HHS Public Access

Author manuscript

J Environ Health. Author manuscript; available in PMC 2022 March 28.

Published in final edited form as:

J Environ Health. 2021 October ; 84(3): 44–48.

Educating the Future Environmental Health Workforce During COVID-19: Developing a Virtual Curriculum for Navajo Student Interns Using the Environmental Health and Land Reuse Certificate Program

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Editor's Note:

Beginning in 2016, the Agency for Toxic Substances and Disease Registry (ATSDR) and the National Environmental Health Association (NEHA) launched a partnership to create a free online course with the goal of building capacity within communities to help remediate and redevelop brownfields sites. Brownfields are land reuse sites often contaminated by harmful chemicals or redeveloped without proper environmental oversight. Due to their potentially hazardous status, brownfields sites can lead to harmful exposures in humans while accentuating and often exacerbating socioeconomic disparities within their communities.

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As a result of this partnership, NEHA and ATSDR launched the Environmental Health and Land Reuse (EHLR) Certificate Program in 2020. The *Journal* is pleased to feature this column to highlight an example of how the EHLR Certificate Program was used to build understanding and increase knowledge on this important topic within environmental health students.

The findings and conclusions in this column are those of the authors and do not necessarily represent the views or official position of NEHA, ATSDR, or the Centers for Disease Control and Prevention. Furthermore, verbal permission was given by the students to use their work in this column.

Background

The Agency for Toxic Substances and Disease Registry (ATSDR) has long-standing partnerships on community revitalization and education projects with stakeholders throughout the Navajo Nation. One partner is the environmental public health program at Diné College, the first tribally controlled and accredited collegiate institution in the U.S.

Diné College hosts a yearly Summer Internship Program (SIP), which is part of the STEM 2020 program that is funded by the National Science Foundation. The STEM 2020 program offers mentored and hypothesis driven 10-week summer internships and research experiences for undergraduate students in environmental science, biology, and STEM (science, technology, engineering, and mathematics). The SIP course develops an inter-disciplinary understanding of the fundamental principles of science, especially in a field research arena. Students learn how to develop basic research skills and hypotheses, use statistics to analyze data, write technical documents, and develop presentations. Students are taught to integrate native science through traditional ecological knowledge and western science methods for the collection and analysis of data, to understand the Diné relationship with their environment, and to achieve reciprocity and sustainability in both worlds.

Typically, these concepts are presented to the student interns during an intensive 3-week senior level biology course. Upon completion of the course, interns are placed in real world research projects to complete a 6-week research experience under the mentorship of research scientists. At the end of the SIP, interns return to campus to present their research findings and experiences to communities and the student body.

Since 2015, 53 students have successfully completed the SIP. Students completing the 10-week program receive 4 credit hours for each component of the SIP, totaling 8 credit hours.

Environmental Health and Land Reuse Training

In summer 2019, ATSDR’s National Land Reuse Health Program hosted two undergraduate students from Diné College who were completing their SIP fieldwork experience. The students toured brownfields (potentially contaminated sites that are slated for cleanup or reuse) in the Navajo Nation and Chicago, Illinois, area. They also completed the free, online Environmental Health and Land Reuse (EHLR) Certificate Program that ATSDR developed collaboratively with the National Environmental Health Association (NEHA).

The five modules of the EHLR Certificate Program are centered around ATSDR's 5-Step Land Reuse Model:

1. Engaging with your community.
2. Evaluating environmental and health risks.
3. Communicating environmental and health risks to the community.
4. Redesigning with health in mind.
5. Measuring success.

The Diné students were joined by a European Fulbright Scholar studying redevelopment in the U.S. and three students who had recently completed degrees ranging from a bachelor of science in geology to a master of public health (MPH) in environmental health. All six students earned their EHLR certificates from NEHA. In August 2019, ATSDR expanded the pilot training into a preconference training for the Tribal Lands and Environment Forum hosted by the Institute for Tribal Environmental Professionals. As a result, 17 tribal environmental professionals earned their EHLR certificates.

In spring 2020, COVID-19 throughout the Navajo Nation impacted Diné College's summer program. As a result, the college decided to conduct its first all-virtual internship. The primary challenge was how to place SIP interns in the 6-week virtual field projects, which was complicated by a lack of access to laptops and reliable internet availability throughout the vast Navajo Nation. Diné College provided laptops to students and obtained internet hotspots. They worked with Tribal College and University Program partner universities and developed the 3-week senior level biology course as a condensed, 2-week virtual course.

They simultaneously partnered with ATSDR's National Land Reuse Health Program (ATSDR Land Reuse Program) to create the 6-week virtual fieldwork project by expanding the training from the previous year. ATSDR's Land Reuse Program created an EHLR instructional team comprised of ATSDR Land Reuse experts, NEHA instructional design experts, and Diné College faculty. The result was an expansion of the existing EHLR curriculum that nine students enrolled in and eight students completed. Diné College commenced its SIP with a week of virtual sessions and a second week of the University of Arizona/University of California, Berkley on cooperative indigenous food, energy, and water sovereignty virtual sessions. Then, the students joined the ATSDR EHLR Classroom Training seminar.

Methods

The SIP has a rigorous curriculum. Table 1 describes a typical prepandemic program, such as the 2019 program. To replace the pre-COVID-19 six-week fieldwork component, ATSDR's Land Reuse Program created a 40-hr/week EHLR curriculum that integrated case examples from the Navajo Nation and surrounding areas. In addition, an integration of native and western science was a consistent method of instruction throughout the full program. An excerpt of the curriculum is shown in Figure 1.

ATSDR's EHLR instructional team, with expertise in environmental and public health assessment, health education, communication, and risk communication, was joined by NEHA staff, Diné College faculty, and guest speakers who supplemented module topics with concepts of native science, resources, and case examples focused on Navajo and indigenous principles. Two ATSDR MPH interns from University of Illinois Chicago (UIC) served as peer mentors for the SIP interns. Students earned their EHLR certificates from NEHA upon completion of the curriculum.

We used the five EHLR modules as the basis of the 2020 SIP field curriculum. We expanded the 10-hr EHLR training into a full-time, 6-week, virtual curriculum with field and research components. Collectively, we created a draft syllabus with weekly topics. Each week the SIP interns completed additional assignments to supplement module topics. Example assignments included literature reviews on community engagement, environmental remediation, and environmental justice among tribal and nontribal communities.

The Role of Peer Mentors: Office Hours

Celine Wysgalla and Yeyzy Vargas, the MPH interns, served as peer mentors for the Diné College undergraduate students. They hosted "Office Hours With Celine and Yeyzy" during which they facilitated discussions and assignments to enhance topics learned in each weekly EHLR module. Wysgalla and Vargas created a weekly student handbook that included the lecture materials and special assignments, such as photo storytelling (i.e., photovoice), risk-based message mapping, demonstrating environmental mapping technologies, creating risk communication materials about typical brownfields contaminants, and reading case studies on environmental contamination incidents.

Guest Speakers

Guest speakers joined the SIP curriculum each week. They provided content on environmental justice in tribal and nontribal communities, risk communication, environmental remediation, and health-focused community revitalization projects, particularly in environmental justice and Navajo Nation communities. For example, ATSDR's communications expert Loretta Asbury delivered the risk communication module and a short exercise on creating key messages. Colleagues from ATSDR's stakeholder network and UIC presented environmental justice, food systems and food security, and health-focused redevelopment projects. A highlight was guest speaker Pam Maples, a Superfund division remedial project manager for the Navajo Nation's Environmental Protection Agency, who hosted a virtual tour of the former Navajo Nation forestry products industry site. Maples told the story of "how a petroleum contamination investigation led to recognizing the environmental conditions of a brownfield site" (P. Maples, personal communication, July 1, 2020). The investigation started with the petroleum contamination site assessment and resulted in finding visible asbestos-containing material along with volatile organic chemical contamination. The students virtually learned the many steps needed to evaluate how historical industrial activities and contaminant migration could lead to where the contamination is today.

Challenges to Engaging Students Virtually

There were several challenges to engaging the SIP interns virtually. These included engagement and interaction in general, virtual connection, and the COVID-19 pandemic.

One-on-one engagement: Engagement of the students was different in the virtual environment. On one hand, engagement of the quieter students was easier. They could respond by writing answers in the comment section. The talkative students could unmute to answer questions or comment. Having a small class, we were able to ensure each student was able to participate by writing comments or speaking. On the other hand, with poor internet connections, most students turned their video off when not responding. Assessing the students' learning was more difficult when we were unable to see the students in real time.

Student interaction: To keep the interest of the students virtually, we had interactive lessons, community projects, and guest speakers. In the photovoice section of one project, for example, the students went out into their community to take pictures of potential brownfields and then described their vision of how redevelopment could address community health disparities. Figure 2 shows an example of a photovoice project.

Internet connection challenges: At times, the instructors and students had difficulty connecting to our virtual platform, Zoom. We had alternatives to Zoom, such as a Skype link with screen sharing and conference call options. In case an internet connection was lost by one instructor, we also had other instructors to serve as backups.

COVID-19 pandemic: We had backup instructors and presentation notes to cover in case of emergencies. For example, we had instructors personally affected by COVID-19 during the semester. For the students, we planned to be flexible if any students had health issues, with extended deadlines if needed.

Career Day

Our final week of the EHLR expanded curriculum culminated in a career day panel. The SIP interns learned about careers with the U.S. Public Health Service, environmental consulting firms, universities, and NEHA. For example, Neilroy Singer emphasized his role in tribal/Navajo education and his connection to Diné culture and education through his role as an environmental specialist at Diné College.

Results and Outcomes

Diné College faculty were actively engaged with the SIP interns, which greatly benefitted the EHLR curriculum. In total, eight students and two faculty successfully passed the course and received their certificates of completion from NEHA. After the SIP ended, Diné College faculty and the peer mentors joined the ATSDR EHLR instructional team to host an EHLR Classroom Training for over 35 tribal environmental professionals attending the virtual Tribal Lands and Environment Forum hosted by the Institute for Tribal Environmental Professionals.

Through their grant mechanism, Diné College evaluated the summer program (Rogers & Laurila, 2020). Overall, nine students responded to the evaluation. In general, students were satisfied with the course and 100% strongly agreed that the course improved their ability to understand the connection between the environment and health. In addition, 88% strongly agreed and 11% agreed that the course improved their ability to visualize solutions to a cleaner, healthier environment (Figure 3).

Discussion

Despite challenges created by the COVID-19 pandemic, internet reliability, and focusing on alternate field experiences, the first-ever virtual SIP was a success. Our collaboration was enhanced by our different backgrounds and perspectives, and along with the students, we learned from each other.

Participant Reflections

Yeyzy Vargas: I gained great experience that helped me obtain a teaching assistantship in the undergraduate Public Health Program at UIC for the following fall and spring semesters. I loved the challenge of working with such a diverse group of students, learning and hearing from the Diné (Navajo) College faculty and all the guest speakers.

Celine Wysgalla: I learned to work with a variety of learning styles by offering constructive feedback, using grading rubrics, and taking time to meet with students to discuss any concerns they had. Ultimately, my experience led to a research assistantship at UIC with the Pediatric Environmental Health Specialty Unit, where I greatly enjoyed speaking Spanish with community members in community engagement and environmental justice capacities.

Neilroy Singer: The goal of this past year's SIP EHLR training was to implement more public involvement, especially with our Navajo Nation communities. This opportunity allowed our interns to conduct effective scientific studies about the environment. The interns were trained on proper procedures and phases to introduce their work to the people in the community before starting their research. So far, we are conducting good research. It was a privilege to share our collective knowledge with the students.

Perry Charley: The integration of Diné traditional ecological knowledge is truly challenging in the EHLR course. A large proportion of this knowledge is ingrained in and sustains the Diné and Native American communities. The integration of traditional knowledge with the course content revealed to the Diné interns the interconnectedness of the Diné environmental and cosmological belief that we live in an interrelated living world in perpetual, creative motion. For thousands of years, Native American knowledge has been used and passed down from generation to generation largely through oral traditions. The introduction of "Native Science," contained in this body of traditional environmental and cultural knowledge, is a unique approach to the ATSDR EHLR seminar. Reciprocity and sustainability to thrive in a complex native and western science environment is seldom taught and learned in this integrated context. The EHLR summer curriculum provided a great opportunity to bring together native and western science, technology, and traditional

wisdom in environmental health and land reuse to STEM students. It provided a unique opportunity to learn and provided a blend of traditional and modern sustainable lifestyles in a healthy environment where Earth is respected and honored. This approach provides an intriguing alternative for implementing applied ecology and could be widely recognized as an essential component of effective ecosystem and land reuse sustainable practice, management, and education.

Next Steps

During the 2021 SIP, ATSDR again provided the virtual EHLR Certificate Program. This year, our Diné College partners integrated tribal ecosystem knowledge (i.e., native science) more comprehensively throughout the class and student assignments, such as pre-paring risk communication materials with consideration of tribal elders and Diné language. In addition, our stakeholder network volunteered to provide supplemental environmental health content for the SIP interns. This unique opportunity enabled the interns to meet and learn from a variety of community and environmental health experts.

ATSDR oversees the EHLR Classroom Training and information about this program can be found at www.atsdr.cdc.gov/sites/brownfields/classroom_training.html. NEHA maintains the online EHLR Certificate Program, which is a self-paced, self-learning course that is asynchronous (i.e., no live or virtual instructors) in their E-Learning course catalog. The program is available at no cost at www.neha.org/ehlr. ATSDR and NEHA continue their collaboration to provide both modalities of the EHLR training, such as at various environmental conferences, and are considering expanding the EHLR content in the future.

Reference

Rogers L, & Laurila K (2020). Summer Institute Environmental Health and Land Reuse 2020 summer program evaluation Diné College, Tribal Colleges and Universities Program.

Date	Task	Activities	Assignments
7/13 9–11:30 a.m. MDT	Environmental Health and Land Reuse Module 4	Complete module activities and self-learning links Examples from the field: Navajo and elsewhere, soilSHOP (RB, MC)	Start literature review Complete posttest, due by 5 p.m. MDT, 7/15
7/13–15	Literature review on healthfields redevelopment	Conduct a literature review and summary (see below)	Literature review and summary due by 5 p.m. MDT, 7/17
7/15 9–10:30 a.m. MDT	Action Model review and exercise	Office hours with Yeyzy and Celine: Take Action! Is there a site you want to redesign near where you live? Complete the Action Model you started in Week 1 through Step 3. Or create a new Action Model and proceed through Step 3. Include at least three community issues.	Journal (2–3 paragraphs): Discuss a plan for your vision to redevelop potentially contaminated areas in Navajo Nation. Due by 5 p.m. MDT, 7/17
7/17	Prepare for Week 5	Read Section 4 Review the Action Model Indicators webpage: https://www.atsdr.cdc.gov/sites/brownfields/reusescorecard.html. Look at some of the indicators in the various categories.	

FIGURE 1. Excerpt From the 2020 Summer Internship Program Draft Syllabus

Week of July 13, 2020: Redesigning With Health in Mind

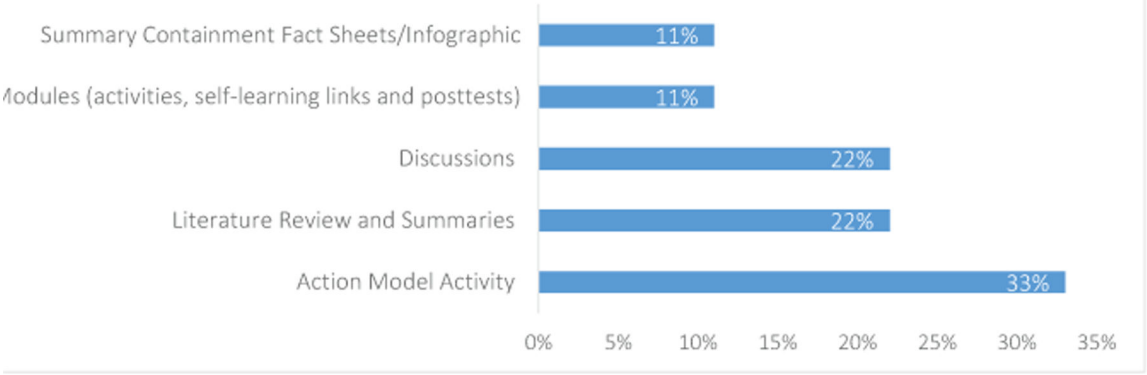
Literature review assignment: Literature review with 10–15 primary (e.g., peer-reviewed journal articles) or “grey” literature (e.g., .gov or .edu) sources, supplemented by 1–5 additional sources, such as newspaper articles. Key word searches: healthfields redevelopment; community health + brownfields; health outcomes + environmental justice; environmental justice + community health.

FIGURE 2. Example of a Student Photovoice Project

The Coal Country. This used to be a good Laundromat. The people of Crownpoint used to always come here on the weekends to do their laundry. This place brings back so much memories when me and my late auntie used to come here every Saturday morning, drinking coffee and doing our laundry. Until it closed in 2017. It is unknown to me if there are any contaminants in the building, or if it was built on top of any source of contamination. It has been closed ever since, and the building is still standing there today.

...while working through the Action Model, I began to see brownfields/abandoned buildings differently. I began to look at what it could become...a new house, a business or even a playground for children. There's a lot of possibilities that could happen.

Figure 3. Course activities that increased students' ability to apply environmental health concepts to their worldview (*n* = 9)



- **100% (*n* = 9)** of students *strongly agreed* that **this course improved their ability to understand the connection between the environment and health.**
- **88% (*n* = 8)** of students *strongly agreed* (11% *agreed*) that **this course improved their ability to visualize solutions to a cleaner, healthier environment.**

I have always cared for the environment and health but with the class I was able to connect them and ways to improve them in my personal life. For example, to determine and know more easily how to detect contamination, what to look at, what questions to ask, who to reach for information.

FIGURE 3.
Excerpt From the Summer Institute Environmental Health and Land Reuse 2020 Summer Program Evaluation

TABLE 1

Diné College Summer Internship Program (SIP) Sample Curriculum From 2019

Timeline	Core Components
Week 1	Diné traditional ceremonial protection way blessing Welcome address
	Overview of course obligations and requirements including lectures and field labs
	Responsible conduct in research training
	Technical writing: Using your library for environmental research Riverside sampling: Freshwater ecology and environmental geology trip
Week 2	Indigenous food, energy, and water security and sovereignty
Week 3	National Science Foundation/Tribal Colleges and Universities Program and Diné Environmental Institute research projects: Cove watershed assessment project, Cove livestock study, and the Gold King Mine spill project
	Former SIP intern presentations
	Navajo Nation and U.S. government research projects National Park Service Canyon de Chelly Ecological remedies for uranium mill tailings
	University research and studies: Air quality, *Helicobacter pylori* study in the Dilkon-Leupp community in Arizona Statistics
	Student Research Experience Program: Experience and research
	Canyon de Chelly biodiversity study
	Soil bacteria for antibiotic therapy
	Water quality and riparian health
	Farms and river visual riparian assessment tool training
Weeks 4–9 (Research Internship)	Undergraduate research experience at internship sites: • Cove livestock study • Aeolian soil deposition • Fawn and water catchment project • Bat and invasive plants research • Indigenous food, energy, and water security and sovereignty • Soil antibiotics • *H. pylori* and unregulated water • NFPI preliminary assessment
Week 10	Leadership and research
	Review research draft with instruction for final paper
	Interns develop final presentation
	Internship presentations
	Final internship evaluation