



Root for Innovation

A Case Study of Professional Development on
Climate Change for Hawai'i Educators

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Key Takeaways

A survey released by the [Smithsonian](#) in September 2023 found that 90% of U.S. teachers said a lack of time posed a challenge to teaching about sustainability, and more than 74% said the same about a lack of instructional materials and expertise on the subject. In order to help educators develop the confidence to integrate climate change education into their curricula, effective and credible professional development should be designed for all grade levels and subjects.

This professional development should show teachers how they can integrate place-based learning and adapt resources to local contexts. In addition, professional development should allow for discussion and resource-sharing amongst local educators, so that classroom activities and lessons can integrate locally relevant climate topics.

SubjectToClimate, Elemental Excelerator, and Teach for America Hawai'i teamed up to host a six-week long professional development course for Hawai'i educators.

After collecting data from the participants, we found that:

Teachers had a **better grasp on the science behind climate change.**



Teachers expressed **more clarity about the legitimacy of climate change**, with nearly all **recognizing the valid scientific evidence that exists in support of the phenomenon in the post-survey.**

100%

of respondents indicated that they **feel capable of incorporating climate change into their curricula more frequently.**



7 out of 9 teachers

expressed a desire to teach **at least four more lessons** than they indicated on the pre-survey.

The Context of Climate Change Education in Hawai'i —

In this study, four out of nine Hawai'i educators in the pre-survey indicated that there are state learning standards related to climate change. However, the 2022 House Concurrent Resolution 134 did not pass the state's Senate Committee on Education, thus, Hawai'i does not currently integrate climate change into the formal curriculum. If enacted, the resolution would have required the Department of Education to ensure that standards “focus on place-based responsiveness to climate change and preparing students to engage in a growing green economy.”¹ One educator commented on the difficulty of integrating climate change for teachers without specific state or district standards: “if you're in a school where you are given the curriculum for the year, and it doesn't include a unit on climate change, it's just going to slip through the cracks. It's a lot to create a curriculum from the ground up.”²

Nevertheless, there are some Hawai'i-specific resources on climate change education. The Hawai'i State Department of Education provides [resources](#) for educators related to biodiversity, food and water security, and climate change. Their database has specific lesson plans for any K–12 grade level and subject, including the Winged Ambassadors unit plan of five lessons for grades 6–8 and 9–12, shown at right—a product of the National Oceanic and Atmospheric Administration in collaboration with Oikonos Ecosystem Knowledge.

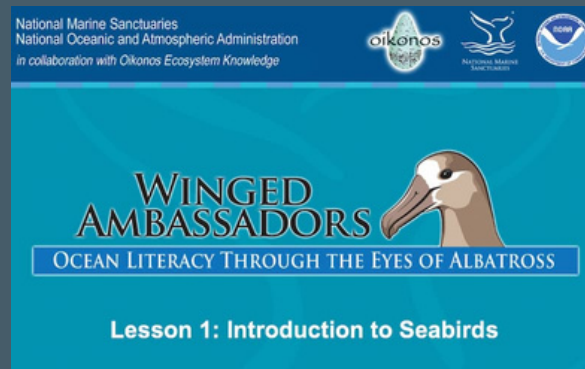


Figure 1. “Curriculum and Activities,” n.d., Cordell Bank National Marine Sanctuary, <https://cordellbank.noaa.gov/education/curriculumactivities.html>.

The [A'o 'Āina Professional Development Program](#) was designed to enhance Hawai'i educators' knowledge of different careers and topics related to natural resources. The program consists of 40 hours of in-person and virtual programming where educators can curate their individual experience to expand on their interests and help fill knowledge gaps. The cohort reports indicate that participants showed a 50% increase in knowledge of stream ecosystems and a 47% increase in knowledge of environmental resource management. Additionally, 100% of participants felt the program was effective at helping to build connections with community partners and increasing their knowledge of natural resource topics and issues.

1 [House Concurrent Resolution 134](#), Hawai'i State Legislature

2 Olivia Dulany in discussion with the authors, August 2023.

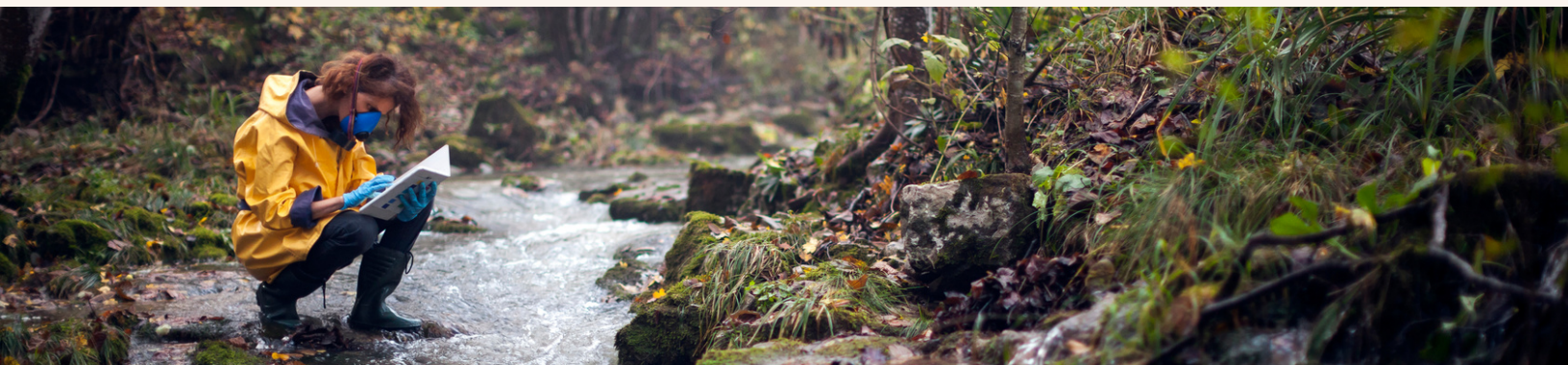
The Context of Climate Change Education in Hawai'i

In addition to this program, the [Hawai'i Science Teachers Association](#), [NOAA](#), and the [USGS Pacific Islands Climate Adaptation Science Center](#) have hosted teacher workshops and produced climate-specific content aimed at discussing how climate change is impacting Hawai'i and sharing how educators can encourage their students to take action through place-based activities grounded in Hawai'ian perspectives.

However, educational climate change resources specific to Hawai'i are mostly focused on integration into science classes, and there seems to be a gap in addressing other subjects. Likewise, there is no unified content hub containing science-based or interdisciplinary climate change resources. Speaking on the need to approach climate change through different academic fields, Professor Christina Gerhardt from the University of Hawai'i says: "If we start to look at all different disciplines through the lens of climate change, meaning what solutions are we therefore going to put forward . . . We'd be in a good place to weather the coming storms."

Interdisciplinary climate education not only raises student awareness about how far-reaching this phenomenon is, but also prepares students to start thinking about prospective careers in the wake of an increasingly green economy. Hawai'i careers in the field of natural resources are increasing 7% annually, and educators need support so that they can best prepare their students to be successful in these careers. This includes sharing background information and spreading awareness about green careers, while also helping students develop particular skills needed to enter the natural resources workforce.

Thus, it appears that there is a need for professional development focused on integrating climate change across all subjects, while also ensuring that educators understand enough about the science of climate change to feel comfortable integrating it into lesson plans and classroom activities. In addition, teachers would benefit from easily available resources on climate change education that they can apply directly in their classrooms.



SubjectToClimate Teacher Training

In summer 2023, [SubjectToClimate](#) partnered with [Elemental Excelerator](#) and [Teach for America Hawai'i](#) to host a teacher training program for Hawai'i educators that covered topics ranging from climate science to environmental justice. SubjectToClimate is a nonprofit online connector for K-12 educators of all subjects to find credible and engaging materials on climate change at no cost. SubjectToClimate has developed a series of professional development modules for teachers about climate change education, divided into three levels.

Level 0: Knowledge	Level 1: Teaching	Level 2: Lessons
<ul style="list-style-type: none"> History and science of climate change Common climate denial narratives Climate solutions Topics like environmental sustainability and climate justice 	<ul style="list-style-type: none"> Outline of climate change education Entry points, teaching tools, and approaches for all grade levels and disciplines Common concerns or obstacles 	<ul style="list-style-type: none"> Lesson plan format and creation process Selection of credible sources K-12 teachers in all disciplines craft climate lesson plans to integrate into their curricula

By actively engaging in lesson plan creation, teachers were motivated to discuss localized climate change issues and incorporate place-based learning techniques³ into their lesson plans. Participants also discussed the context of climate change in Hawai'i and how place-based learning can serve as a connector for educators to bridge the subject with their students. In general, resources for climate change education should be grounded in climate science and tailored to a state or district's unique environmental features. For example, while Florida and Hawai'i are both at similar latitudes, they are impacted by climate change in different ways. If educators are able to show their students how climate change affects their daily lives, they will be better able to connect in-classroom discussions with viable solutions and action items.⁴

The modules were delivered to a cohort of ten Hawai'i educators over a period of six weeks. Levels 0 and 1 were delivered asynchronously, and Level 2 was delivered using a hybrid model, wherein SubjectToClimate staff scheduled virtual synchronous meetings with the Hawai'i cohort and provided asynchronous support during the lesson writing process.

Surveys were conducted before and after the training to examine how interdisciplinary professional development affects teachers' attitudes, knowledge, confidence, and frequency of climate change education. Analysis of this data provides insights into the best practices for professional development focused on climate change. Survey questions were derived from the [National Center for Science Education](#) and can be found in the [Appendix](#).⁵

3 Place-based learning is an instructional approach that focuses on developing students' sense of place and learning through exploring their environment. Source: [University of Nebraska Lincoln](#).

4 See [What Makes Yale Climate Connections Stories Work?](#)

5 See [Appendix A](#).

Survey Data

Teacher Attitudes About Climate Change

After completing the training, teachers were more aware of the impact and severity of climate change, with 60% feeling “very worried” about climate change in the post-survey, and 56% believing that climate change will personally affect them “a great deal.” An increased awareness of climate change effects was most notable amongst respondents who reported that they teach a subject outside of science. Non-science educators indicated in the pre-survey that it would be challenging to begin a competent discussion on climate science or mitigation strategies in their classroom. However, one science educator also responded that their curriculum focuses on topics such as physics and astronomy, which they felt were not as easily connected with climate change. These responses indicate a lack of understanding on how to integrate climate change into **all subjects**.

Teacher Knowledge About Climate Change

Overall, teachers were fairly well-versed in the science behind climate change both before and after the training. The training seemed to confirm the reality of climate change and its scientific credibility—after an initial 67% strongly disagreed that the data for climate change is ambiguous, a full 89% of respondents strongly disagreed after taking the modules, as shown in Figure 2. All respondents strongly disagreed with the statements that “climate change is incapable of being scientifically tested and validated,” and “climate change is not a scientifically valid idea.”

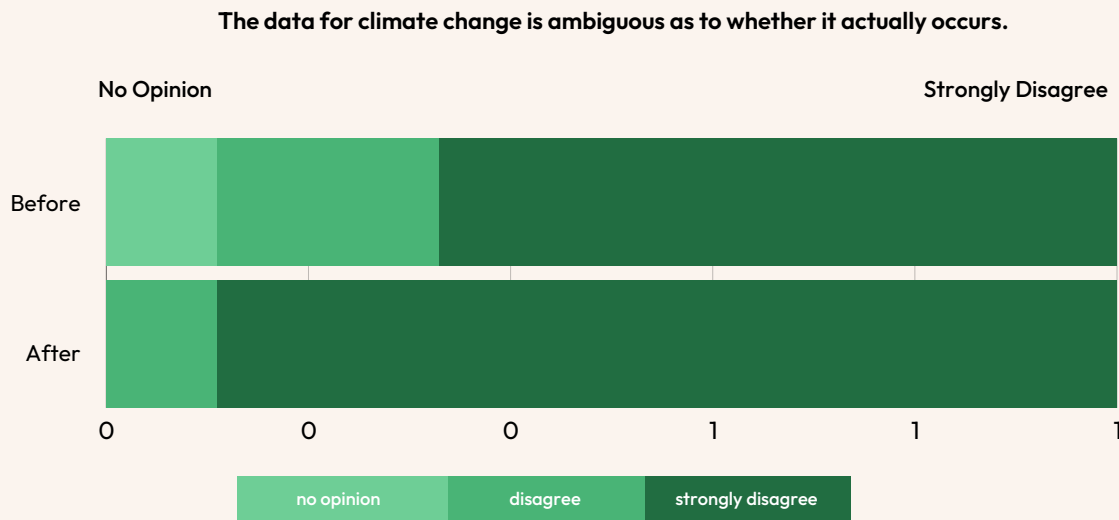


Figure 2. Likert-scale measure of teacher opinion on the ambiguity of climate change data.

Overall, the teacher training was able to solidify many basic points about climate science.

Teacher Confidence in Teaching About Climate Change

After completing the teacher training modules, educators felt more confident discussing the impacts of climate change with their students, including how to cope with it and address positive change through mitigation or adaptation.

After the training, 100% of respondents agreed or strongly agreed that they were confident in their ability to discuss potential climate solutions with students.

There were a few subtopics of climate education that teachers were slightly less confident about after completing the training modules. When asked if they felt confident aligning climate change content to a state learning standard, integrating globally and locally relevant climate change topics, and teaching about both adaptation and mitigation strategies regarding climate change, some teachers who marked “strongly agree” before the training marked “agree” after the training. When connecting climate change to environmental and social justice, or even teaching climate justice as its own field, educators’ levels of confidence were more split: five felt more confident teaching about these topics and four felt less confident. While educators still overwhelmingly agreed that they felt confident integrating these topics, the shift from “strongly agree” to “agree” suggests a need for further training on these subtopics of climate change education.

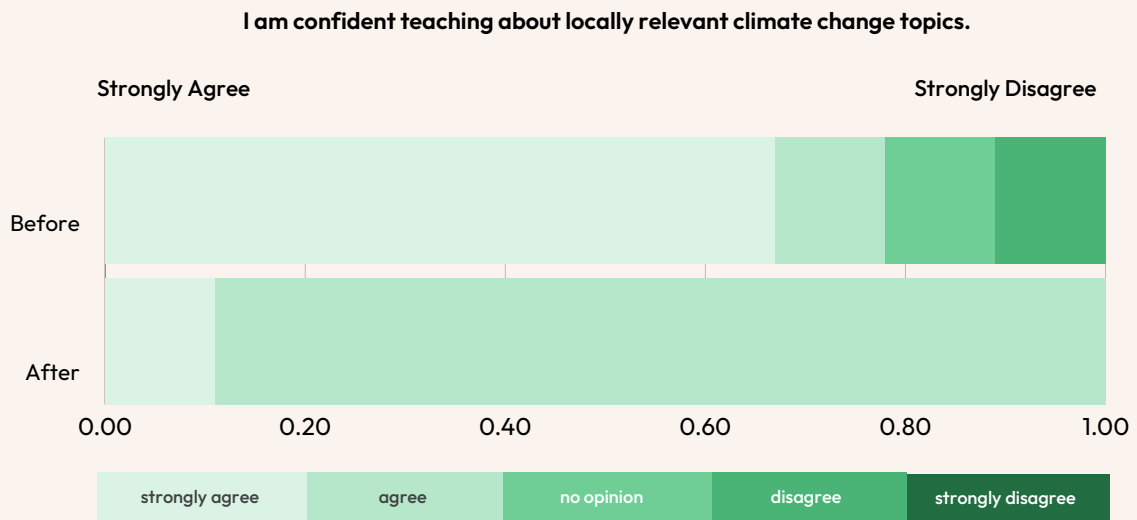


Figure 3. Note: four teachers initially responded “strongly agree” before the training, then chose “agree” afterwards—indicating that they still felt capable but perhaps slightly less certain. This trend was also reflected in other questions assessing confidence in teaching about climate change content.

The above figure displays a higher level of overall agreement with the statement, “I am confident teaching about locally relevant climate change topics,” but a closer examination shows that fewer people strongly agreed with the statement after the training (the 67% who initially agreed strongly with the statement was reduced to 11% in the post-survey).

Overall, respondents seemed more clear on the fundamental aspects of the science behind climate change, and they were fairly confident in their abilities to integrate climate change into their classrooms. Discrepancies in responses about specific climate change topics suggests the need for further professional development on certain subtopics of climate change such as climate justice and locally-relevant climate topics.

Time Spent Teaching About Climate Change

After the training sessions, 100% of respondents indicated that they feel capable of incorporating climate change into their curricula more frequently.

Similarly, when asked to estimate how many lessons they plan to teach about climate change, seven out of nine teachers expressed a desire to teach at least four more lessons per year than they indicated in their pre-survey. This is a promising result that suggests increased interest in climate change integration amongst educators, which will help them discuss the topic more often with their students.

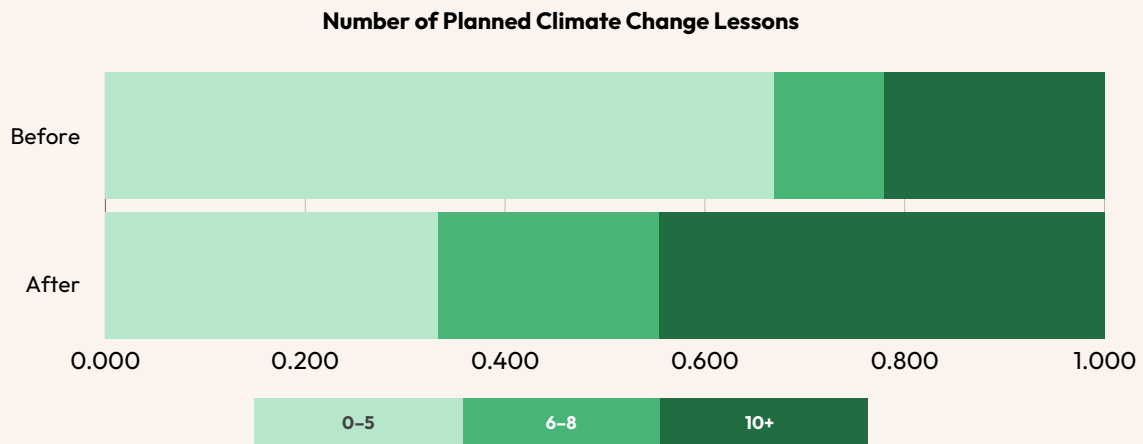


Figure 4. Data representing number of climate change lessons teachers plan to teach before and after taking the SubjectToClimate teacher training.

Frequency of Climate Change Integration

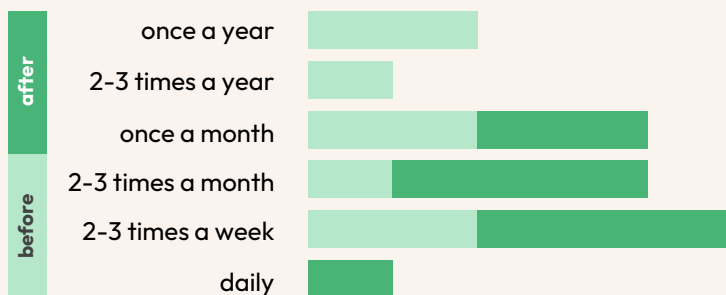


Figure 5.

Figure 5, shown at left, tracks the change in frequency of climate change integration into curricula, from the reported amount in the pre-survey to the planned amount in the post-survey. Of note, no educators planned to teach about climate change less often than “once a month” in the post-survey, and two educators who initially reported teaching about climate change “once a month” planned to include it “2-3 times a week.”

78% of respondents planned to teach about climate change on a more frequent basis than originally reported.

Participant Interview Data

After analyzing the survey data, we held interviews with a few respondents to gain more insight into their responses. We found that these educators were self-motivated to build skills to integrate climate change into their classroom, and that they had some knowledge of climate change prior to the training, but not enough that they felt comfortable to teach about the topic in their classrooms.

These educators expressed that certain resources within the modules stood out. One interviewee appreciated the illustrative examples from the training videos, i.e., an art teacher who encouraged their students to create something beautiful from litter on their community streets. Similarly, it was helpful to see videos that “highlighted teachers from different countries . . . and emphasize[d] their favorite talking points,”⁶ which demonstrated ways that climate change can be integrated into a variety of classrooms. This educator added, “I found it validating to see that it wasn’t just homerooms or academics that were being highlighted in the videos. It was specialty teachers, like art.”⁷

Thus, providing educators with a range of examples and methods of implementation better encourages and informs the integration of climate change topics into any subject or grade level.

Educators also found that having credible statistics and facts about climate change was very useful, and they expressed a desire for additional fact sheets or other references to be distributed for use after the training session, as this would help them write more original climate-focused lesson plans and generally facilitate the integration of climate change into their classroom materials.

Top impacts (as described from participant interviews):



Cleared up
climate misinformation
and climate science



Provided
ideas for working with
different learning levels



Eliminated
the complicated search
for credible resources



Demonstrated
how other educators
integrate climate change

6 Ember Brock in discussion with the authors, August 2023.

7 Ember Brock in discussion with the authors, August 2023.

In terms of obstacles, educators noted that their curriculum currently emphasizes math or English language arts skills and test scores rather than place-based learning.⁸ Our interviewees also brought up that they have difficulty adapting the curriculum to meet the wide array of academic achievement levels amongst their students and balancing “very different styles of conducting investigation activities and hands-on activities.”⁹

One participant developed their own climate curriculum for high school students prior to taking the teacher training course and described having “trouble finding visuals that were digestible for learners with learning disabilities, and just 10th graders in general.”¹⁰ It can be overwhelming for educators to creatively integrate climate change that will engage a wide variety of students. Additionally, it is hard to find credible educational resources that incorporate climate change and allow options for extension, differentiation and adaptation to different classroom settings.

After undergoing this training, participants feel they can:



Accurately
address the science of
climate change and common
misinformation



Save time
integrating climate change
into curricula that might not
already include it



Integrate
place-based learning
without overlooking core
subject skills and test scores

- 8 Note: This is why SubjectToClimate has created [pacing guides](#) to help teachers see how to integrate climate change into math or English language art skills.
- 9 Ember Brock in discussion with the authors, August 2023.
- 10 Olivia Dulany in discussion with the authors, August 2023.
- 11 Note: This is why SubjectToClimate curates credible resources and provides educators with teaching tips that supply differentiation methods. For example, see a [sample lesson](#) where teachers are given suggestions for how to simplify the vocabulary in the lesson, alternatives for videos to be shown in the lesson, and ideas for extension activities such as exploring local pollinators and plants in their community.

Conclusion

In conclusion, educators in Hawai'i are motivated to integrate climate change education into their curriculum, but since it's not a required topic in most schools, they need additional resources and training. Such support most often comes through outside sources, notably professional development opportunities that cater to educators and address their needs or preexisting gaps in the content they have available to them. After completing SubjectToClimate's teacher training, educators felt they "[had] more resources to do [their] own research and to make learning more meaningful,"¹² and felt that they were able to read through scientific information in a more informed manner.

The survey data showed that teachers who participated in SubjectToClimate's training knew more about climate change, were more confident teaching about climate change, and planned to teach about climate change more frequently than before the professional development course. Discrepancies in responses about specific climate change topics suggests the need for further professional development on certain subtopics of climate change such as climate justice and locally-relevant climate topics.

12 Ember Brock in discussion with the authors, August 2023.


Implications for Future Applications

After evaluating teacher feedback, there were several significant takeaways on professional development for teachers on climate change education. Notably, climate change education requires more time and resources to be supplied to educators in order to support their own learning and their curriculum development. Educators noted the value of training modules—such as those provided by SubjectToClimate, referenced in this case study—as supplying them with essential information and credible resources for teaching about climate change.

In order to maximize effectiveness and integrate all aspects of climate education, professional development needs to incorporate the following components:

Passive

Educators learn about the science behind climate change through a brief introductory period, then begin discussing local climate topics and reviewing relevant resources. Teachers are given pedagogical strategies to integrate climate change into their curricula, regardless of grade or subject.



Active

Foster participation through the creation of lesson plans and locally relevant curriculum content, connecting what educators are learning to their classrooms. Participants also engage in discussion and collaboration to create positive mitigation strategies and allow their students to become models of sustainability.

Interactive

Educators are supplied with resources that they can reference at any point after the workshop, including the content they created or started to draft during the workshop and recordings of educator discussion sessions. Importantly, providing fact sheets about climate science and climate misinformation, environmental justice and climate mitigation strategies, and locally-relevant, place-based topics or projects, would prove very helpful based on feedback we received from the Hawai'i cohort.



Implications for Future Applications

Alternatively, future professional development can deviate from the model used in this instance, and focus on more specific topics. Educators already have limited time and resources to dedicate to an asynchronous or synchronous session, so perhaps shorter workshops can be offered with a duration of up to three days, addressing specific subtopics such as how to teach about the local impacts of climate change or how to weave the topic of green careers into the classroom. Structured as a series of several offerings, these professional development sessions can allow teachers to pick and choose which they are able to attend or which topics relate most to their students. Finally, such professional development should be made available for continuing education credits, so that educators can simultaneously learn about climate change education while also fulfilling requirements for continuing education that they would need to fulfill regardless.



Appendix

Appendix A: Survey Questions

Pre-survey

Background

1. What state are you from?
2. Your responses will be anonymized and no personal identifying information will be shared along with your response. We will keep who you are confidential unless you explicitly give us permission. We will be using the aggregate data to analyze the effects of our teacher training modules, which will likely be published in a white paper. Do you consent for your responses to be used for research purposes?
 - a. Yes
 - b. No
3. What grade levels do you teach? Select all that apply.
 - a. K
 - b. 1st
 - c. 2nd
 - d. 3rd
 - e. 4th
 - f. 5th
 - g. 6th
 - h. 7th
 - i. 8th
 - j. 9th
 - k. 10th
 - l. 11th
 - m. 12th
4. What subjects do you teach? Select all that apply.
 - a. Art
 - b. Computer Science & Design thinking
 - c. English Language Arts
 - d. Health
 - e. Math
 - f. Science
 - g. Social Studies
 - h. World Languages
 - i. Other
5. If you selected "other" above, please specify.

Pre-survey

6. What is your school classification?
 - a. Rural
 - b. Suburban
 - c. Other
7. How many total school years have you been a teacher?
8. Are there any educational standards for your grade level(s) and subject area(s) that address climate change?
 - a. Yes
 - b. No
 - c. I'm not sure

Importance of Climate Change

9. How important is the issue of climate change to you personally?
 - a. Extremely important
 - b. Very important
 - c. Somewhat important
 - d. Not too important
 - e. Not at all important
10. How worried are you about climate change?
 - a. Very worried
 - b. Somewhat worried
 - c. Not very worried
 - d. Not at all worried
11. How much do you think climate change will harm you personally?
 - a. A great deal
 - b. A moderate amount
 - c. Only a little
 - d. Not at all
 - e. Don't know
12. How much do you think climate change will harm future generations of people?
 - a. A great deal
 - b. A moderate amount
 - c. Only a little
 - d. Not at all
 - e. Don't know

Pre-survey

Knowledge of Climate Change

In the following table, please indicate your selection regarding the causes of climate change (not a cause, minor/secondary cause, major/primary cause).

13. Emissions from business/industry
14. Destruction of tropical forests
15. Depletion of ozone - upper atmosphere
16. People driving their cars
17. Use of chemicals for insect pests
18. Nuclear power generation
19. Use of coal and oil by utilities
20. Use of aerosol spray cans

For each of the following statements please select your level of agreement (strongly disagree, disagree, undecided, agree, strongly agree).

21. Climate change is incapable of being scientifically tested and validated.
22. The data for climate change are ambiguous as to whether it actually occurs.
23. Most scientists accept that climate change is occurring.
24. Scientists' understanding of climate change is based on speculation and not valid scientific accounts.
25. A significant body of data supports climate change.
26. Climate change science methods are too unsure to be trusted.
27. Climate change is not a scientifically valid idea.
28. Current knowledge about climate change is the result of sound scientific research and methodology.

Confidence in Teaching About Climate Change

For each of the following statements please select your level of agreement (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree).

29. I am confident in teaching about the scientific consensus that recent global warming is primarily being caused by human release of greenhouse gasses from fossil fuels.
30. I am confident in teaching the impacts of climate change.
31. I am confident teaching about potential solutions or steps students can take to address challenges of climate change.
32. I am confident in teaching adaptation strategies regarding climate change.
33. I am confident in teaching mitigation strategies regarding climate change.
34. I am confident teaching about locally relevant climate change topics.

Pre-survey

(continued...)

- 35. I am confident teaching about globally relevant climate change topics.
- 36. I am confident teaching about the misconceptions of climate change.
- 37. I am confident teaching about environmental justice as it relates to climate change. I am confident teaching about social justice as it relates to climate change. I am confident teaching about climate justice.
- 38. I am confident in aligning climate change content to a state learning standard.
- 39. I am confident in developing lesson plans related to climate change.
- 40. On a scale from 1 to 10, how confident are you in teaching your students about climate change?
- 41. Please explain your response above.

Time Spent Teaching Climate Change

- 42. How often do you discuss climate change with your students? This can include brief or in-depth climate change connections.
 - a. Daily
 - b. 2-3 times a week
 - c. Once a week
 - d. 2-3 times a month
 - e. Once a month
 - f. 2-3 times a year
 - g. Once a year
 - h. Never
- 43. In a typical year, how many lessons do you teach that include topics related to climate change?
- 44. Do you feel you spend enough time teaching about climate change currently?
 - a. Yes
 - b. No
- 45. Please explain your response above.
- 46. Is there anything else you would like to share regarding your climate change teaching?

Post-survey

Background

1. What state are you from?
2. Your responses will be anonymized and no personal identifying information will be shared along with your response. We will keep who you are confidential unless you explicitly give us permission. We will be using the aggregate data to analyze the effects of our teacher training modules, which will likely be published in a white paper. Do you consent for your responses to be used for research purposes?

Importance of Climate Change

3. How important is the issue of climate change to you personally?
 - a. Extremely important
 - b. Very important
 - c. Somewhat important
 - d. Not too important
 - e. Not at all important
4. How worried are you about climate change?
 - a. Very worried
 - b. Somewhat worried
 - c. Not very worried
 - d. Not at all worried
5. How much do you think climate change will harm you personally?
 - a. A great deal
 - b. A moderate amount
 - c. Only a little
 - d. Not at all
 - e. Don't know
6. How much do you think climate change will harm future generations of people?
 - a. A great deal
 - b. A moderate amount
 - c. Only a little
 - d. Not at all
 - e. Don't know

Post-survey

Knowledge of Climate Change

In the following table, please indicate your selection regarding the causes of climate change (not a cause, minor/secondary cause, major/primary cause).

7. Emissions from business/industry
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26. I am confident in teaching adaptation strategies regarding climate change.
27. I am confident in teaching mitigation strategies regarding climate change.
28. I am confident teaching about locally relevant climate change topics.

Post-survey

(continued...)

29. I am confident teaching about globally relevant climate change topics.
30. I am confident teaching about the misconceptions of climate change.
31. I am confident teaching about environmental justice as it relates to climate change. I am confident teaching about social justice as it relates to climate change. I am confident teaching about climate justice.
32. I am confident in aligning climate change content to a state learning standard.
33. I am confident in developing lesson plans related to climate change.
34. On a scale from 1 to 10, how confident are you in teaching your students about climate change?
35. Please explain your response above.

Time Spent Teaching Climate Change

36. After completing the workshop, how often do you anticipate that you will be able to discuss climate change with your students? This can include brief or in-depth climate change connections.
 - a. Daily
 - b. 2-3 times a week
 - c. Once a week
 - d. 2-3 times a month
 - e. Once a month
 - f. 2-3 times a year
 - g. Once a year
 - h. Never
37. After completing the workshop, how many lessons do you plan to devote to teaching about climate change?
 - a. Yes
 - b. No
38. After going through the workshop, do you feel that you will be able to incorporate climate change into your curriculum more often?
39. Please explain your response above.

Appendix B: Figures

Figure 2

The data for climate change is ambiguous as to whether it actually occurs.

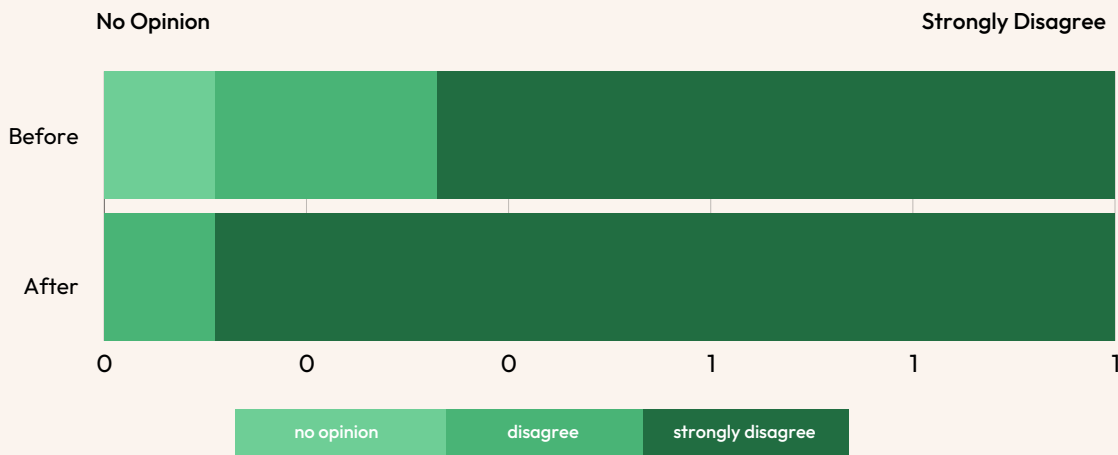


Figure 3

I am confident teaching about locally relevant climate change topics.

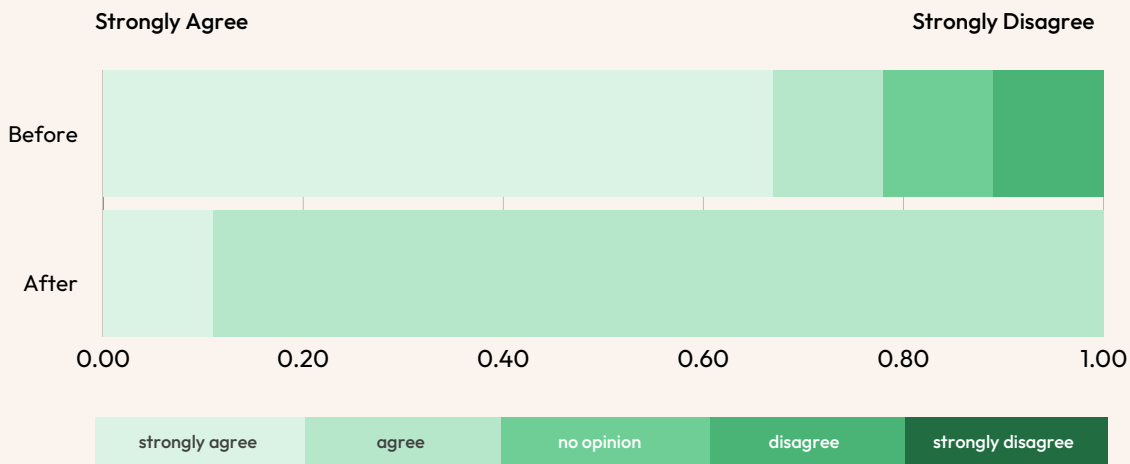


Figure 4

Number of Planned Climate Change Lessons

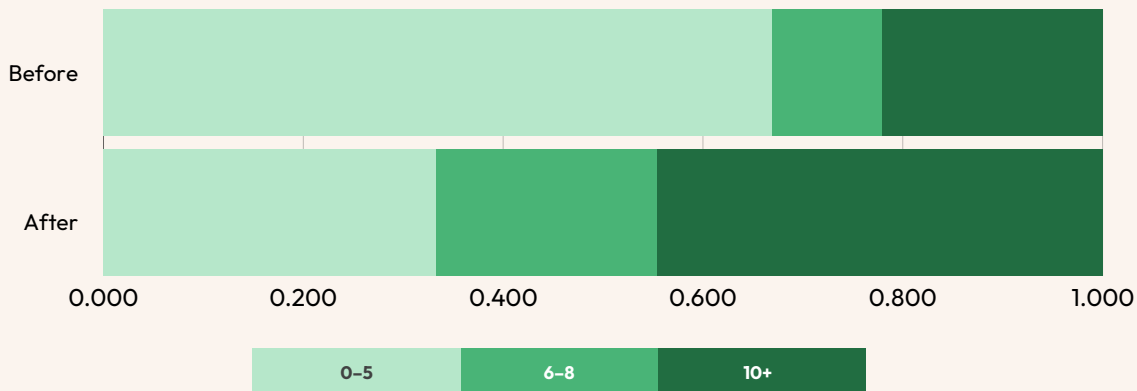


Figure 5

Frequency of Climate Change Integration

