Different Ways Of Knowing: In Support Of A Broadened Life Science Classroom

Kaleidoscope Journal
/
Spring 2024

BY:

Liz Dengate
Cohort 2020

Liz and her co-teachers value and teach local indigenous knowledge and ways of knowing in an interdisciplinary environmental science classroom.

I joined my current teaching team in the fall of 2020, at the School of Environmental Studies, a public high school in Minnesota on the ancestral land of the Dakota and Lakota tribes. That fall, in masks and oscillating between in-person and Zoom class, we added the specific study of traditional ecological knowledge (TEK) to our curriculum. None of us on the teaching team are Native, and we were all raised in the Western way of doing science. Is it possible for us to teach our students that our Western science toolbox is limited, we wondered, when our ancestors built and defended that toolbox, and we were raised inside its opacity? I reached out to some of the staff at the Nawayee Center School, an indigenous high school in Minneapolis, a couple miles from where I live and about 20 minutes from my school. In 2020 and 2021, the director of the school, Joe Rice, and the director of the school's Medicine Wheel program, Rocky Makes Room for Them, both spoke to our senior class, starting their presentation with a sage smudging in a giant circle outside. In the fall of 2022, Rocky came solo to speak to the students. Rocky, who is Lakota, is an artist and muralist, a teacher, and a speaker. He was

born in South Dakota but has lived in Minnesota for many years. He's funny and warm and seems completely at ease in front of an audience of 80 teenagers. Each time Rocky spoke to our students he began in Lakota and introduced himself with his whole name. He then launched into a story about his grandmother, asked some questions. and then told another story about an uncle.

At the back of the room, I felt itchy and antsy. He'd given the students and I nothing that I would call a "road map." I didn't know his thesis or his subtopics. He was jumping from topic to topic, anecdote to anecdote. While I cringe now to admit it, I think I started composing an email in my head: *Yes, we'd love to have you back again next year! It would be great if you could start us off with a list of the topics you'll be covering so the students can anticipate and [even] better learn from you.* I'd given a lot of presentations in my day, and the lesson was drilled into me: first, sure, engage with a spark, but then, *tell them what you're going to teach them. Then teach them. Then tell them what we just learned.* I liked a hook, a thesis, and clear transitions from point to point.

But as Rocky continued to speak, the effect on our students was obvious: 80 pairs of eyeballs looked his way. While they were always an awesome class, they're also teenagers and being engaged listeners for an extended period of time is hard. Somehow he'd gotten the whole lot of them engaged and responding in a way I'd never seen them do before: visibly nodding, giving verbal affirmations, many of them responding aloud—respectfully and enthusiastically—to all the questions he posed. It wasn't a presentation I realized, not a regurgitation or lecture, but a conversation, one in which many of my students clearly felt free and empowered.

As he went on, I realized we were walking a spiral together: looping through big ideas of sustainability and ecology by moving in a circle between them, adding something new every time we returned for another pass by a big idea. His talk wasn't messy or unintentional, but instead a complex, purposeful, thoughtful, circular path that lasted about an hour and was, months later, according to my survey data, many students' most memorable day of the entire school year.

"I love to teach all students what *relative* means," Rocky said, "and how we identify it in our community and space." Everything in nature that is alive *or makes*

life possible or impossible is our relative, he told our students. Could a rock give you life? he asked. Students mused answers—Yes! Minerals. Soil. Could a rock take life away? For sure! they shouted. Rocks are our relatives, Rocky said. Sky is our relative. Water, definitely, is our relative. And every plant, every animal, every fungus. That means we're grateful for the seven generations before us, who took care and left all of these relatives here with us and it means we have our own familial responsibility.

He told us stories about listening deeply to plants, paying closer attention to meadows than likely any of us ever had, and stories about healing medicine that was built on plant life, physical touch, all five senses, and listening to the patient in need.

There are so many ways to know the world and tell its story, so many concepts of ecology, and so many tools for inspecting the world around us. I am still growing into my own comfort with these ideas. I am a White, English-speaking, cis female science teacher, born and raised in Detroit and its suburbs. Like many science teachers and scientists, I've long found comfort in data tables, well-labeled graphs, and transparent p-values. I endorse clear and replicable results and large sample sizes. For many years, I declared anthropomorphizing problematic, and felt a very real, internal shudder at any ideas that invoked mysticism, magic, or souls. While I'll write here about my own shifts, in many ways I am still this person.

For a long time, I didn't see this as "one" way of doing science—I saw it as the way: the right way, maybe the only way, to truly understand the world around me. And the knowledge gleaned through these "scientific methods" was the one true understanding of that world, by definition incomplete, by definition subject to change, but truer than anything else we had.

But throughout college and grad school, my knowledge was growing and stretching. I took an environmental justice class with Dr. Dorceta Taylor, the renowned environmental sociologist whose powerful research and writing focuses on environmental justice and racism in the environmental movement. I read Braiding Sweetgrass (2015) by Robin Wall Kimmerer and I started reading more about Indigenous environmental fights and Indigenous understandings of ecology. I

read more and more about social justice issues, had long, important conversations with new friends, and began the relentless, necessary, infinite work of grappling with white supremacy and systemic racism and my place within it.

One of the many reckonings that came (that is coming) out of this work is that I started to concede that my way of doing science—the way I'd learned in middle and high school, in my undergrad degree in environmental studies, and to some extent in my master's degree in ecology—was not actually the best or only way. Instead, it offered one valuable, clear lens. There were other valuable, clear lenses, and I could expand and deepen my view of this beautiful, complex world.

Here, I write about one specific lens: adding local Indigenous knowledge and language to my science classroom. Local Indigenous knowledge is another crucial route to understanding the ecology of our place. But at risk of stating the very obvious, the world's set of lenses is greater than two: it's not simply "Western" science versus Indigenous North American knowledge. Not only does every Indigenous community around the world hold their own local knowledge and storytelling traditions, so do other cultures, and each and every human contains multitudes. Valuing the way every student sees the world, asks questions, and shares what they've learned adds richness to the knowledge generation of our classroom.

There is so much tied up in all of this. Although this is not an essay about the incredibly vicious, prolonged, targeted, and ongoing violence against Indigenous people in this country or others, it is about one of the many losses and impacts of that violence. "We are slowly learning how crucial traditional knowledge and language diversity is," Chi Luu wrote in 2019. "As more researchers understand the value of different ways of doing science, there have been calls for there to be an integration of long disregarded Indigenous knowledge into the academy's scientific process. Traditional knowledge often values a more nuanced, contextual, and holistic view of information from observation and thought, not just piecemeal experimentation of discrete, Individual components of a system."

> As teachers, we know there are different ways of learning…There are also different ways of sharing knowledge…[T]here are different ways of generating knowledge.

As teachers, we know there are different ways of *learning*. We know our students who need to move and stand, our students who learn by reading, and our students who learn by processing aloud. There are also different ways of *sharing knowledge*. We know our students often tell their stories, present, write, or add to discussions in ways we do not: some share what they know best in writing, some in art or music, some in reels or memes, some in formal presentations, and others in informal conversation. I believe we can also value and respect that there are different ways of *generating knowledge*. What could leaning into this look like in a science classroom?

When left without prescription, I've watched students create bizarre but beautiful charts for their data, combining variables in a way that at first makes me cringe and then makes me question. I've watched how some students start with studying maps, and others plunge immediately into the forest, some talk it out with a group, while yet others sketch their own maps in the snow.

Teaching a long fall unit about biodiversity and Indigenous ecological knowledge helps me learn more (one of the best things about being a teacher is that teachers are always learners). As an environmental science teacher at our school, I teach an interdisciplinary class alongside an English language arts teacher and a social studies teacher. By the end of our first 12 weeks, our goals are for our students to understand deeply that diversity means resilience, that there are many ways to know the world and many tools in their toolboxes, and that "Western" or "mainstream" science is both wonderful—and limited.

We teach our students about four central concepts of TEK, using a reading from Canada's First Nations Education Steering Committee (2019). There is an enormous breadth and depth of Indigenous ecological understanding across our planet, and incredible localized knowledge held by each tribe, nation, or

community. However, some common threads appear across many or most Indigenous understandings: the importance of *reciprocity*; the inevitability of *transformation and renewal*; the *interconnectedness*, at a familial level, of all living and even non-living things; and the awareness of a deep *sense of place*. We come back to these four concepts all year, asking students to think about what meaning each might add in the context of each of our units.

When I first read about the concepts, I layered them over my past academic work in ecology. What does a recognition of reciprocity mean for our understanding of competition, predation, and ecosystem services? How does sense of place link together discrete researchers? How do we grapple with reconciling the words "pristine" and "constantly transforming?"

I took classes in college like Woody Plants, Biology of Insects, and Soil Ecology. This was a whole ecosystem neatly tweezed into separate pieces and studied on their own, usually under a microscope. My professors reminded us, frequently, to try at all costs to keep ourselves—our pasts, our wants, our needs—out of our research. We teach our students now that there is another way of thinking about this—that maybe *another* understanding can only come by leaving the connections whole, and by recognizing that we are a part of the picture too.

Over the summer, students read portions of *Braiding Sweetgrass*, and we use that in class at the start of the year. Kimmerer—an ecologist, a writer, and a member of the Potawatomi nation—is someone who is able to use the power of multiple lenses. She uses the Three Sisters, an Indigenous form of agriculture in which beans, squash and corn are grown together, mutually benefitting one another, as a metaphor. "The Three Sisters offer us a new metaphor for an emerging relationship between Indigenous knowledge and Western science, both of which are rooted in the earth," she writes. "I envision a time when the intellectual monoculture of science will be replaced with a polyculture of complementary knowledges. And so all may be fed" (Kimmerer, 2015, p. 139). The science classes I've taken were certainly all monocultures. In our unique classroom, now, we're trying to plant and nurture a polyculture.

> The science classes I've taken were certainly all monocultures. In our unique classroom, now, we're trying to plant and nurture a polyculture.

Of course, one of the ways to do this is by teaching in an interdisciplinary classroom, which is hard to replicate spontaneously and in other contexts. If I could offer one piece of advice, ultimately, I would tell you to get coworkers and co-conspirators like the ones I have. The daily lessons my students get have been cooked up in a pot we all added ingredients to and that everyone has stirred, and the resulting stew is rich, complex, and new every day.

A week after Rocky's rich spiraling conversation with our students, I interviewed two of my students on their impressions. They were both sitting on the floor in study hall, and I recorded their words to transcribe later. I have used a pseudonym for each student. "What impressions did Rocky leave with you from his talk?" I asked.

"Rocky talked about how culturally, everyone is related to him—I mean, not even culturally—we *are* all related," Alex said. "—It just is a different way of thinking from this Westernized thought process that we use today."

"It made me think a lot about that too," Emma said. "Just like, the relation between strangers, making them not strangers, having that close connection to them—and also having that familial connection, like you said, to nature. It gives it a sense of like spirit—and it's harder to destroy something you think of as family."

"You're both good scientists," I said. "As you two graduate and go out into the world, do you see yourself using different ways of knowing? Will you lean more on one?"

Alex leaned forward. "Yeah—like, I've always considered myself a very scientific person," she said.

And I still value data very highly, but just having that other route of understanding—once you kind of recognize that people have been making observations since the beginning of people, and so there's a lot of stuff that

science doesn't even come close to explaining, that Indigenous cultures have already observed, have already even, in their own way, been tracking data on. And yeah, sometimes it's not in a spreadsheet, but it's been passed down culturally through oral tradition. So going forward, I definitely want to pull on more traditional ecological knowledge.

Emma was nodding. Alex continued:

> Like it's not necessarily that I'm looking for one particular species, and I'm watching this one particular species, but instead, I'm going to watch all of these species together as a whole and understand the interconnectedness of our ecosystem. Which I think that, science—because of how separated different sections of science are—sometimes we miss that, being pulled away from connection.

Alex and I both looked to Emma, who looked thoughtful for a moment. "So, for me, in my career paths, I'm either going to go into pathology or agricultural conservation, because that's something I'm passionate about," she finally said.

Emma continued:

> So using traditional knowledge, like Alex said, to help support those industries. Because a lot of traditional knowledge is based on sustainability, is based on: okay, we have a mutual understanding of what the environment needs, what we can take, and what is not allowed. So, using that in pathology is interesting—I'm not *quite* sure how I'd do that.

She laughed a little. "But definitely in agriculture—so I currently have a small garden, just like an acre at my grandparents, but we're trying to rejuvilize—rejuvilize? You know words." She waved her hand and laughed again. (Rejuvilize is clearly an excellent word creation and I have left it in.) "Rejuvilize the soil to protect all the animals around there and increase the natural biodiversity," Emma continued.

> So like Rocky said, with the sibling thing, if everybody's related, and they're related to each other, that helps you like, prevent the bias. So if I'm related to the deer and the wolves, I'm not going to shoot the wolves to help the deer, I'm going to help them work together because siblings do fight but you can't

> just kill a sibling. Like we're not going to have a Cain and Abel situation. That's kind of what we've been doing, and I don't think it's the right way to do it.

Now Alex was nodding.

Bringing multiple lenses into a life science classroom can look many different ways. It will, and should, vary depending on the students in that classroom, the ecosystem it sits within, and the local knowledge and culture that are present. Over the past few years, alongside my phenomenal co-teachers, I've thought a lot about how we can bring in and value multiple ways of learning, generating knowledge, and storytelling in our classroom, and make our classroom trace a spiral instead of a line. It's a process that continually unfolds, although many or most of these activities are things my coworkers have been leading at the school since long before I arrived.

In our class, "science" includes things like solo sits, where students spend 20 minutes or more sitting quietly alone in nature, without technology, reflecting and observing. It includes creative writing and art, where students can use poetry, short stories, music, or visual art to explore and tell conservation and environmental stories. And for us, science means learning from local experts in the field, both via guest speakers, and by encouraging students to conduct phone, email, or in-person interviews with experts of their choice (including, sometimes, relatives) as one or more of their sources for research projects.

Our curriculum also includes a unit on ethnobotany, where students learn about the local Indigenous uses of the different common plants growing around our school, including for medicine and food, and choose one to explore in depth. On a warm day in late September, we roamed the school grounds identifying the scrappy plants growing in sidewalk cracks and amongst the Kentucky bluegrass lawn. We sat in a circle in the rain garden and talked about how we generate knowledge, what data is, and how to distill truth.

We read *Power* (1988) by Indigenous author Linda Hogan during our endangered species unit, exploring and juxtaposing the population decline of both the Florida panther and a fictional Indigenous community.

We spend several weeks considering land management, and how we can manage natural spaces with a mindset of reciprocity and consideration of the "triple bottom line:" the environment, economics, and social justice and equity. Students research a management decision relevant to a place they care about, eventually creating a public StoryMap (a type of interactive web page incorporating text, images, and maps) to lay out all sides of the issue and what they'd advocate for. They consider a place or species that gives them something and think about how they can reciprocate: through action or advocacy for a specific law, management decision, or education.

At the end of the fall, after reading *Braiding Sweetgrass* and *Power* and excerpts about TEK from Canadian First Nations writers; after exploring ethnobotany and discussing the economics of endangered species and climate change; after meeting Joe and Rocky; after identifying plants and rocks and reading stories while visiting the nearby sacred site of the Bdote, the confluence of the Minnesota and Mississippi Rivers considered to be the ancestral birthplace of the Dakota people; after collecting data on the health of our local oak trees and exploring the biodiversity of our pocket prairie; after eating fuzzy sumac berries and plantain leaves together; after making plans to sustainably manage our own local areas as partners in a reciprocal relationship; after all of this, we asked the students in a written form what they thought our learning goals for them this trimester were.

"I think it was more of a question," one student wrote. "How can we encourage them to think about things that are bigger than themselves? How can we make them ask those tough questions?" The goal was to "understand the interconnected nature of aggregate topics," another student said, "using different lenses and ways of knowing to more fully understand something complex and dynamic." "Looking back at it," a third student said, "I think the message was perspective. I think [the] teachers wanted their students to see other environmental issues and how we need to see the world in other perspectives. We also learned tons and tons more about Native American culture and we learned about the history of language.—The end goal was to make us look outside of our westernized thinking." Another student said, "Learning about TEK concepts helped us gain insight on literally

every unit—economics, trail management, carbon cycle."

We didn't tell the students a list of explicit learning goals at the start of the trimester. Instead, we spent 12 weeks weaving TEK concepts and different voices into each unit, repeatedly coming back to some of the same big ideas in a new context. At a superficial level, our mini-units and lesson plans were on things like biodiversity, economics, and climate change. I'm excited to see the students picking out instead the deeper, overarching themes of questioning, using multiple perspectives, and valuing Indigenous knowledge.

Before teaching, I worked for the National Park Service, including three seasons at Isle Royale National Park, a large island archipelago in Lake Superior famous for its long-running wolf and moose study. Like all of the national park units, this "wilderness" park is in reality carefully managed.

A conversation from one season sticks in my head. One sunny summer day, I was talking to Candy Peterson on the slopes outside her summer home, a very old, small wooden cabin on one of the park's peninsulas. The hill is studded with collected moose skulls; moose bones are helping the researchers understand not only the lives of moose, but also the lives of wolves and beavers, and even how osteoporosis and arthritis progress in human beings. Candy, who reminds me in appearance a little of Jane Goodall, is a writer, a teacher who presents to over 2,000 park visitors a summer, an excellent baker, and a phenomenal scientist in her own right. She is partner—wife and unofficial research partner—to Rolf Peterson, one of the island's leading wolf researchers.

We have to stop thinking about nature like it's something separate from us, she said to me that day. *We're animals. We're a part of nature too. We have needs and wants and a role to play.*[1] At the time I was more stuck in my mindset of separation and this rocked me. Could I really consider myself a part of this lush forest I was living within, a node in the food web, belly full of thimbleberries? It opened doors in my mind.

My students are 17- and 18-years-old. They are curious. They have questions. They are natural scientists and natural storytellers. I want to show them many roads to understanding their world and telling its story, to feel comfortable both with a

meter stick and bug net in hand and parsing the complex meaning in a story from an elder who's lived in this landscape far longer than they have. Last fall, after Joe and Rocky left, one of my students told me, *This is the first time I've ever felt like I could be myself and could recognize my family in school.*[1]

When I call myself a "scientist" (and I try to claim that for myself – a teacher but also a knowledge generator and sharer), the word heralds a multitude of tools and ingredients, a list growing bigger every day. This is for me, this is for our future, and this is for my students, both for their edification and to make all of them feel they have a home and a space in their science classrooms.

[1] Words attributed to a speaker but not in quotation marks are paraphrased according to the memory of the author.

ACKNOWLEDGEMENTS

Thank you to Rocky Makes Room for Them, both for your ongoing contributions to our classroom and for reading this piece and providing feedback before publication. Thanks also to Candy Peterson, for your reading of this piece and our conversations about it.

Thank you, always, to Brooks Autry, Patrice Callahan, Chad Forde, Brian Johnson, Billy Koenig, Molly Melton, Charlie Varley, and others from the present and past of the School of Environmental Studies, for being thought partners, leaders, extraordinary teachers, and creative, funny, inspirations who push me to be a better teacher every single day.

And thank you to my students, who teach me, push me, make me laugh, and help me grow.

CITATION

Dengate, L. (2024). Different ways of knowing: In support of a broadened life science classroom. *Kaleidoscope: Educator Voices and Perspectives, 10*(2).