Culturally Responsive Education in Environmental Data Science (CREEDS) Workshop

Evaluation Report

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Acknowledgements

Table of Contents

Introduction

A workshop, *Culturally Relevant Education in Environmental Data Science (CREEDS)*, was hosted on August 10 and 17, 2021 to bring together data science educators, data scientists, and community leaders interested in the application of cultural relevance and inclusive pedagogy to environmental data science education. The workshop built on the efforts of a conference hosted in April 2019, where participants examined diversity, equity, and inclusion at the intersection of the environmental and data science fields. During this event, attendees established the Environmental Data Science Inclusion Network (EDSIN) to begin addressing priority areas that emerged from the conference discussions: *accessibility* of courses and relevant tools; full integration of *data ethics*; *co-creation and collaboration* for resource development; *demonstrating relevance* of environmental data science to diverse communities; and building and implementing *culturally and socially relevant curricula* (Crall et al. 2020). The CREEDS workshop was pulled together as an opportunity to engage the EDSIN community and additional networks in further discussions around this last priority area. The workshop explored what it means to approach education around data science principles and skills from a culturally responsive perspective, reducing barriers to teaching data literacy in the classroom. The event was meant as a starting point, to enable participants to consider a potential framework for effectively engaging on this topic and establishing a collaborative network for future activities.

About the Workshop

A workshop planning committee of six individuals was formed to ensure that the event was developed with diverse faculty needs and student engagement at the forefront. The four faculty serving on the committee included representatives from vastly different institutions (from small teaching colleges to large, public research universities), including a Historically Black College University (HBCU) and a Hispanic Serving Institution (HSI). Our committee also included scientists working with environmental big data (National Ecological Observatory Network) and data science training (The Carpentries) organizations. Through a series of meetings, the planning committee identified a framework to adopt for effectively engaging participants in relevant topics. The workshop would consist of both asynchronous and synchronous activities. During the synchronous portion of the workshop, interdisciplinary teams would be formed to participate in a series of curricula deconstruction and reconstruction activities as described below.

Participant Recruitment and Selection

The workshop pulled together interdisciplinary teams to discuss existing and new approaches for developing culturally responsive data science curricula in the environmental sciences. Anyone with interest could apply and recruitment of applicants focused on bringing diverse perspectives and expertise to the workshop discussions. The planning committee developed a flyer advertising the event that was distributed to their existing networks via newsletters and social media posts. They relied heavily on recruiting through the Environmental Data Science Inclusion Network (EDSIN), Quantitative Undergraduate Biology Education and Synthesis (QUBES), and The Carpentries. The EDSIN website is housed on the QUBES platform, and all three groups have a large number of community members focused on culturally relevant data science education. To ensure that the workshop participants represented diverse backgrounds and perspectives (i.e., from data science, pedagogy, practice), prospective workshop

participants were also identified by the planning committee and invited to submit applications. Prior to the workshop, we sent out a form to assess interest in applying to the CREEDS workshop and/or staying updated on our activities. We had a total of 129 people fill out the interest form.

The application included basic questions (e.g., contact information) in addition to a request to list up to three projects, communities, or teams in which the applicant was involved that were relevant to the workshop theme. Two open-ended questions asked the applicant to give a brief description of their work as it related to the workshop and their motivation for applying to attend (Appendix A). The application period was open for three weeks (May 21 – June 11), and the planning committee received 29 applications during that time. A scoring rubric was used by each committee member to independently review the applications. These scores were then used to facilitate discussion among committee members to come to consensus on who to select. The committee considered whether the applicant identified as someone underrepresented in STEM fields; their relevant projects; their experience reaching diverse communities; their motivation for attending; and their background which was scored based on the number of applications within each category. This ensured the workshop included participants with diverse perspectives who could form the interdisciplinary teams. After participants were selected, we sent out a pre-workshop registration form to obtain information on any accessibility needs (e.g., live closed captioning, assistance with childcare; Appendix B). Participants were also able to opt-out of receiving a stipend for their time attending the workshop. After reviewing budget needs for stipends and accessibility requests, we were able to accommodate all but two applicants to attend the workshop.

Workshop Structure

Pre-workshop activities: Between July 27 and August 10, workshop attendees were asked to spend approximately 4 hours preparing for the workshop. The planning committee compiled a variety of resources (guides, scientific articles, podcasts, videos) and teaching modules that were added to two collections on the EDSIN website (Appendix C). These resources were not meant to be exhaustive but provided the necessary context to facilitate workshop discussions. An EDSIN community call was hosted on July 1 to provide opportunities for workshop participants and those unable to attend to engage with each other on these topics. Call participants were placed into breakout groups and given three question prompts to guide their conversation: Does your community/project address cultural relevance in its work?; What does cultural relevance mean for environmental data science education?; One of the resources shared (Muñiz 2020) identifies a set of competencies for culturally responsive teaching. Which of these is most important? Which of these is most challenging?

Workshop activities: The synchronous portion of the workshop applied a deconstruction/reconstruction framework established by the planning committee. During the deconstruction session on August 10, participants heard from the educators who developed the teaching modules they reviewed in preparation for the workshop during lightning talks. Participants were placed into breakout rooms with their pre-assigned team to deconstruct these activities, focusing on how they could be used to support culturally relevant teaching. Teams were structured to include a diversity of perspectives and each had at least one data scientist, one educator, and one community leader. A list of questions were provided to guide the discussion (Appendix D). Prior to the second session on August 17, teams were encouraged to spend an hour to begin discussing questions and datasets of shared interest that could be used to construct their own model. During the August 17 reconstruction session, teams outlined how they would approach creating a culturally relevant teaching activity, using the question/dataset they identified to structure their discussions around. We provided guiding questions and a slide

template for each team to organize their ideas (Appendix E). Each team then used their slide to present their module idea to all participants to get feedback on their approach.

Post-workshop activities: A post-workshop community call was hosted by EDSIN on September 2. During this call, the planning committee provided an overview of the CREEDS workshop and facilitated a discussion on next steps. Call participants were placed into breakout groups and given three question prompts to guide their conversation: What topics related to culturally relevant education are you most interested in learning more about?; What activities would you like to see the group organize to support your work in this space?; and What products should we develop as resources for EDSIN members?

Post Workshop Evaluation

After the first day of the workshop, a short survey was distributed to participants to identify ways to improve on the workshop for day two (See Appendix F). We received 18 responses, a 67% response rate. Most respondents were pleased with the format on day one although some requested time for more breaks. This request resulted in more break time on day two.

After the workshop ended, a post workshop evaluation was sent to all attendees (Appendix G). The survey collected data on inclusion and accessibility of the event; participant satisfaction with the workshop and tools utilized; their overall experience; and to what extent they plan to engage in future CREEDS activities. We received 23 responses to our post conference evaluation, a 85% response rate.

Workshop Outcomes

Diversity of workshop participants

The planning committee received 14 partial applications and 29 full applications to participate in the workshop, with 33% of those that completed the application identifying as a member of an underrepresented group in STEM. Applicants were affiliated with a range of institutions, primarily universities (59%), but also colleges, non-profits, and museums/labs (Figure 1). There were no applications from faculty at Minority Serving Institutions even though two of the members of the conference planning committee were faculty from an HBCU and TCU.
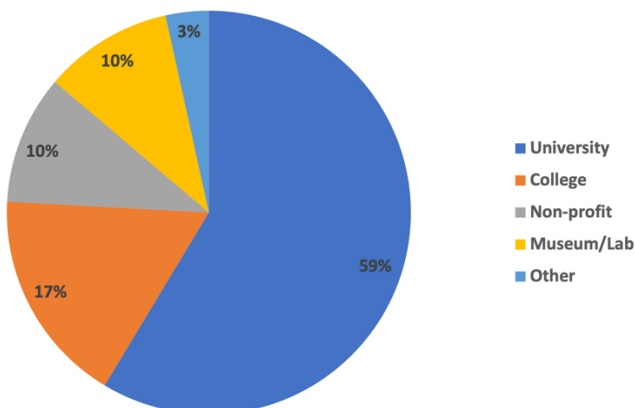

Figure 1. Percentage of applicants affiliated with each category.

Most applicants identified as an environmental scientist (62%) and approximately half of applicants identified as educators (45%) or data scientists (41%). Only a quarter identified as a community leader (24%). Most applicants came with a high level of comfort performing skills relevant to the workshop theme (83-100% comfortable), but only 64% had previous experience developing data science curricula (Table 1).

Table 1. Percentage of applicants ranking themselves as comfortable or uncomfortable with each of the following skills.

Skills	Uncomfortable (%)	Comfortable (%)
Leading interdisciplinary teams/projects	0%	100%
Working with local communities to identify/address research priorities	10%	90%
Engaging public in science practices	17%	83%
Applying inclusive pedagogy to teaching	17%	83%
Working with big datasets	17%	83%
Developing environmental science curricula	17%	83%
Developing data science curricula	36%	64%

There were a range of motivations for attending the workshop. Many educators sought to make their existing resources more culturally relevant for their students and to build new curricula centered in cultural relevant and inclusive pedagogical practices. Some were in the process of building entire courses at their institutions around these practices. Others hoped to gain insights on how to better engage local communities in their research and teaching and network with others who have similar interests.

Changing Participant Perceptions of Culturally Relevant Education

One of the goals of the workshop was to change the ways in which participants thought about culturally responsive education in their work. All respondents indicated some degree of change with no one indicating that the workshop had not influenced them at all (Figure 2).

Figure 2. Percentage of respondents (N=23) who responded a great deal, a lot, a moderate amount, a little, or none at all to the question: To what extent did the exchange of ideas that took place at the workshop influence the ways in which you think about culturally responsive education?

The parts of the workshop that influenced change varied by respondent. Engaging with other workshop participants seemed to have the greatest impact with 39% indicating that it resulted in a great deal of change and 35% a lot of change (Figure 3). Only the pre-workshop reading/materials and the lightning presentations resulted in no change for some of the respondents (Figure 3).
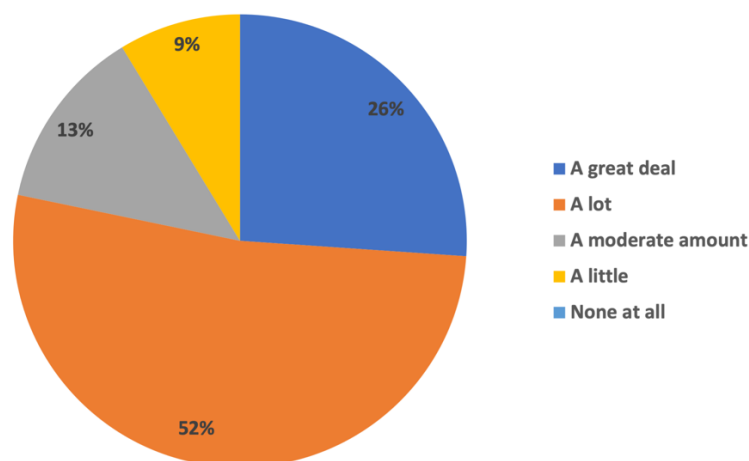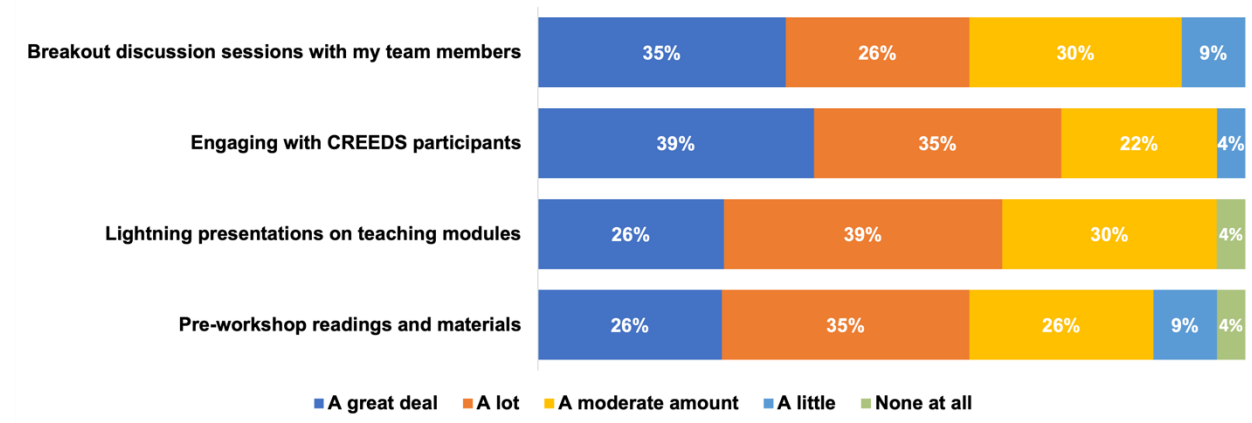

Figure 3. Percentage of respondents (N=23) who responded a great deal, a lot, a moderate amount, a little, or none at all to the question: To what extent did each of the following increase your understanding of culturally responsive education?

One respondent commented on how the brevity of the event and virtual workshop space may have potentially reduced the impact:

> *"The workshop was a good use of time and a great experience. I'm glad I participated. However, it is hard for me to accomplish much change in 2 three hour sessions. I think "a moderate amount" is appropriate given that I have some experience with the topic, the duration of the workshop, and the challenges of "zoom learning." I had trouble following the lightening presentations because of issues with my own concentration abilities"*

Some of the key takeaways listed by participants included:
- *We are all struggling with developing more culturally relevant ways of communicating, teaching, and learning.*
- *Culturally relevant is about both personal connection AND making sure students are aware of systemic injustices, using both to help them feel connected to the topic and engaged.*
- *Meeting a great group of people from different backgrounds with the same goals in mind, and all of the resources and activities created will be really useful when we are developing curriculum.*
- *Data science is an important aspect which compliments culturally relevant education*
- *Engage students in field data collection work*
- *Discussion of inclusiveness for specific teaching activities / case studies is effective*
- *There are some really cool ways we can incorporate data into our classes in a way that is culturally responsive*
- *There is great work being done out there to make education culturally applicable.*
- *Thinking about the kinds of assignments and assessments I have students do. How they report back or what they turn in can be tailored in a culturally meaningful way to the students.*
- *Everyone is new to this!*

Participant Experience and Satisfaction

For any event to be successful, those who participated need to be satisfied with their experience. Therefore, the post workshop evaluation asked a series of questions relevant to participant experience (Appendix G). Findings demonstrated a satisfactory experience overall, with 100% agreement to statements relevant to the event being accessible and inclusive (Figure 4). Open-ended comments on ways to make the event more accessible included:

- *I like the Zoom platform because it is globally accessible. On the opposite, I don't like the global connectivity because of the personal constraints with time zones. The knowledge is there, the accessibility to share that knowledge with similar peers is NOT always there. Break-out groups according to regions might be helpful? But what about different expertise? A larger sample size is obviously the solution but the facilitation and organization that comes with it is not always feasible.*
- *Have the "lightning talks" prerecorded and assigned beforehand. Flipped instruction: makes it easier to digest the info.*
- *If the workshop was earlier in the day it could have been more accessible to those in other time zones.*
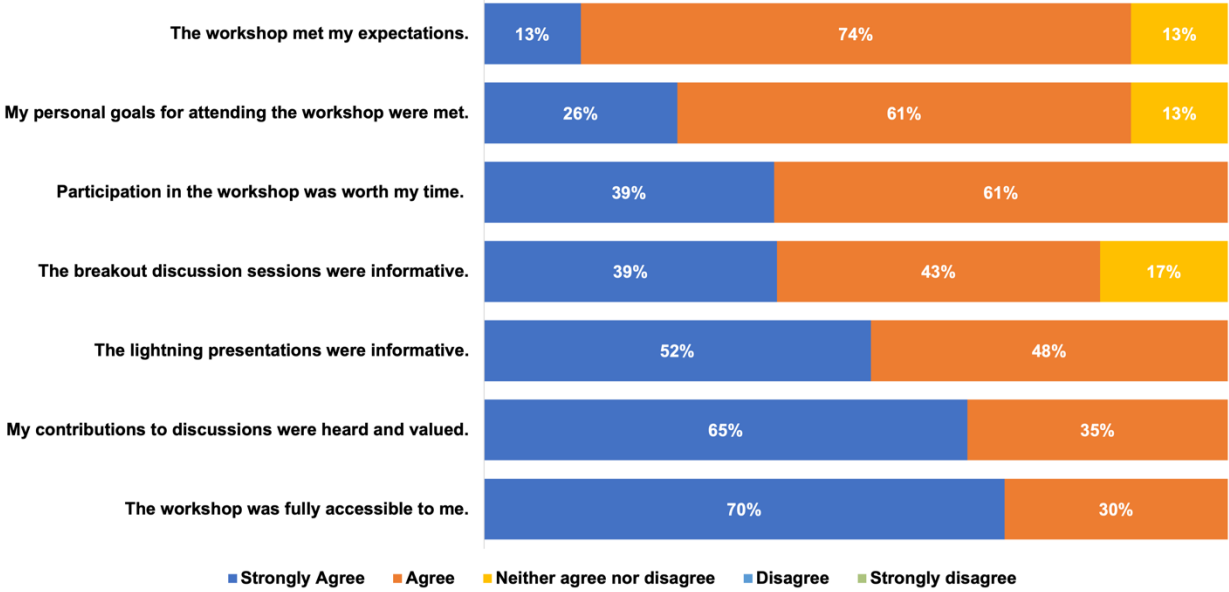

Figure 4. Percentage of respondents responding strongly disagree to strongly agree on the post survey to a list of statements relevant to participant experience.

We wanted to get a sense of how satisfied participants were with the logistical aspects of the event as well, including the platforms used, workshop facilitation, and communications from and interactions with the workshop planning committee. Generally, a large majority of participants were satisfied with these (Figure 5). One participant wrote: *"The meeting facilitation in particular I felt was top notch. Lightning presentations and modules to deconstruct were very well chosen. The amount of work that went into preparing for this workshop really shows, it was excellent."*
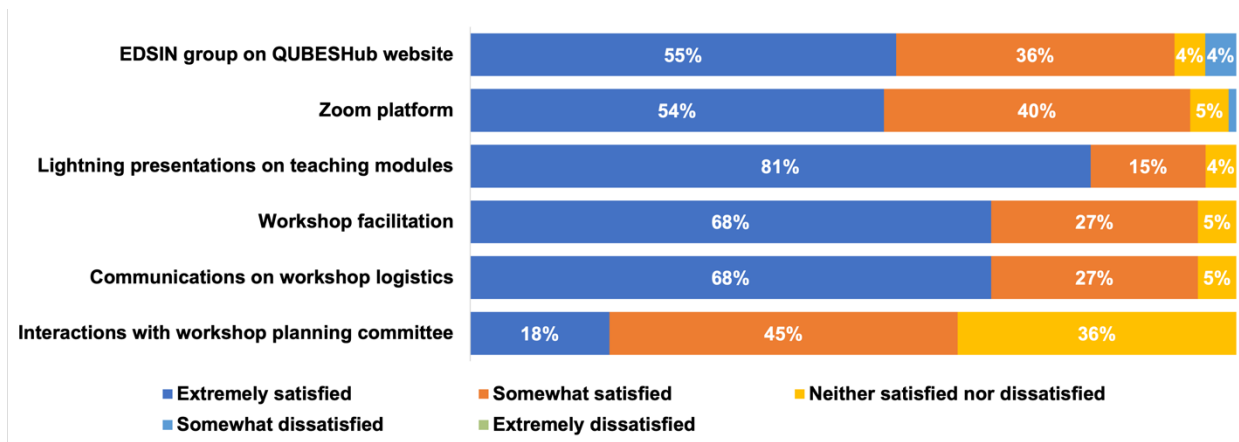
Figure 5. Percentage of participants satisfied with various aspects of the workshop.

There was some dissatisfaction with the QUBES platform, but it seems this dissatisfaction related to a lack of understanding on how to engage effectively with it. No one posted to the forum to discuss the modules prior to the synchronous portion of the workshop. There were two posts made by one individual related to the pre-reading materials. The most asynchronous engagement occurred through introductions from participants with 35 individuals introducing themselves on the platform. Someone indicated that *"homework" was kind of hard to navigate - there were a lot of links and emails, maybe could have had a landing page or linktree?"* Someone else commented:

> *"There were A LOT of different forms and information at the end of the first day of the workshop and I don't think all of them had been provided at the beginning (e.g. the CREEDS Google Drive folder as a whole or the potential data resources word document). It was hard to find them for next steps. That said, WOW such great community and planning and resources for this workshop."*

Another aim of the workshop was to further engage the CREEDS community of practice in culturally relevant education practices. To do this required retaining participants after the workshop ended. We asked two questions to gauge retention. A majority of respondents indicated an intention to stay engaged with the community (69%) but a smaller number indicated that they plan to contribute to after-workshop activities (43%). However, only 4% indicated no intention to contribute to these activities. We also asked if participants identified collaboration opportunities with new colleagues, and 52% indicated that they had. One participant wrote:

> *"This workshop made me think a lot about the importance of collaboration in order to produce culturally relevant modules. There are so many organizations doing important work about environmental data and leaning on these organizations is a great way to expand my own knowledge and produce more informed teaching modules."*

Recommendations

Based on feedback received from the evaluation and the experiences of the conference planning committee, the following recommendations should be considered when planning future events and activities.

The framework used supports development of culturally relevant curricula

The deconstruction/reconstruction framework developed by the planning committee to guide the workshop seems to be an effective approach for supporting the development of culturally relevant curricula. It allowed participants to examine what is already being done and apply relevant practices to modules around areas of common interest for the teams. Many respondents liked the lightning talks where module developers presented on various modules relevant to data science education with the module creator leading the breakout discussion.

> *"I really enjoyed working through a module to have something concrete and then taking that to build a module. I think I would be confident to design a culturally responsive module and course. And find resources to improve it as I taught."*

> *"I will be using the readings and our discussions to inform how I structure my data science coursework going forward."*

> *"I thought the idea of using different modules as a jumping off point was very interesting, and all of the modules were really cool. Lots of creative ideas and potential to build the more inclusive pedagogy."*

> *"I loved hearing from the creators of the modules. It was such a great diversity of exercises and led to interesting brainstorming in our group. Also, it was exceptionally well facilitated! "*

More time for discussion and breakout group work

Even with the framework having success, many respondents felt that more time was needed to fully engage with the content presented. This included: time to explore community priority setting within curricula, more time to finalize proposed curriculum, and more time in discussion about the details of and the implementation of core tenants of culturally relevant education. One participant wrote:

> *"More time for the breakout groups -- we barely touched on each of the topics of discussion, and given the limited time this week and next, I would have preferred another hour during this synchronous time to really deconstruct the curriculum to understand what it was aimed at and where it might be improved / repurposed."*

Several participants stated that they would have liked more time for the module developers to present, providing additional context surrounding development but also implementation. One participant wrote:

> *"I think there was a bit of context missing from the "modules" we reviewed...class sizes and compositions, modality of delivery of the class materials, length of time of instruction that is used to get through the module. Goals of a module in terms of what students should walk-away with...new skills, new insights, new understandings, etc."*

Additional time would have also allowed each team more time to build on the conception of the module they hoped to develop.

> *"If done a second time, I would structure it such that there was one additional day, on which people who were interested in developing a module together*

would agree upon a topic and develop readings, datasets, and a rough teaching guide for a particular module. The broader discussions we had in our breakout groups were helpful, but I would have found it equally helpful to work through more of the nitty-gritty in-class considerations that go with developing an in-class module"

Recruitment should ensure diverse perspectives are represented

A few participants commented that it would have been good for more diverse perspectives to be represented at the workshop. Although there was limited capacity for this event, a future planning committee should explore additional ways to recruit faculty from Minority Serving Institutions and individuals serving as community leaders. Hosting the event in multiple time zones could also facilitate international participation.

Further encourage asynchronous engagement

There was limited engagement in the asynchronous activities from participants. A future event might identify additional ways to encourage engagement in online forums. For example, to save time during the synchronous portion, time was not available for introductions. Participants were asked to introduce themselves in the online forum before the synchronous portion, but not everyone did this.

Host the event in-person instead of online

Finally, many respondents indicated the challenge of doing this type of engagement online instead of in-person.

> *"It's a long time to be on Zoom! Thanks for more breaks the second day! Not sure how to address this but it was hard to stay actively participating for the full three hours each day."*

References

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Appendix A: Workshop Application

CREEDS Workshop

Culturally Responsive Education in Environmental Data Science (CREEDS) The Culturally Responsive Education in Environmental Data Science (CREEDS) workshop will engage interdisciplinary teams in discussions around existing and new approaches for developing culturally responsive data science curricula in the environmental sciences. The goal of this workshop is to help make environmental data science more inclusive and accessible. This event was funded in full by a grant from Code for Science & Society, made possible by grant number GBMF8449 from the Gordon and Betty Moore Foundation. Please answer the following questions to be considered for participation in the workshop which will be held online **August 10 and 17, 2-5pm EDT** (time conversion tool). Please note that applying to the workshop implies a commitment to attending both days. For more information, please visit the workshop website. We will be updating information on this site as it becomes available. **All applications for the workshop must be received by June 11 and selected participants will be notified June 18.** One of the explicit goals of this workshop is to bring together a wide range of stakeholders to bridge community partners, employers, academic contexts, and data science projects. Priority consideration will be given to applicants who help us reach our goal of becoming a diverse group of stakeholders and can bring new perspectives to these discussions. Applicants from community groups, historically underrepresented groups, and minority serving institutions are strongly encouraged to apply. **Click the arrow below to begin your application.** If you have any difficulties filling out or submitting the application or have questions about the workshop, please contact Natasha Gownaris.

Please provide us with your name, email, and affiliation.

- ○ Name _____
- ○ Email _____
- ○ Affiliation _____

The goal of this workshop is to leverage interdisciplinary perspectives to inform the development of culturally relevant data science curricula. Do you identify with any of the following roles? Please select all that apply.

- ❑ Community leader
- ❑ Data scientist
- ❑ Environmental scientist
- ❑ High school or undergraduate educator
- ❑ Other _____

The workshop planning committee is committed to the values of diversity, equity, and inclusion. We believe this workshop's effectiveness will rely on convening a participant group that reflects the diversity of those we expect our workshop outputs to serve. Therefore, identifying as someone underrepresented in science, technology, engineering, and mathematics (STEM) will be one of the factors used in selecting participants.

Do you identify as someone from an underrepresented group in STEM? Groups traditionally underrepresented or underserved in STEM include: persons with disabilities, African

Americans/Blacks, Hispanic Americans, American Indians, Alaska Natives, Native Hawaiians, Native Pacific Islanders, and persons from economically disadvantaged backgrounds.

- ○ I do not wish to provide
- ○ Yes
- ○ No

If you are comfortable doing so, please share more details. Your response is optional.

_____

Please rank your comfort level with each of the following.

	Very uncomfortable	Uncomfortable	Comfortable	Very comfortable
Working on interdisciplinary teams/projects	○	○	○	○
Working with local communities to identify and address research priorities (e.g., community science)	○	○	○	○
Engaging the public in science practices (e.g., citizen science)	○	○	○	○
Applying principles of inclusive pedagogy to teaching	○	○	○	○
Working with big datasets	○	○	○	○
Developing environmental science curricula	○	○	○	○
Developing data science curricula	○	○	○	○

Please give a brief description of your general background, interests and research/work focus, as it relates to this workshop. (1250 characters max)

_____

Are you involved in any projects/communities/teams relevant to the workshop? We are particularly interested in opportunities you may have to share these ideas with others working in this area. Please provide up to three examples.

	Project Name	URL
Example 1		
Example 2		
Example 3		

Please select your role in each of the examples you provided in the previous question.

Display This Choice:

If If Are you involved in any projects/communities/teams relevant to the workshop? We are particularly interested in opportunities you may have to share these ideas with others working in this area. Plea... Example 1 - Project Name Is Not Empty

Display This Choice:

If If Are you involved in any projects/communities/teams relevant to the workshop? We are particularly interested in opportunities you may have to share these ideas with others working in this area. Plea... Example 2 - Project Name Is Not Empty

Display This Choice:

If If Are you involved in any projects/communities/teams relevant to the workshop? We are particularly interested in opportunities you may have to share these ideas with others working in this area. Plea... Example 3 - Project Name Is Not Empty

	Leadership	Active contributor	Participant	Observer	Other
Display This Choice: *If If Are you involved in any projects/communities/teams relevant to the workshop? We are particularly interested in opportunities you may have to share these ideas with others working in this area. Plea... Example 1 - Project Name Is Not Empty* Example 1	❍	❍	❍	❍	❍
Display This Choice: *If If Are you involved in any projects/communities/teams relevant to the workshop? We are particularly interested in opportunities you may have to share these ideas with others working in this area. Plea... Example 2 - Project Name Is Not Empty* Example 2	❍	❍	❍	❍	❍
Display This Choice: *If If Are you involved in any projects/communities/teams relevant to the workshop? We are particularly interested in opportunities you may have to share these ideas with others working in this area. Plea... Example 3 - Project Name Is Not Empty* Example 3	❍	❍	❍	❍	❍

What is your motivation for applying to this workshop? How do you imagine this meeting informing any of the projects you listed in the previous question? (1250 characters max)

_____

You are at the end of the application. Once you press the right arrow below, your application will be submitted and you will not be able to go back.

Appendix B: Workshop Registration

CREEDS Workshop Registration

Culturally Responsive Education in Environmental Data Science (CREEDS)   We are excited to learn with you during the upcoming CREEDS workshop. We aim to make this workshop a space for each participant to learn and grow, and would like to collect some additional information to ensure that our event is accessible to you. Please fill out the following information by **July 9, 2021** and email Sam Donovan if you have any questions.

Please provide us with the following information.

○ Name _____

○ Affiliation _____

○ Email _____

- -

Please provide us with your contact information. This information is being requested to share with other attendees. If you do not want your contact information shared, please skip this question.

○ City _____

○ State _____

○ Country _____

- -

Please provide us with your pronouns.

○ Prefer not to answer

○ Any pronoun is fine

○ She/Her/Hers

○ He/Him/His

○ They/Them/Theirs

Because this is a collaborative event, synchronous participation is necessary on August 10 and 17, 2-5pm EDT.

○ I am able to attend both three-hour synchronous sessions

○ I cannot attend the synchronous sessions so will no longer be able to participate in this event.

We aim to create an inclusive and collaborative environment among participants from different disciplines and institutional types, as well as different personal backgrounds. We have developed a Code of Conduct to help guide the workshop. Please review the Code of Conduct here.

○ I have read, and agree to adhere to, the Code of Conduct:

All participants in this workshop will be offered a $250 stipend for their time, but you may waive this stipend to provide additional support to other workshop participants. Please select from the options below:

- ○ I would like to accept the $250 workshop stipend for my time.
- ○ I would like to waive the $250 workshop stipend.

In addition to asynchronous preparation for the event, this event will consist of two, three-hour workshops conducted over Zoom and will utilize Google Docs for collaborative note-taking. Though there will be some presentations during the workshop, the bulk of the workshop will consist of discussions among participants and working sessions in breakout rooms. Please select any accommodations you require during the workshop from the list below.

- ○ None
- ○ Electronic copies of materials in advance
- ○ Support for internet access/data
- ○ Live Closed Captioning
- ○ Other _____

Will you need support for childcare to participate fully in this workshop?

- ○ Yes
- ○ No

Display This Question:

    If Will you need support for childcare to participate fully in this workshop? = Yes

Please provide an estimate of the cost for child care, including details on how these services should be paid. Will it be a direct payment to a provider or a reimbursement?

_____

Q13 Please tell us any additional needs you may have for this meeting, with as much specificity as possible.

_____

Appendix C: Pre-Workshop Preparation Packet

Pre-Workshop Preparation
Culturally Relevant Education in Environmental Data Science (CREEDS)

Estimated Time Required: Approximately 3 Hours

The resources below provide background on concepts central to the CREEDS workshop. Please keep track of any thoughts or questions that come to mind as you go through these resources and, if you are comfortable doing so, share them on the CREEDS forum, which is hosted on QUBES. We welcome viewpoints that differ from those laid out in these resources and look forward to your feedback before, during, and after the workshop. Please remember to follow the CREEDS Code of Conduct while interacting with workshop participants and organizers.

These resources are by no means exhaustive but instead are meant to jumpstart our discussions during the workshop. As part of our efforts, we are curating a larger database of resources on culturally relevant environmental data science. During the workshop, we will share these resources with you and ask that you add resources that others might find useful.

The resources below include material taken from guides, scientific articles, podcasts, and videos. If you have trouble accessing any of these materials, please contact Natasha Gownaris (ngownaris@gmail.com) for assistance. All time estimates are based on word counts (except for videos and podcasts). We do not expect you to explore all of these materials in one sitting, but we recommend that you follow the order that we outlined below.

Culturally Relevant and Culturally Responsive Pedagogy
These resources provide a brief overview of culturally relevant and responsive teaching and will help you to reflect on approaches to this model of teaching.

1) Culturally Responsive Teaching: A Reflection Guide - 25-Minute Read (link will take you to a PDF online)
This guide, written by Jenny Muñiz, is based on the framework for culturally responsive teaching that was developed by New America in 2019. The framework consists of eight core competencies for culturally responsive teaching. Jenny Muñiz provides brief descriptions of and reflection questions for each of these competencies.

2) Table 2 in The development of a model of culturally responsive science and mathematics teaching - 5-Minute Read (link will take you to a full PDF of the paper; page 20 of the PDF shows Table 2)
In this 2013 paper, Cecilia Hernandez, Amanda Morales, and Gail Shroyer outline a model for culturally responsive teaching in STEM. Though you are welcome to read through this paper in its entirety, the model is well-summarized in Table 2 (page 20). You can refer to this table periodically as you consider approaches to culturally responsive pedagogy.

3) The Cult of Pedagogy Podcast, Episode 78: Four Misconceptions About Culturally Responsive Teaching - 45-minute Read or Listen (link will take you to the episode webpage and transcript)

Jennifer Gonzalez, the host of "The Cult of Pedagogy Podcast", interviews Zaretta Hammond in this episode. Zaretta Hammon is the author of the book "Culturally Responsive Teaching in the Brain". Jenniver and Zaretta discuss common misconceptions that educators have about culturally responsive teaching. The podcast is available on all major podcast apps or the transcript can be read at the link above.

Community-Driven Data Science and Environmental Justice
These resources outline best practices for engaging communities in data sharing and integration and provide an example of community-led data science linked to environmental justice.

4) [Excerpts from the Toolkit for Centering Racial Equity Throughout Data Integration by Actionable Intelligence for Social Policy - 15-Minute Read (link will open up a PDF on Google Drive)](#)

This toolkit examines how data sharing and integration by governments can be more equitable and transparent and engage communities. The PDF linked above provides an overview of best practices at each stage of the data science process, from planning through dissemination.

5) [Episode 2 of "The Crowd and the Cloud" Series, "Citizens + Scientists" - Stop at 21:42 for end of Philly Unleaded - 22-Minute Video or Read (link will open up to video; transcript linked below video)](#)

This episode of the Crowd and the Cloud, hosted by former NASA Chief Scientist Waleed Abdalati, highlights four community-led data collection projects. These projects focus on issues of air and water pollution and on how citizens have taken data collection into their own hands to promote awareness and enact change. Though all of these stories are excellent and you are welcome to watch the full episode, we have selected just one project for the pre-workshop preparation (Philly Unleaded), which ends at 21:42.

Explore Workshop Curricula

Now that you have gone through the above resources, we ask that you explore the five teaching modules that we will work with during the "deconstruction" phase of the workshop on August 10th. Workshop organizers and module creators will provide a brief (5-minute) overview of these modules during the workshop. The presentations will be followed by a discussion of the modules and their applicability to culturally relevant or responsive environmental data science curricula.

Given our limited time together, it will be helpful for everyone to come to the workshop with some familiarity with these modules. **We anticipate that exploring the modules prior to the workshop will take you approximately 1 hour.**

Questions to Consider
- Does this resource support culturally relevant and/or responsive teaching?
- If so, what approaches to cultural relevance and/or responsiveness has this resource adopted?
- If not, do you think this resource has the potential to support culturally relevant and/or responsive teaching? What revisions/additional resources would be necessary?

Modules

- "Sustainability Metrics" by Dr. Natalie Hunt
- "Implementing Demography from Cemetery Module" by Dr. Alexis Racelis
- "Quantifying the Drivers and Impacts of Natural Disturbance Events - the 2013 Colorado Floods" by Dr. Leah Wasser and Dr. Megan A. Jones
- "Graphing and Mapping Patterns of Air Quality in Los Angeles, California Through an Environmental Justice Lens" by Dr. Adriane Clark Jones
- "Phenology Trends and Climate Change in Minnesota" by Pamela Freeman
- "Spiders under the Influence" by Chris Hawn and Aaron Curry

Appendix D: Day 1 Discussion Questions

These questions were modified from resources developed by Jenny Muñiz 2019 and Hernandez et al. 2013.

Will this activity…
1. make use of "cultural scaffolding"?
    a. allow students to see themselves and others reflected in the activity?
    b. draw on students' background knowledge, cultures, and traditions?
    c. incorporate content from various cultures?
    d. connect to students' daily lives, including experiences with racism and injustice?
2. help students to reflect on their own biases and biases in the system?
    a. help students and instructors to reflect on their own cultural lens?
    b. recognize and redress bias in the system?
    c. encourage students to question the status quo?
3. involve collaboration with local communities and/or connect to real-world issues and encourage students to be agents of change?
    a. connect students to local environmental and/or social issues?
    b. empower students to solve problems in their lives, their communities, and in the world?
4. model high expectations for all students and help to ensure all students remain engaged?
    a. provide scaffolding to help all students meet goals and remain engaged?
    b. help students to develop empathy, respect, and understanding for people who are similar to and different from them?
    c. rely on whole and small group collaborations within the classroom?
    d. use a variety of methods to engage students (visuals, hands-on activities, etc.)?

Appendix E: Day 2 Discussion Questions

In addition to the day one questions, participants were asked to consider these additional questions on day two:

- What data are available to address your environmental justice issue?
- Are there any ethics issues involved with these data? Are data ethics considered?
- What types of resources would you want to create using these data?
- What would your learning goals be?
- What additional information/data would you need to make this activity socially/culturally relevant?

Appendix F: Post Day 1 Survey

CREEDS Day 1 Post Evaluation

Culturally Responsive Education in Environmental Data Science (CREEDS)   Thanks for joining us as a participant in the CREEDS workshop. We would like to get feedback on your experience following day one to inform better implementation of day two. If you have any questions or need any support completing the survey, please contact Alycia Crall.

What did you like most about today's workshop?

_____

What would you change about the workshop?

_____

Please provide any additional comments relevant to your experience as a CREEDS workshop participant.

_____

Appendix G: Post Workshop Survey

CREEDS Post Workshop Survey

Culturally Responsive Education in Environmental Data Science (CREEDS)
Thanks for joining us as a participant in the CREEDS workshop. We would like to get feedback on your experience to inform better implementation of future workshops. If you have any questions or need any support completing the survey, please contact Alycia Crall.

Please rank how strongly you agree with each of the following statements relevant to your participation.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
The workshop met my expectations.	○	○	○	○	○
Participation in the workshop was worth my time.	○	○	○	○	○
My personal goals for attending the workshop were met.	○	○	○	○	○
The workshop was fully accessible to me.	○	○	○	○	○
The lightning presentations were informative.	○	○	○	○	○
The breakout discussion sessions were informative.	○	○	○	○	○
My contributions to discussions were heard and valued.	○	○	○	○	○
I identified collaboration opportunities with new colleagues.	○	○	○	○	○
I intend to stay engaged with the community now that the workshop is over.	○	○	○	○	○
I intend to contribute to after-workshop activities.	○	○	○	○	○

Please provide any comments relevant to your above responses.

_____

Please rank your level of satisfaction with each of the following.

	Extremely dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Extremely satisfied
Interactions with workshop planning committee	○	○	○	○	○
Communications on workshop logistics	○	○	○	○	○
Workshop facilitation	○	○	○	○	○
Lightning presentations on teaching modules	○	○	○	○	○
Zoom platform	○	○	○	○	○
EDSIN group on QUBESHub website	○	○	○	○	○

Please provide any comments relevant to your above responses.

_____

To what extent did each of the following increase your understanding of culturally responsive education?

	A great deal	A lot	A moderate amount	A little	None at all
Pre-workshop readings and materials	○	○	○	○	○
Lightning presentations on teaching modules	○	○	○	○	○
Engaging with CREEDS participants	○	○	○	○	○
Breakout discussion sessions with my team members	○	○	○	○	○

To what extent did the exchange of ideas that took place at the workshop influence the ways in which you think about culturally responsive education?

- ○ A great deal
- ○ A lot
- ○ A moderate amount
- ○ A little
- ○ Not at all

Please provide any comments relevant to your above responses.

_____

What do you feel was the most useful aspect of the workshop?

_____

What would you change about the workshop?

_____

What were your key takeaways from participating?

_____

What are ways we can make future workshops more accessible?

_____

Please provide any additional comments relevant to your experience as a workshop participant.

_____