CREATING, IMPLEMENTING, AND ASSESSING EQUITABLE ENVIRONMENTAL EDUCATION AMONG STUDENTS WHO IDENTIFY AS BLACK, INDIGENOUS, PEOPLE OF COLOR (BIPOC)

by

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This thesis investigates interventions to increase environmental literacy among Black, Indigenous, and People of Color (BIPOC) students and examines the systemic racism that has been embedded throughout the field of natural resources and environmental education (EE). I took a case study approach to research environmental literacy among northern New York and Vermont high school students who qualify as coming from “modest income households” and whose parents did not obtain a four-year degree. I conducted qualitative analysis on student observations and pre- and post-survey data to understand student’s levels of environmental stewardship, connectedness to nature, and environmental career aspirations. The results are organized into four chapters: an introduction chapter, two manuscripts intended for stand-alone publication (Chapters 2-3), and a conclusion chapter. Chapter 2 reports on the current state of the field of natural resources and the development of an equitable survey tool which indicated that students across similar socio-economic backgrounds have similar levels of environmental interest yet career paths shift in BIPOC youth. Chapter 3 discusses strategies for increasing stewardship, connectedness to nature, and environmental career aspirations among students. Finally, Chapter 4 synthesizes the findings from Chapters 2-3. These results provide useful information about the current state of environmental education and provides recommendations on how environmental education can be more inclusive.
Dedication

For Shane, who has accompanied me throughout every journey. Thank you for supporting me in pursuing my aspirations and consistently inspiring me in life. And for Theodore, who went above and beyond any expectations of what a father should be. I love you both.
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# Table of Contents

Chapter 1 .......................................................................................................................... 1
Introduction ..................................................................................................................... 1
References ....................................................................................................................... 4
Chapter 2 .......................................................................................................................... 5
Literature Review ............................................................................................................. 6
Methods .......................................................................................................................... 12
Case Description .......................................................................................................... 18
Results ........................................................................................................................... 21
Discussion ...................................................................................................................... 21
Conclusion ..................................................................................................................... 23
References ..................................................................................................................... 25
Chapter 3 ........................................................................................................................ 31
Introduction ................................................................................................................... 32
Background ................................................................................................................... 33
Methods ......................................................................................................................... 36
Results ........................................................................................................................... 44
Discussion ...................................................................................................................... 45
Conclusion ..................................................................................................................... 48
References ..................................................................................................................... 49
Chapter 4 ........................................................................................................................ 55
References ..................................................................................................................... 58
Appendix A ..................................................................................................................... 60
Appendix B ..................................................................................................................... 61
Appendix C ..................................................................................................................... 65
Appendix D ..................................................................................................................... 67
List of Tables

Table 1: County Demographics ................................................................. 12
Table 2: Classes and Number of Students Reached for SUNY Plattsburgh UB 2022 … 15
Table 3: Measurement Tool Constructs and Questions .................................. 17
Table 4: Self-Reported Student Ethnicity for the University of Vermont (UVM) Upward Bound (UB) Students ................................................................. 18
Table 5: Self-Reported Student Ethnicity for SUNY Plattsburgh (PSU) Upward Bound (UB) Students ................................................................. 19
Table 6: Upward Bound’s Definitions of “low-income” for the United States ........ 19
Table 7: Data Analysis Labels ................................................................. 20
Table 8: Racial Regression Analysis and Significance ..................................... 21
Table 9: Data for Diversity in Environmental Careers and Natural Resource Departments ........................................................................................................ 33
Table 10: County demographics ............................................................... 36
Table 11: Upward Bound’s Definitions of “Low-income” for the United States ..... 36
Table 12: Classes and Number of Students Reached for SUNY Plattsburgh UB 2022 .. 37
Table 13: Measurement Tool Constructs and Questions ................................. 39
Table 15: Facial Expression Analysis Codes ................................................. 44
Table 16: Paired Sample Correlations for Pre- and Post-Survey Responses for the Summer of 2022 .............................................................................. 45
Table 17: Results and Corresponding Chapters ............................................. 56
Table 18: Total Race Demographics for the Summer of 2022 .......................... 62
Table 19: Total Grade Demographics for the Summer of 2022 ......................... 62
Table 20: Total Gender Demographics for the Summer of 2022 ....................... 62
Table 14: Codes for informal student interviews ............................................. 62
List of Figures

Figure 1: Thesis Chapter Themes ......................................................... 3
Figure 2: Case Study Map ...............................................................12
Figure 3: Racial Demographics of Students reached during the Summer of 2022 ........13
Figure 4: Student Self-reported Grade Levels for the Summer of 2022 ...............14
Figure 5: Student Self-reported Gender for the Summer of 2022 ......................14
Figure 6: Differences between Environmental Literacy (EL) and Environmental
Knowledge (EK) .................................................................................. 34
Figure 7: Case Study Map .................................................................... 35
Figure 8: Coded Field Notes Data .......................................................... 48
Attribution

The work represented in this thesis was primarily carried out by me. However, Chapters 2 – 3 are journal article manuscripts, which I wrote with co-authors. The co-authors contributed to the manuscripts by clarifying ideas, suggesting alternative framing, improving the writing, and reorganizing arguments and key concepts. The co-authors are listed in the order that they will appear in journal articles and the order of authorship represents the level of contribution made by each author. Both manuscripts will be submitted for publication in the near future.
Chapter 1

Introduction

The United States has a history of centuries of oppression and systemic racism, and the modern environmental movement emerged from within this context. For years, activists and scholars have attempted to break down systems of oppression with varied success. A number of scholars have called attention to the fact that occupations related to Science, Technology, Engineering, and Mathematics (STEM) remain dominated by white individuals. Subsequently, there is a growing body of research focused on increasing participation by Black, Indigenous, and People of Color (BIPOC) in STEM. There is a great need to create equitable STEM education in order to increase diversity in STEM-related fields and majors. Despite growing attention to inequities in STEM, individuals who identify as BIPOC remain unequally represented across STEM fields.

These patterns exist within the specific STEM disciplines that study natural resources such as ecology, forestry, wildlife biology, watershed science, and others, as natural science degree programs in the U.S. tend to serve higher proportions of ethnic Europeans than BIPOC students, hindering their participation (Sharik, 2015; Sharik et al., 2015; Taylor, 2015). Enrollment data of natural resource departments at 61 institutions across the U.S., for instance, reveals that only 12% of enrolled students identify as BIPOC (Sharik et al., 2015); in contrast, roughly 42% of students enrolled in postsecondary programs in the U.S. identify as BIPOC. These numbers are mirrored in the environmental workforce; a 2014 study of 166 environmental nonprofits in the US revealed that only 12% of staff identified as BIPOC (Taylor 2015).

These trends are problematic for moral reasons, and because there is an increasing need to create an environmentally literate society that is prepared to address demanding and emerging environmental issues worldwide, such as climate change, deforestation, desertification, and many other natural resource crises (Stevenson et al. 2013).

The term “environmental literacy” (EL) is defined in environmental education (EE) literature as having four major components: knowledge, affective attitudes (i.e. feelings about nature), cognitive skills, and behavior (Hollweg et al. 2011). While students do learn about the environment, they are often only increasing their basic understanding of environmental knowledge (Chamberlin 2020). While environmental knowledge is important, it is only a small component of environmental literacy. At its core, environmental knowledge is the recognition of environmental issues (Chamberlin 2020). Environmental literacy drives the importance of individuals understanding their impact on the environment. Environmental education and environmental literacy play vital roles in developing what individuals know, how they feel, what actions they take, what environmental priorities they have, and what skills they acquire (Leonard 2020).

Environmental literacy relies on levels of environmental education, meaning the more equipped an individual is with EE, the more likely they are to effectively deal with environmental issues, questions, and actions (Leonard 2020).

While there is an increase in programs targeting EL improvement, these programs have largely served white individuals, excluding BIPOC populations (Warren et al. 2014). As natural disasters such as floods, fires, hurricanes, and drought become more common and severe, environmental educators need to serve as stewards for developing a
civilization that not only understands why these changes are occurring but to adapt to the new and ever-changing climate. By having these gaps in environmental education, BIPOC communities are not being equipped with the knowledge required to participate in environmental planning, management, and decision-making processes. This is known as procedural injustice and is a component of environmental injustice and white supremacy culture.

To begin to address this injustice, this project expanded work that begun through a partnership between the Center for Earth and Environmental Science (CEES) at SUNY Plattsburgh, The Rubenstein School of Environment and Natural Resources (RSENR) at the University of Vermont (UVM), UVM Extension, Upward Bound at both SUNY Plattsburgh and UVM, and the Lake Champlain Sea Grant Watershed Alliance Program. To evaluate student’s levels of environmental literacy, we partnered with Upward Bound at Plattsburgh State University and the University of Vermont to measure student’s stewardship, connectedness to nature, and environmental career aspirations before and after participating in educational implementations related to watershed science. This thesis employs Kara et. al.’s (2022) equitable survey tool (discussed in the following chapters) to measure student’s levels of environmental stewardship, connectedness to nature, and environmental career aspirations. This study also investigates how to implement equitable educational interventions related to natural resources and more specifically watershed science in order to successfully increase students’ environmental literacy.

I employed three data collection methods for this research: a pre-survey, a post-survey, and student observations. This project used the Embedded Experimental Model (Creswell et al. 2013) to collect quantitative and qualitative data regarding environmental literacy before and after educational interventions. Upward Bound employees administered both the pre- and post-surveys, following IRB protocols. To develop an equitable and inclusive research project, I followed the Critical Race Theory theoretical framework and validated survey questions through an extensive literature review. During this research, I sought to answer the following questions:

1. What types of educational interventions are effective at creating equitable environmental literacy among BIPOC students?
2. Does student participation in educational interventions related to watershed science increase stewardship, connectedness to nature, and environmental career aspirations?

The findings are organized into two manuscripts, each intended for stand-alone publication. Chapter 2 discusses the creation of an equitable survey tool and how students in the same socio-economic group have similar levels of interest in natural resources but career path interest shifts in BIPOC youth. Chapter 3 discusses strategies for increasing stewardship, connectedness to nature, and environmental career aspirations among Upward Bound students. The final chapter, Chapter 4, synthesizes the findings from the two manuscripts into an overarching proposal of how environmental education can be more equitable and inclusive. Chapter 2 and Chapter 3’s data came from the same research project, resulting in some overlap between the chapters particularly in the methods sections. Ultimately, this research helps illuminate the need for diversity within natural resource education and careers. Specifically, it reports on strategies to increase
BIPOC students’ environmental literacy in an equitable and inclusive manner while simultaneously highlighting the systemic racism that is embedded within the United State’s education system and natural resource fields.

This thesis was written with a focus on diversity, equity, and inclusion. We recognize the importance of inclusive, non-harmful language, recognizing that language is continuously evolving. The language utilized throughout this thesis reflects current preferred language as of 2022.

Figure 1. Thesis Chapter Themes
References


Chapter 2

More the Same Than Different: The Interest in Natural Resources is there but Career Paths Shift in BIPOC Youth

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ABSTRACT

Traditional views of Black, Indigenous, People of Color (BIPOC) individuals related to the environment often portray them as being hindered and inundated by historical discrimination and marginalization. This leads to the beliefs that BIPOC individuals spend limited time outdoors, are disinterested in the environment, lack knowledge about the environment, and do not have the appropriate academic backgrounds to work in environmental organizations. At the root of these beliefs is the fact that individuals of color are less exposed to environmental education and that previous research has been conducted through a Eurocentric lens, leading to the creation of biased tools. When biased tools are used, biased results will be produced. In order to generate equitable results, a new tool was developed through the lens of Critical Race Theory (CRT). This tool was implemented during the summer of 2022 in the Upward Bound Programs at the State University of New York at Plattsburgh (SUNY) and the University of Vermont. The tool measured changes in attitude related to environmental stewardship, connectedness to nature, and environmental career aspirations. The tool was implemented before and after three educational interventions. Analysis indicated that there were no significant differences in environmental stewardship, connectedness to nature, and environmental career aspirations across racial demographics. This paper examines the incorrect notions that people of color are less interested in the environment and what support systems need to be in place for individuals of color to pursue environmental careers.
Introduction

Solving many of society’s pressing problems will require ideas, perspectives, and experiences of individuals from diverse backgrounds (Coleman and Gould 2019). In particular, there is an urgent need to develop environmentally literate citizens prepared to address pressing and emergent environmental issues worldwide, such as climate change, deforestation, desertification, and many other natural resource crises (Stevenson et al. 2013). However, there exists a pervasive perception of “environmentalists” as white, upper-middle class, politically liberal, and college-educated (Mock 2014, Coleman and Gould 2019), and the environmental workforce is predominately white (Taylor 2015). Further, environmental initiatives, such as sustainable development, often reinforces inequalities (Coleman and Gould 2019, Krings and Schusler 2020). This lack of equity in the environmental movement is unethical and limits opportunities to leverage diverse perspectives and experiences (Coleman and Gould 2019). Thus, there is a need to create an environmentally literate citizenry that includes, rather than excludes, Black, Indigenous, and People of Color (BIPOC).

One of the major ways that scholars and practitioners alike have attempted to address the need for an environmentally literate citizenry is through environmental education (EE), the goal of which is to foster environmental literacy by helping people develop the attitudes, values, knowledge, dispositions, and skills needed to address pressing environmental issues (Ardoin and Bowers 2020). The term “environmental literacy” (henceforth EL) is defined in environmental education literature as having four major components: knowledge, affective attitudes (i.e. feelings about nature), cognitive skills, and behavior (Hollweg et. al 2011). Programs designed to cultivate environmental literacy are pervasive and are offered through museums and aquaria, at national and state parks, at summer camps, in formal school settings, and through a variety of non-profit, governmental, academic, and private organizations (Anderson 2021).

Within these structures lies Environmental Education (EE) where diversity is incredibly low. A 2014 study of 166 environmental nonprofits in the US revealed that only 12% of staff identified as BIPOC (Taylor 2015). One explanation for the lack of racial equity in EE is that the field continues to emerge and align with the values of white male middle-class culture (McLean 2013).

Literature Review

White Supremacy Culture

White Supremacy Culture is defined as “the ideology that white people and the ideas, thoughts, beliefs, and actions of white people are superior to People of Color and their ideas, thoughts, beliefs, and actions” (Okun 2021). Specific areas such as the media, education system, western science, and the Christian Church have all played fundamental roles in further spreading and integrating the idea of white supremacy. These institutions have furthered the narrative that white is "normal," "better," "smarter," and "holy" in contrast to Black, Indigenous, and other People and Communities of Color (Okun 2021). Within the United States, scholars highlight the fact that racism is embedded within the nation. White Supremacy Culture has shaped historical, social, cultural, and political contexts as a means to further group individuals together based on the idea of racial superiority or inferiority (Spring 2016). Consequently, the conceptualization of race through White Supremacy Culture has diminished BIPOC individuals’ lived experiences.
(Spring, 2016) and contributed to the oppression of BIPOC communities throughout history (Tatum 2007). By examining the structures of race and racism, the varying ways in which structural systems shape racialized identities and intersectionality come to light (Crenshaw 1991). Through the lens of intersectionality, we can see that multiple forms of discrimination such as racism, sexism, and classism are all integrated within the systems we participate in. Political systems and representations of communities or the lack of representation, directly impact lived experiences of BIPOC individuals in compounding and mounting forms (Crenshaw 1991). There is an intensifying need to recognize and address the history, culture, politics, and power in environmental education (Cole 2007), in terms of educational content and practices in a professional setting (Johnson 2019).

In the United States, societal structures of oppression form and underpin virtually every occupation and industry, including environmental education (Romero et. al. 2022). Despite the growing attention and efforts to diversify the environmental education workforce in the US, environmental fields have had minimal success attracting and retaining professionals who identify as BIPOC. In 2014, studies indicated that 94% of residential outdoor science program leaders identify as white (Snow and Romero 2014). These trends are also mirrored in environmental organizations. In 2021, The Wilderness Society reported 84% of senior staff and 74% of overall staff identify as white (The Wilderness Society 2021). Recently, a study of 67 environmental NGOs reported that 73.1% of head positions were held by individuals who identified as white (Green 2.0 2021). This study also revealed that the majority of full-time staff are white. The report indicated that both Black and Hispanic/Latinx/Chicana staff are the most represented yet still fall below national demographic baselines (Green 2.0 2021). Individuals who teach and participate in EE and environmental organizations are disproportionately white despite BIPOC communities being disproportionately affected by environmental degradation and harm (Taylor 2014). While this is a dynamic that has operated in all other potential racism delivering contexts in the United States, EE and environmental organizations are just two of those contexts and in no way unusual.

Environmentalism and Environmental Education
The environmental movement in the United States arose from the desires of wealthy white men to preserve natural areas for their own hunting, recreation, and entertainment (Mock 2017). Preservation came at a cost and was often at the expense of Indigenous and Black individuals who were forcibly removed from the land for any reason, but in this case, it was to establish the National Parks (Tuck et al. 2014). The preservation of the National Parks and fields of Natural Resources are rooted in the beliefs and structures that amplify systematic racism. Previous literature has suggested Black, Indigenous, People of Color (BIPOC) individuals are less connected to nature. Some early claims reported Black high school students preferred urban landscapes while White students were more attracted to pastoral settings (Peterson 1977). Another study claimed that Black youth preferred urban scenes while environmental educators preferred areas with little to no disturbance (Medina 1983). These narratives were later amplified by researchers such as Kellert (1984) and Schroder (1989) who argued that Black individuals and urban dwellers were less likely to be attracted to nature and were less knowledgeable about environmental issues than White rural residents or White
suburbanites. Johnson (1998) argued that Black folks and urban dwellers have an aversion to wildlands, stating that the alienation is a result of slavery, lynching, and other acts of violence against ethnic Africans in forests. While all of these studies were validated, they were validated exclusively through the use of a historically Eurocentric white male lens. By using this Eurocentric lens, research becomes biased. It is worth noting that all research in this field is not biased, but this bias is systematic within environmental education.

Pieces of connectedness to nature and the landscape preference literature portray the relationships between People of Color and nature as negative and ill-disposed (Taylor 2019). False narratives that suggest that BIPOC individuals are less likely to engage with nature and might not necessarily have the financial ability to engage with the environment are still being produced as of recently (Cronin et al. 2021, Xiao et al. 2018, O’Brien et al. 2020). It is important to state the fact that BIPOC individuals as a whole are not a single population whose views are consistent across all ethnic groups. Each ethnic group holds different cultural values that influence their interactions with the environment (Morales et. al. 2022). Noticeably, when researchers use a Biophobia1 lens they are oversimplifying the relationships that People of Color have with nature and their perceptions of wildlife. The way pro-environmentalism is conceptualized and measured reinforces White environmental perspectives and priorities which de-emphasize behaviors that would reduce hazards, which is a large concern to environmentalists of color (Compton 2021).

When thinking about relationships with nature it is critical to remember the history of the United States which encompasses slavery, lynchings, and segregation. Jim Crow laws that barred People of Color from entering certain areas of National Parks, local parks, and natural areas are not that far into the past yet, BIPOC connectedness to the natural environment is often ignored. The BIPOC community has always had a long history of intimate knowledge and deep appreciation for forests. Enslaved individuals would use forests as places of healing, spiritual uplift, sustenance, and as a space to oppose violence and oppression (Talyor 2018). Natural areas such as forests are central to Black Americans’ environmental heritage and forests are often referred to as “embedded in the souls of black folks” (Finney 2014). Some of the first park rangers in America’s National Parks, the Buffalo Soldiers, were ethnic Africans. Literature in environmental history highlights the roles of history, culture, and socio-ecological dynamics in the development of Black relationships with the environment. Analyses conducted indicate that Black individuals possess a rich outdoor heritage, contradicting many popular beliefs (Finney 2014). In the nineteenth and twentieth centuries, the white middle class traveled to remote locations, explored the wilderness, and participated in outdoor recreation. When the Black middle class tried to pursue these same interests, they were met with closed doors (Taylor 2018). In response, Black folks created their own leisure spots in areas such as Hot Springs, Arkansas and wilderness retreats such as Indlewind, Michigan (Taylor 2018). Black folks often created their own outdoor clubs and engaged in equity and anti-discrimination battles to get into many of the nation's parks and wild spaces. These battles continued into the 1960s and 1970s where Black individuals pushed to desegregate national parks and campgrounds. These actions and crusades embody the idea of what it means to be connected to nature. Recently, a study of household recreation
across the United States indicated that Black folks and Whites participate in urban outdoor activities such as picnicking, tennis, horseback riding, and swimming at similar rates (Finney 2014). When looking at connectedness to nature and environmental ties, it is harmful and irresponsible to simply state that People of Color are not interested. Since the Civil Rights Era, Black Environmentalists have been shining a light on and trying to prioritize issues such as environmental hazards. However, these issues have not been included in mainstream discussions of what it means to be pro-environmental because they do not fit into White Environmentalists' agendas of conservation and preservation (Compton 2021). In 2010, Stern and colleagues found that urban adolescents that were predominantly Black displayed a higher degree of environmental responsibility than their primarily White rural counterparts in Maryland (Stern et al. 2021). It is not that communities of color do not care about the environment, they have been systematically excluded from natural resources, environmental education, and are met with constant barriers that their ethnic European peers do not face. It is for this reason and numerous others that environmental education exposure is increasingly important.

**Importance of Critical Race Theory In Environmental Education**

Critical Race Theory (CRT) and black cultural studies offer pivotal insights into the understanding the ethnic African environmental consciousness as well as the historic contingencies that have shaped the experiences/processes (Finney 2014). It is important to note how Critical Race Theory (CRT) ties into education. Critical Race Theory started to emerge in the 1970s through writings by Derrick Bell, a Black civil rights lawyer and the first Black individual to teach at Harvard Law (Delgado and Stefanic 1998). Bell specifically looked at interest convergence as a means of understanding Western racial history and the conflicts of interest that were woven into civil rights litigation. Bell’s ideas were furthered by Richard Delgado, who showed that eminent white male scholars rarely if ever cited the work of scholars of color even when writing helpful and sympathetic articles about civil rights. By the late 1980s, a number of critical scholars including Kimberle Crenshaw had emerged and began developing numerous critical themes, creating the foundation for Critical Race Theory (Delgado and Stefanic 1998).

Critical Race Theory is the most appropriate framework for examining and critiquing all issues regarding race. We follow in the lead of other Environmental Justice scholars who have used CRT in similar ways. Scholars have been intergrading Critical Race Theory into EE through deliberate language planning, creating inclusive learning environments, and understanding Educators of Color’s experiences when teaching EE (Arreguin-Anderson and Kennedy 2013, Miller 2018, Romero et. al. 2022). Within education and social science research, scientists found that systems, structures, epistemologies, and methodological approaches reflect White, Eurocentric narratives and values. This privileges dominant ideologies, allowing for the continued marginalization, oppression, and exclusion of People of Color (Delgado and Stefancic 2017). By integrating CRT into EE, CRT provides a framework that engages in the deconstruction of oppressive structures and engages in the reconstruction of the human legacy, and the construction of equitable and socially just relations of power (Ladson-Billings 1998).

The continued disproportionate overrepresentation of ethnic Europeans within environmental education organizations further highlights the need for critical conversations about racial and cultural diversity among responsible parties in setting the
appropriate agenda for outdoor and environmental education (Romero et. al. 2022). Through using CRT, we aim to elevate the voices and experiences of BIPOC individuals, creating an opportunity for people of color’s narratives to come to light (Delgado and Stefancic 2017). These narratives would actively challenge and disrupt the White Supremacy narrative that has been pushed for too long. It can be said that some environmental organizations have made some kind of effort to prioritize diversity, equity, and inclusion (DEI) but the majority of the organizations have been and continue to be white-led, failing to center racial justice (Romero et. al. 2022). Part of this issue can be traced back to the framing. The United States has always been portrayed and painted itself as a generally benevolent nation that consists of a few disgusting and horrid moments of racial ugliness throughout its history instead of looking at the nation as one that did not begin with benevolence as it’s calling card to ethnic Africans. This nation has made racial discrimination, racial abuse, racial superiority, and ultimately racial stratification from ethnic Africans through the implementation of legalized segregation. The question should never be ‘whether’ racism touched society, it should be to what degree has it warped our society and how deeply is it intertwined with our ‘normal’ everyday lives and activities. Racism has actively discouraged qualified BIPOC individuals from applying to jobs related to environmental education or environmental organizations due to the lack of DEI, cultural relevance among organizers, lack of mentors, and colleagues of color within the environmental and natural resource fields (Romero et. al. 2022). For the most part, current educational systems do not incorporate CRT. Without implementing and truly understanding CRT, white educators continue to push a narrative that excludes people of color. By not implementing CRT throughout environmental education, white educators exclude students of color from meaningful participation in environmental education and the environmental workforce. This exclusion further maintains the structures of a predominantly white natural resource field and white environmental education workforce. Therefore, students of color often experience more success in learning when their educators share similar backgrounds and experiences that match their own (Romero et. al. 2022). This is because Environmental Educators of Color who share a similar socio-cultural lens as their BIPOC students can connect and deliver culturally relevant instruction to their students. Environmental Educators of Color can also serve as role models, highlighting the fact that there are opportunities for BIPOC students to have careers in environmental education as well as environmental organizations (Romero et. al. 2022). Having a racially diverse workforce, at every level of an organization, is crucial for creating culturally relevant programming that reflects interests, values, and priorities of communities of color (Johnson 2019).

**Defining Critical Race Theory**

CRT holds four key tenets that have been summarized by Lantz (Lantz 2021):

1. Race is a social construct: The way that race is defined and experienced is the result of social and political thoughts and actions that change over the course of time, yet the possessors of the ‘power’ to “define” the idea of what race is, has not. “Race” is seen as a way to classify or organize humans, is defined, measured, and experienced in different ways across society over time. Race is not a biological imperative that drives disease or longevity, but a human-
constructed marker for how individuals within populations experience physical and social exposures, risks, and facilitators.

2. Racism and its outcomes are reproduced throughout society: Although individuals themselves can be racist, racism and its outcomes are maintained in society through social processes above and beyond one individual's actions. Cultural norms, institutional rules, laws, and regulations all sustain racism. There is institutional and structural racism, personally mediated racism, and internalized racism. CRT emphasizes how institutions, policies, and systems can be designed in ways that reinforce, codify, and perpetuate exposures, risks, and opportunities that vary across socioeconomic and racial groups.

3. Racism is common rather than rare: The different treatment of individuals based on racial classifications is embedded within social systems and institutions. This is seen within public policy and laws. Racism is omnipresent in society, CRT labels this as “normal”. This is not saying that CRT suggests that it is “normal” or even appropriate for white individuals to be racist, rather that differential access to resources, opportunities, benefits, and burdens mediated by one’s perceived “race” is embedded within many aspects of our institutions. Understanding that structural racism is embedded within all of our systems and policies including those related to education, income, housing, food, criminal justice, the environment, and healthcare, is critical when addressing population health inequalities.

4. Listening and understanding lived experiences: Racism is perpetuated at the structural and macro-level in society, and we must therefore listen to and understand the lived experiences of individuals in that society. This is essential for understanding how racism works to create inequities in individual outcomes (including mental and physical health). CRT asserts the fact that there is a need to better represent individuals of color in research, the media, and policy advocacy in order to reform how racism at all levels is experienced by people and in what ways racism is experienced.

CRT highlights the fact that racism is not in the past. Educational institutions should reflect diverse perspectives but at this point in time, they are not. Critical Race Theory acknowledges the provisions of slavery, segregation, and the imposed second-class citizenship on Black Americans and other individuals of color to pervade the social construct of the United States (George 2021). Students should gain knowledge of the past in order for modern society to lead forward-thinking lives while learning from previous generations' mistakes (The Opportunity Agenda 2021). CRT is an umbrella term for any type of pedagogy or training that tries to illuminate institutional or systemic discrimination, implicit bias, colonialism, and other terms related to racial inequality (Lantz 2021). Critical Race Theory recognizes the contrasting treatment of individuals based on race is embedded within social systems and institutions, including education (Lantz 2021). The foundation of CRT acknowledges that race is a socially constructed phenomenon rather than a biological fact and that racism is a nucleus that permeates the American legal and social structures rather than an aberration (The Opportunity Agenda 2021).
Overall, CRT provides a framework for understanding and unpacking the fact that racial differences such as social outcomes, morbidity, mortality, and other health indicators do in fact exist and persist in the United States. CRT is fundamental to a scientific understanding of racial inequality in every aspect of social, economic, health, and environmental outcomes (Lantz 2021). Thus, Critical Race Theory provides the best theoretical framework for this research. We employ CRT to explore the question, “Is there a relationship between race and stewardship, connectedness, and environmental career aspirations?”.

Methods

This research follows a mixed methods approach and uses Parallel Mixed Methods Design (Hesse-Biber 2011). Researchers conducted a literature review in the beginning of the study to gain a better understanding of how to integrate CRT into EE. Information gained from this literature review was used to develop an equitable survey tool. The questions in this study were shaped by recent literature that suggests having an emotional connection to nature can be improved through environmental exposure and education (Chamberlin 2020). This survey tool was piloted during the summer of 2021 with SUNY Plattsburgh Upward Bound Students. Modifications to the survey were made in the fall of 2021.

Site Selection

This study worked with Upward Bound (UB) students from SUNY Plattsburgh and the University of Vermont’s summer programs. The students in the SUNY Plattsburgh UB program are from Clinton, Essex, and Franklin counties in northern New York. SUNY Plattsburgh’s Upward Bound program serves 15 districts in the North Country of New York. The students in the University of Vermont’s UB program are from Chittenden County in Northern Vermont. The University of Vermont’s Upward Bound program solely serves the Winooski School District. The Winooski School District has a high refugee population. Students who participated in this study were in grades 9-12th. All surveyed students were currently enrolled in high school.
Figure 1. Map of New York and Vermont showing which counties the students from SUNY Plattsburgh and UVM’s UB students are from.

Table 1. County demographics reported as a percentage for Clinton, NY, Essex, NY, Franklin, NY, and Chittenden, VT reported by the US Census 2020. *We recognize that these labels do not reflect preferred language but reflect how the US Census reported the data.

<table>
<thead>
<tr>
<th>County</th>
<th>White</th>
<th>Black</th>
<th>Native</th>
<th>Asian</th>
<th>Hispanic</th>
<th>Islander</th>
<th>Other</th>
<th>Two+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinton County, NY</td>
<td>90%</td>
<td>4%</td>
<td>0%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Essex County, NY</td>
<td>92%</td>
<td>3%</td>
<td>0%</td>
<td>0%</td>
<td>3%</td>
<td>0%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Franklin County, NY</td>
<td>81%</td>
<td>6%</td>
<td>6%</td>
<td>1%</td>
<td>4%</td>
<td>0%</td>
<td>0%</td>
<td>2%</td>
</tr>
<tr>
<td>Chittenden County, VT</td>
<td>88%</td>
<td>3%</td>
<td>0%</td>
<td>4%</td>
<td>2%</td>
<td>0%</td>
<td>0%</td>
<td>3%</td>
</tr>
</tbody>
</table>

**Student Demographics**

About seventy-four percent of the students reached identified as White or Caucasian (97 students). Roughly six percent of the students identified as Black or African American (8 students). About five percent of students identified as Multiracial (7 students). Roughly nine percent of students identified as Asian or Pacific Islander (12 students). Almost four percent of students identified as LatinX (5 students). Less than one percent of students identified as Native American or Alaska Native (1 student). Less than one percent of students identified as Middle Eastern (1 student).

![Summer 2022 Upward Bound Pre-Survey Demographics](image)

Figure 2. Racial Demographics of Students reached during the Summer of 2022.

**Grade Levels**

Students self-reported grade levels in both the Summer 2022 pre- and post-survey. The majority of the students reported that they are in 11th and 12th grade. There were less
students who reported they were in 9\textsuperscript{th} and 10\textsuperscript{th} grade. This corresponds to Upward Bound student reports where the majority of students who participate in the program are in 11\textsuperscript{th} and 12\textsuperscript{th} grade.

![Summer 2022 Upward Bound Grade Data](image)

Figure 3. All students self-reported grade levels for the Summer of 2022.

**Gender**

The majority of survey respondents identified as Female. The second highest reported category was Male. In this survey, students self-reported genders including non-binary, unlabeled/unsure, and questioning.

![Summer 2022 Upward Bound Gender Data](image)

Figure 4. All students self-reported genders for the Summer of 2022.

**Upward Bound**
In the United States, the Upward Bound program is funded by the US Department of Education. The Upward Bound program provides support to high school students in their preparation for college. Upward Bound serves high school students who are from modest-income households and or students whose parents do not have a bachelor's degree. Upward Bound’s goal is to increase the rate at which students who participate in the program complete secondary education and graduate from college. Upward Bound projects provide students with academic instruction in mathematics, laboratory sciences, composition, literature, and foreign languages (US Department 2021). Upward Bound also provides tutoring, counseling, mentoring, cultural enrichment, work-study programs, education, and counseling services that are designed to improve the financial and economic literacy of students. The programs and activities Upward Bound provides are specifically designed for students who are limited English proficient, students who have historically been excluded from postsecondary education, students who also have disabilities, students who are experiencing homelessness, students who are in foster care, and students who might be viewed as needing additional resources (US Department 2021).

**Educational Interventions**

During the Summer of 2022 three sets of educational interventions were carried out. The first intervention implemented was working with Upward Bound teachers to integrate a lesson about watershed science into their summer curriculum. The SUNY Plattsburgh Upward Bound students collected and identified macroinvertebrates in the Saranac River behind the SUNY Plattsburgh campus. Students participated in kick netting and using dichotomous keys to identify which invertebrates were found. Students then used macroinvertebrate data to assess the water quality of the Saranac River. Overall, nine classes were reached, 93 students, ranging from chemistry to collaborative mural painting. The types of classes and the number of students is shown in Table 1. The students enrolled in the art classes added an additional element to the watershed science lesson. The art students not only participated in a hands-on watershed science activity but their findings were also incorporated into numerous forms of artwork. This activity allowed students to integrate their hands-on watershed science experiments into various forms of art, intertwining two different fields.

Table 2. Classes and Number of Students Reached for SUNY Plattsburgh UB 2022

<table>
<thead>
<tr>
<th>Class</th>
<th>Number of Students Reached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Environment</td>
<td>13</td>
</tr>
<tr>
<td>Chemistry</td>
<td>20</td>
</tr>
<tr>
<td>Chemistry</td>
<td>10</td>
</tr>
<tr>
<td>Intro to Printmaking</td>
<td>6</td>
</tr>
<tr>
<td>Ceramics</td>
<td>9</td>
</tr>
<tr>
<td>Collaborative Mural Painting</td>
<td>10</td>
</tr>
<tr>
<td>Intro to Printmaking</td>
<td>6</td>
</tr>
<tr>
<td>Ceramics</td>
<td>9</td>
</tr>
</tbody>
</table>
The second educational intervention implemented was a green stormwater infrastructure lesson at both SUNY Plattsburgh and the University of Vermont. During this lesson, students learned what green stormwater infrastructure was definitionally, and its importance to a healthy environment. The students on both sides of the lake also painted and implemented a rain barrel in the Lake Champlain Basin. The lessons also directly tied into issues of misinformation that the public has heard about Lake Champlain. The lessons included information about nutrient runoff and how the implementation of green water infrastructure can directly affect excess nutrients from entering the Lake Champlain Basin. The rain barrel activities were integrated into Upward Bound’s afternoon activity programming and the activity was open to any interested students at both UVM and SUNY Plattsburgh. Fourteen students from SUNY Plattsburgh and twelve students from UVM participated in these activities.

The third educational intervention implemented was an interactive scientist panel. One panel was held at SUNY Plattsburgh and another panel was held at the University of Vermont. The two panels of researchers were implemented in an effort to increase interest in watershed science among first-generation college students in the Lake Champlain Basin. The goal of these panels was to expose students to a range of research topics in order to highlight several different career paths, demonstrate the diversity of water research jobs, and answer any questions students might have about pursuing natural science in college. Panelists representing a diverse range of backgrounds described their work, professional paths, and experiences in natural resource college classes, and offered career advice to Upward Bound students. The panels were integrated into Upward Bound’s afternoon activity programming at both SUNY Plattsburgh and the University of Vermont. The activity was open to any interested students at UVM and all students from SUNY Plattsburgh’s UB program attended. Six students participated in UVM’s panel and over 160 students participated in SUNY Plattsburgh’s panel discussion.

*Measuring Program Outcomes*

To measure the impact of these activities on students’ both pre- and post-surveys were implemented. First, the research team conducted an extensive review of environmental literacy survey tools which measured the traditionally cited components of environmental literacy: knowledge, affective attitudes (i.e. feelings about nature), cognitive skills, and behavior (Hollweg et. al 2011) and which had already been empirically validated (see Table 2 below). The survey is aimed at extending the state of knowledge in order to contribute to a robust analysis of strategies for increasing student environmental literacy. This survey tool draws on Critical Race Theory (CRT) as an analytical framework to measure a student’s relationship on environmental topics such as Environmental Stewardship, Connectedness with Nature, and Environmental Career Aspirations. This survey tool was created to track environmental education interventions and reflect on what changes need to be made in order for EE to be more inclusive. This tool was developed with the idea of equity and inclusion in mind. It is for this reason that we decided to omit survey questions that have an ecological knowledge base. Questions related to ecological knowledge base were not included in this survey in order to measure students’ feelings surrounding environmental topics. While ecological knowledge base is
important, these questions were omitted because we wanted to measure students’ relationship in relation to connectedness. A student may be incredibly interested in the environment but not had the exposure to environmental education. We also recognize that environmental education is not equally accessible. If we were to include a section on ecological knowledge base questions, we would be penalizing students for their lack of access to environmental education programming. By omitting questions related to ecological knowledge, we aimed at measuring student aspirations and attitudes towards the environment, without penalizing them for the lack of ecological knowledge they have. We also did not use a New Ecological Paradigm (NEP) scale approach. Recently, there has been a growing body of literature that recognizes the limitations of the NEP scale. It has been shown that NEP Scale items are influenced by context-related factors that are present in each survey, producing significant differences results (Pienaar et. al. 2013). By not using questions that reflect a New Ecological Paradigm scale approach, we were able to create a survey tool that did not give context dependent results and produced questions that did not penalize individuals for their lack of knowledge.

Our questions were structured based on interests related to individual environmental stewardship, connectedness with nature, and environmental career aspirations. These are our main constructs because they measure personal connection to the environment and see where students view themselves in the environmental science field. While both approaches share similar interests, the NEP is structured in a way that excludes individuals who might not have knowledge of ecology and economics. The NEP scale is also created through a lens that is not equitable to all demographics (Pienaar et. al. 2013). NEP statements include “The balance of nature is strong enough to cope with the impacts of a modern industrial nation”, “Humans have the right to modify the natural environment to suit their needs”, and “The Earth has plenty of natural resources if we just learn how to develop them” (Anderson 2012). The questions in the NEP are more ecological and economic focused, looking at how individuals view and rank anthropogenic needs compared to environmental health. The questions asked in this study were created through a Critical Race Theory lens, ensuring that the questions being asked were inclusive and did not discourage the individual from answering honestly. This survey tool was created to track environmental literacy improvement and interest in natural resource careers. The questions in this study were shaped by recent literature that suggests having an environmental connection to nature can be improved through environmental exposure and education (Chamberlin 2020). The pre-survey was piloted during the Upward Bound program in the summer of 2021. Modifications made to the survey include asking students to select what grade they are in and in the post-survey asking students to report if they had participated in any watershed science activities, having the students write what the activities were, and asking the students if they had attended a watershed scientist panel.

The pre-survey was administered before educational interventions were implemented, during the first week of the Upward Bound program. The SUNY Plattsburgh pre-survey was administered by SUNY Plattsburgh UB employees and the pre-survey for UVM was administered via emailed by a UVM UB employee. The post-survey was administered after students participated in activities related to watershed science. All of the post-surveys were administered via Upward Bound employees.

Table 3: Measurement Tool Constructs and Questions
Case Description

Determining the Racial Demographics of UB Programs

In the UVM Upward Bound program, students self-reported their ethnicity. The majority of the students in the UVM Upward Bound self-identify as Asian followed by Black. UVM’s Upward Bound racial demographics are much more diverse than the SUNY Plattsburgh demographics. In the SUNY Plattsburgh Upward Bound program, the majority of the students identify as White.

Table 4. Self-Reported Student Ethnicity for the University of Vermont (UVM) Upward Bound (UB) Students.
Table 5. Self-Reported Student Ethnicity for SUNY Plattsburgh (PSU) Upward Bound (UB) Students.

<table>
<thead>
<tr>
<th>Student Ethnicity</th>
<th>Percentage of PSU Upward Bound Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>90.5%</td>
</tr>
<tr>
<td>Non-White</td>
<td>9.5%</td>
</tr>
</tbody>
</table>

Socioeconomic Context

At UVM UB, 90% of students are both limited-income and first-generation, while the remaining 10% are limited-income or first-generation (UVM UB). To be eligible for Upward Bound, students must be from modest-income households. The U.S. Department of Education defines a "low-income individual" as an individual whose family's taxable income for the preceding year did not exceed 150% of the poverty level amount (US Department of Education).

Table 6. Upward Bound’s definitions of “low-income” for the United States.

<table>
<thead>
<tr>
<th>Size of Family Unit</th>
<th>48 Contiguous States, D.C., and Outlying Jurisdictions</th>
<th>Alaska $</th>
<th>Hawaii $</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$20,385</td>
<td>$25,485</td>
<td>$23,445</td>
</tr>
<tr>
<td>2</td>
<td>$27,465</td>
<td>$34,335</td>
<td>$31,590</td>
</tr>
<tr>
<td>3</td>
<td>$34,545</td>
<td>$43,185</td>
<td>$39,735</td>
</tr>
<tr>
<td>4</td>
<td>$41,625</td>
<td>$52,035</td>
<td>$47,880</td>
</tr>
<tr>
<td>5</td>
<td>$48,705</td>
<td>$60,885</td>
<td>$56,025</td>
</tr>
<tr>
<td>6</td>
<td>$55,785</td>
<td>$69,735</td>
<td>$64,170</td>
</tr>
<tr>
<td>7</td>
<td>$62,865</td>
<td>$78,585</td>
<td>$72,315</td>
</tr>
<tr>
<td>8</td>
<td>$69,945</td>
<td>$87,435</td>
<td>$80,460</td>
</tr>
</tbody>
</table>

Data cleaning and Aggregation

The survey data was exported into excel files from Google Forms. Both the pre- and post-survey data were cleaned and verified via inspection by two researchers. Individuals who were not in grades 9th-12th were deleted from the data set. Student responses were converted from a Likert scale to 1-5 with 1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly Agree. The more neutral answer was selected for questions with more than one answer. For example, if a student selected both Agree and Neutral, the answer was converted to Neutral (3). To analyze pre- to post-intervention differences, researchers manually went through pre- and post-survey data to find student codes that had answered both pre- and post-surveys. Students who had both pre- and post-responses were then put into a new excel spreadsheet to avoid analysis errors.

Analysis

First, we report the descriptive statistics of the sample with regard to self-reported racial demographics. We had students self-report gender, race, and grade level. Students
also created a unique code allowing researchers to track individual variation before and after participating in the educational interventions.

Reliability statistics were conducted on the three constructs to ensure the validity of the results. When conducting reliability statistics for the Stewardship category, a Cronbach’s alpha of 0.807 was produced. When conducting reliability statistics for Connectedness with Nature, a Cronbach’s alpha of 0.822 was produced. When conducting reliability statistics for Environmental Career Aspirations, a Cronbach’s alpha of 0.858 was produced. A Cronbach’s alpha range of 0.8-0.9 was accepted and supported in literature (Vaske et. al. 2017).

Indexes per category were also created in order to identify any significant relationships. The Stewardship index was created by computing variables. The variables used for the stewardship category were V7, V8, and V9. These variables represent the three questions in the stewardship category (examine Table 7. for the full list of questions). The numeric expression for this index reads \((V7+V8+V9)/3\). The Connectedness with Nature index was created by computing variables. The variables used for the stewardship category were V10, V11, and V12. These variables represent the three questions in the stewardship category (examine Table 7. for the full list of questions). The numeric expression for this index reads \((V10+V11+V12)/3\). The Environmental Career Aspirations index was created by computing variables. The variables used for the stewardship category were V13, V14, and V15. These variables represent the three questions in the stewardship category (examine Table 7. for the full list of questions). The numeric expression for this index reads \((V13+V14+V15)/3\).

Table 7. Label with corresponding question for data analysis.

<table>
<thead>
<tr>
<th>Label</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>V7</td>
<td>I am interested in learning how to protect the environment</td>
</tr>
<tr>
<td>V8</td>
<td>I will take action to protect the environment</td>
</tr>
<tr>
<td>V9</td>
<td>I will speak up to friends and family about protecting the environment</td>
</tr>
<tr>
<td>V10</td>
<td>I feel connected to nature</td>
</tr>
<tr>
<td>V11</td>
<td>I feel that I am part of the web of life</td>
</tr>
<tr>
<td>V12</td>
<td>I feel inspired by nature</td>
</tr>
<tr>
<td>V13</td>
<td>Having an environmental job is important to me</td>
</tr>
<tr>
<td>V14</td>
<td>I plan to study the environment in college</td>
</tr>
<tr>
<td>V15</td>
<td>I plan to work in an environmental field</td>
</tr>
</tbody>
</table>

Researchers then compared means for each index. The dependent variable was the index being investigated and the independent variable was the pre-survey. From there, descriptive statistics were calculated through crosstabs. Pre-survey and Stewardship Index were investigated through a chi-squared test.

We then addressed the research question, “Is there a relationship between race and stewardship, connectedness, and environmental career aspirations?”, by conducting regressions based on race. Dummy variables were then created for each racial demographic. Individuals got a 0 or 1 depending on how they identified per variable. This allows us to regress race upon other variables. This allowed for linear regressions to be run against the three categories. The dependent variable in the linear regressions was the stewardship index, connectedness with nature index, and environmental career.
aspirations index respectively. The independent variables were the dummy race variables. Analysis was done using IBM SPSS Statistics 27 software and R Data Analysis Software.

Results

For the chi-squared test, the Pearson Chi-Square was 15.091 and the Asymptotic Significance (2-sided) was 0.302. Crosstabs were also calculated for Connectedness to Nature where the Pearson Chi-Square was 11.297 and the Asymptotic Significance (2-sided) was 0.841 and Environmental Career Aspirations Pearson Chi-Square was 15.091 and the Asymptotic Significance (2-sided) was 0.302.

Table 8. Regression analysis and Significance on each category based on race.

<table>
<thead>
<tr>
<th>Race</th>
<th>Environmental Stewardship</th>
<th>Connectedness with Nature</th>
<th>Environmental Career Aspirations</th>
</tr>
</thead>
<tbody>
<tr>
<td>White or Caucasian</td>
<td>0.133</td>
<td>0.034</td>
<td>0.977</td>
</tr>
<tr>
<td>Black or African American</td>
<td>0.921</td>
<td>0.351</td>
<td>0.483</td>
</tr>
<tr>
<td>Multiracial</td>
<td>0.186</td>
<td>0.135</td>
<td>0.769</td>
</tr>
<tr>
<td>Asian</td>
<td>0.092</td>
<td>0.028</td>
<td>0.959</td>
</tr>
<tr>
<td>Latin X</td>
<td>0.257</td>
<td>0.447</td>
<td>0.868</td>
</tr>
<tr>
<td>Indigenous</td>
<td>0.339</td>
<td>0.069</td>
<td>1.000</td>
</tr>
</tbody>
</table>

We were able to survey a total of 131 students. The majority of respondents were SUNY Plattsburgh Upward Bound students due to the larger program size. While there were differences in Stewardship, Connectedness with Nature, and Environmental Career Aspirations, the majority of the differences were not statistically significant (see Table 8). In the Connectedness with Nature category, the variable White or Caucasian was significant with a value of 0.034 and the variable Asian or Pacific Islander was specific with a value of 0.028. There were no statistically significant differences among races in the Stewardship or Environmental Career Aspirations categories.

Discussion

Results from the regression analysis indicate two instances of significance. White or Caucasian and Asian students produced statistically significant results within the connectedness with nature category. While these two instances are statistically significant, they are not significant at the 0.01 level. While worth nothing, these are two instances of significance out of 18. Results from this research stand in contrast to previous research and literature that states BIPOC students are less connected to the environment. Preceding research states that white people are generally noted to be interested in the environment, concerned about environmental issues, and knowledgeable about nature and the environment while portraying People of Color as lacking interest and concern for the natural environment, lacking knowledge in regards to nature, and having negative attitudes towards the environment (Cronin et al. 2021, Xiao et al. 2018, O’Brien et al. 2020). These generalizations of racial groups are incredibly harmful and have been disproven in recent literature and throughout this study. The findings of this study do not support the results of previous research. Generalizations that People of Color fear nature led to alienation from the environment and outdoor activities. Although many researchers state that there are numerous reports and studies indicating that People of Color fear
nature in a recent study, Taylor (2018) found that none of the respondents in her study stated that fear comes to mind when they think of nature.

There is also a massive body of literature that leads readers to the misconception that People of Color are less connected to nature. Student respondents in this study had similar connectedness levels across racial demographics. Taylor (2018) also found that none of the Black students in her study reported that they are somewhat or disconnected from nature and neither did any other students. The vast majority of Black respondents indicated that they were somewhat or very curious about nature. These reports were similar to the percentages of other respondents. In previous research, scholars have stated there is a lack of environmental connectedness within communities of color, leading to the assumption that People of Color are disassociated with nature (Taylor 2018). In this research, there was no evidence that suggests major significant differences in connectedness across any racial groups. Taylor cites an extensive list of outdoor groups such as Outdoor Afro, Journey Outdoors, and African American Hunting Association in her research disproving the misconception that Black folks and other People of Color are disassociated from nature (Taylor 2018). Outdoor organizations do not see high enrollment of People of Color because they have been historically systematically excluded and unwelcomed into environmental organizations and groups. A recent study by Freeman and Taylor (2010) indicated that Black folks are not universally repulsed by natural landscapes or disassociated from them. 119 Black recreationist were most likely to state that they viewed nature, went fishing, camped, went birding and interacted with wildlife, and hiked while visiting Smith Park. Smith Park is a black-owned farm that converted part of its land to a camping and outdoor recreation space, demonstrating how equity, justice, economic self-help, and racial uplift are intertwined within safe spaces and connectedness to nature.

Throughout this research, a recurring theme is misconceptions and generalizations about people of color, especially Black folks. Scholars should not think of racial groups as monolithic entities or that race is the only determining factor when investigating relationships with nature (Taylor 2018). Managers, planners, and environmental organizations should refrain from making numerous generalizations about any racial demographic when it comes to their thoughts, understandings, and interactions with nature. Researchers, environmental psychologists, and landscape preference scholars have been incredibly slow to recognize and investigate how social and structural barriers can influence perceptions and connectedness to nature. This slow movement to action and use of harmful and biased tools has only continued to solidify misconceptions and harmful stereotypes that damage communities of color and continue exclusionary practices. There needs to be a conscious effort to decolonize nature and the idea of the natural environment. Currently, the majority of researchers and environmentalists view nature through a colonizer lens. This is why it is increasingly important to create and implement equitable survey tools. By creating and implementing equitable tools, researchers are able to combat harmful narratives including ones related to BIPOC individuals and nature.

**Limitations and future research**

Like all studies, ours has limitations. The sample size for this study is small however, it is within the ranges of samples used in this type of research. This study also focused on a
specific population rather than the general public. Due to the limited scope of this work, it was not feasible for the researchers to obtain a national sample.

Each population described within this study has immense diversity within itself. This research only demonstrates the general trends across northern New York and Vermont students who fall into Upward Bound program criteria. Larger samples are needed to examine broader-scale trends across the United States. Furthermore, the populations studied were not selected to be statistically representative of larger populations across the United States. Instead, the students sampled represent the individuals who participated in the Upward Bound programs during the Summer of 2022 at SUNY Plattsburgh and the University of Vermont.

Also, this study did not account for differences in EE program design and delivery. Larger and more diverse sample sizes would be needed to further examine whether different approaches to the development and delivery of EE educational interventions yield different results for different subpopulations of students. However, it is worth noting that even large-scale systematic investigations can only identify broad trends. There needs to be continued case study research, both on the qualitative and quantitative scales, to strengthen an understanding of why these trends exist and how to best address them in fixed situations in the United States.

Lastly, it is important to note the implications of COVID-19. COVID-19 had a profound effect on educators as well as students. In the beginning of this research, we attempted to engage with educators in an effort to increase educator environmental literacy. Overall, we received incredibly low responses from teachers regarding interest in the program. Throughout this project, we heard from numerous educators that they were feeling burnt out and not appreciated both by students and administration. If the educators who participated in this study felt more appreciated and valued there could have been a higher number of students reached and more research among educators.

**Conclusion**

This research has indicated that there are not substantial differences among environmental stewardship, connectedness with nature, and environmental career aspirations across racial demographics when respondents are part of the same socio-economic group. Many environmental education programs continuously rely on and reproduce colonial ideas of race and space by perpetuating colonial frameworks resulting in exclusion and inaccurate results (McLean 2013). Through conducting this research there is hope that researchers and environmental educators will recognize the systems they participate in and retire tools and curricula that are inherently biased and produce results stemming from White Supremacy Culture.

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1 Biphobia: a partly genetic predisposition to readily associate, on the basis of negative information or exposure, and then persistently retain fear or strong negative/avoidance responses to certain natural stimuli that have constituted risk during evolution (Ulrich 1993)

2 Institutional and Structural racism: Differently influences access to the goods, services, and opportunities of society by race (Lantz 2021).
3Personally mediated racism: Between individuals, which includes unintentional and intentional prejudices (different assumptions about the abilities, worth, and motives of individuals based on their race). This also includes discrimination (different actions towards others based off of race) (Lantz 2021).

4Internalized racism: The acceptance of negative beliefs or thoughts by members of a stigmatized race related to their worth, abilities, or deservedness (Lantz 2021).

Disclosure statement  
No potential conflict of interest was reported by the authors of this study.

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Acknowledgments  
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References


Chapter 3

Strategies for Increasing Stewardship, Connectedness to Nature, and Environmental Career Aspirations Among Upward Bound Students

Jillian Kara, Dr. Kimberly J. Coleman, Dr. Leon Walls, and Nate Trachte

ABSTRACT
The goal of education has always been to increase knowledge and literacy. Currently, social and environmental injustices are at the forefront when dismantling systems of oppression and systemic racism within the United States. At the intersection of these injustices lies environmental education (EE). Historically, environmental education has predominantly served white populations, largely leaving out communities of color. As climate change continues to worsen, youth need to be environmentally literate in order to navigate through the numerous obstacles and shifts that will be brought on by the new and ever-changing climate. In order to increase environmental literacy and environmental education efforts, three educational interventions were implemented in the Summer of 2022 Upward Bound Programs at the State University of New York at Plattsburgh (SUNY) and the University of Vermont. These educational interventions were measured through pre- and post- surveys which were given before and after student participation in the program. Analysis indicated that there was a significant difference in environmental stewardship and connectedness to nature after participating in the educational interventions. However, analysis also indicated that there was not a significant difference when examining environmental career aspirations. This study investigates why Black, Indigenous, and People of Color (BIPOC) are less likely to pursue environmental careers even though interest levels are statically similar to their white peers.
Introduction

Decades of research have demonstrated that environmental education (EE) and programs designed to cultivate environmental literacy (EL) can have significant impact on participants. Environmental literacy programs have been shown to cultivate pro-environmental attitudes, promote awareness of environmental crises like climate change, increase ecological knowledge, encourage environmentally responsible behaviors, and build a range of important professional skills (Ardoin et al. 2018, Dettmann-Easler and Pease 1996, Stern et al. 2014, Thomas et al. 2019). Environmental education and its evolution can be traced back to thinkers, writers, and educators such as Humboldt, Haeckel, and Montessori in the eighteenth- and nineteenth centuries (Palmer 1998). EE began to emerge during the 1960s having roots in a variety of fields such as nature education, resource use education, outdoor education, and science education (Roth 1992). With the environmental movements in the 1970s, environmental education became its own field (Aylward and Mitten 2022). During the 1990s, growing concern for the environment led to support for an educational approach that considered immediate environmental improvements as a goal and ways to address educating for sustainability for the long term (Tilbury 1995). Modern environmental education works to shift students from awareness to action. Specifically, environmental education focuses on creating a population that is aware of and equipped with the knowledge and skills to produce and implement solutions for current and future environmental issues (Meighan and Fuhrman 2018).

A major objective of environmental education is producing individuals who are motivated towards the rational use of the environment in order to develop and maintain the highest possible quality of life for all (Roth 1992). Other objectives include the understanding that humans are not a separate form of life nor completely independent but intertwined with the life around them. EE also aims to ensure that individuals have an understanding of the biophysical world, including the biosphere (natural environment), the psychosphere (the man-made environment), and the role of resources in society (Roth 1992). EE also attempts to arm individuals with the knowledge of identifying environmental issues, solving these issues, and accepting responsibility for the implementation of solutions in order to resolve these issues. Recent literature has suggested that students who participate in environmental education have an ethic of care and stewardship for the environment (Ballantyne and Packer 2002).

However, environmental education and environmental literacy programs have largely served white populations, leaving out BIPOC individuals (Warren et al. 2014) and environmental degree programs at the university level have failed to attract BIPOC students (Sharik 2015, Sharik et al. 2015, Taylor 2015). This mirrors and reinforces the aforementioned trend of inequity in the environmental movement more broadly. While there is increased awareness for the need for greater equity in EL programming (Anderson 2021), efforts to develop environmentally literate citizens prepared to address pressing and emergent environmental issues have, to date, largely excluded BIPOC individuals. Environmental education has extensively called for an inclusive approach to engage diverse audiences, yet, it has historically emphasized the values of White middle-class culture in the West and has continued to be criticized for failing to adequately
consider the perspectives and experiences of People of Color (Stern et. al. 2021). The reality is that the majority of mainstream outdoor and environmental education maintains strong links to Eurocentric, White, male, heteropatriarchy perspectives that historically and systematically exclude People of Color (Aylward and Mitten 2022). Historically, leadership qualities and characteristics that have been deemed as admirable are specifically targeting White, able-bodied, upper-class, heterosexual males which solidify specific sociopolitical and sociocultural ideologies (Warren et. al. 2014). Environmental and outdoor education programming continuously favor instructors who have graduated from expensive instructor training courses and privileges White, male outdoor leadership perspectives (Warren et. al. 2014). As the United States demographics continue to diversify and racial and socioeconomic disparities, injustices, and other topics remain broadly apparent, there are calls for more inclusive and culturally representative approaches to environmental education (Stern et. al. 2021). To contribute to research in this area, we take a mixed methods approach to evaluate the outcomes of a program aimed at implementing educational interventions with students and teachers in the Lake Champlain Basin. We conducted research on the outcomes of specific environmental education (EE) interventions in terms of their ability to engender EL.

Background

There is a great need to create equitable STEM education in order to increase diversity in STEM-related fields and majors. It should be every educator's goal to create a classroom where everyone feels welcome, regardless of race or ethnicity. BIPOC students need to be exposed to environmental education in a way that is accessible and introduced to STEM fields in a way that feels welcoming and engaging. Despite growing attention to inequities in STEM, women, individuals who identify as BIPOC, economically disadvantaged people, and people with disabilities remain unequally represented across STEM fields (National Academies of Sciences, Engineering, and Medicine 2018). Notably, low-income and BIPOC individuals are the least likely to possess the STEM skills they need to succeed in college and careers (SUNY 2011). These patterns exist within the specific STEM disciplines that study natural resources such as ecology, forestry, wildlife biology, watershed science, and others, as natural science degree programs in the U.S. tend to serve higher proportions of ethnic Europeans than BIPOC students, hindering their participation (Sharik 2015; Sharik et al., 2015; Taylor 2015). Enrollment data of natural resource departments at 61 institutions across the U.S., for instance, reveals that only 12% of enrolled students identify as BIPOC (Sharik et al., 2015); in contrast, roughly 45% of students enrolled in postsecondary programs in the U.S. identify as BIPOC (US Department of Education 2016). These numbers are mirrored in the environmental workforce; a 2014 study of 166 environmental nonprofits in the US revealed that only 12% of staff identified as BIPOC (Taylor 2015). While these numbers focus on race, similar studies have discussed concerns regarding representation in terms of gender and socioeconomic status (Kelly 2016, Taylor 2015, Coleman and Gould 2018). Table 1 indicates information regarding diversity in relation to race and gender in environmental careers and natural resource departments. The literature indicates a need for more empirical research on educational
interventions related to STEM in order to increase environmental literacy among BIPOC students.

Table 1. Data on diversity in environmental careers and natural resource departments with validations.

<table>
<thead>
<tr>
<th>Group</th>
<th>Percentage (%)</th>
<th>Numeric Value</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States General Population</td>
<td>100%</td>
<td>332,403,650</td>
<td>US Census</td>
</tr>
<tr>
<td>Employment of Scientists and Engineers</td>
<td>11%</td>
<td>35,540,000</td>
<td>National Science Foundation</td>
</tr>
<tr>
<td>BIPOC Individuals Highered at Environmental Agencies</td>
<td>11.7%</td>
<td>N/A</td>
<td>Taylor 2014</td>
</tr>
<tr>
<td>BIPOC Individuals in Leadership roles in Environmental Organizations</td>
<td>11%</td>
<td>N/A</td>
<td>Taylor 2014</td>
</tr>
<tr>
<td>BIPOC Students Enrolled in College</td>
<td>42%</td>
<td>N/A</td>
<td>Sharik et al., 2015</td>
</tr>
<tr>
<td>BIPOC Students in Natural Resource Departments</td>
<td>12%</td>
<td>N/A</td>
<td>Sharik et al., 2015</td>
</tr>
<tr>
<td>Environmental Scientist Jobs</td>
<td>100%</td>
<td>80,478</td>
<td>Zippia</td>
</tr>
<tr>
<td>Environmental Scientist Jobs-Men</td>
<td>59%</td>
<td>47,240</td>
<td>Zippia</td>
</tr>
<tr>
<td>Environmental Scientist Jobs-Women</td>
<td>38%</td>
<td>30,581</td>
<td>Zippia</td>
</tr>
<tr>
<td>Environmental Scientist Jobs-White</td>
<td>87%</td>
<td>69,854</td>
<td>Zippia</td>
</tr>
<tr>
<td>Environmental Scientist Jobs-Black</td>
<td>5%</td>
<td>4,104</td>
<td>Zippia</td>
</tr>
<tr>
<td>Environmental Scientist Jobs-LatinX</td>
<td>5%</td>
<td>3,782</td>
<td>Zippia</td>
</tr>
<tr>
<td>Environmental Scientist Jobs-Asian</td>
<td>4%</td>
<td>2,897</td>
<td>Zippia</td>
</tr>
<tr>
<td>BIPOC Students at SUNY Plattsburgh</td>
<td>29%</td>
<td>1,563</td>
<td>SUNY Plattsburgh</td>
</tr>
<tr>
<td>BIPOC Students at University of Vermont</td>
<td>11%</td>
<td>1,308</td>
<td>University of Vermont</td>
</tr>
<tr>
<td>BIPOC Students at Center for Earth and Environmental Science (CEES)</td>
<td>14%</td>
<td>58</td>
<td>SUNY Plattsburgh</td>
</tr>
<tr>
<td>BIPOC Students at Rubenstein School of Environment and Natural Resources [RSEN]</td>
<td>6%</td>
<td>46</td>
<td>University of Vermont</td>
</tr>
</tbody>
</table>

This is not to say that students of color are uninterested in natural resources and environmental careers. There is a strong body of evidence that indicates that students of color are interested in environmental careers despite data indicating that there are low numbers of individuals of color working within natural resources and environmental careers (Taylor 2018). The lack of diversity within leadership roles, educators, and scientists in EE programs and environmental organizations contributes to lower EL among BIPOC individuals (Leonard 2020). Corresponding cultural norms in the field of EE conceal the culture and history of communities of color, further rendering their experiences invisible and strengthening the barrier, blocking the creation of meaningful relationships within BIPOC communities (Finney 2014; Warren 2016). Due to this lack of diversity within EE programs, the needs of BIPOC individuals are not being addressed furthering the struggle to make programming accessible and relevant within BIPOC
communities (NEEF 2015). As a result, there is a growing awareness of the need to create both a culturally inclusive learning environment as well as a culturally inclusive work environment (Romero et. al. 2022). In order to have more just and equitable EL experiences, EE practitioners and curriculum designers must invite, recognize, value, and attend to the diverse lived experiences and perspectives of all learners from all backgrounds (Romero et. al. 2022). Critical Race Theory can create an equitable EE program where all students get inclusive access to environmental topics and strengthen their environmental literacy. While there is an increase in programs targeting EL improvement, these programs have largely served white individuals, excluding BIPOC populations (Warren et al. 2014).

Strategies to increase Environmental Stewardship, Connectedness to Nature, and Environmental Career Aspirations all can be increased through exposure to Environmental Education (EE) and Environmental Literacy (EL) programming. Environmental Education is educational programming aimed at developing a society that is aware and concerned about the natural environment and corresponding issues (Stapp 1997). Environmental education equips individuals with the knowledge, motivations, attitudes, commitment, and skills to work on an individual and collective level towards solutions of current and future challenges. The term “environmental literacy” (EL) is defined in environmental education literature as having four major components: knowledge, affective attitudes (i.e. feelings about nature), cognitive skills, and behavior (Hollweg et. al 2011). While students do learn about the environment, they are often only increasing their environmental knowledge and not their environmental literacy (Chamberlin 2020). Key differences between environmental literacy and environmental knowledge are that EL involves action, critical thinking, communication, responsible consumerism, values, and beliefs (Chamberlin 2020). While it is important to note that environmental knowledge is critical, it is only one component of environmental literacy.

<table>
<thead>
<tr>
<th>Environmental Literacy</th>
<th>Environmental Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Action</td>
<td>• Amount of information individuals have on environmental topics</td>
</tr>
<tr>
<td>• Critical Thinking</td>
<td>• Recognition of environmental issues</td>
</tr>
<tr>
<td>• Communication</td>
<td></td>
</tr>
<tr>
<td>• Responsible consumerism, values, and beliefs</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Differences between Environmental Literacy (EL) and Environmental Knowledge (EK) adapted from Chamberlin 2022.

The field of research that investigates programs related to effectively increasing Environmental Literacy is still emerging (Szczytko et al. 2019, Stevenson et al. 2013). There is limited research that uses pre- and post-survey designs to measure the effectiveness of educational interventions developed to promote environmental literacy (Stevenson et al. 2013). Among published works, some studies have highlighted the limited abilities of classroom activities in relation to components of environmental literacy (Rickison 2001). Spending time outside of the classroom, and engaging in activities such as playtime in natural areas, has been linked to the development of an
emotional connection with nature (Cheng and Monroe 2012). By taking students on environmental trips and outdoor learning experiences, educators can trigger and engage students’ natural curiosity for the natural environment and encourage students to pursue environmental interests (Chamberlin 2020). This may help promote the development of affective attitudes towards nature and increase interest in environmental education programming. Connectedness to nature is often enlisted in studies as having knowledge or information about nature, having experiences in nature, demonstrating some kind of emotional connection to nature (mind, body, spirit), and/or having a committed mind, body, spirit connectedness with nature that one lives (Taylor 2018). The goal of our work was to explore specific EE interventions, their ability to increase connectedness to nature, and the extent to which connectedness to nature translates into career aspirations.

**Methods**

**Site Selection**

This research project sampled Upward Bound (UB) students from SUNY Plattsburgh (PSU) and the University of Vermont’s (UVM) summer programs. The students in the SUNY Plattsburgh Upward Bound program are from Clinton, Essex, and Franklin counties which are located in northern New York. SUNY Plattsburgh’s Upward Bound program serves fifteen districts in the North Country of New York. The students in the University of Vermont’s Upward Bound summer program are from Chittenden County in Northern Vermont. The University of Vermont’s Upward Bound program serves the Winooski School District which has a high refugee population. All of the students who participated in this study were in high school.

![Map of New York and Vermont showing which counties the students from SUNY Plattsburgh and UVM’s UB students are from.](image)

Figure 2. Map of New York and Vermont showing which counties the students from SUNY Plattsburgh and UVM’s UB students are from.

Table 4. County demographics reported as a percentage for Clinton, NY, Essex, NY, Franklin, NY, and Chittenden, VT reported by the US Census 2020. *We recognize that these labels do not reflect preferred language but reflect how the US Census reported the data.*
Upward Bound

In the United States, the Upward Bound (UB) program is funded by the U.S. Department of Education. The Upward Bound program provides support to high school students in preparation for pursuing college. The Upward Bound program serves high school students who are from modest-income households and/or students whose parents do not have a four-year degree. Upward Bound’s goal is to increase the rate at which students who participate in the program complete secondary education and graduate from college. The projects Upward Bound provide attempt to increase students' skills in mathematics, laboratory sciences, composition, literature, and foreign languages. Upward Bound also provides a variety of tools such as tutoring, counseling, mentoring, cultural enrichment, work-study programs, education, and counseling services that are designed to improve the financial and economic literacy of students (US Department 2021). The programs and activities Upward Bound provides are specifically designed for students who are limited English proficient, students who have historically been excluded from postsecondary education, students who also have disabilities, students who are experiencing homelessness, students who are in foster care, and students who might be viewed as needing additional resources.

Socioeconomic Context

In the University of Vermont’s Upward Bound program, 90% of students are both limited-income and first-generation. The remaining 10% of students are limited-income or first-generation (UVM Upward Bound). To be eligible for Upward Bound, students must be from modest-income households whose rates are set by the U.S. Department of Education. The U.S. Department of Education defines a "modest income individual" as an individual whose family's taxable income for the preceding year did not exceed 150% of the poverty level amount (US Department of Education 2021).

Table 5. Upward Bound’s definitions of “low-income” for the United States.

<table>
<thead>
<tr>
<th>Size of Family Unit</th>
<th>48 Contiguous States, D.C., and Outlying Jurisdictions</th>
<th>Alaska</th>
<th>Hawaii</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$20,385</td>
<td>$25,485</td>
<td>$23,445</td>
</tr>
<tr>
<td>2</td>
<td>$27,465</td>
<td>$34,335</td>
<td>$31,590</td>
</tr>
<tr>
<td>3</td>
<td>$34,545</td>
<td>$43,185</td>
<td>$39,735</td>
</tr>
<tr>
<td>4</td>
<td>$41,625</td>
<td>$52,035</td>
<td>$47,880</td>
</tr>
<tr>
<td>5</td>
<td>$48,705</td>
<td>$60,885</td>
<td>$56,025</td>
</tr>
<tr>
<td>6</td>
<td>$55,785</td>
<td>$69,735</td>
<td>$64,170</td>
</tr>
<tr>
<td>7</td>
<td>$62,865</td>
<td>$78,585</td>
<td>$72,315</td>
</tr>
<tr>
<td>8</td>
<td>$69,945</td>
<td>$87,435</td>
<td>$80,460</td>
</tr>
</tbody>
</table>
**Educational Intervention 1**

Based on the conversations we had with educators, we decided to collaborate and create lesson plans focused on watershed science with three SUNY Plattsburgh Upward Bound teachers. All of the lesson plans implemented included students collecting and identifying macroinvertebrates in the Saranac River located behind the SUNY Plattsburgh campus. The students participated in kick netting, allowing students to collect their own samples and be involved throughout the entire collection and identifying process. Students then used dichotomous keys to identify which invertebrates were found. The students were also provided with checklists, allowing them to assess the water quality of the Saranac River. The students were asked before participating in the collection what they thought the water quality of the Saranac River was. Overwhelmingly, students responded that they thought the water quality was poor and the river was polluted. After collecting and analyzing data, students were excited to report that the macroinvertebrate samples found reflected a healthy river ecosystem with very little pollution.

These lesson plans were integrated into nine total classes shown in Table 1.

<table>
<thead>
<tr>
<th>Class</th>
<th>Number of Students Reached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Environment</td>
<td>13</td>
</tr>
<tr>
<td>Chemistry</td>
<td>20</td>
</tr>
<tr>
<td>Chemistry</td>
<td>10</td>
</tr>
<tr>
<td>Intro to Printmaking</td>
<td>6</td>
</tr>
<tr>
<td>Ceramics</td>
<td>9</td>
</tr>
<tr>
<td>Collaborative Mural Painting</td>
<td>10</td>
</tr>
<tr>
<td>Intro to Printmaking</td>
<td>6</td>
</tr>
<tr>
<td>Ceramics</td>
<td>9</td>
</tr>
<tr>
<td>Collaborative Printmaking</td>
<td>10</td>
</tr>
</tbody>
</table>

During this time, a wide variety of students were reached. While the watershed science lessons were implemented in a variety of science classes, the lessons were also implemented in a variation of art classes. The art students who participated in the watershed science lessons created an interdisciplinary project. The students produced numerous forms of artwork such as drawings, paintings, and ink prints. In total, 93 Upward Bound students were reached.

**Educational Intervention 2**

For intervention two, two interactive watershed scientist panels were organized in an effort to increase interest in watershed science among first-generation college students in the Lake Champlain Basin. The interactive panels were integrated into Upward Bound’s
afternoon activity programming at both SUNY Plattsburgh and the University of Vermont. The activity was open to any interested students at UVM and all students from SUNY Plattsburgh’s UB program attended. Since the program was optional at the University of Vermont, six students participated. The SUNY Plattsburgh Upward Bound program conducted high advertisement for the activity and over 160 students participated in the SUNY Plattsburgh’s panel discussion. The goal of this panel was to expose students to a range of research topics in order to highlight several different career paths, demonstrate the diversity of water research jobs, and answer any questions students might have about pursuing natural science in college. Panelists representing a diverse range of backgrounds described their work, professional paths, and experiences in natural resource college classes, and offered career advice to Upward Bound students. There were three individuals who identified as women and two individuals who identified as men who participated in the University of Vermont’s panel discussion. The SUNY Plattsburgh panel had three individuals who identified as women and one individual who identified as a man. This range of gender demographics allowed students to see that women also work in natural resources.

Educational Intervention 3

For the third educational intervention, students participated in an interactive green water infrastructure lesson. During this lesson, the Upward Bound students learned that green stormwater infrastructure is an approach to water management designed to mimic natural environments and capture precipitation where it falls. The students also learned what stormwater is, how soil absorbs runoff, how vegetation can slow down, spread out, and act like a filter to stormwater before it reaches bodies of water such as Lake Champlain, and the importance of having stormwater infrastructure in our communities. The students in both Vermont and New York painted and implemented a rain barrel in the Lake Champlain Basin. SUNY Plattsburgh Upward Bound students also took a tour of the campus community garden. Both of the rain barrel activities were integrated into Upward Bound’s afternoon activity programming at SUNY Plattsburgh and the University of Vermont. The activity was open to any interested students at both SUNY Plattsburgh and the University of Vermont. SUNY Plattsburgh had a turnout of 14 students and the University of Vermont had a turnout of 12 students.

Data Collection:

Data collection took two form: the pre/post-survey and student observations. This was to increase validity. Student observations were recorded in field notes by researcher when implementing educational programming related to watershed science. Student observations were also recorded via photographs when students were participating in the educational interventions.

Survey Design

In order to measure the impact of these activities on students, a pre- and post-surveys were implemented. Both of the surveys were created using questions adapted from other research studies (see Table 2 below). The research team first conducted a review of environmental literacy survey tools which measured the traditionally cited components of
environmental literacy: knowledge, affective attitudes (i.e. feelings about nature), cognitive skills, and behavior (Hollweg et. al 2011) and which had already been empirically validated. Using Critical Race Theory as theoretical framework, the team then screened the survey tools for questions that might bias results based on race. For example, questions about specific environmental knowledge were omitted to avoid preferencing certain demographic groups. The remaining questions were consolidated into a survey tool that assessed environmental literacy by measuring students’ connectedness to nature (affective attitudes), stewardship of nature (behavior), and interest in natural resource degree programs (cognitive skills).

Table 3: Measurement Tool Constructs and Questions

<table>
<thead>
<tr>
<th>Construct</th>
<th>Question</th>
<th>Adapted From</th>
</tr>
</thead>
</table>

Survey Implementation
The pre-survey was administered pre-educational interventions during the first week of the Upward Bound program in both the SUNY Plattsburgh and University of Vermont’s Upward Bound programs. The SUNY Plattsburgh pre-survey was administered by SUNY Plattsburgh Upward Bound employees and the pre-survey for UVM was emailed out by a UVM Upward Bound employee. The post-survey was administered after students participated in activities related to watershed science. The post-surveys were also administered via Upward Bound employees. All post-surveys were emailed out to students. Follow-up emails were sent out by Upward Bound employees to remind students to fill out the pre- and post-surveys. To ensure students were taking the surveys during the preferred time frames, the pre-survey was unable to be submitted after any educational interventions were implemented. The post-survey was closed the last week in August after both Upward Bound programs had ended their summer sessions.

When filling out the pre- and post-survey, students were asked to create a unique code (see Appendix C and D). Researchers asked students to enter their first initial, the first three letters of their last name, and the day of their birth date. As an example, if the students name is Charlie Brown and they were born on May 14, 2020, they would write Cbro14. The unique code allowed researchers to track individual variation before and after participating in the educational interventions.

Student Observations

During these interventions, researchers were able to conduct participant observations. Observation has been adopted by education researchers are other social scientists as an ethnographical approach to social research (Cotton et. al. 2010). Ethnography may involve the researcher participating in events, observing activities, taking notes, and collecting unstructured data in order to produce an accurate account of the situation being investigated. When researchers implement a post-experience questionnaire, they are faced with limitations such as selectivity and stereotyping. In order to combat these limitations, researchers took observations along with pre/post-surveys as a form of triangulation, using more than one data collection method in order to provide a greater understanding of the situation (Cotton et. al. 2010). As a way to combat reliability concerns, researchers took both photographic observations as well as field observations (field notes). Observational methods have a strong claim to validity due to the fact that they give a first-hand view of events (Cotton et. al. 2010). These first-hand accounts report actions as they were occurring unlike data collected in an interview or questionnaire which report data after the event. This study incorporated the frameworks of participant observation and structured observation.

In participation observation, researchers become active members of the group they are studying. In this research, researchers emerged themselves with the students being studied and participated in the educational interventions being implemented (Glesne 1999, Jhangiani et. al. 2019). During these activities, researchers observed students’ behavior. Observational data was collected during these interventions. Photographs were taken of the students (with student consent and signed media release forms) and researchers participating in the educational interventions and notes were taken after the researchers had ended the educational interventions and were not in the presence of students. Traditional participant observation was not followed.
Researchers intertwined aspects of disguised participant observation when taking student observations. While the main researcher did tell students she was a graduate student working on environmental education programming, she did not disclose that she was the individual collecting pre/post-survey data from the students. She also did not disclose the theme of her research or disclose that her goal was to create equitable EE programming for BIPOC youth. Instead, she told the students that she was “a graduate student who is interested in environmental education and creating interesting watershed science programs”.

There are numerous reasons why this hybrid of observation techniques was used. Participant observation was used because it allows researchers to have a better position on understanding participants’ viewpoints and what they are experiencing during the study (Jhangiani et. al. 2019). Disguised participant observation and structured observation were implemented because researchers did not want their participants to act differently than they would if a watershed educator was implementing the educational program. Researchers also wanted to mimic the classroom setting that students would be in when participating in EE programming. Implementing structured observation was critical because it also reduces time and expenses (Jhangiani et. al. 2019).

In order to validate student observations, observations were coded. Coding requires clearly defining a set of behaviors (Jhangiani et. al. 2019). Researchers coded notes that were taken along with coding photographs based on the emotions students are exhibiting in the photographs. In order for target behaviors to be defined in a way that guides observers to code them consistently, codes were created and defined. Two sets of codes were created in order to properly code the different types of observations. To code students’ facial expressions, facial expression analysis literature was reviewed and codes were validated based on existing literature. To code informal interview data, codes were created and validated using existing EE literature. Codes were created and verified based on existing literature as shown in Table 4 (informal student interviews) and Table 5 (facial expressions). Field notes were coded using NVivo software.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger</td>
<td>nostrils raised, mouth compressed, furrowed brow, eyes wide open, head erect, (chest expanded, arms rigid by sides, stamp ground, body sways backwards/forwards, tremble)</td>
<td>(Matsumoto and Ekman 2008)</td>
</tr>
<tr>
<td>Contempt</td>
<td>lip protrusion, nose wrinkle, partial closure of eyelids, turn away eyes, upper lip raised, (snort, body expiration, expiration)</td>
<td>(Matsumoto and Ekman 2008)</td>
</tr>
<tr>
<td>Disgust</td>
<td>lower lip turned down, upper lip raised, expiration, mouth open, spitting, blowing out protruding lips, clear throat sound, lower lip, tongue protruded</td>
<td>(Matsumoto and Ekman 2008)</td>
</tr>
</tbody>
</table>
Engaged
- smiling, making eye contact with instructor, asking and responding to questions, participating and interacting with group, listening
  (Fulton 2019)

Fear
- eyes open, mouth open, lips retracted, eye brows raised and pulled together, (crouch, pale, perspiration, hair stands on end, muscles shiver, yawn, tremble)
  (Matsumoto and Ekman 2008, Lanteigne 2011)

Happiness
- eyes sparkle, skin under eyes wrinkled, mouth drawn back at corners
  (Matsumoto and Ekman 2008)

Joy
- zygomatic, orbicularis, upper lip raised, naso labial fold formed (muscle tremble, purposeless movements, laughter, clapping hands, jumping, dancing about, stamping, chuckle/giggle)
  (Matsumoto and Ekman 2008)

Sadness
- corner mouth depressed, inner corner eyebrows raised (low spirits)
  (Matsumoto and Ekman 2008)

Surprise
- eyebrows raised, mouth open, eyes open, lips protruded, (expiration, blowing/hissing, open hands high above head, palms toward person with straightened fingers, arms backwards)
  (Matsumoto and Ekman 2008)

---

1 Selectivity—students may only report aspects of their experience which are felt to ‘fit’ with the researcher’s perspective

2 Stereotyping—in some circumstances research has shown that when asked about what behaviors individuals undertake, respondents provide a more stereotyped view than what is actually the case if their behavior is observed

Analysis
First, we report the descriptive statistics of the sample with regard to self-reported racial demographics. We had students self-report gender, race, and grade level. We were able to obtain pre- and post-survey results from 21 students through matching the students’ unique codes. Reliability statistics were conducted on the three constructs, Stewardship, Connectedness to Nature, and Environmental Career Aspirations, to ensure the validity of the results. We then addressed the research question, “Did student attitudes change after participating in educational interventions related to watershed science? ”, by comparing the survey results from students who filled out both the pre- and post-surveys. Researchers then conducted paired t-tests in order to identify significant differences between pre- and post-survey responses. Due to the sample size being relatively small, it is not feasible to conduct analyses on variables such as gender and grade level. Statical analysis was done using IBM SPSS Statistics 27 software and R Data Analysis Software.
Field notes were coded using NVivo software. To ensure the validity of the coding, the field notes were coded twice and analyzed for variation. Photographs were manually coded using the facial expression analysis codes (Table 5).

Table 6. Paired Sample Correlations for Pre- and Post-Survey Responses for the Summer of 2022.

<table>
<thead>
<tr>
<th>Construct</th>
<th>N</th>
<th>Correlation</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre/Post Stewardship</td>
<td>21</td>
<td>0.524</td>
<td>0.015</td>
</tr>
<tr>
<td>Pre/Post Connectedness with Nature</td>
<td>21</td>
<td>0.494</td>
<td>0.023</td>
</tr>
<tr>
<td>Pre/Post Environmental Career Aspirations</td>
<td>21</td>
<td>0.102</td>
<td>0.660</td>
</tr>
</tbody>
</table>

Results

A Cronbach’s alpha of 0.807 was produced when conducting reliability statistics for the Stewardship category. A Cronbach’s alpha of 0.822 was produced when conducting reliability statistics for the Connectedness to Nature category. A Cronbach’s alpha of 0.858 was produced when conducting reliability statistics for the category Environmental Career Aspirations. A Cronbach’s alpha range of 0.8-0.9 was accepted and supported by Vaske et. al. (2017).

We were able to identify 21 students who had filled out both the pre- and post-surveys. The paired sample correlation test resulted for Stewardship produced significant result of 0.015. This indicates that there were statically significant changes in students' environmental stewardship survey results after participating in the educational interventions (shown in Table 6). The paired sample correlation test resulted for Connectedness to Nature produced significant result of 0.023. This indicates that there were statically significant changes in students' connectedness to nature survey results after participating in the educational interventions (shown in Table 6). The paired sample correlation test resulted in a not significant result of 0.660 for Environmental Career Aspirations at the 0.005 level. This indicates that there were not statistically significant differences in students’ environmental career aspirations after participating in the educational interventions related to watershed science. While implementing educational interventions, researchers took student observations.

Student observations were key in this study. Student engagement was high during educational interventions. High numbers of engagement, joy, and happiness were recorded when analyzing photographs for facial expression analysis. When speaking to students, researchers were made aware of how critical representation is when looking for a career. Students were quick to state that they did not want to go into a career where they were not represented and felt unwelcome. Themes of exclusion and cultural racism were mentioned numerous times by students throughout the interventions (Figure 3). Also, students explained it was not that they are uninterested in natural resources, they are just not exposed to career options until much later in life or at all.
Results of Qualitative Analysis

While having open conversations, students expressed that the only science or STEM careers they were introduced to or felt they could pursue were either being a nurse or a doctor. There is an entire conversation that these students are missing, leading to an unawareness of natural resource careers. Students indicated they feel limited in their career choices because natural resource careers are not being introduced. These issues can also tie back to the fact that natural resource organizations and employers have been and still continue to be predominantly white male-dominated.

During our student observations, researchers noted that shifts in student interests can be traced back to classroom demographics. Throughout the watershed scientist panel, students were open to sharing how the lack of diversity in classrooms affects enrollment and performance. One student explained that she “did not feel comfortable” in her honors class. She stated that she was the only BIPOC individual in the entire classroom. The student went on to explain that she felt incredibly unwelcome in the classroom, not because of actions from her peers or the teacher, but because she was the only person of color in the space. The student explained how she had open communication with her teacher about being the only BIPOC individual in the classroom and why she would not speak during class. She went on to explain that she did not feel welcome in the classroom. She explained that there was no one specific student or action that made her
feel this way, rather, it was the fact that she was the only non-white student in a full class of her peers.

Discussion
Our results revealed an increase in stewardship and connectedness to nature but not in career aspirations. This indicates that while students have environmental stewardship and connectedness to nature, there is something preventing them from pursuing an environmental career. Recent literature has indicated that one potential reason BIPOC students are not pursuing environmental careers is the lack of representation when job searching. When looking for employment, individuals of color are more likely to look for an organization that reflects their cultural background (Taylor 2018). 19.6% of White students felt it was somewhat or very important that the organization they worked at reflected their cultural background in contrast to over half of the BIPOC students who indicated that they felt it was somewhat or very important that their workplace should reflect their cultural background (Taylor 2018). In addition, Taylor reported that when speaking with environmental organizations, there were discussions of a lack of leadership and promotion opportunities for people of color. There were also discussions about a lack of mentoring for individuals of color (Taylor 2018). Overall, regardless of race, students pursuing environmental careers expect environmental organizations to be places that engage with diversity in a serious manner. Students have indicated that they want to work in environmental organizations but will also take diversity in those organizations into consideration when deciding where to work (Taylor 2018). Recent literature has also exposed equity issues within natural resource employment and environmental organizations.

Despite increases across the board, People of Color are still not equitably represented in professional associations, mainstream environmental organizations, and government agencies (Taylor 2018). When looking at positions of power within environmental institutions, the exclusion of individuals of color is more apparent. The percentage of BIPOC individuals in senior staffing positions in environmental organizations is lower than the percentage of BIPOC individuals who are in general staffing positions (Taylor 2018). Within these environmental organizations, Environmental Educators of Color are constantly leaving their positions (Romero et. al. 2022). Environmental Educators of Color expressed that they feel as if they are not wanted in the field and are being pushed out. Environmental Educators of Color stated reasons such as feeling tokenized, marginalized, burdened, silenced, and burnt-out, the perceived differences between their personal and their organizations’ definitions and understandings of diversity, equity, and inclusion (DEI), and explained they experience a superficial level of attention across all aspects of the environmental organizations directly related to how equity, inclusion, and diversity are prioritized and implemented (Romero et. al. 2022). Research has shown that low numbers of People of Color in leadership positions deter students of color when looking at natural resource jobs (Romero et. al. 2022). Exposure to natural resource careers is also critical.

There is an entire conversation that these students are missing, leading to an unawareness of natural resource careers. There needs to be more education and outreach for natural resource careers so students can see there are a variety of options available to them. Students indicated they feel limited in their career choices because natural resource
careers are often not being introduced, and if they are, students do not see themselves represented in the workforce (Finney 2014, Taylor 2014, Leonard 2020). These issues can also tie back to the fact that natural resource organizations and employers have been and still continue to be predominantly white male-dominated (Snow and Romero 2014, Wilderness Society 2021, Green 2.0). Literature has suggested a wide variety of approaches to increase diversity within environmental education and exposure (Morales et. al. 2022, Graham et. al. 2022, Stets et. al. 2018) but there is a limited amount of research that discusses the introduction and retention of natural resource careers to students of color. This growing body of literature that discusses recruitment and retention of People of Color in natural resources indicates that there is currently a lack of culturally competent mentors (Morales et. al. 2022), lack of allyship (Graham et. al. 2022), invalidation of science identity (Stets et. al. 2018), among other issues. Educational opportunities such as research experiences and field experiences must be developed with the specific goal to build positive cognitive personal outcomes in order to be effective at recruiting and retaining students of color (Graham et. al. 2022). Research opportunities and experiences are not created equally and researchers, educators, and administrators should be vigilant when implementing these programs in order to ensure students are supported, feeling welcomed, and succeed.

When exposing students to natural resources, implementation of environmental education should begin as early as possible and encompass a variety of activities. When examining literature, most environmental education programs target middle and high school students (Stevenson et. al. 2013, Ramadhan et. al. 2021, Robinson 2005). By starting environmental education interventions earlier, students will be exposed to and start thinking about environmental careers at an earlier age. One successful approach was evaluated by Cutter-Mackenzie (2009) where multicultural school gardens were implemented in low-income schools across multiple grade levels and students cooked multicultural dishes using ingredients produced from the garden, celebrating cultural diversity (Cutter-Mackenzie 2009). In this program students got to engage with peers in an outdoor setting, discuss and participate in activities that promoted environmental sustainability, and increased student’s environmental attitudes (Cutter-Mackenzie 2009). This program allows students to spend more time outdoors, engaging in natural areas. Activities such as these link environmental education with the celebration of cultural diversity, a positive relationship that is currently shown to be lacking within environmental organizations but a priority to individual seeking employment (Taylor 2018). Research has shown that students who spend time outside of the classroom, engaging in natural areas have been shown to develop an emotional connection with nature (Cheng and Monroe 2012, Chamberlin 2020). When investigating educational implementations, students were eager to explain how classroom demographics also have an impact on career choices and what classes students pursue.

Numerous students during the session explained that they did not want to pursue honors, dual enrollment, or Advanced Placement (AP) classes because it was hard being the only BIPOC individual in the classroom and left students feeling excluded in their learning environment. It is important to note that this student was not from the SUNY Plattsburgh Upward Bound program where the majority of the student demographics are white, this student attended Winooski High School where 34.2% of students identify as Black, 33.7% of students identify as White, 22.4% of students identify as Asian, 6.6% of
students identify as two or more races, 2.6% of students identify as Hispanic, and 0.5% of students identify as American Indian/Alaska Native* (*language used reflects language reported) (US News). There is current evidence that highlights persistent racial and ethnic inequality in STEM degree achievement (Riegle-Crumb et al. 2019). National data on a recent cohort of college students from the Beginning Postsecondary Study (BPS) indicated that BIPOC youth who begin college as STEM majors are twice as likely to drop out of the STEM major or college altogether compared to their white peers (Riegle-Crumb et al. 2019). This rate could be attributed to the issue of opportunity hoarding within K–12 schools (Anderson 2010) and privileged youth being disproportionately represented in the most advanced academic classes such as honors and dual enrollment courses (Riegle-Crumb et al. 2019) leaving little room for students of color to feel welcome. These advanced and honors courses provide students with educational benefits, accessibility to college courses, and experienced performance in college-level courses. These issues of enrollment can be traced back to the biased beliefs of white parents, educators, and even students, leading to the systematic exclusion of BIPOC students from advanced classes (Lewis and Diamond 2015). With this knowledge, there is a need to create and implement intentional strategies to include BIPOC students in educational programming with a specific focus on STEM, dual enrollment, honors level, and Advanced Placement (AP) courses.

Limitations and future research
Like all studies, ours has limitations. The sample size for this study is small however, it is within the range of samples used in this type of research. This study also focused on a specific population rather than the general public. Due to the limited scope of this work, it was not feasible for the researchers to obtain a national sample. Each population described within this study has immense diversity within itself. This research only demonstrates the general trends across northern New York and Vermont students who fall into Upward Bound’s program criteria. Larger samples are needed to examine broader-scale trends across the United States. Furthermore, the populations studied were not selected to be statistically representative of larger populations across the United States. Instead, the students sampled represent the individuals who participated in the Upward Bound programs during the Summer of 2022 at SUNY Plattsburgh and the University of Vermont. Also, this study did not account for differences in Environmental Education (EE) program design and delivery. Larger and more diverse sample sizes would be needed to further examine whether different approaches to the development and delivery of EE educational interventions yield different results for different subpopulations of students. However, it is worth noting that even large-scale systematic investigations can only identify broad trends. There needs to be continued case study research, both on the qualitative and quantitative scales, to strengthen an understanding of why these trends exist and how to best address them in fixed situations in the United States.

Conclusion
Scholars acknowledge that environmental education lacks a much-needed critical race analysis and overall does not include the history of colonial violence or political analysis of the destruction of the natural environment. The theories, policies, and themes that
create the system of environmental education are drawn from a western framework that disregards issues consistently highlighted by People of Color (McLean 2013). All of these factors shape the issues of inequity and lack of representation that is seen in natural resource jobs and environmental organizations today. Implementing environmental education at an earlier age is beneficial in terms of exposure but in order to address employment issues, we need to look at the source. There is an obvious lack of diversity, equity, and inclusion within natural resource jobs and organizations. While there are recent movements to increase diversity and inclusion, these companies are lacking key elements of appeal. Many Environmental Educators of Color feel as if they are being employed just for the sake of diversity. There is a growing body of research that demonstrates the issue is not stemming from a lack of interest or ability but rather the barriers and challenges that discourage and prevent BIPOC individuals from perusing natural resource careers. There needs to be a substantial and genuine effort that engages individuals from diverse cultural backgrounds, not just ethnic Europeans.

**Disclosure statement**

No potential conflict of interest was reported by the authors of this study.

**Funding**

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**Acknowledgments**

The authors would like to thank both the SUNY Plattsburgh and the University of Vermont’s Upward Bound program for their participation in this study. The researchers would also like to thank the Lake Champlain Research Institute (LCRI) at SUNY Plattsburgh and the LCRI staff for assisting with the macroinvertebrate collection and identifying.
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Chapter 4

Conclusion

The goal of this work was to create and implement equitable environmental education. Chapter 2 discusses the systemic racism that is embedded throughout environmental education. Throughout this chapter, the creation of an equitable survey tool is presented along with data, indicating individuals from the same socio-economic backgrounds display similar levels of environmental stewardship and connectedness to nature but career interests shift in BIPOC youth. This chapter also discusses the importance of implementing Critical Race Theory within EE. Chapter 3 discusses strategies for increasing environmental stewardship, connectedness to nature, and environmental career aspirations. When taken as a whole, this research illuminates how racism in the field of natural resources has actively and continuously discouraged individuals of color from pursuing environmental career aspirations. Specifically, Chapters 2 and 3 highlight the importance of creating equitable and inclusive environmental education in order to diversify the field of natural resources while increasing environmental literacy. Increasing environmental literacy is a theme throughout this entire thesis. Environmental education needs to be accessible to all communities, regardless of race, income, and other factors in order to arm all citizens with the knowledge required to participate in planning,
management, and decision-making processes. Increasing access to environmental education and environmental literacy prepares individuals with the knowledge required to navigate and understand climate change and other pressing natural resource disasters.

Table 1. Results and Corresponding Chapters.

<table>
<thead>
<tr>
<th>Finding</th>
<th>Source</th>
<th>Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Stewardship and Connectedness to Nature is similar among students from the same socio-economic background regardless of racial demographic.</td>
<td>Analysis from pre-survey data (Chapter 2) indicated that there were no major significant differences among students from different racial backgrounds.</td>
<td>Continue conducting research that is equitable and using tools that do not reflect Western bias (Taylor 2015, Taylor 2018, Taylor 2019).</td>
</tr>
<tr>
<td>BIPOC youth are interested in the environment, yet they feel actively discouraged from pursuing environmental careers.</td>
<td>BIPOC youth expressed interest in the environment, via survey data and student observations (Chapters 2 and 3), yet voiced concerns over not feeling welcomed in STEM and not having natural resource careers presented to them.</td>
<td>Increase BIPOC student’s accessibility to natural resource professionals who reflect similar cultural values and increase equitable research opportunities (Morales et. al. 2022, Graham et. al. 2022, Taylor 2018).</td>
</tr>
<tr>
<td>When students participate in Environmental Education, levels of Environmental Stewardship and Connectedness to Nature increase.</td>
<td>Pre/Post-Survey data comparisons (Chapter 3) indicate significant changes in levels of Environmental Stewardship and Connectedness to Nature after students participated in educational interventions related to watershed science.</td>
<td>(Chamberlin 2020, Cheng and Monroe 2012, Cutter-Mackenzie 2009)</td>
</tr>
</tbody>
</table>

Results from this work demonstrate that students of color are interested in the environment, yet career options in the environmental workforce are not presented to BIPOC youth at the same levels as their white peers (Chapter 2, Chapter 3). There is still an abundance of work that has to be done in order for environmental education to become equitable among BIPOC students. There is no one plan to increase equitable environmental education, but to start, scholars and educators in the field of natural resources must recognize that the systems we participate in are structured in injustice and racism. By integrating Critical Race Theory into Environmental Education, Critical Race Theory provides a necessary framework that engages in the deconstruction of the oppressive structures embedded within the EE system and engages in the reconstruction of a socially just and equitable relation of power (Ladson-Billings 1998). By using CRT, we aim to elevate the experiences and voices of People of Color, creating opportunities...
for BIPOC individual’s narratives and experiences to come to the forefront (Delgado and Stefancic 2017). It is critical for these narratives to be highlighted because they actively challenge and disrupt the White Supremacy narratives that have been pushed for too long. Many environmental organizations have made some kind of effort to prioritize diversity, equity, and inclusion yet the majority of organizations continue to be white-led and white-dominated, failing to center racial injustice (Romero et. al. 2022).

Based on my results, there are numerous ways to create equitable environmental education. We have to start and continue to fight for justice, meaning breaking down systems of oppression that have been withheld for centuries. There is no one perfect answer to being breaking down all of these barriers, but we must start wherever we can and continue onward, elevating the voices and lived experiences of our communities of color in an inclusive and just way. Changes such as having students self-report race on a survey when participating in EE will allow educators to see who is attending these programs, seeing if the benefits of the programs are equally distributed. Initiatives like these may require more collaboration among students, teachers, and environmental organizations in order to understand the unique barriers People of Color face when trying to participate in environmental education programming (Anderson 2021). Also, creating equitable environmental education very well means discontinuing some traditional practices that have been in place for decades. Equitable environmental education needs new formats, interventions, and faces. There is no step-by-step guide on how to create equitable EE successfully but what we do know is that the current structures of EE alienate and exclude individuals of color, leading to low diversity, low participation from diverse audiences, and lived experiences that are being intentionally silenced. Further, increasing avenues of inclusion such as increasing the number of culturally competent mentors (Morales et. al. 2022), increasing allyship (Graham et. al. 2022), and validating science identity in students of color (Stets et. al. 2018) are all places to start.

Given these findings, environmental organizations and environmental educators may take specific steps to increase inclusive practices. By employing these initiatives to elevate voices of color and dismantle the racism that has been embedded throughout the natural resource field, we can hope to see increases in justice, diversity, equity, and inclusion. The promotion of DEI is not and should never be looked at as a trend or “just using buzzwords”. The promise of DEI is a commitment to ensure that all individuals can be heard, contribute, feel valued, and create positive change because of their unique perspectives and backgrounds. These changes directly relate and challenge ideas such as colorblindness, often in relation to the phrase “I don’t see color”. These views are harmful and diminishes the lived experiences of individuals of color (Anderson 2021). These conversations are hard to have and can be uncomfortable. By staying in a state of comfort, we are actively and continuously participating in racist systems that harm people of color. With discomfort comes progress. Without asking difficult questions and listening to the honest responses of individuals who have experienced racism and discrimination, progress will not be made. If reading this thesis made you feel sadness, anger, guilt, and/or discomfort, good. It means you were paying attention. A new path must be made in order to include diverse voices and promote and implement various ideas that reflect modern needs. It includes recognizing the failures of the past. The recognition that the current EE structure is not working may be difficult for many, but this recognition is what has to be done in order to create a space that is diverse, equitable,
and inclusive. There is still a long way to go in order to create equitable and inclusive environmental education, let's start somewhere and keep pushing forward.
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https://www.tandfonline.com/doi/full/10.1080/10899995.2022.2052553


Appendix A
Internal Review Board Approval

J. Stephen Mansfield <mansfj@plattsburgh.edu>    Thu, May 12, 2022 at 3:41 PM
To: kcole014@plattsburgh.edu
Cc: Marianne Wemete <wemette@plattsburgh.edu>, Steve Mansfield <mansfj@plattsburgh.edu>, Michael Simpson <simpson@plattsburgh.edu>

Dear Dr. Kim Coleman,

In accordance with the Campus Policy on the Use of Human Subjects, we have reviewed your project entitled "Investigating Interventions to Increase Environmental Literacy among K-12 Teachers and Students from Underrepresented Backgrounds" (IRB #1714). We have approved this study, including your intent to use passive (i.e., opt-out) consent, under expedited review.

Thank you for submitting this project information for our expedited review and we wish you well as you implement the project. This approval is for a one-year period effective 5/12/2022. If the interaction with human subjects extends beyond one year, a request for continuing review must be filed to seek approval for additional time.

Regards,

--
Dr. Steve Mansfield
Institutional Review Board (IRB), chair
plattsburgh.edu

Kimberly Coleman <kcole014@plattsburgh.edu>    Thu, May 12, 2022 at 4:09 PM
To: "J. Stephen Mansfield" <mansfj@plattsburgh.edu>

Hello,

Excellent, thank you. We will resubmit next spring for summer 2023 data collection.

Best,
Kim

[Quoted text hidden]

--
Kim Coleman, Ph.D. (she/her/hers)
Assistant Professor
Center for Earth and Environmental Science
SUNY Plattsburgh
101 Broad Street
Plattsburgh, NY 12901
Appendix B
Chapter 2-3 Additional Tables

Table 9. Total Race Demographics for the Summer of 2022.

<table>
<thead>
<tr>
<th>Race</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>White or Caucasian</td>
<td>97</td>
<td>74.05</td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>12</td>
<td>9.16</td>
</tr>
<tr>
<td>Black or African American</td>
<td>8</td>
<td>6.11</td>
</tr>
<tr>
<td>Multiracial</td>
<td>7</td>
<td>5.34</td>
</tr>
<tr>
<td>Latinx</td>
<td>5</td>
<td>3.82</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Native American or Alaska Native</td>
<td>1</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Table 10. Total Grade Demographics for the Summer of 2022.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Total</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9th grade</td>
<td>2</td>
<td>1.53</td>
</tr>
<tr>
<td>10th grade</td>
<td>21</td>
<td>16.03</td>
</tr>
<tr>
<td>11th grade</td>
<td>56</td>
<td>42.75</td>
</tr>
<tr>
<td>12th grade</td>
<td>52</td>
<td>39.69</td>
</tr>
</tbody>
</table>

Table 11. Total Gender Demographics for the Summer of 2022.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Total</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>67</td>
<td>51.15</td>
</tr>
<tr>
<td>Male</td>
<td>55</td>
<td>41.98</td>
</tr>
<tr>
<td>Non-Binary</td>
<td>6</td>
<td>4.58</td>
</tr>
<tr>
<td>Questioning</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Unsure/Unlabeled</td>
<td>2</td>
<td>1.53</td>
</tr>
</tbody>
</table>

Table 4. Codes for informal student interviews.

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
<th>Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active participation</td>
<td>Participants are actively involved in the education experience, not just passive receivers of verbal or visual information or communication</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td>(AP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>Individual participants’ change in attitude toward the subject of the EE or environmental actions related to the programming</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awareness</td>
<td>Individual participants’ change in recognition or cognizance of issues or concepts</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Behavior</td>
<td>Individual participants’ self-reported behavior changes or staff observations of behavior change following exposure to EE</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td>BIPOC</td>
<td>Black, Indigenous, and People of Color</td>
<td></td>
</tr>
<tr>
<td>Cooperative/group learning (C/G)</td>
<td>The learning environment requires participants to work with others, either through group deliberation/discussion and/or active participation/investigation</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td>Critical Race Theory (CRT)</td>
<td>The critique of how the social construction of race and institutionalized racism maintains a racial caste system that relegates People of Color to the bottom tiers</td>
<td>(George 2021)</td>
</tr>
<tr>
<td>Cultural Racism</td>
<td>How the dominant culture is founded upon and then shapes the society's norms, values, beliefs and standards to validate and advantage white people while oppressing People of Color. Cultural racism uses cultural differences to overtly and covertly assign value and normality to white people and whiteness in order to rationalize the unequal status and degrading treatment of Black, Indigenous, and People of Color.</td>
<td>(Okun 2022)</td>
</tr>
<tr>
<td>Culture</td>
<td>Knowledge, experience, beliefs, values, attitudes, meanings, hierarchies, religion, notions of time, roles, spatial relations, concepts of the universe, and material objects and possessions acquired by a group of people in the course of generations through individual and group striving.</td>
<td>(Okun 2022)</td>
</tr>
<tr>
<td>Diversity</td>
<td>Psychological, physical, and social differences that occur among any and all individuals, including but not limited to race, ethnicity, nationality, religion, socioeconomic status, education, marital status, language, age, gender, sexual orientation, or mental or physical ability. A diverse group, community, or organization is one in which a variety of social and cultural characteristics exist</td>
<td>(Romero et al. 2022)</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>Individual participants’ overall satisfaction or enjoyment levels associated with the educational experience</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td>Environmental Justice</td>
<td>The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental</td>
<td>(EPA 2022)</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
<td>Source</td>
</tr>
<tr>
<td>------</td>
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<tr>
<td>Environmental Literacy</td>
<td>Defined in environmental education literature as having four major components: knowledge, affective attitudes (i.e. feelings about nature), cognitive skills, and behavior</td>
<td>(Hollweg et. al 2011)</td>
</tr>
<tr>
<td>Equity</td>
<td>The guarantee of fair treatment, access, opportunity, and advancement while at the same time striving to identify and eliminate barriers that have prevented the full participation of certain groups. The principle of equity acknowledges that historically underserved and underrepresented populations exist and that fairness regarding these unbalanced conditions is needed to ensure equality in the provision of effective opportunities to all groups</td>
<td>(Romero et al. 2022)</td>
</tr>
<tr>
<td>Exclusion</td>
<td>The act of not allowing someone or something to take part in an activity or to enter a place</td>
<td>(Cambridge Dictionary 2022)</td>
</tr>
<tr>
<td>Hands-on observation and discovery (HO)</td>
<td>Participants have to physically manipulate some aspect of the environment in some way to explore a concept or solve a problem</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td>Inclusion</td>
<td>The act of creating environments in which any individual or group feels welcomed, respected, supported, and valued to fully participate. An inclusive and welcoming climate embraces differences and offers respect in both words and actions for all people</td>
<td>(Romero et al. 2022)</td>
</tr>
<tr>
<td>Intentions</td>
<td>Individual participants’ self-reported intent to change a behavior</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Individual participants’ change in knowledge of the subject after exposure to EE.</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td>Multimodal delivery of content (Mod)</td>
<td>Content is delivered in a way that uses more than one mode or media, requiring the use of other senses such as touch, smell, visual stimuli, etc</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td>Multiple points of view (View)</td>
<td>Program explicitly acknowledges multiple points of view</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td>Place-based learning (Place)</td>
<td>The educational program is grounded in the particular attributes of a place, using in situ natural and community systems and themes as the</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td><strong>Project-based learning (Proj)</strong></td>
<td>Students are engaged in selecting, planning, implementing, and evaluating a real-world environmental project and making informed choices for action</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td><strong>Skills</strong></td>
<td>Individual participants’ change in abilities to perform a particular action.</td>
<td>(Stern et. al. 2014)</td>
</tr>
<tr>
<td><strong>Social exclusion</strong></td>
<td>Multidimensional phenomenon not limited to material deprivation; poverty is an important dimension of exclusion, albeit only one dimension. Accordingly, social inclusion processes involve more than improving access to economic resources.</td>
<td>(United Nations 2016)</td>
</tr>
<tr>
<td><strong>White Supremacy Culture</strong></td>
<td>The idea (ideology) that white people and the ideas, thoughts, beliefs, and actions of white people are superior to People of Color and their ideas, thoughts, beliefs, and actions. In particular the media, the education system, western science (which played a major role in reinforcing the idea of race as a biological truth with the white race as the &quot;ideal&quot; top of the hierarchy), and the Christian church have played central roles in reproducing the idea of white supremacy (i.e. that white is &quot;normal,&quot; &quot;better,&quot; &quot;smarter,&quot; &quot;holy&quot; in contrast to Black, Indigenous, and other People and Communities of Color</td>
<td>(Okun 2022)</td>
</tr>
</tbody>
</table>
Appendix C
Summer 2022 Pre-Survey

Upward Bound Pre-Survey Summer 2022

We are doing a study to learn about Upward Bound students' interest in the environment and environmental careers. If you agree to be in this study, we will ask you to take two surveys, one now and the second survey towards the end of the summer. Both surveys will ask you questions about the environment.

You can ask questions about this study at any time. You can also decide not to finish the survey. The questions we will ask are only about what you think. There are no right or wrong answers because this is not a test.

If you continue with this survey, it means that you have read this and that you want to be in the study. If you don’t want to be in the study, do not complete the survey questions. Being in the study is up to you, and no one will be upset if you don’t answer the questions or if you change your mind later.

You can contact Jillian Kara at jkara004@plattsburgh.edu or Dr. Kimberly Coleman at kcole014@plattsburgh.edu with any questions or concerns.

We want to ask you to create a unique survey code that is only for you. Please enter your first initial, the first three letters of your last name, and the day of your birth date. For example, if your name is Charlie Brown and you were born on May 14, 2020, you would write Cbro14.

How do you identify in terms of gender?
- Male
- Female
- Non-Binary
- Other:

How do you identify in terms of race?
- Asian or Pacific Islander
- Native American or Alaska Native
- Latinx
- Black or African America
- White or Caucasian
- Multiracial
- Other:

What is your grade level?
9th grade
10th grade
11th grade
12th grade
Other:

I am interested in learning how to protect the environment (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I will take action to protect the environment (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I will speak up to friends and family about protecting the environment (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I feel connected to nature (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I feel that I am a part of the web of life (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I feel inspired by nature (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

Having an environmental job is important to me (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I play to study the environment in college (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I plan to work in an environmental field (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)
Appendix D
Summer 2022 Post-Survey

Upward Bound Post-Survey Summer 2022

We are doing a study to learn about Upward Bound students' interest in the environment and environmental careers. You may remember taking the first survey earlier in the summer. This is the second survey and will ask you the same questions about the environment.

You can ask questions about this study at any time. You can also decide not to finish the survey. The questions we will ask are only about what you think. There are no right or wrong answers because this is not a test.

If you continue with this survey, it means that you have read this and that you want to be in the study. If you don’t want to be in the study, do not complete the survey questions. Being in the study is up to you, and no one will be upset if you don’t answer the questions or if you change your mind later.

You can contact Jillian Kara at jkara004@plattsburgh.edu or Dr. Kimberly Coleman at kcole014@plattsburgh.edu with any questions or concerns.

We want to ask you to create a unique survey code that is only for you. Please enter your first initial, the first three letters of your last name, and the day of your birth date. For example, if your name is Charlie Brown and you were born on May 14, 2020, you would write Cbro14.

How do you identify in terms of gender?
Male
Female
Non-Binary
Other:

How do you identify in terms of race?
Asian or Pacific Islander
Native American or Alaska Native
Latinx
Black or African America
White or Caucasian
Multiracial
Other:

What is your grade level?
9th grade
10th grade
11th grade
12th grade
Other:

I am interested in learning how to protect the environment (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I will take action to protect the environment (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I will speak up to friends and family about protecting the environment (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I feel connected to nature (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I feel that I am a part of the web of life (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I feel inspired by nature (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

Having an environmental job is important to me (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I play to study the environment in college (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I plan to work in an environmental field (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

Did you attend a presentation from a watershed scientist during Upward Bound? Yes No

Did any of your Upward Bound classes involve lessons connected to Lake Champlain? Yes No

Please describe any lessons connected to Lake Champlain that you learned in your Upward Bound courses this summer.

Did any of your Upward Bound classes involve projects connected to Lake Champlain? Yes No
Please describe projects connected to Lake Champlain that you worked on in your Upward Bound classes this summer.