technology Integration</b>				<b>Key Terms, Phrases, Sentences (English/Tribal Language):</b>		
<b>Gathering Content and Data</b>						
<b>Interactive Web-based Activities</b>						
<b>Resources (Archival, PPWP, manipulatives)</b>						
<b>Day</b>	<b>Engage</b>	<b>Explore/ Environment</b>	<b>Elders</b>	<b>Explain</b>	<b>Elaborate</b>	<b>Evaluate</b>

Table 2. The 7E Template

We are not able to share a fully filled out template with curriculum that has been created by our tribal partners, as we do not have permission from them to do so. However, we would like to give a few

<sup>1</sup> In the template, the categories of Explore and Environment have been combined into one column, so there are a total of six headings.

examples of what the content of the template can include. The (Traditional Ecological Knowledge) TEK learning outcomes include students understanding the harvesting of traditional foods and how that relates to survival and that water potato gathering sites were interconnected with wildlife. The western science learning outcomes include students understanding that water potato harvest has been impacted by dams and pollution and that water health can be measured in the lab. Key terms include many words in the Coeur d'Alene language along with their English translation. On any given day some of the 7E columns are filled in while others are not. For example, a day might include Engaging by having key words on the board with a call and response session and Elders joining and sharing a traditional story. Elaboration may happen by having students share their family history relating to the water potato harvest.

Curriculum content creation began in group meetings with cultural experts, language holders, and teachers from all three tribal nations, as well as the WSU team. During the initial stages, the group chose to focus on writing a series of lessons for each of the four seasons. At the direction of the Elders and community experts, the seasonal themes chosen were traditional food preparation for fall, storytelling for winter, root knowledge for spring, and plant identification and gathering for summer. These themes are used as the Unit Title in the template. The overall theme of each season would be similar for each tribe, but the content of the lesson would be unique to each tribe's place and traditions.

Once the larger group had decided on the seasonal themes, the work was done in smaller groups focused on each tribe and their specific content, with time to share out to the larger group. The WSU team took the lead in translating the knowledge and skills into a 7E lesson plan that included technology and western science alongside the cultural and language aspects. We compiled information for one season at a time, learning from and with each other, with language teachers and cultural experts talking and sharing their thoughts and ideas. As the curriculum began to take shape, we recognized that language and science naturally work well together in these lessons because science is embedded within the language to understand the stories, the sites for gathering, and the world around us.

Using the 7E template, the team began to develop written curriculum for each season that reflected and centered the Indigenous knowledge of the tribal partners with the western science curriculum. Each tribal partner has completed at least a partial set of lessons for each season; however, we are reminded that none of the curriculum is ever truly "finished." The CRIS curriculum is housed with the individual teacher(s) that worked on it in each school, as well as in a central password-protected website accessible to the entire team.

## 7E AT COEUR D'ALENE

In Coeur D'Alene, the fall lesson was focused on gathering and preparing traditional foods—on gathering and preparing water potatoes. The water potato (*Sagittaria latifolia*), which is also called arrowhead or wapato or duck potato, is a wetland plant with arrow-shaped leaves. It produces small tubers—or potatoes—on its underground stem. These small tubers are eaten raw or roasted, boiled, or fried and taste a little like a potato or a chestnut (Sqigwts Ha'chsetq'it, Water Potato Day Info Brochure, 2011; Missouri Botanical Garden, 2023).

At the Coeur d'Alene Tribal School, the CRIS curriculum is being implemented by James. Due to a lack of resources and teacher availability, there has been minimal involvement with the school's science teacher and program, which posed some challenges in utilizing the 7E tool.

James, a tribal member, reflected on his initial interactions with the 7E template. He was unsure of how to utilize it best, considering he had not gone through a western teacher training program: "I guess I thought I wasn't a teacher... I just wasn't the teacher that understood the E's. Or any other type of

curriculum format that most teachers get in school.” James and the team of language experts expressed having difficulty using the tool to organize their lessons because they often structured their teaching around the students’ interests and their own community events. We had hoped that teachers like James would be able to collaborate with the science teachers in their schools so that they could help each other understand different aspects of the 7E template. James once again showed us that we needed to “go with the flow” and assess the template and curriculum as something that could be used by one teacher rather than a team of teachers.

Other challenges that we encountered include the fact that the language class in the Cd’A tribal school is an elective rather than required, with students and their parents choosing between language, art, and physical education. The class is also shorter than the “regular” classes, running for 30 minutes rather than an hour. Implementations (particularly partnerships and field trips) were impacted by the COVID-19 pandemic and the resulting community safety measures. These measures caused James and other teachers to make substantial modifications to their usual teaching practices.

The difficulties felt by the Cd’A language team were not because there was a lack of science knowledge within the team or that the template was missing something, but because the template did not represent the way in which they think about their lessons. James typically centers students in his lessons as he decides what to focus on and what to teach each week and did not see how he could do that with the 7E template. Sequoia, along with other members of the WSU team, stepped in to help James use the 7E template to create lessons that revolve around student needs, as well as the happenings and cultural events within the community.

A large part of the WSU teams’ role was supporting James in cultivating an understanding that he was already making connections between Indigenous knowledges and western sciences. Implicitly, James utilized place as a sense of direction for his lessons. In Indigenous ways of knowing the “place in which one lives provides the connectedness of all things, the relationships between all things, and therefore place gives us a base for teaching about the natural world in the context of science curriculum” (RunningHawk Johnson, 2018, p. 88). With this understanding and notion of place, we were able to work with James to shift his perspective on his value as a teacher, specifically to affirm that what he was sharing *was* science, and to better support him in the documentation of the curriculum.

An example of this curriculum that James and the WSU team developed were the fall lessons surrounding sqigwts (water potato). While students were very familiar with the Water Potato Days event that the Coeur d’Alene community holds every year, they began to learn the language around gathering and the places in which they gather. Students were challenged to learn and identify ancestral locations in which sqigwts were gathered, using digital interactive content that was created by James. James used a map for this, showing “numerous places where water potatoes used to be and were picked.” He developed another piece of interactive content to show how the gathering areas on the map have changed and are now smaller and more fragmented than they were historically. He continued to reflect: “[N]ow it’s only in certain areas, where now you’re taking the size [of that area] and saying well, why aren’t they in these areas? There’s just little pieces that are being put in there. I mean, most of these kids have been doing the water potato dig forever not realizing that... it has to do with placement or... [that] they’re able to eat it.” Using the interactive digital maps and language, the classes also discussed why they might not gather from certain places anymore. James uses this opportunity to teach his students about habitat loss due to changes in the lake caused by irrigation for agricultural use and pesticides.

Another component of the water potato lessons includes water testing to learn the ways in which water quality might impact the growth and safety of the sqigwts. Unfortunately, due to COVID restrictions and in order to maintain community safety measures, this was something we were unable to implement.



James asks: “Are they sure they’re able to eat it because it’s there? It could be poisonous or be weird, that’s where implementing all of the, like the lake management stuff of water testing and whatnot was coming into a huge part of the project.” Answering this question can incorporate both Indigenous traditional knowledge about where water potato is found and how to keep it healthy with modern science techniques of water quality testing.

Stephany RunningHawk Johnson and Michelle Jacob (2022) write that we empower students through reclaiming Indigenous knowledges in educational settings, to “embrace their ways of knowing and being, to celebrate our/their relationship with Land rather than domination over it, and to create better relationships with Land that have the ability to ameliorate the climate crisis” (p. 178). The 7E template is one way to create a western science lesson plan that centers Indigenous practices, languages, and knowledge within classrooms as well as providing a way for non-Indigenous teachers to pick up that lesson and carry it forward.

## SCIENCE IN LANGUAGE CLASS

James completed a curriculum that represents the deeply meaningful and intricate relationship that language has with the land and furthered the relationship of the students with that knowledge of their homelands. He came to the project seeing himself as someone who knew his traditional language and who liked working with kids. He did not see himself as a teacher, and certainly not a science teacher. In fact, he tells us that “I hated science. Myself, I don’t know why, but it was a horrible subject.” He goes on to say that “I don’t care for science. But I know the language part I can do, that I can step in and help where needed. I just don’t expect to write up any lesson plan science.”

We believe that Indigenous languages and science are intricately connected, that “the language reminds us, in every sentence, of our kinship with all of the animate world” (Kimmerer, 2017, p. 132), so part of this project became about showing James, and others, that through language he was already good at science, and good at teaching it. We could clearly see the science involved in the sqigwts lesson that James designed. James knew that sqigwts are edible, where to find them, how to gather them responsibly, and how to prepare them as a traditional food.

As we worked together, James began to see that teaching his students language and culture included a lot of science. James says that it “kind of blew my mind that there was a lot of stuff that we were doing traditionally, that was still science.” This happened through conversations with WSU team members Sequoia, Stephany, and Francene, as well as developing the curriculum into the 7E template. James said that “working with all this stuff, and then realizing that most of it is science itself was like a huge kind of like eye-opener.”

He also appreciated the support of the WSU team. He said that “having the actual teacher to sort of be able to notice what we’re doing here, integrating the western science itself, to like mash that up was like, that’s why I am drawn to this project.” We, as researchers, often saw and continue to see our role in this work as interpreters—in this instance interpreting what science is and can be and affirming for James that perhaps the most important aspect of his work was affirming his students’ cultural identities.

Teaching students language and science together makes a lot of sense, if you are coming at education from an Indigenous worldview. Indigenous science consists of traditional ecological knowledge, is grounded in place, language, and reciprocity, and includes “knowing the world through diverse perspectives” (RunningHawk Johnson, 2018, p. 89), which often include the land, water, plants, and animals. Cariou (2018) writes that “Indigenous philosophies of language and belonging reverse the trajectory of Western mimesis, starting with the land as the source of not only sustenance but also of knowledge. If we follow the implications of this idea, it means that when we study Indigenous stories

and literatures, we are in a way studying the land and trying to learn from it” (p. 341). Linda Tuhiwai Smith (2012) defines traditional ecological knowledge as “environments, bodies, stem cell lines, identities, historical and contemporary practices, lores, laws, values and belief systems, knowledge frameworks, ways of thinking and knowing, products and creations, concepts” (p. 221) and more.

“Our toddlers speak of plants and animals as if they were people, extending to them self and intention and compassion—until we teach them not to” (Kimmerer, 2017, p. 133). But if we keep teaching them that our more-than-human relatives are just that—our relatives—then we all have a different sense of connection, relationship, and responsibility.

By teaching science in the language classroom and in the Coeur d’Alene language, snchitsu’umshtsn, James is teaching his students that their cultural understandings of who counts as a person and a community member is broader than simply the humans; he is bringing in all his more-than-human relatives and the land as well. And, because “language was given to us by the land we live within” (Armstrong, 1997, p. 175), James is teaching his students both language and science, his lessons revolving around the lives of the community and the families as they practiced their traditional cultural values and ways of working with the land.

The 7E template offers a western tool and structure to help build a bridge to teachers who may not be aware of these life lessons in the community. For non-Indigenous teachers coming into this community, learning about, honoring, and incorporating the Cd’A worldview and Indigenous science into their teaching is crucial. As Susan Dion (2007) writes, “the majority of teachers... have a limited understanding of Aboriginal people, history, and culture; rather their understanding is informed by dominant discourses” (p. 330). Brayboy and Castagno (2008) write that “in order for teachers to engage in culturally responsive science education for Indigenous youth, they need a particular set of knowledge that they do not currently receive in teacher training programs” (p. 744). However, there is also the possibility that non-Indigenous teachers can learn from teachers like James, that they can “take up alternative ways of knowing, to imagine new relationships, and to think about how they might want to work toward transforming their practice” (p. 330). By collaborating with teachers and language experts such as James, we can give non-Indigenous teachers a better way to work with Indigenous students and communities.

## INDIGENOUS TEACHING AND LEARNING METHODS

James is an excellent teacher, and while he is very humble, we see the brilliance and care with which he teaches and works with his students. We learned so much from James, and we are grateful for this gift. He is not a university-trained teacher but he has both the cultural and content knowledge to engage with his students in culturally responsive ways that honor Coeur d’Alene culture and traditional tribal values. Kirkness & Barnhardt (1991) describe the four R’s of Indigenous education: respect, relevance, reciprocity, and responsibility, and we see James doing all of them with his students. He says, “I feel like kids should be involved more. Because I mean, I’m a big kid. But, like a bunch of adults trying to decide how to do this for kids. It becomes like, you put it in front of kids, and they’re like, I hate this. And they try to figure out why. Ask the kid, the kid will tell you why.” James respects his students, he makes his teaching relevant to their lives, and he has a strong sense of why he teaches, as well as a responsibility to teach in good ways. He respects his students enough to ask them their opinion, to know that they can tell him what they are thinking and feeling, and to honor what they tell him.

Children are not forced to learn if they are not “into” it; they are still in the classroom and around the lesson and material but they have a choice of whether or not to engage. They learn to not disrupt those who do want to learn, but they do not have to participate. This educational practice shows how the

“reciprocity relation is not a circle but instead something more like a scattering... This gift is intended to be shared anywhere, without restrictions, as long as it is shared” (Cariou, 2018, p. 346). James demonstrates this beautifully.

Another aspect of Indigenous education that James demonstrates is relevance, with the use of intergenerational classrooms. James describes that “the way I wanted to do it was teaching kindergarten to eighth grade. That’s why all of them would be, like, universal, because usually that’s how my class is. I mean, the little kids don’t learn as extensive as eighth graders, but they are still basically learning the same thing throughout the same time.” James asserts that the larger goal “is getting them to be able to talk to each other.” He employs intergenerational learning intentionally and at all times in his classroom.

Brayboy and Castagno (2008) write that “aspects of effective science education for Indigenous youth include learning in an environment that is rich with the language of science, curricular content that is interesting and relevant, beginning with the natural environment of the students, including Elders and community members in curriculum development and presentation, incorporating oral traditions as a source of knowledge about the natural world, and supplementing textbooks with other curricular materials” (p. 743). Another Coeur d’Alene language teacher gave a perfect local example of how teaching in the traditional ways outlined by Brayboy and Castagno is good for his students. He said “there’s no lesson plan for grand entry<sup>2</sup>. That’s just an experience that you go through. And even then, if somebody came and asked you to be the arena director for a *powwow*, and, you know, you’ve been going to *those* your whole life you don’t say, well, how do I do this? Could you write that down for me? No, you just, you go, you learn and you watch and then you just do it.” This type of teaching and learning requires learning from Elders and community members, from oral traditions that have been passed on through many generations.

## ONGOING QUESTIONS

As researchers and teacher educators we want to continue to reflect on our process and the generous lessons brought to us by our community partners. We see value in both Indigenous and western sciences and continue to struggle with how to center Indigenous science when it has been erased in colonized schooling systems for centuries. As Indigenous women, we know the value of continuing to nurture and cherish the relationships we have built with James and others in the language department of the Coeur d’Alene tribe. Here are some of the challenges that we have not resolved, as well as questions that we want to keep working on. These are not necessarily questions that could or should be answered right away but ones that we feel it is important to reflect on when doing this type of work.

How do we communicate that cultural knowledge *is* science without creating a hierarchy where western science is most important? Is naming science within cultural knowledge important? If so, to whom?

We think there need to be times when we affirm with Indigenous teachers and students that their knowledge of reading maps and identifying and locating *sqigwts* is science, the kind of western science they learn about in school. It feels appropriate to ask ourselves questions regarding the balance between affirming cultural knowledge as legitimate within western education and letting the knowledge exist as is, affirming its importance without tying it to a word that we as researchers and educators understand as science. We recognize that other scholars have wrestled with this question; however, we still see it as relevant. Perhaps putting Indigenous science first might mean that we intentionally do not call it science because it existed prior to the school subject of science.

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2 Grand Entry is the beginning of a powwow session of dancing.

How do we demonstrate to non-Indigenous, particularly White, educators trained in western schools that culture in the classroom is important and is part of school? Do we need to make this point?

Our work with James and other folks from the Coeur d'Alene tribe shows us that they already know this. For educators coming to tribal communities from western teacher training programs, the answer is yes, we do need to make this point. Brayboy and Castagno (2008) write that we “must come to see that there are multiple legitimate ways of knowing that must enter the science ‘classroom’. The epistemologies and sciences of tribal nations have enabled them to survive for thousands of years, and this knowledge is relevant to contemporary science learning” (p. 739). We fully agree. We hope that the work we have done and will continue to do with James can help us create templates and curriculums that will further this type of work.

Curriculum templates are useful, but for whom? How do we create tools that empower Indigenous knowledge-keepers and teachers, while also not burdening them with the creation of a “bridge” into the western education world?

This question is the heart of the pedagogical considerations in this essay. The 7E template is a useful way to work through science curriculum that centers Indigenous knowledge within a western education system. Non-Indigenous teachers trained in western institutions can understand and recognize the 7E template. It allows us to outline what we hope the lessons can and will accomplish. When James was asked if he found the template to be useful, he responded, “For me specifically, no. But... if I give it to a teacher that comes in, they can teach it and they understand most of that because I think the way it was explained was like the seven E's was the easiest model to follow for everybody.” While James may not find the template the most useful tool he has available to him, many teachers will find it useful, particularly those who are non-Indigenous and have gone through a teacher training program at a university.

One of the tribal language teachers asked if there was a different way of doing lesson plans, specifically Indigenous lesson plans. This prompts us to pause and think about who curriculum templates are made for, how they can be helpful, and most importantly how to adapt them to meet the needs of our Indigenous knowledge teachers. We also ask ourselves how we as researchers and teacher educators can take on the work of creating templates that are usable and understandable by non-Indigenous educators working with Indigenous students, while centering Indigenous knowledges and values in curriculum.

We ask ourselves, as researchers at a university, how projects similar to this one can be successful. We believe that we must define our roles as collaborators and translators—not as knowledge experts. The language teachers and cultural experts from each tribe are the knowledge experts and we must listen to them and defer to them. We must ask them what they need and want and how we can best support them. It is evident to our team that any success coming out of the CRIS project is mostly due to teachers and knowledge-sharers like James, to our tribal partners and collaborators. James is committed to being in right relation with his students, his community, and his place. He meets his students where they are, with encouragement and support to take ownership of their learning. James, with the help of his language team, is a science teacher and we, as researchers, Indigenous women, and human beings are extremely grateful to have worked with him, his students, and the Coeur d'Alene language department team; to have been invited to “go with the flow” with them.

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## ABOUT THE AUTHORS



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