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The messy middle: an exploratory study of adolescent environmentalists in North Carolina

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ABSTRACT

Today's adolescents have grown up with technology as a main element in their lives and are particularly susceptible to experiencing mental health challenges, so-called nature-deficit disorder, and eco-anxiety around the climate crisis. This unique developmental context may necessitate a reconceptualising of adolescents' relationships with the environment including their connection to nature. We identified nine adolescents from North Carolina who had high levels of connection to nature and participated in environmental education programs. Using reflexive thematic analysis of data gathered through semi-structured interviews, we developed three themes to reflect how this group of US-based adolescents experience their connection to nature: *optimism and limitations related to individual actions*; *environmentalism as more than a phase*; and *complex relationships (with nature, environmentalism, and technology)*. This exploratory study has prompted us to reflect upon how traditional conceptualisations of core concepts in the field of environmental education may require more nuance in the twenty-first century.

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Introduction

There are extraordinary young people all over the world who have committed their lives to environmentalism. Perhaps best known is Greta Thunberg, a 21-year-old activist from Sweden who is credited with starting the 'School Strikes for Climate' movement, which calls on students to skip school on Fridays in order to attend or carry out demonstrations demanding action on climate change (Wallis & Loy, 2021). Greta's influence is global; she was named *Time* Person of the Year in 2019, has received multiple Nobel Prize nominations, and frequently speaks at high-profile events, including an internationally famous speech at the United Nations climate conference in 2019 (Kraemer, 2021). Greta represents just the tip of the iceberg when it comes to adolescents acting on behalf of the environment on the global stage.

In contrast to environmental activists like Greta, many adolescents are reportedly more disconnected from nature than ever before. Indeed, some research suggests that connection to nature and pro-environmental behaviours and actions dip drastically during adolescence (Olsson

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& Gericke, 2016). However, since these concepts were developed several decades ago, much has changed in the world. The first iPhone was released in 2007, accelerating an era of continuous online access. The following year, humans officially became an urban species; for the first time ever, more humans were living in urban areas than rural ones (Vargo, 2014). These shifts and more are likely to have important implications for Generation Z, or those born in the late 1990s and early 2000s, and future generations. This group of young people are often defined by the constant presence of social media and technology in their lives (Twenge, 2017). They are also considered the most diverse generation in history (Fry & Parker, 2018). The increasing urgency of the climate crisis coupled with globally rising mental health challenges means that Generation Z is likely to experience eco-anxiety at a higher rate than older generations (Coffey et al. 2021).

Generational differences are commonplace, so it is important to revisit concepts and question assumptions that may change over time. Given the global conversation on climate change (e.g. Berger, 2023; Klein, 2014), the social and cultural effects of technology (e.g. Turkle, 2017), and the emphasis on individual behaviour changes to promote sustainability (e.g. Mann, 2021), Generation Z might have new perspectives and experiences that could alter what environmental education needs to encompass moving forward (Ardoin et al. 2013). To understand the influences that shape connection to nature in adolescents in the early twenty first century, we interviewed nine young people in North Carolina who 1) participated in environmental programs or attended schools with an environmental focus, and 2) scored highly on the Nature Relatedness Scale (Nisbet et al. 2009). In this exploratory study, we sought to better understand how connection to nature and pro-environmental behaviour are discussed by adolescents in North America who appear to be highly connected to nature and who have been exposed to environmental education programming.

Literature review

Defining and measuring connection to nature

Connection to nature is conceptualised in various ways but typically refers to the relationship a person perceives that they have with non-human nature (Capaldi et al. 2015). It is also sometimes defined as an individual's tendency to include nature in their idea of self (Schultz, 2002). Higher levels of connection to nature, sometimes called nature relatedness (Zelenski & Nisbet, 2014), are linked to a higher likelihood of engaging in environmentally-oriented behaviours in both children and adults (Chawla, 2020; Cheng & Monroe, 2010; Frantz & Mayer, 2014; Hughes et al. 2018; Whitburn et al. 2020). An individual's connection to nature seems to be strongly influenced by family values (Oh et al. 2021). Given the immense challenges that exist with climate change and its devastating impacts to the environment, the association between connection to nature and pro-environmental behaviour could have an important influence on shifting young people's attitudes towards tackling environment-related issues; thus, the benefits of interacting with and psychologically connecting to nature extend beyond the individual level.

As connection to nature predicts the likelihood an individual will engage in pro-environmental behaviour, measuring connection to nature could serve as a proxy for identifying individuals who are more likely to act in the interest of the environment (as we have done in the recruitment process for the present study) or perhaps identify as an environmentalist. Identities, including environmental identities, that are formed in adolescence are likely to inform attitudes and behaviours throughout life (Wray-Lake et al. 2010). Underpinning the importance of this transformational time, Hughes et al. (2018) reported that adolescence is a time period during which connection to nature hits a low point; thus, understanding how young people experience and connect with nature during this time is vital to addressing this diminished relationship and, hopefully, promoting pro-environmental behaviour and identity.

While many measures of connection to nature exist, researchers have raised questions about their utility given the limited applicability of some. According to Salazar et al. (2020), measures of connection to nature tend to ask about very specific experiences within particular contexts (e.g. white, able-bodied, United States-based). In their guide on using measures of connection to nature, Salazar et al. call for future research that considers more diverse contexts and expands the limitations of current work. Researchers outside of the United States and United Kingdom (where much of the research in this field is conducted) have begun addressing the need to examine this construct in more diverse samples. For instance, Tseng and Wang (2020) conducted interviews with 10 adolescents in Taiwan to understand how they experienced connection to nature and concluded that adolescent connection to nature might look different from connection to nature in either younger childhood or adulthood. The authors also noted the ways connection to nature fluctuates in adolescents and its susceptibility to influence from educational inputs.

Nature-deficit disorder and eco-anxiety

Generational differences in relationships with nature have been observed in prior research. Long before members of Generation Z were born, Pyle (1993) described the 'extinction of experience' observed in reference to human relationships (or lack thereof) with nature. Soga and Gaston (2016) suggested that this has detrimental impacts for the planet, given that people who spend less time in nature are less likely to care about or act to protect nature (DeVillie et al. 2021). In a review of research on childhood nature connection, Chawla (2020) described the way that this fractured relationship with nature might be passed on from parents to children, perpetuating the 'extinction of experience'.

In the early 2000s, a concerted effort was made to increase engagement with and connection to nature in children. Louv (2005) published *Last Child in the Woods*, which described how children were more likely to experience what he termed 'nature-deficit disorder' as a result of a shift in societal norms towards more time inside and more time using digital technology. It is important to note that this concept has been critiqued (e.g. Dickinson, 2013) as it emphasises the need to recover a very specific type of childhood-nature experience and suggests that nature is a separate entity from which humans can disconnect. As Dickinson wrote, it also seems to suggest that environmental degradation is a modern problem experienced only by younger generations. With this in mind, however, it is still useful to consider the movement around Louv's idea as one example of action to address what is a relatively modern tension between unstructured time in nature and the urbanisation and technological orientation of today's childhoods.

Alongside this so-called nature-deficit disorder and the worsening climate crisis, some children and young people who have been encouraged to re-engage with nature are also suffering from eco-anxiety (Crandon et al. 2022). Brophy et al. (2023) define eco-anxiety in the context of young people as 'distress, worry, or concern related to the climate change crisis' (p. 633). Some researchers also conceptualise this to include feelings of uncertainty, frustration, and being overwhelmed, reflecting the wider heterogeneity in how terms are defined and used within this field of research. Zacher and Rudolph (2023) suggested that environmental knowledge is negatively related to eco-anxiety such that people who had more environmental knowledge experienced less eco-anxiety. For young people, environmental education might therefore be one means through which they could combat eco-anxiety by feeling empowered through knowledge.

Adolescent identity and mental health

Adolescence is a time period of formative identity development (Erikson, 1968). Erikson's influential Stages of Psychosocial Development suggest that it is during this period that young people determine their unique identity and their position within social groups. School plays

an outsized role in both intentionally and unintentionally influencing that development (Verhoeven et al. 2019). Throughout their secondary school career, young people are both directly told how to act and what to do and, simultaneously, are exposed to pressure from peers and expectations from teachers that shape how they behave and what they believe. Participation in extracurricular activities, specific classes, and additional programs provide supplemental learning experiences and opportunities for young people to be exposed to these influences. Thus, engaging with programs that focus on environmental education during this time could be one way to promote a lifelong interest in nature (Ardoin et al. 2015; DeVille et al. 2021; Rosa & Collado, 2019).

While adolescents are developing their identities, they often suffer worsening mental health. According to the Centers for Disease Control and Prevention (2021), adolescent mental health across the United States has worsened in the last decade. Technology and the prevalence of social media seem to play an important role in this increase, particularly in those adolescents spending more than three hours per day on social media (Riehm et al. 2019). Additionally, for some adolescents, the climate crisis is also associated with worsening mental health (Léger-Goodes et al. 2022). The combination of multiple factors influencing mental health, a formative but tumultuous period of development, and the worsening climate situation places adolescents in a difficult place as they navigate their relationships with the environment.

Environmental education programs are one avenue of providing support, knowledge, and means of expression for adolescents. Given the prevalence of mental health problems amongst adolescents and the nature of the topics in environmental education programs, diverse though they may be, it is likely that environmental educators will encounter students for whom participation in environmental education might worsen feelings of eco-anxiety (Pihkala, 2020). Conversely, equipping students with more knowledge and feelings of competence around the environment might give some adolescents reasons to feel hopeful. For both of these responses, and any range in between, Pihkala (2020) emphasised that it is important that environmental educators reflect on their role in helping young people to work through these conflicting emotions. Environmental education programs have the ability to confront these topics head on, though not all do so. Additionally, while environmental education programs might be associated with increased nature connection in participants, Chawla (2020) reported that this might be true more often in younger children compared to adolescents. Thus, in facilitating environmental education programs with adolescents, educators must listen to the voices of young people to understand how they experience connection to nature, how they navigate their relationships with the environment, and what they take with them after participating in these programs to understand how best to prepare young people to engage with and care for nature throughout their lives.

Previous research has focused on the experiences and actions of those young people who might identify as activists given their involvement in protests and climate strikes (e.g. Eide & Kunelius, 2021; Wallis & Loy, 2021). While these perspectives are certainly important, particularly in understanding what motivates young people to engage in pro-environmental behaviours such as weekly protests, the perspectives of adolescents who are connected to nature but may not be as politically active are less often considered. Given that so many young people may not be those who are actively participating in climate strikes or protests, it can be helpful to learn from adolescents who are aware of environmental challenges, have participated in environmental education, and are connected to nature to understand the role that environmental education programs and other common influences might have played in shaping their identities and perspectives.

Methods

We conducted an exploratory qualitative interview study (Brinkmann & Kvale, 2018) of nine adolescents across North Carolina in the United States to better understand their connection

to nature, interest in environmentalism, and engagement (or lack thereof) in pro-environmental behaviour. This study was approved by the Elon University ethics review board .

Research sites and survey

We contacted five sites in North Carolina that provide environmental programming to adolescents; all agreed to share an online recruitment survey with their program participants. Of these sites, two are charter schools that include environmental stewardship in their mission statements and integrate the North Carolina Environmental Literacy Plan (North Carolina Department of Public Instruction and North Carolina Department of Environmental Quality, 2014) into their respective curricula. The remaining three sites are summer environmental programs for teenagers. Three research sites are located in the central region of North Carolina, and the remaining two sites are located in the western part of the state.

The survey was distributed online with the aim of identifying participants for the interview portion of the study. Thirty-two participants from the aforementioned sites completed the survey. Every participant read and signed a consent form detailing the purpose, benefits, and risks associated with the study. Additionally, each participant younger than age 18 obtained parent or guardian permission to participate in the study. Next, all participants completed a section of the survey that requested basic demographic information, including age, contact information, hometown, and the summer environmental program or charter school to which they were affiliated. The survey concluded with the Nature Relatedness Scale (NRS; Nisbet et al. 2009), a 21-question survey that is used to ascertain the degree to which individuals see themselves as part of the natural world (see [Appendix A, supplemental material](#)). The survey used a Likert scale ranging from one (strongly disagree) to five (strongly agree). Eight of the 21 questions were reverse-coded. NRS scores from the whole sample ($n=32$) ranged from 2.67 to 4.67 ($M=3.93$). Participants scoring above a 3.0 on the NRS were invited to participate in a subsequent interview ($n=30$). As such, scores on this measure of connection to nature, in conjunction with their participation in environmental education programs, were used as a proxy for identifying adolescents with a relatively strong connection to nature who may be interested in environmentalism. Of the 30 adolescents invited for interviews, nine accepted the invitation.

Participants

Participants from the overall sample of adolescents in the United States ($n=32$) ranged in age from 12 to 19 years old. Ten participants came from one of two charter schools with an explicit environmental focus, and 21 participants took part in a summer program focused on environmental issues. One participant was recruited through a personal connection with one of the authors. Participant profiles for the nine adolescents who took part in the interviews can be found in [Table 1](#). Of the nine participants interviewed, six identified as women and three identified as men. We did not collect information on the participants' racial identities or ethnicities beyond what was disclosed during interviews.

Interviews

Interviews allowed participants to share their stories in a more comprehensive manner than through surveys alone (Brinkmann & Kvale, 2018). Qualitative research, according to Chawla (1998), can 'bridge the rational and emotional sides of environmental learning' (p. 384), which is necessary for research in this field. Interviews took place either at the participant's school or in a local library or coffee shop. Interviews were semi-structured, which allowed the participants' answers to guide conversation. However, there was an interview schedule followed for every

Table 1. Participant profiles.

Name	Age	NRS score	Description
Adam	18	4.29	Adam grew up on a rural farm with 11 siblings and participated in Boy Scouts, which he said is where he learned the importance of pro-environmental behavior. He expressed a strong desire to leave the United States to travel and homestead with his older brother.
Azalea	15	3.76	Azalea shared that she first became interested in environmental issues in 6th grade when she joined the Environmental Committee in her school's United Nations club. She indicated that she does not spend much time outside but rather spends the majority of her time using technology.
Katie	14	4.33	Katie shared that most of her environmental knowledge comes from school classes. She also engages in her school's garden club as a way of spending time with friends.
Mackenzie	14	4.57	Mackenzie said that her family and the outdoor nature experiences she had as a child were the strongest influences in shaping her care for the environment. She said that she feels connected to nature and believes this connection stems from spending a lot of time outside and noticing that she is happy when outside.
Rahel	19	4.10	Rahel is a first-year college student majoring in environmental studies. She participated in a summer environmental program and ended up assuming a leadership position in it the following year. Rahel was born in an urban area to immigrant parents.
Reese	12	4.38	Reese said that he first became aware of environmental issues at age five and cares about the environment because it is necessary for life. His mother is very environmentally aware, which he shared has been influential for him.
Sabrina	17	3.76	Sabrina is a student at a rural charter school with an explicit environmental focus. She said she first became aware of environmental issues on a school field trip around age seven. She also noted that she was influenced by one of her close friends to be interested in the environment.
Stephanie	15	3.81	Stephanie was born in Korea and has lived in various cities in since she and her family came to the United States. Her interest in the environment began at age 14 in school. Stephanie said that she uses a lot of technology and does not spend much time outside apart from running with her cross country team.
Zane	13	4.33	Zane attends a charter school with an explicit environmental focus, and he said that he became aware of environmental issues in his 7th grade science class. In the future, Zane wants to spend a lot more time outside travelling around the country in a van, rock climbing, and snowboarding.

participant regardless of their answers to previous questions (see [Appendix B, supplemental material](#)). Interviews ranged from 20 to 45 min in length, and participants received a \$20 gift card for their time. Interviews were recorded with participant consent and transcribed by an external professional.

Data analysis

We began our analysis by determining participant scores from the NRS; scores were first calculated individually and then averaged across all participants to determine a mean from the sample. Internal consistency for the NRS was very good (Cronbach $\alpha = 0.85$). Participants were assigned pseudonyms and interview content was anonymized. Interview transcripts were analysed following Braun and Clarke's (2006, 2019) reflexive thematic analysis process. First, we familiarised ourselves with the data by re-reading transcripts and discussing our initial ideas and impressions of the data. Then, we again looked at each transcript carefully and developed a list of initial codes. Following discussion of these codes, we sorted them into potential themes. During these discussions, we explored how our own perspectives around environmental education and nature were shaping the findings. We challenged one another and ensured that our analytic choices were supported by data extracts. We then revisited the transcripts with these themes in mind to ensure that they accurately reflected what we interpreted, encompassed all of the data, and told a clear story. Another discussion allowed us to refine the themes.

In line with Braun and Clarke's (2006, 2019) reflexive style of thematic analysis, which acknowledges researcher subjectivity as a strength rather than a weakness, it is important to note that our own experiences and careers shaped our findings; one of us works for an environmental non-profit while the other two conduct research in the fields of environmental education and ecopsychology. As such, we identify as environmentalists ourselves and are therefore 'insiders' when researching this topic (Braun & Clarke, 2013). Additionally, we are all white, able-bodied, English-speaking citizens of the United States, and university-educated; two of us identify as women and one of us identifies as a man. These perspectives, and our accompanying views on what constitutes knowledge, have influenced the findings we present below.

Findings

Theme 1: optimism and limitations related to individual actions

The young people in this study described a tension between both feeling that they were taking all the individual action within their ability and also wishing they could do more to help the environment or counter some of the impacts of climate change. Reese, for instance, described the actions that his family would typically take:

We try to turn off all the power in the house before everyone goes out for work or school, like this morning. We don't leave the water running, and yeah, that's pretty much all we can do.

Similarly, Azalea felt limited in what she, on her own, could do to make things better: 'That's the thing, where I don't know what else I could be doing other than what I'm already doing.' However, when describing the actions that she did currently take in service of the environment, she stated that she did:

...a lot less than I wish I was doing. I recycle, that's about it. I try to save electricity by turning off and unplugging stuff I'm not using, but I wish I could do more like compost.

These young people seem to be experiencing some level of cognitive dissonance as they grapple with the limitations of their individual actions, their connection to nature, and their knowledge of the state of the climate crisis. Stephanie described this discomfort but had a reason which justified the choice: 'I do use plastic bags and plastic utensils sometimes, which bothers me but they're also very convenient.'

One factor compounding this cognitive dissonance could be the feeling that humans are intrinsically intertwined with nature and the environment. Several participants spoke of their frustration that humans were causing harm to the environment and impacting nature with their actions with no attention paid to the impacts of this. For Reese, this was felt at an even deeper level: '[The environment is] what I'm based off of, it's how I survive, and I don't want it to die.' This belief seems to suggest that the relationship between humans and nature is not one that can successfully be separated, placing the onus on humans even more to act responsibly.

At the least, these individual actions provided some of the young people with reasons to be hopeful. Azalea, for instance, said, 'Sometimes it's hopeful because I know that some people, a lot of people are trying to take steps to fixing these problems.'

Theme 2: environmentalism as more than a phase

While many aspects of adolescent identity come and go as phases, this theme captures the idea that environmentalism, in the forms that these adolescents experienced it, was not simply a passing phase or hobby. Rather, environmentalism was inherently related to serious political and social issues that impacted their lives in real and sometimes scary ways. For two

participants, conversations around environmentalism were linked to their feelings about politics and the government, though this looked different for each of them. Adam, who grew up on a farm, tied many of his feelings about nature and the environment with his opinions on politics and government action; many of these were negative:

I don't see the sense that the EPA [Environmental Protection Agency] is trying to help [the environment], because I feel like it's more of a money creator, to pull in money for the government...I feel like if our government was less for the businesses and more for the people, I feel like that would change how we cultivate our land and what we do with it. I feel like that would change, but any time soon, I do not see that happening.

While Adam's interest in the environment was closely tied to his views on how government policies impact farmers, Rahel had a different perspective. As the child of immigrants living in the US through Trump's presidential campaign and presidency, Rahel paid close attention to politics given their direct impact on her family. As a result, Rahel learned more about environmental issues at the same time:

It's not only an environmental issue but it's now become a political issue. I keep up with politics, just because it affects my life and it affects everyone's life but I feel like sometimes since I'm not a generic white person, then it affects me a little more, especially with people like Trump who are out there insulting my religion and my community so I have to keep up with this stuff so that I'm updated so that I know if he says something stupid that could put me in danger kind of thing. I don't know. For me, that was my gateway to doing something that changes the world and I think the fact that it's also not just environmental but it's also political makes me more drawn to it.

Even for those participants who did not reference politics in relation to environmentalism, their environmental identity shaped other choices or aspects of their life. One clear example of this was in participants' future aspirations for their university studies and careers beyond education:

I want to be an engineer, but then also trying to help the earth. Like creating more efficient solar panels and try to make alternate sources of power more efficient, so then we can use them more. Then maybe try to decrease the CO2 emissions or something like that, and trying to do stuff like that as an engineer. (Zane)

For some participants, this environmental identity was influenced or reinforced by family members who prioritised environmentalism as a family value. Mackenzie described how her parents' decision to be vegan encouraged her to think more closely about caring for animals, while Sabrina developed a love for animals inspired by her grandfather who worked at the zoo. Reese also noted that his parents inspired his interest in the environment. In particular, Reese credited his mom, saying: 'She cares...she just cares about the environment, what's happening to it, why it's happening.' For these adolescents, observing their parents' beliefs and behaviours about the environment seemed formative in helping them to build their own environmental identities.

Theme 3: complex relationships (with nature, environmentalism, and technology)

Adolescence is a time of change and complexity, and this extends to the emotions and relationships that these young people had with nature, environmentalism, and technology. For some, nature was a happy place, somewhere they thought of as fun. Katie shared that for her, nature is a place of refuge:

It's very peaceful to me and quiet. It's a place I can go to relax from everywhere else, like everyday life. It's just kind of like a safe place. I don't know. That's kind of how I view the environment and like the natural world, like the woods and the mountains and stuff...Because it's always just like [a] place where I can go to reflect, and it's like there's nothing, like there's no hubbub going on. I don't know. It's like a good safe place for me I guess. Yeah. I've always just loved the environment.

Simply being outside is not necessarily a quick route to more positive emotion, however. Zane shared that the conditions have to be more specific to experience benefits from the outdoors:

For me, it's kind of weird. If it's just outside, it doesn't do much, but if I'm in the woods or away from civilization, it makes me feel really good. Like, if I'm on a hike and there's only us out there, there's no roads or anything, it makes me feel really happy that it's still...not necessarily untouched, but still not domesticated. Since we live in the mountains, there's still a good amount around us. I couldn't imagine living in a big city, it just would be awful.

For others, nature and environmental issues prompted feelings of anger, anxiety, and frustration. Mackenzie described feeling guilt when she accidentally harms the environment but said she feels angry when she sees others do the same. The participants who described these negative emotions often referenced the climate emergency more broadly in describing the impact on their own feelings:

After learning about the problems that the earth faces, I just got really concerned and I know it's important. We live on this earth, we have to take care of it or else we won't be here, so I think that's really important. (Azalea)

It was not always a case of being one or the other; for some participants, certain elements of nature or ways of interacting with it elicited more positive feelings while those same people felt more negative or distressing feelings about specific topics to do with climate change or environmental degradation. Reese, for example, shared that being in nature made him feel happy, particularly seeing that areas of nature nearby were still okay after recent forest fires. At the same time, however, he also felt:

...bad. I could've been part of it. Something with sparks, or something like a single spark from a campfire going up into the trees and starting an entire forest fire. Little tiny things like that. Even if you put the fire out, there can still be a spark that goes up when you put it out. Little tiny things like that cause massive problems.

Further, their beliefs about nature did not always seem to be reflected in their reported actions in the ways that might typically be expected. For instance, some of the young people spoke at length about how much they care for nature and environmental issues but said they spent little time outside:

I try to [spend time outside], but I'm using this camp as a way to push myself to, because I want to but I just don't. I'm pretty sure after this camp I'll be outside more...Around my house, I don't because there's not really much to do. I'll go to the playground but it's for little kids and I'll just sit there. (Azalea)

There was also notable complexity as it pertained to their relationships with technology and its role in their connection to and knowledge of nature; indeed, it seemed that social media could be a kind of environmental education for nearly all of these adolescents. Participants referenced social media (e.g. SnapChat), news websites, and documentaries (e.g. on Netflix) as places where they got information about the environment or as initial sources of inspiration for their interest in environmentalism.

Despite the prevalence of technology amongst younger generations, even within this small group of young people, the role that technology played depended on the person. For some, technology was part of the 'problem' contributing to disconnection from nature and climate change while for others technology was a mechanism through which they connected to nature and learned more about environmental challenges. For Adam, technology fell into the former category:

I don't like technology, just because you can see anything now, you can hear anything, if you want, if you have the technology. I feel like it separates people and draws people further away, when it was initially to bring people together. I feel like that's the flaw in and of itself. I feel like technology, it's hurting the environment, for sure. The more we progress, the more we have to use gas to supply the energy to build skyscrapers and make these buildings.

The complexity reflected in participants' observations on their feelings and experiences of nature demonstrate that while nature might be associated with a range of benefits, having a strong environmental identity might not be so straightforwardly positive or quite so easy to develop.

Discussion

The young people from the United States in our study spoke candidly about their connection to nature, pro-environmental behaviours, and feelings about nature more generally in a way which reflected other forms of identity development during adolescence. Participants described being exposed to new ideas about environmentalism through their peers; through specific teachers, classes, and curriculum; and through their participation in environmental education programs. These align with the intentional and unintentional influences on adolescent identity that young people experience at school, as described by Verhoeven et al. (2019). Despite all the participants having a shared influence – their participation in some sort of environmental education programming – their beliefs and actions diverged, as did the tensions that they felt around things like the role of technology, the emotions their relationship with nature evoked, and the extent to which their behaviours matched their aspirations.

These tensions, particularly those around behaviour, as described in *theme one*, are not unique to these adolescents and are illustrative of larger conversations around environmentalist ideals. That these adolescents seemed to have some cognitive dissonance around their perceptions of 'everything they could do' and what they actually wished they could be doing reflects the optimism and limitations of individual behaviour in response to systemic issues. Although only two of the adolescents referenced the role of government or businesses in relation to their environmentalism (seen in *theme two*), the group, overall, seemed to express a discrepancy in what they felt they reasonably could do as just one person compared to what actions were necessary to make considerable change. This discrepancy is commonly seen in the movement to encourage individuals to take shorter showers, walk or bike instead of drive, and recycle rather than focusing on pressuring businesses and governments to enact large-scale or systemic changes (e.g. Jensen, 2009; Stern, 2002).

Additionally, this attitude/action gap has long been noted as researchers have sought to determine how best to theorise the relationship between environmental attitudes and knowledge and pro-environmental action; Kollmuss and Agyeman (2002) described the complexity of this relationship and noted the influence of various demographic factors including cultural and social norms. Indeed, at an individual level, the cultural and social factors that Adam and Rahel mentioned in *theme two* seem to be strong influences regarding their environmental knowledge and attitudes. In light of Kollmuss and Agyeman's proposed model of pro-environmental behaviour, we acknowledge that the complexities of this relationship are not unique to younger generations. However, we suggest that these complexities be more centrally considered in environmental education with adolescents today, particularly in light of changing priorities (e.g. Ardoin et al. 2013).

We noted a similar gap between belief and behaviour from participants' descriptions of the role they felt technology played in their interactions with and knowledge of nature; this was described in *theme three*. While many expressed their belief that technology did not (or should not) cross over into their experiences in nature, they also spoke about being attached to some form of technology at all times. Notably, digital platforms, like Snapchat and Netflix, were a main source of environmental news for some of the participants, meaning that technology supported their relationship with nature in some cases. This suggests a need to move away from the either/or argument of nature versus screens and instead embrace that screens can be a way into nature. For environmental education programs, this might look like including social media literacy as part of the curriculum. This aligns with Greenwood and Hougham's (2015)

thoughts around mitigation and adaptation of technology as it pertains to its inclusion in environmental education; the authors acknowledged that it is futile to attempt to remove or avoid technology altogether, so efforts should instead focus on deliberate adaptations of technological tools where they can enhance the experience. With the rise of artificial intelligence tools like ChatGPT, all areas of education will need to take a similar mitigation and adaptation approach, and environmental education is no exception (North et al. 2023). However, in embracing the exciting innovations available at their fingertips, educators must also consider the barriers that exist around integrating technology into environmental education; these include the cost (and the cost to the environment) of such devices and the technological literacy required of many of the apps and softwares available for use.

Participants in this exploratory study also described conflicting emotions around their relationship with nature; some nature-based experiences made them feel happy and relaxed, while their environmental knowledge and awareness often provoked feelings of frustration, anxiety, and helplessness. Understanding the role of emotions, both positive and negative, in motivating environmental action can be useful in designing environmental education experiences and wider messaging (e.g. in media), which will effectively encourage pro-environmental behaviour. That both positive and negative emotions are related to pro-environmental behaviour (Brosch, 2021) is important given the increased awareness of children and young people experiencing eco-anxiety (Léger-Goodes et al. 2022). Pihkala (2020) wrote about the impacts that the increased eco-anxiety (and related emotions) amongst young people will have on environmental education and, in particular, the role of the facilitators of such programs. Pihkala suggested providing safe spaces for students to express these emotions, reflecting on and discussing their own difficult emotions, and incorporating opportunities to feel hopeful and joyful about nature. These recommendations will be important for environmental educators teaching adolescents experiencing these conflicting emotions.

In this study, we used a measure of connection to nature, the NRS (Nisbet et al. 2009), to identify adolescents with higher levels of connection to nature with the aim of better understanding what that connection to nature looked like in this group. Their responses helped to illuminate why some of the commonly used measures of connection to nature might require adjustments to account for the nuance reflected in younger generations' experiences. For instance, measures of connection to nature often emphasise individual action rather than collective or political action; however, several participants in the present study discussed the politicization of climate change and environmentalism (seen in *theme two*), pointing towards the potentially inextricable link between caring for nature and needing larger, systemic actions to stave off further catastrophe. Equally, though, some participants did not mention these larger systems at all, suggesting that these adolescents may still be wrestling with the complexity of these concepts. Regardless, as suggested by Swim et al. (2022), there are generational differences, small though they might be, in how younger generations feel and talk about climate change; it seems likely that these differences would extend to other relationships with nature, too, requiring reflection on how these concepts are measured across diverse groups.

Implications and future research

There are several additional implications of this study and ways forward for further research. First, longitudinal research exploring the development and evolution of adolescents' relationships with nature over time could provide insight into how connection to nature evolves and the impact this might have on environmental attitudes, behaviours, and emotions. Similarly, follow-up interviews with the same participants from this study several years from now could serve a similar purpose to observe what elements of their environmental identity remained throughout adolescence into early adulthood. As both the climate and mental health crises worsen, it will also be necessary to more closely track the impact of eco-anxiety on adolescents. Future research

should continue to explore how adolescents experience these concepts and how these experiences might differ from older generations. Findings from such studies could shape environmental education to promote connection to nature and improve environmental knowledge in adolescents while simultaneously helping to reduce the ill-effects of climate-related emotions.

Limitations

This was an exploratory study that was never intended to represent the viewpoints or experiences of all members of Generation Z. The adolescent participants in this study all came from the same state in the United States, meaning that their experiences were bound by that socio-cultural context. However, this small sample of adolescents from various parts of the same state demonstrate both the diversity of experiences amongst this generation and the ways in which a shared influence – environmental education programming – can influence attitudes and behaviours in many ways. As with all qualitative research, elements of the present study are likely transferable to similar contexts (Braun & Clarke, 2013) and might have relevance for practitioners working with adolescents in environmental education settings, including the types from which the participants in the present study were drawn.

Additional limitations arise from the sampling method and the number of participants; while Braun and Clarke (2013) noted that nine participants is appropriate for a small-scale, exploratory interview study of this kind, we acknowledge that only about 30% of those adolescents surveyed agreed to participate in a subsequent interview. Had we been able to interview more of these adolescents, our understanding of their experiences might have been different as participants who volunteered to take part in the study likely had different experiences or characteristics compared to those who chose not to participate in an interview. In terms of research methods, the semi-structured nature of the interviews lent themselves to creating opportunities for divergent responses, as even slight variations in the wording of questions may have impacted the type of responses received (Chawla, 1998).

Conclusion

Overall, findings from this exploratory study of adolescents in the United States who have been exposed to various forms of environmental education demonstrates the messy middle these adolescents inhabit; from middle school to the middle of development and the middle between childhood and adulthood and their associated responsibilities and emotions, nothing about the relationships these adolescents had with nature were straightforward. Environmental education programs will be improved by engaging with these complexities head-on. Additionally, environmental educators should reflect on whether their programs and practices perpetuate stereotypes about what it looks like to be an environmentalist or what it looks like to be connected to or acting in service of nature. Given the rise of climate anxiety, environmental education programs might need to focus more on approaches that go beyond simply informing students about the environment and into approaches that support intellectual and emotional processing, connecting to nature for the benefit of physical and mental wellbeing, and direct political action (Wray-Lake 2019).

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