Environmental Education Research

Routledge
Taylor & Francis Group

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/ceer20

Who teaches placed-based education: identifying relationships between environmental value orientation and pedagogical values

Miranda M. Conlon, Meena M. Balgopal, Brett L. Bruyere, Diane S. Wright, Kevin R. Crooks & Jonathan Salerno

To cite this article: Miranda M. Conlon, Meena M. Balgopal, Brett L. Bruyere, Diane S. Wright, Kevin R. Crooks & Jonathan Salerno (06 Jun 2024): Who teaches placed-based education: identifying relationships between environmental value orientation and pedagogical values, Environmental Education Research, DOI: 10.1080/13504622.2024.2354342

To link to this article: https://doi.org/10.1080/13504622.2024.2354342

Published online: 06 Jun 2024.

ENVIRONMENTAL EDUCATION RESEARCH
https://doi.org/10.1080/13504622.2024.2354342

Routledge
Taylor & Francis Group

Who teaches placed-based education: identifying relationships between environmental value orientation and pedagogical values

Miranda M. Conlon[a], Meena M. Balgopal[b,c], Brett L. Bruyere[a], Diane S. Wright[b,c], Kevin R. Crooks[c,d] and Jonathan Salerno[a,c]

[a]Department of Human Dimensions of Natural Resources, Colorado State University, Fort Collins, Colorado, USA; [b]Department of Biology, Colorado State University, Fort Collins, Colorado, USA; [c]Graduate Degree Program in Ecology, Colorado State University, Fort Collins, Colorado, USA; [d]Department of Fish, Wildlife, & Conservation Biology, Colorado State University, Fort Collins, Colorado, USA

ABSTRACT

Place-based education (PBE) offers teachers a unique opportunity to increase engagement and academic outcomes while strengthening students' connections to their environment and inspiring future conservation. In most instances, classroom teachers must independently choose to implement PBE, such as when discussing topics surrounding wildlife and the environment. Environmental values orientations of teachers may explain teachers' implementation of PBE. Through thematic analysis of phenomenological interviews with 11 middle and high school science teachers in Colorado we identified their environmental value orientations. We found that teachers with predominantly mutualist environmental value orientations were associated with high levels of implementation. Our findings can inform professional development of teachers learning about the relationship between PBE and pro-environmental value orientations and behaviors among future generations.

ARTICLE HISTORY
Received 18 January 2024
Accepted 22 April 2024

KEYWORDS
Place-based education; environmental value orientations; phenomenology

SUSTAINABLE DEVELOPMENT GOALS
SDG 4: Quality education

Introduction

As societal challenges of biodiversity loss, climate change, and the need for renewable energy increase in prominence, addressing environmental literacy in K-12 classrooms becomes increasingly necessary. Yet, young people need more than just knowledge; they need to demonstrate a concern for, commitment to, and willingness to change the way humans interact with the natural world (Wright, Crooks, and Balgopal 2022). Purposefully designed environmental education can increase students' awareness of human relationships with the environment, promoting eco-centric worldviews (Goldman, Assaraf, and Shaharabani 2013; Ballard, Dixon, and Harris 2017). Environmental education can also increase pro-environmental behaviors among students who participate in outdoor, nature-centered, and place-based programs (Wells and Lekies 2012; Duerden and Witt 2010). For these reasons, scholars have called for the implementation of place-based education (PBE) in K-12 classrooms (Gruenewald and Smith 2014).

CONTACT Miranda M. Conlon andie.conlon@colostate.edu Department of Human Dimensions of Natural Resources, Colorado State University, Fort Collins, CO, USA

PBE allows instructors to use local contexts to teach scientific concepts, strengthen connections between the natural and human world, promote civic engagement, and integrate interdisciplinary ways of problem-solving (Semken et al., 2017; Sobel 2005; Wright et al. 2021). PBE has roots in experiential learning (Woodhouse and Knapp 2000), and has been shown to connect students to their socio-natural environment, such as through place attachment and stronger links to native wildlife among youth (Vaske and Kobrin 2001; Chawla 2015). Place attachment has been linked to pro-environmental behaviors (Vaske and Kobrin 2001), so understanding the factors behind teachers' decision to incorporate PBE into their curricula has important implications for preparing environmentally literate citizens.

While PBE lessons can be integrated into curricula to meet academic standards, it is not a requirement in the U.S., and teachers may perceive barriers to teaching PBE lessons (Wright et al. 2021; Miller and Twum 2017). Thus, it is important to identify what factors might explain teachers' decisions to implement PBE. Here, we define PBE lessons as those that (1) are inspired by local cultural or biophysical context or issues, (2) allow school and community organizations or experts to collaborate, (3) integrate interdisciplinary content, (4) use inquiry and experiential pedagogy, and (5) are designed to encourage civic engagement (Wright et al. 2021; Woodhouse and Knapp 2000; Smith and Sobel 2010). Since teachers' pedagogical decisions are shaped by their values (McNeal, Petcovic, and Reeves 2017), our study is informed by theories of value orientations.

Pedagogical values

Exploring the drivers of teachers' instructional decisions is challenging as there remain conflicting explanations (Pruneau et al. 2006). A throughline across most candidate theories, however, is that teacher behaviors are ultimately rooted in their pedagogical values (Homer and Kahle 1988; Borg 2001). Generally, values are an important component of people's social cognition, informing how we not only process, retain, and use information but also direct our own behavior (Bulgarelli and Molina 2016; Schultz 2011). Values can be described as trans-situational; unlike other social-psychological attributes (e.g. attitudes) that may shift to reflect different situations or environments, values are formed during youth and tend to remain fixed as we age (Schwartz 2012; Manfredo et al. 2021). Schwartz (1992) identified six main characteristics of values, they: (i) are inherently connected to a person's affect and linked to feelings; (ii) refer to goals that guide actions; (iii) are unchanging and do not shift to accommodate specific situations; (iv) serve as an individual's set of standards for evaluating other people, actions, or events; (v) are prioritized in importance relative to one another; and (vi) this relative prioritization of multiple values is what drives action. Therefore, pedagogical values generally refer to teachers' pedagogical goals that drive their instructional choices, their pedagogical philosophies, their trans-situational pedagogical dispositions, and their prioritization of pedagogical actions.

There is a lack of empirical evidence for direct predictive validity between values and behaviors (including pedagogical approaches), often referred to as the 'value-action gap'—when someone's actions do not coincide with their values (Kollmuss and Agyeman 2002). Social psychologists theorize that value orientations play a mediating role in filling this gap in the relationship between values and behaviors (Homer and Kahle 1988; Schwartz 1992). Value orientations refer to a set or pattern of basic beliefs about certain objects or situations, such as the environment, helping one associate values with more concrete meanings (Whittaker, Vaske, and Manfredo 2006).

Environmental value orientations

Teachers' pedagogical values can influence their teaching styles, academic goals, and classroom management style (Pudelko and Boon 2014; Barni, Russo, and Danioni 2018). In this paper, we

assert that science teachers' pedagogical values also intersect with their *environmental value orientations*, or their pattern of beliefs about the environment, to inform their decisions to implement PBE science lessons. Specifically, because environmental values, and their relationship to behaviors, are abstract and difficult to identify and measure, a practical alternative involves exploring the environmental value orientations of teachers – in conjunction with their pedagogical values – and how that may influence their curricular choices (Whittaker, Vaske, and Manfredo 2006).

Fulton, Manfredo, and Lipscomb (1996) identified two main value orientations that people have regarding human-wildlife interactions, which we use to inform conceptualization about the environment. A person with a *mutualist value orientation* views wildlife as living in harmony with humans, having basic rights, and deserving of compassion; the *utilitarian value orientation* views wildlife as something that should be used and managed for human benefit (Fulton, Manfredo, and Lipscomb 1996). These ideas were expanded into four unique value orientation types by Teel et al. (2005). A *pluralist value orientation* describes someone having both a mutualist and utilitarian perspective toward wildlife. This means they may hold either value orientation depending on the situation, such as understanding and accepting the practice of hunting but choosing not to do it themselves for moral reasons (Teel et al. 2005). This reflects the psychological concept of pluralism, referring to a person's ability to hold multiple, sometimes conflicting, beliefs, convictions, or interests (Cooper and McLeod 2007). A *distanced value orientation* describes someone who has neither the mutualist nor utilitarian value orientation and remains disconnected from wildlife-related issues altogether (Teel et al. 2005).

Many scholars have taken the core ideologies of mutualism and utilitarianism and adapted them, such as defining value orientations on a continuum ranging from anthropocentric to biocentric, while others use an egoistic-biospheric spectrum (Steel, List, and Shindler 1994; De Groot and Steg 2008). We adapted the mutualism-utilitarian dimensions and wildlife value orientations but applied them to the environment broadly, referring to these as environmental value orientations (EVO), distinct from de Groot and Steg's (2008) definition.

Because there is little knowledge of how science teachers' pedagogical values and EVOs might relate to their decision to implement PBE in environmental science lessons, we sought to answer the following questions: (1) What motivated science teachers to teach PBE? (2) How do these teachers' pedagogical values and EVOs align?

Methods

Using phenomenology, we explored secondary science teachers' lived experiences and perceptions of PBE (Hall, Chai, and Albrecht 2016). To evaluate participants' EVOs and pedagogical values, we interviewed participants who indicated that they were *already* implementing PBE. Interviews centered on participants' classroom teaching strategies and perceptions of implementing PBE lessons, as well as their personal relationships with the environment and wildlife as both children and adults. A phenomenological lens allowed us to center our analysis on participant experiences, perceptions, and motivations for teaching PBE (Hall, Chai, and Albrecht 2016).

Participants

The study population comprised 11 science teachers, with whom we had preexisting affiliations from school district – university partnerships (Wright et al. 2021; Cicchino et al. 2023). They each represented a different school and taught grades ranging from 6-12 across primarily life science subjects (Table 1). The participants consisted of 10 women and 1 man, and their teaching experience ranged from one to 30 years of experience. All names of schools and teachers presented are pseudonyms.

Data collection and analysis

We interviewed participants using a semi-structured interview protocol (Appendix A) for an average of one hour each after providing consent (as per our university-approved IRB protocol #3201). Conversations focused on the participants' professional background, personal interactions with wildlife and the environment across time, and their current teaching strategies, including the implementation of PBE. Each interview was transcribed using Otter.ai's live transcription software (Otter.ai Software, 2016) and then transcripts were reviewed and cleaned by the first author prior to being uploaded into MAXQDA for coding (Verbi Software, 2021). We used thematic analysis to identify patterns across participants' interviews through two rounds of coding (Clarke and Braun 2013).

Transcripts were first inductively coded using an iterative process to identify what teachers believed were examples of PBE lessons. Our goals were to engage in 'open inquiry rather than mold it into a previously established theoretical framework' (Charmaz 2020, 168). Themes were revised, combined, and refined, resulting in one of the following codes describing teachers' perceptions of how they integrated discussions of wildlife and the environment into their lessons: general teaching style and goals, definitions of PBE, importance of PBE, and barriers to PBE. We adhered to our (Wright et al. 2021) definition of PBE: (1) inspired by local cultural or biophysical issues, (2) uses local expertise, (3) is interdisciplinary, (4) is inquiry-based and experiential, and (5) promotes civic engagement. Teachers who incorporated 1-2 of these components were classified as 'low-level implementers', those who used three of these components were classified as 'mid-level implementers', and those who used 4-5 components were classified as 'high-level implementers'. All participants used at least one component of PBE, so a score of zero was not included in the implementation scale. Note that we did not provide definitions of PBE nor correct participant definitions.

Participants were categorized by EVOs following procedures outlined in prior qualitative value orientation research (Dayer, Stinchfield, and Manfredo 2007; McCoy, Bruyere, and Teel 2016): mutualist, pluralist, utilitarian, or distanced (Table 2, Appendix B). While previous studies have categorized 'Attraction/Interest' and 'Concern for Safety' as belief dimensions that are separate from the four main EVO types (Dayer, Stinchfield, and Manfredo 2007; Laverty et al. 2019), we included these as part of the Mutualist and Distanced types, respectively (Table 2). These were the EVOs of best fit, as an attraction/interest toward the environment tended to correspond with a degree of care, and previous research found a higher level of concern for safety among Distanced individuals (McCoy, Bruyere, and Teel 2016). We also coded how participants assigned value to the environment or wildlife based on perceived contribution or worth to the greater system or to humans. We used a definition of assigned values as 'those things in the world that are valued by people' or 'the estimated worth of a thing or place' (Ives and Kendal 2014, 68). For instance, if a participant voiced that they value macroinvertebrates because of how they support the greater riparian ecosystem, this would be coded as an assigned value with an ecosystem focus. Lastly, we identified the relationship between teachers' experiences implementing PBE and their EVOs. To validate our code book, 20% of the data were coded by a

Table 1. Participant profiles including grade level, subject, and number of years of experience.

Pseudonym	Grade Level	Subject	Years of Experience
Lynn	Middle School	Science	7
Caroline	High School	Biology	2
Maura	Middle School	Science	6
Erin	High School	Chemistry, Math	1
Hannah	High School	AP Physics, Horticulture, River Science	4
Natalie	Middle School	Science, Math	1
Janet	Middle School	Science	31
Marcia	Middle School	Science, Outdoor Education	4
Chris	Middle School	Science, Outdoor Education	15
Jackie	Middle School, High School	Science, Environmental Science	3
Chloe	Middle School	Science	17

Table 2. Definitions[1] and examples of environmental value orientations (EVOs) and dimensions used for deductive coding.

Value Orientation	Definition	Example
Mutualist *Feelings/Emotions* *Respect* *Spiritual/Therapeutic* *Attraction/Interest*[2]	View the natural world as capable of relationships with humans, as if part of an extended family, and as deserving of rights and care. They are less likely to support actions resulting in death or harm to wildlife, more likely to engage in pro-environmental behaviors, and more likely to view the natural world in human terms.	'You need to care for the land. That is your job. Not to try to conquer it, but to care for it'. 'Well, it has like this innate right to be here just like we do'. 'The closer to a natural environment or less manicured environment I feel the better'
Utilitarian *Consumptive or abusive recreation* *Wildlife as nuisance*	Believe that the natural world should be used and managed primarily for human benefit. They are more likely to prioritize human well-being over the environment in their attitudes and behaviors. They are also more likely to participate in consumptive activities such as hunting or fishing and see wildlife as pests or a nuisance.	'Fishing is probably the closest I come to interacting with that type of wildlife'. 'My husband ended up killing the baby rattlesnake'.
Pluralist	Can hold both mutualist and utilitarian value orientations toward the natural world, meaning that which of the orientations plays a role is dependent on the situation. For certain issues, Pluralists are likely to respond in a manner like that of Utilitarians, whereas for other issues they may behave more like Mutualists.	'You know, I'm not a hunter. I value wildlife more for appreciating its beauty and its place. But, I also understand why we have hunting [and] all the management regulations and exactly how it can benefit wildlife in general as well'. 'I have mixed feelings…[about wildlife that] conflicts with my gardening desire'.
Distanced *Lack of interest* *Concern for safety*[2] *Disgust*	Hold neither a mutualist or utilitarian orientation. As their label suggests, they tend to be less interested in wildlife and wildlife-related issues. More likely to express fear or disgust related to interacting with the natural world.	'I'm not very active with wildlife I'll say that much. It's just not something personally that I really got into'. 'I'm always kind of little on edge when I'm by myself out there'. 'I hate bugs…it's still so difficult for me to let stonefly nymphs crawl on my hands'.
Assigned Value[3] *Human focus* *Ecosystem focus*	Refers to the relative worth assigned to the natural world, either for its contributions to human or ecosystem well-being	'I just don't think people think of the ecosystem services that we get from wildlife all the time'. 'I definitely view wildlife as essential…I see the benefits of an ecosystem having a variety'

[1]Adapation of McCoy, Bruyere, and Teel (2016) and Dayer, Stinchfield, and Manfredo (2007).
[2]Belief dimensions identified by Dayer, Stinchfield, and Manfredo (2007) as separate value orientations, but for the purposes of this paper were placed into category of best fit.
[3]Adaptation of Ives and Kendal (2014).

second coder, following training on methods. Initial inter-coder reliability was 84%, and after discussion of discrepancy a revised codebook resulted in full agreement of the subset of data. The first author used the revised codebook to complete analysis.

Findings

Science teachers' perceptions of teaching PBE using wildlife examples were related to their pedagogical values, as well as their perceptions of both benefits of and barriers to implementing PBE.

Pedagogical values

Teachers' pedagogical values seemed to correspond with their decision to implement PBE. All described a goal of improving student engagement by integrating experiential learning

opportunities. They described accomplishing this using project- and inquiry-based learning, integrating hands-on and experiential techniques, and making lessons relevant to student lives. For instance, both Erin and Jackie use 'hands on' approaches, while Lynn and Hannah mentioned using 'inquiry-based' and 'project-based learning' approaches, respectively. Similarly, just as Caroline explained prioritizing 'ways to make it personal and connected', Chris wanted students to 'dive into the material in a way that is meaningful to them'. PBE curricula was perceived to make content relevant and, therefore, valuable.

Teachers described wanting to: instill curiosity and an excitement for learning about the natural world, build real-world skills and independence, prepare students for futures, and encourage a connection to their community through civic engagement. Caroline and Chloe, for instance, described how they helped students form connections to science and the environment. While Caroline hoped 'that [students] gain some appreciation and understanding of science', Chloe strove 'to instill some sort of passion [for learning science]'. Focusing on how scientific knowledge is generated, Chris's goal was for 'students [to] walk out with more of a *skill of* science rather than a *knowledge of* science'. Jackie and Marcia highlighted encouraging civic engagement among their students. Jackie explained that she was transitioning to a new job so she can 'teach a class about wildlife in Colorado and try and get more people to care', while Marcia wanted her students to 'be more [climate] resilient and [engage in wildfire mitigation] at their own home'. The pedagogical value of PBE for our participants centered on helping students improve their understanding of how scientific knowledge is constructed and the real-world applications of that knowledge.

Perceived benefits of PBE

All participants perceived PBE to mean using local resources and applying course content to improve their communities. All the participants emphasized the local *natural* environment. Hannah, for instance, explained PBE as 'looking at where you're at and, specifically with ecology, the wildlife, or the environment around you and that's "place"'. In other words, none of the participants defined place as anything other than the physical, natural space. They did not describe cultural or social spaces as part of place. For instance, Marcia explained, 'It's building opportunities for students to learn in the context of a certain place…Place can take on any kind of scale [to] incorporate their own backgrounds and who they are into this context'. She concluded that it's 'in the name' - place-based education.

All participants perceived that PBE was important, and they described its potential to improve students' learning and application of concepts. Chloe stated that PBE focuses on 'helping kids actually come up with their own creative solutions to things that are happening locally'. Participants also explained the value of PBE to make content meaningful, relatable, and personal because it engages students and elicits interest. Chloe and Natalie stated that PBE can 'open [students'] eyes to…all the things we have in the natural world' or 'change a lot of perspectives…they were in awe'. PBE can allow students who struggle in a traditional classroom setting to flourish. Janet recounted how 'a kid inside that has a hard time sitting in their seat or a hard time focusing…get them in the river and they're the first kids in the water'.

Participants were also motivated by their sense of responsibility to evoke students' pride and affection towards the environment. Chloe, Chris, Erin, and Maura explicitly described the importance of fostering civic and community engagement. Erin explained that PBE involves 'helping students get connected not only to the content but to their community', while Maura explained that PBE lessons allow students to be 'more involved in their community …because it affects them personally'. Chris was the only teacher who described the value of integrating local expertise: 'bring[ing] in people, especially scientists from different areas that can talk with students about their specialties'.

These perceived benefits of PBE align with some of the participants' pedagogical values of making content engaging, experiential, and meaningful. Although, one teacher (Maura) explained that PBE lessons did not change the level of student engagement, as she explained here: '[I] feel like the kids that were typically engaged, maintained engagement, and I feel like the kids that were not typically engaged tended to be excited that we were going outside but then not complete whatever we were working on anyway'. Although Maura implemented PBE in her classroom, she was the only participant to not assign value to PBE because of its potential to increase student engagement. However, in general, our participants described constructivist pedagogical values that acknowledge that learners' perceptions of their world may differ based on their own prior knowledge and experiences.

Perceived barriers to implementation

Most participants (nine) cited barriers to implementing PBE, and some of them chose *not* to implement PBE lessons even if they acknowledged its potential. Chris believed that PBE is only relevant for teaching biological concepts: 'It just doesn't apply very directly…actually a pretty indirect connection'. Similarly, Jackie and Maura thought PBE is only relevant in their ecology units, which, as Maura explained, 'was for one unit rather than throughout the year…we didn't use [PBE] a ton'.

Participants also referenced barriers such as time, funding, safety, and more. While Lynn explained that 'the limiting factor is time', Janet stated that 'the biggest hurdle with getting kids outside is the teacher getting comfortable with taking kids outside…if you don't have those safety protocols, taking kids outside is chaos'. Both Marcia and Jackie mentioned 'funding' constraints, calling the logistics of trying to integrate PBE 'very frustrating' and 'a nightmare', respectively. Hannah and Chloe referenced 'challenges' with administration or the public school system when trying to use any sort of creative or experiential approach to their teaching. Hannah believed there was a 'lack of autonomy and creative expression in lesson plans', and Chloe felt as though the 'community doesn't value science education in the classroom…I just have to [teach] what they're telling me to teach'. Although most of the participants perceived barriers to implementing PBE, they also believed the costs were worth the benefits.

Relationship between PBE and EVOs

We identified a relationship between participants' EVOs and their perception of PBE. Most of the participants (10) had a Mutualist EVO; however, all participants were also assigned a secondary EVO, following methods of Schwartz (2006). These secondary EVOs allowed participants to be placed into categories: Strong Mutualists, Weak Mutualists, and Weak Distanced. All participants reported implementing PBE to some extent, but the instructional approaches varied, especially across grade levels and subject matter.

Strong mutualists: Lynn, Maura, Natalie, Janet

Four of the 10 participants – Lynn, Maura, Natalie, and Janet – were considered Strong Mutualists' because they expressed *only* mutualistic sentiments. For example, Lynn mentioned feeling 'very connected' to nature, and Maura actively sought out 'ways to be connected with nature'. Natalie and Janet's viewed humans as part of or equal to the natural world. Janet stated, 'We are part of the ecosystem, not simply an outsider looking at wildlife outside the ecosystem'. Natalie supported this mutualist idea by wishing that people would give wildlife 'the respect you would give another person'. Each of these Mutualists emphasized the 'beauty' of nature or the 'respect' they feel for it. These words and attributes being ascribed to the environment and wildlife

reflect mutualism. Interestingly, these Strong Mutualists wanted their students to be engaged, but described a range (high, mid, and low levels) of implementation strategies. Lynn and Janet were mid- and high-level implementers. Lynn 'developed some lessons around looking at the mule deer population in [state] and the impacts on that'. Meanwhile, Janet used data from wildlife camera traps set up in natural areas on or near school property. She encouraged her students to find a good spot for the cameras, and 'the photographs and resulting data were used to analyze the health of the local ecosystem' and contributed to a wider community project.

Janet and Lynn have well-developed perceptions of PBE and its value. Both teachers have participated in Research Experiences for Teachers (RETs) projects around the world. They referenced these learning opportunities during their interviews. Janet explained that she had, 'been to some cool places…and then I can bring that excitement for learning back to the kids and talk about, "How does this all fit together?" and, "Look at the cool things I got to do"'. Similarly, Lynn discussed how she incorporated her experience abroad in her lessons: '[students] can choose to work with [exotic] food webs too because I always try to bring that work in as well'. For these two teachers, PBE allowed them to expand their own expertise as teachers, and now they share those benefits with their students.

Although also classified as Strong Mutualists, Maura and Natalie were lower-level implementers of PBE. Natalie, a first-year teacher, provided a few examples of implementing PBE, such as collecting insects on school grounds and discussing 'why they're there, their habitat, how they interact with everything else'. Newer to the concept, she perceived PBE as being limited to the local natural environment. Maura, on the other hand, had been teaching for longer and had a more nuanced understanding of PBE implementation, yet she was also a low-level implementer of PBE. Despite valuing experiential learning and inquiry-based lessons, she did not cite benefits of PBE and instead focused on the barriers to implementation. Maura was concerned about budget limitations, class behavioral issues, and lack of parent involvement. For these participants, their pedagogical values were not a strong enough motivator for PBE implementation. If barriers were removed, their implementation of PBE may increase.

Weak mutualists: Caroline, Erin, Hannah, Chris, Jackie, and Chloe

While the Mutualist EVO was the primary orientation for six participants, they held other EVOs as well, putting them into the Weak Mutualist category. Among these weak mutualists, Jackie and Chloe expressed some Pluralist/Utilitarian EVOs, though these statements were infrequent. Erin, Hannah, Caroline, Chloe, and Chris had clearer secondary EVOs. Interestingly, Chris, Caroline, and Chloe were classified as having Utilitarian EVOs as their secondary value orientation. Caroline viewed certain wildlife as a nuisance, voicing how rabbits negatively affected her garden, or, on one occasion, how her husband had to kill a rattlesnake on her property. For Chris and Chloe, on the other hand, their secondary Utilitarian EVOs reflected their recreation activities. Chris enjoyed fishing, a utilitarian activity (Dayer, Stinchfield, and Manfredo 2007), while Chloe described boating with her family– another utilitarian activity (Hoover 2021).

Erin was a unique Weak Mutualist because her primary Mutualist EVO was followed closely by Distanced EVO. She often conveyed a lack of interest in the environment or did not prioritize spending time in nature. She described much appreciation for the environment and wildlife but explained, 'I very much like my inside time'. She also shared that she does not 'have that pull to want to go and be out in the wild'.

Despite some differences, we identified commonalities in the mutualistic way these participants engaged with nature. Each Weak Mutualist viewed wildlife as an extension of human life and valued co-existence. Caroline thought it was 'nice to share space with wildlife'; Jackie felt

that wildlife 'has this innate right to be here'; and Chris viewed wildlife 'as more of a neighbor'. Chloe, Hannah, and Erin added that humans should not interfere with wildlife as much as we do. For instance, Erin stated, 'I want to make our areas…more welcoming to wildlife, so we can cohabitate with them rather than just take over their land and kick them out'. Hence, these participants expressed values that overlap with the Strong Mutualists' view that humans are part of or equal to the natural world.

These participants varied in their PBE implementation approaches. Jackie was a low-level implementer, Caroline and Erin were mid-level implementers, and Chloe, Hannah, and Chris were high-level implementers. Despite Jackie's emphasis on a mutualistic sense of 'urgency' to 'inspire younger generations to care for the planet', her experience implementing PBE only integrated the use of a local biophysical context and the desire for civic engagement (although she did not explain how). When teaching a unit on food chains and food webs, she explained that '[students] were making food chains and food webs of these pictures that were taken of wildlife in their backyard'. Jackie also wanted her students to 'realize their real impact on the environment every single day', and she indicated a desire to implement more PBE in the future.

Caroline and Erin, like Jackie, implemented lessons that centered on local contexts and the importance of civic engagement; however, they each added another PBE component. Caroline invited experts from her city's water treatment facility to 'talk about the watershed…what you should not put down your drains', and Erin designed inquiry-based and experiential lessons. For example, her biology students explored their nearby river and were asked to 'design a lab based on what they saw around them. Some people chose to try to figure out how many different kinds of plants they saw, some tried to count beetles'. Erin was motivated to continue using PBE and wanted to take students to a nearby national state park to study local geology.

Finally, Chloe, Hannah, and Chris were all Weak Mutualists who were also high-level implementers of PBE by implementing almost all the five components. None of them described the interdisciplinary component of PBE, which only means that it did not arise during interviews. They may all very well make explicit connections to other disciplines (e.g. language arts, mathematics, social studies). To collaborate with experts to engage their students, Chloe invited a university's wildlife club to her classroom and Hannah collaborated with Colorado River Watch to collect macroinvertebrates as biological indicators of water quality. These participants described using experiential or inquiry-based pedagogy. Chris engages his students by using camera trap data in 'community research…they had to go count how many deer were in 1000 pictures and how did that relate to the number of birds'. They also all emphasized the importance of civic engagement. For example, Hannah referenced news about a new gas pipeline to 'encourage students to think a lot about what that would do to the land we have that is preserved…[and] the land rights'. Her goal was to initiate a discussion about environmental policy and the role that citizens play in advocating for rights.

Weak distanced: Marcia

Marcia was the only participant who held a Distanced EVO, with a secondary Mutualist EVO. Unlike Erin whose secondary Distanced EVO reflected a lack of interest in the environment and wildlife, Marcia emphasized a concern for safety given the risks of sharing a landscape with them. While she 'appreciates' nature and sees it as 'essential', she also cited some sense of fear. She stated, 'I worry a lot more about mountain lions [here]', and she wanted to 'respect [her] distance' with wildlife because she is 'very aware of [her] surroundings'. While she assigned value to wildlife for its ecological importance ('I see the benefits of an ecosystem having a variety'), she admitted a lack of personal interest ('I'm not very active with wildlife, I'll say that much. It's just not something that I really got into'). Hence, her pedagogical motivations were to explain to students how wildlife is a part of ecosystems, and nothing more. This explained why she was a high-level implementer of PBE, referencing all 5 components of an effective PBE

lesson. Marcia encouraged her students to get involved in a statewide competition where they were expected to 'look at a natural hazard that impacts [their] community and then propose a solution'. Her students picked a local issue on their own, and she then arranged for students to 'meet people from the fire department, the National Park Service, [and] Colorado Parks and Wildlife' as they prepared their plan. Students collaborated with the fire department 'to break up pine needles and pinecones' for local homeowners to prevent forest fires (an important statewide environmental issue). Hence Marcia was motivated by her professional interests, rather than her personal beliefs, when implementing PBE lessons.

Discussion

Because PBE can help students feel connected to their natural environment and instill a sense of civic engagement (Woodhouse and Knapp 2000), PBE has the potential to foster pro-environmental behaviors necessary to address a plethora of environmental issues (Gruenewald and Smith 2014). Hence, improving our understanding of what motivates teachers to implement PBE lessons informs teacher educators. Teachers are motivated by both their professional and personal values when making pedagogical choices (McVittie et al. 2020). Motivation to teach about place can be shaped by both values about pedagogy and environmental orientation. To better understand the relationship between these two sets of values, we recruited secondary science teachers who were already teaching PBE curricula. Our participants, in general, described a Mutualist EVO. These teachers formed perceptions of their local environment during childhood and described motivations to implement lessons centered on environmental issues. However, we found differences in the 'strength' of their EVO and the level at which they implement PBE explained, in part, by a combination of their EVOs and pedagogical values.

All our participants had some level of a Mutualist EVO, meaning they have an affinity towards the natural world (Fulton, Manfredo, and Lipscomb 1996). It thus makes sense that these teachers are PBE implementors. Just as each teacher conveyed mutualistic views by describing their personal experiences in nature during their childhood, they also each discussed their desire to take students outside into nature to have those same experiences. In fact, the word 'outside' was the most frequently referenced word of our participants. Outside experiences were described in terms of hands-on or experiential learning opportunities. Indeed, one of the strongest motivators for teachers taking students outside is to recreate their own positive experiences as students (Bergmark et al. 2018). Three of our participants shared with us their own experiences with a teacher or mentor who instilled a passion for the outdoors. Experiences in nature and positive role models are important drivers in creating a connection to nature (Chawla 2007) and reflect how teachers with a Mutualist EVO might be drawn to approaches that connect students with nature. In fact, not only do significant life experiences in nature relate to an affinity for nature as adults, but they can also specifically connect to teachers' beliefs and behaviors. A study of significant life experiences found that time spent in nature during childhood was associated with different types of teachers' dispositions, classroom strategies, and utilization of natural resources and field trips as learning materials (Altan and Lane 2018). Schaefer (2022) also found that teachers practicing nature-based education are more likely to have their students 'mirror' their own childhood experiences. Given that all of our participants reported positive experiences as children spent outdoors, and that these experiences were cited as contributing to their positive relationship with the environment as adults, it is likely that these significant life experiences in nature have some sort of relationship with their teaching practices, strategies, or dispositions (Dewey 1938/1997; Orr 1992).

A self-nature connection has been shown to positively relate to the development of biospheric values, which 'reflect the importance people attach to caring about nature and the environment' (Wang et al. 2021, 2; Martin and Czellar 2017). As such, we posit that our participants' foundational experiences in nature likely shaped their affinity toward nature, helping form their Mutualist

EVOs as well as their pedagogical values of using PBE. While there is still more to explore about what drives the formation of individual EVOs (Martin and Czellar 2017), particularly among teachers, our findings suggest that, just as early childhood experiences in nature contribute to the formation of pro-environmental values (Ewert, Place, and Sibthorp 2005), this same type of relationship might exist for the formation of Mutualist EVOs as well.

We acknowledge limitations in our study. We only recruited teachers from our professional network who had shared with us that they use PBE. Because of this, there is an absence of observed relationships between EVOs and a *lack of* implementation of PBE. Although, because we had a prior relationship with participants, it is possible that they felt comfortable sharing details about their personal views of nature, including from their childhood, which enabled deeper examination of links among EVOs and implementation of PBE. Nevertheless, our pre-existing relationships with participants and the self-selection bias linked to PBE use remain notable, limiting the generalizability of findings. In addition, it is likely that participants knew one another, through their existing networks, which could be reflected through shared approaches to or experiences with PBE, or through similar EVOs. We recognize the need for other studies that recruit a broader and more diverse participant pool to further examine the relationship between pedagogical values and EVOs. Study populations should be expanded beyond environmental educators to other disciplines including literacy, civics, social studies, and health (e.g. Smith and Sobel 2010; PEEC. 2010; Azano 2011). Yet, we maintain that our study can inform subsequent studies that examine the relationship between pedagogical values and environmental values orientation.

While most of our participants were primarily Mutualists, many of them - such as the Weak Mutualists - also held other EVOs, some even at the other end of the mutualist-utilitarian spectrum. Schwartz (2006) deduced that values are prioritized in importance relative to one another and this relative prioritization of multiple values is what drives action, yet more research is needed to determine if this is the case for value orientations.

Implications

Our findings can contribute to environmental education because they suggest the potential for teachers' implementation of PBE to foster pro-environmental affects and behaviors among their students. It is already understood that one of the most important ways to instill a societal value for the environment is by targeting youth and fostering a connection to nature through nature-based education (Chawla 2015; Owens and McKinnon 2009; Nabhan and Trimble 1994; Chawla and Derr 2012). Chawla (2007) reported that time spent in nature during childhood and influential role models are the two most significant indicators of pro-environmental behavior in adulthood. Not only are our participants themselves important role models, but their own significant life experiences in nature seem to have motivated them to foster nature connections for their own students through PBE. Thus, because PBE can strengthen place attachments to promote greater civic engagement, exploring how value orientations might relate to a teachers' implementation of PBE has important implications for future of pro-environmental young leaders (Vaske and Kobrin 2001). Teachers' values can be transmitted to students during schooling through behavioral choices (Schmidt et al. 2019; Dietrich et al. 2015). For instance, a teacher's enthusiasm for a course subject has been shown to influence a student's valuation of that subject (Parrisius et al. 2020). By that logic, it should be possible for a teacher's Mutualist EVO to be transmitted to students, instilling a care and appreciation for nature.

While more research is needed to further understand the links between value orientations and pedagogical values, our findings contribute to education research by exploring a relationship between teachers' Mutualist EVOs and their decision to implement PBE lessons. Importantly, our participants' value orientations reflect the persistence of that connection between people and the environment. Through PBE instruction, teachers convey these values to their students.

Acknowledgements

We thank the teachers who participated in this study, which was conducted during the COVID-19 pandemic. We also thank the Center for Collaborative Conservation, advisors from the Human Dimensions of Natural Resources Department, and graduate student members of the Balgopal science education research group for helpful feedback during the design and implementation of this study.

Disclosure statement

No potential conflicts of interest were reported by the authors.

Data availability and deposition

To protect the identity of respondents, data are not made publicly available.

Funding

This work was supported by the National Science Foundation under Grant #1950290 and the Center for Collaborative Conservation at Colorado State University.

Notes on contributors

Miranda "Andie" Conlon is an Outreach and Education Specialist for the Natural Resource Ecology Lab at Colorado State University. Her masters research on place-based education explored the relationship between implementation and value orientations.

Meena Balgopal is a Professor in the Department of Biology and University Distinguished Teaching Scholar at Colorado State University. Her research group explores how people make meaning of natural science concepts with a focus on writing, reading, quantitative literacies, and place-based education.

Brett Bruyere is a Professor in the Department of Human Dimensions of Natural Resources at Colorado State University. He also serves as the Academic Director of the department's Conservation Leadership Through Learning program.

Diane Wright is an Assistant Professor of Experiential Education in the Department of Biology at Colorado State University. Her research on environmental literacy investigates the impact of using place-based education curriculum in K-12 classrooms.

Kevin Crooks is a Professor in the Department of Fish, Wildlife, and Conservation Biology at Colorado State University. He is Director of the CSU Center for Human-Carnivore Coexistence, focused on integrating transformative science, education, and outreach to minimize conflict and facilitate coexistence between humans and carnivores.

Jonathan Salerno is an Assistant Professor in the Department of Human Dimensions of Natural Resources at Colorado State University. He is an ecologist who studies people, focused on how and why humans make decisions, particularly in response to environmental changes.

ORCID

Meena M. Balgopal http://orcid.org/0000-0002-3846-9256
Brett L. Bruyere http://orcid.org/0000-0001-7802-5468

References

Altan, Servet, and Jennie Farber Lane. 2018. "Teachers' Narratives: A Source for Exploring the Influences of Teachers' Significant Life Experiences on Their Dispositions and Teaching Practices." *Teaching and Teacher Education* 74: 238–248. https://doi.org/10.1016/j.tate.2018.05.012.

Azano, A. 2011. "The Possibility of Place: One Teacher's Use of Place-Based Instruction for English Students in a Rural High School." *Journal of Research in Rural Education* 26 (10), 1–12

Ballard, H. L., C. G. H. Dixon, and E. M. Harris. 2017. "Youth-Focused Citizen Science: Examining the Role of Environmental Science Learning and Agency for Conservation." *Biological Conservation* 208: 65–75. https://doi.org/10.1016/j.biocon.2016.05.024.

Barni, D., C. Russo, and F. Danioni. 2018. "Teachers' Values as Predictors of Classroom Management Styles: A Relative Weight Analysis." *Frontiers in Psychology* 9: 1–5. https://doi.org/10.3389/fpsyg.2018.01970.

Bergmark, U., S. Lundström, L. Manderstedt, and A. Palo. 2018. "Why Become a Teacher? Student Teachers' Perceptions of the Teaching Profession and Motives for Career Choice." *European Journal of Teacher Education* 41 (3): 266–281. https://doi.org/10.1080/02619768.2018.1448784.

Borg, M. 2001. "Key Concepts: Teachers' Beliefs." *ELT Journal* 55 (2): 186–188. https://doi.org/10.1093/elt/55.2.186.

Bulgarelli, D., and P. Molina. 2016. "Social Cognition in Preschoolers: Effects of Early Experience and Individual Differences." *Frontiers in Psychology* 7: 1–11. https://doi.org/10.3389/fpsyg.2016.01762.

Charmaz, K. 2020. "With Constructivist Grounded Theory You Can't Hide": Social Justice Research and Critical Inquiry in the Public Sphere." *Qualitative Inquiry* 26 (2): 165–176. https://doi.org/10.1177/1077800419879081.

Chawla, L., and V. Derr. 2012. "The Development of Conservation Behaviors in Childhood and Youth." In *Oxford Handbook of Environmental and Conservation Psychology*, edited by S. Clayton, 527–555. New York, NY: Oxford University Press.

Chawla, L. 2007. "Childhood Experiences Associated with Care for the Natural World: A Theoretical Framework for Empirical Results." *Children, Youth and Environments* 17 (4): 144–170. https://doi.org/10.1353/cye.2007.0010.

Chawla, L. 2015. "Benefits of Nature Contact for Children." *Journal of Planning Literature* 30 (4): 433–452. https://doi.org/10.1177/0885412215595441.

Cicchino, A., Weinberg, A.E., Sample McMeeking, B., and Balgopal, M.M. 2023. "Critical pedagogy of place to enhance management activities." *Conservational Biology*. 37: e14023.

Clarke, V., and V. Braun. 2013. "Teaching Thematic Analysis: Overcoming Challenges and Developing Strategies for Effective Learning." *The Psychologist* 26 (2): 120–123.

Cooper, M., and J. McLeod. 2007. "A Pluralistic Framework for Counselling and Psychotherapy: Implications for Research." *Counselling and Psychotherapy Research* 7 (3): 135–143. https://doi.org/10.1080/14733140701566282.

Dayer, A., H. M. Stinchfield, and M. J. Manfredo. 2007. "Stories about Wildlife: Developing an Instrument for Identifying Wildlife Value Orientations Cross-Culturally." *Human Dimensions of Wildlife* 12 (5): 307–315. https://doi.org/10.1080/10871200701555410.

De Groot, J. I. M., and L. Steg. 2008. "Value Orientations to Explain Beliefs Related to Environmental Significant Behavior." *Environment and Behavior* 40 (3): 330–354. https://doi.org/10.1177/0013916506297831.

DeVille, N.V., Tomasso, L.P., Stoddard, O.P., Wilt, G.E., Horton, T.H., Wolf, K.L., Brymer, E., Kahn, P. H., Jr and P. James. 2021. "Time Spent in Nature is Associated with Increased Pro-Environmental Attitudes and Behaviors." *International Journal of Environmental Research and Public Health* 18 (14). 7498. https://doi.org/10.3390/ijerph18147498

Dietrich, J., A. L. Dicke, B. Kracke, and P. Noack. 2015. "Teacher Support and Its Influence on Students' Intrinsic Value and Effort: Dimensional Comparison Effects across Subjects." *Learning and Instruction* 39: 45–54. https://doi.org/10.1016/j.learninstruc.2015.05.007.

Duerden, M. D., and P. A. Witt. 2010. "The Impact of Direct and Indirect Experiences on the Development of Environmental Knowledge, Attitudes, and Behavior." *Journal of Environmental Psychology* 30 (4): 379–392. https://doi.org/10.1016/j.jenvp.2010.03.007.

Dupuis, J., and D. Jacobs. 2021. "Making Environmental Education Accessible for All Students: Inclusion of Students with Emotional and Behavioral Disabilities." *Journal of Science Education for Students with Disabilities* 24 (1): 1–18. https://doi.org/10.14448/jsesd.13.0004.

Ewert, A., G. Place, and J. Sibthorp. 2005. "Early-Life Outdoor Experiences and an Individual's Environmental Attitudes." *Leisure Sciences* 27 (3): 225–239. https://doi.org/10.1080/01490400590930853.

Fulton, D. C., M. J. Manfredo, and J. Lipscomb. 1996. "Wildlife Value Orientations: A Conceptual and Measurement Approach." *Human Dimensions of Wildlife* 1 (2): 24–47. https://doi.org/10.1080/10871209609359060.

Goldman, D., O. B. Assaraf, and D. Shaharabani. 2013. "Influence of a Non-Formal Environmental Education Programme on Junior High-School Students' Environmental Literacy." *International Journal of Science Education* 35 (3): 515–545. https://doi.org/10.1080/09500693.2012.749545.

Gruenewald, D.A., & Smith, G.A. (Eds.) 2014. *Place-Based Education in the Global Age: Local Diversity*. New York: Routledge.

Hahl, K., and E. Mikulec. 2018. "Student Reflections on Teacher Identity Development in a Year-Long Secondary Teacher Preparation Program." *Australian Journal of Teacher Education* 43 (12): 42–58. https://doi.org/10.14221/ajte.2018v43n12.4.

Hall, E., W. Chai, and J. A. Albrecht. 2016. "A Qualitative Phenomenological Exploration of Teachers' Experience with Nutrition Education." *American Journal of Health Education* 47 (3): 136–148. https://doi.org/10.1080/19325037.2016.1157532.

Homer, P. M., and L. R. Kahle. 1988. "A Structural Equation Test of the Value-Attitude-Behavior Hierarchy." *Journal of Personality and Social Psychology* 54 (4): 638–646. https://doi.org/10.1037/0022-3514.54.4.638.

Hoover, K. S. 2021. "Children in Nature: Exploring the Relationship between Childhood Outdoor Experience and Environmental Stewardship." *Environmental Education Research* 27 (6): 894–910. https://doi.org/10.1080/13504622.2020.1856790.

Ives, C. D., and D. Kendal. 2014. "The Role of Social Values in the Management of Ecological Systems." *Journal of Environmental Management* 144: 67–72. https://doi.org/10.1016/j.jenvman.2014.05.013.

Kollmuss, A., and J. Agyeman. 2002. "Mind the Gap: Why Do People Act Environmentally and What Are the Barriers to Pro-Environmental Behavior?" *Environmental Education Research* 8 (3): 239–260. https://doi.org/10.1080/13504620220145401.

Laverty, T., T. Teel, R. Thomas, A. Gawusab, and J. Berger. 2019. "Using Pastoral Ideology to Understand Human–Wildlife Coexistence in Arid Agricultural Landscapes." *Conservation Science and Practice* 1 (5): e35. https://doi.org/10.1111/csp2.35.

Manfredo, M. J., R. E. Berl, T. L. Teel, and J. T. Bruskotter. 2021. "Bringing Social Values to Wildlife Conservation Decisions." *Frontiers in Ecology and the Environment* 19 (6): 355–362. https://doi.org/10.1002/fee.2356.

Martin, C., and S. Czellar. 2017. "Where Do Biospheric Values Come from? A Connectedness to Nature Perspective." *Journal of Environmental Psychology* 52: 56–68. https://doi.org/10.1016/j.jenvp.2017.04.009.

McCoy, C., B. L. Bruyere, and T. L. Teel. 2016. "Qualitative Measures of Wildlife Value Orientations with a Diverse Population in New York City." *Human Dimensions of Wildlife* 21 (3): 223–239. https://doi.org/10.1080/10871209.2016.1137108.

McNeal, P., H. Petcovic, and P. Reeves. 2017. "What is Motivating Middle-School Science Teachers to Teach Climate Change?" *International Journal of Science Education* 39 (8): 1069–1088. https://doi.org/10.1080/09500693.2017.1315466.

McVittie, J., G. Webber, L. A. M. Hellsten, and D. Miller. 2020. "Pathways and Pedagogies: Conversations with Teacher Educators about the Role of Place-Based Learning." *Canadian Journal of Environmental Education* 23 (1): 33–49.

Miller, D., and S. Twum. 2017. "The Experiences of Selected Teachers in Implementing Place Based Education." *Education* 23 (1): 92–108.

Nabhan, G. P., and S. Trimble. 1994. *The Geography of Childhood*. Boston, MA: Beacon Press.

Orr, D. W. 1992. *Ecological Literacy*. Albany: SUNY Press.

Owens, P. E., and I. McKinnon. 2009. "In Pursuit of Nature: The Role of Nature in Adolescents' Lives." *Journal of Developmental Processes* 4 (1): 43–58.

NGSS Lead States 2013. *Next Generation Science Standards: For States, by States*. Washington, DC: The National Academies Press.

Parrisius, C., H. Gaspard, U. Trautwein, and B. Nagengast. 2020. 101891. "The Transmission of Values from Math Teachers to Their Ninth-Grade Students: Different Mechanisms for Different Value Dimensions?" *Contemporary Educational Psychology* 62: 101891. https://doi.org/10.1016/j.cedpsych.2020.101891.

PEEC. 2010. The Benefits of Place-based Education: A Report from the Place-based Education Evaluation Collaborative (Second Edition). Retrieved from http://www.litzsinger.org/PEEC2010_web.pdf.

Pudelko, C. E., and H. J. Boon. 2014. "Relations between Teachers' Classroom Goals and Values: A Case Study of High School Teachers in Far North Queensland, Australia." *Austrailian Journal of Teacher Education* 39 (8): 14–36.

Pruneau, D., A. Doyon, J. Langis, L. Vasseur, E. Ouellet, E. McLaughlin, G. Boudreau, and G. Martin. 2006. "When Teachers Adopt Environmental Behaviors in the Aim of Protecting the Climate." *The Journal of Environmental Education* 37 (3): 3–12. https://doi.org/10.3200/JOEE.37.3.3-12.

Sauvé, L. 2005. "Currents in Environmental Education: Mapping a Complex and Evolving Pedagogical Field." *Canadian Journal of Environmental Education 10:* 11–37.

Schaefer, L. 2022. "The Influence of Significant Life Experiences on the Teaching Practices of Early Childhood Educators in Traditional and Nature-Based Preschools." *International Journal of Early Childhood Environmental Education* 9 (3): 39–48.

Schmidt, J. A., S. S. Kafkas, K. S. Maier, L. Shumow, and H. Z. Kackar-Cam. 2019. "Why Are we Learning This? Using Mixed Methods to Understand Teachers' Relevance Statements and How They Shape Middle School Students' Perceptions of Science Utility." *Contemporary Educational Psychology* 57: 9–31. https://doi.org/10.1016/j.cedpsych.2018.08.005.

Schultz, P. W. 2011. "Conservation Means Behavior." *Conservation Biology: The Journal of the Society for Conservation Biology* 25 (6): 1080–1083. https://doi.org/10.1111/j.1523-1739.2011.01766.x.

Schwartz, S. H. 1992. "Universals in the Content and Structure of Values: Theoretical Advances and Empirical Tests in 20 Countries." In *Advances in Experimental Social Psychology*, edited by M. P. Zanna, vol. 25, 1–65. New York: Academic Press.

Schwartz, S. H. 2006. "Value Orientations: Measurement, Antecedents and Consequences across Nations." In *Measuring Attitudes Cross-Nationally - Lessons from the European Social Survey*, edited by Jowell, R., Roberts, C., Fitzgerald, R., and Eva, G., 169–203. London, UK: Sage.

Schwartz, S. H. 2012. "An Overview of the Schwartz Theory of Basic Values." *Online Readings in Psychology and Culture* 2 (1): 11–20. https://doi.org/10.9707/2307-0919.1116.
Semken, S., E. G. Ward, S. Moosavi, and P. W. U. Chinn. 2017. "Place-Based Education in Geoscience: Theory, Research, Practice,and Assessment." *Journal of Geoscience Education* 65: 542–562. 10.5408/17-276.1.
Smith, G. A., and D. Sobel. 2010. "Bring It on Home." *Educational Leadership* 68 (1): 38–43.
Sobel, D. 2005. *Place-Based Education: Connecting Classroom and Community*. Great Barington, MA: The Orion Society.
Steel, B. S., P. List, and B. Shindler. 1994. "Conflicting Values about Federal Forests: A Comparison of National and Oregon Publics." *Society Nat. Resources* 7 (2): 137–153.
Teel, T. L., A. A. Dayer, M. J. Manfredo, and A. D. Bright. 2005. Regional results from the research project entitled "Wildlife Values in the West." (Project Rep. No. 58). Project Report for the Western Association of Fish and Wildlife Agencies. Fort Collins, CO: Colorado State University, Human Dimensions in Natural Resources Unit.
Vaske, J. J., and K. C. Kobrin. 2001. "Place Attachment and Environmentally Responsible Behavior." *The Journal of Environmental Education* 32 (4): 16–21. https://doi.org/10.1080/00958960109598658.
Wang, X., E. Van der Werff, T. Bouman, M. K. Harder, and L. Steg. 2021. 618956. "I Am vs. We Are: How Biospheric Values and Environmental Identity of Individuals and Groups Can Influence Pro-Environmental Behaviour." *Frontiers in Psychology*. 12:618956
Wells, N. M., and K. S. Lekies. 2012. "Children and Nature: Following the Trail to Environmental Attitudes and Behavior." In *Citizen Science: Public Collaboration in Environmental Research*, edited by J. Dickinson and R. Bonney, 201–213. Cornell University Press. ISBN-10:0801456746
Whittaker, D., J. J. Vaske, and M. J. Manfredo. 2006. "Specificity and the Cognitive Hierarchy: Value Orientations and the Acceptability of Urban Wildlife Management Actions." *Society & Natural Resources* 19 (6): 515–530. https://doi.org/10.1080/08941920600663912.
Woodhouse, J. L., and C. E. Knapp. 2000. *Place-Based Curriculum and Instruction: Outdoor and Environmental Education Approaches*. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools.
Wright, D.S., Balgopal, M.M., Crooks, K.R., Hunter, D., and Krumm, C. 2021."Middle school science teachers' motivations to implement place-based education curricula about wildlife." *Environmental Education Research*. 27(10): 1519–1537.
Wright, D.S., Crooks, K.R., and Balgopal, M.M. 2022."Wildlife photographs: Seeing, caring, and learning through place-based education." *Frontiers in Education: Science Education*. 7: 910324.

Appendix A

Semi-structured Interview Protocol

1. Can you please introduce yourself, your background, experience and knowledge around wildlife biology, and describe your position/role at your school?
    a. How would you say your background has led you to where you are now?
2. How would you describe your interactions with the environment during your *childhood*?
    a. How did your family/friends/community engage with nature, if at all?
3. How would you *currently* describe your relationship to the environment?
    a. How would you describe your feelings about wildlife specifically?
    b. What do you think people gain, if anything, by interacting with the environment?
4. What are your perceptions of wildlife relevant to your local community?
5. How would you describe yourself as a teacher (teaching styles, strengths, etc.)?
6. Explain your understanding of place-based education and the role it may play in teaching
7. Can you help me understand how *your* ideas about PBE developed? (e.g. from your personal experiences, hobbies, or education)?
8. Do you currently integrate PBE into your curricula, and if so, can you describe these?
9. How do you integrate discussion of socio-scientific issues into your curriculum?
10. How do you choose to frame these socio-scientific issues to your students?
11. How do you integrate discussion of local wildlife into your curriculum?
12. How do you choose to frame topics of wildlife to your students?
13. By your own evaluation, to what extent, if any, would you say your own experiences and perceptions about the environment and wildlife influence how you teach about these topics?

Appendix B: Thematic codebook

Theme	Sub-Theme	Sub-sub Theme	Definition	Example
Environmental Value Orientation	Mutualist		View the natural world as capable of relationships with humans, as if part of an extended family, and as deserving of rights and care. They are less likely to support actions resulting in death or harm to wildlife, more likely to engage in pro-environmental behaviors, and more likely to view the natural world in human terms.	'You need to care for the land. That is your job not to try to conquer it. But to care for it'. 'They were very conscious of things like recycling'
		Feelings/Emotions	Describes the natural environment using language involving positive feelings or emotions toward it, such as expressing care or affection for it	'I just fell in love with nature out here' 'There was always an innate love [for nature]'
		Respect	Sees the natural world through a lens of admiration and reverence. May be more likely to advocate for a 'hands-off' approach to the environment out of respect for it	'these creatures are just trying to survive it's not my place to come in and interfere' 'It's kind of like nice to share space with wildlife. And I think I have a respect for it'.
		Spiritual/Therapeutic	Emphasizes feeling a *connection* to the environment and expresses how spending time or reflecting in the natural world can improve their mood, stress, or mental health	'If it was a bad day [or] something that upset me the way I worked it out was by going outside and being outside' 'There's an inherent connection [to the wild] there'
		Attraction/Interest	Demonstrates overall fascination and interest in the natural world or a desire to engage more	'[He] really wanted to see wolves while we were in Yellowstone' 'I've always been fascinated with wild cats in particular like large cats'
	Pluralist		Can hold both mutualist and utilitarian value orientations toward the natural world, meaning that which of the orientations plays a role is dependent on the situation. For certain issues, Pluralists are likely to respond in a manner similar to that of Utilitarians, whereas for other issues they may behave more like Mutualists.	'You know, I'm not a hunter. I value wildlife more for appreciating its beauty and its place. But, I also understand why we have hunting [and] all the management regulations and exactly how it can benefit wildlife in general as well'. 'I have mixed feelings…I was shocked by the amount of rabbits in Colorado, and that kind of conflicts with my gardening desire'.
	Utilitarian		Believe that the natural world should be used and managed primarily for human benefit. They are more likely to prioritize human well-being over the environment in their attitudes and behaviors. They are also more likely to participate in consumptive activities such as hunting or fishing and see wildlife as pests or a nuisance.	'My husband ended up killing the baby rattlesnake'.
		Consumptive or abusive activities (defined below)	Interacts with the environment within the context of a consumptive or abusive outdoor recreation activity (defined below)	'Fishing is probably the closest I come to interacting with that type of wildlife'.
		Nuisance/Pests	Sees aspects of the natural world as a nuisance, irritation, or pest that they want to get rid of	'Moths are everywhere and I keep telling them "Don't come into the apartment! You don't need to be in here!"'

(*Continued*)

Theme	Sub-Theme	Sub-sub Theme	Definition	Example
	Distanced		Neither a mutualism or a utilitarian orientation. As their label suggests, they tend to be less interested in wildlife and wildlife-related issues. More likely to express fear or disgust related to interacting with the natural world.	'I don't have that pull to want to go and be out in the wild'.
		Fear/Concern for safety	Concern related to interacting with the natural world because of the possibility of harm, such as through injury or contracting disease	'I'm always kind of little on edge when I'm by myself out there'.
		Disgust	Expresses disdain for interactions with the natural world but does not want to harm or use it	'I hate bugs…it's still so difficult for me to let stonefly nymphs crawl on my hands'.
		Lack of interest	Demonstrates a lack of interest in the natural world and would rather focus attention on other things	'I'm not very active with wildlife I'll say that much. It's just not something personally that I really got into'.
Assigned Value for Environment	Ecosystem focus		Participant assigns value to the natural world through the lens of ecosystems or system-level processes, such as placing emphasis on more scientific concepts like biodiversity or ecosystem health	'If you can teach kids the importance of biodiversity, then hopefully they'll live in a way to help promote biodiversity'. 'I definitely view wildlife as essential…I see the benefits of an ecosystem having a variety'
	Human focus		Participant assigns value to the natural world through the lens of humans, such as providing ecosystem services to us	'I just don't think people think of like ecosystem services that we get from wildlife all the time'. 'Knowing about the wildlife where you live…and how we benefit from them as well'
Pedagogical Value Orientation	Disciplinary Mastery		Participant emphasizes wanting students to come away with fundamental knowledge, understanding, and skills. Discusses course content in the context of meeting state standards. Really wants students to be prepared for the following year.	'I think that you should make sure you're covering what needs to be covered'. 'Interpreting graphs is just a skill that they need to develop in middle school'.
	Learning Process		Mentions skills like critical thinking and problem solving. Wants students to be able to think for themselves and come to their own conclusions. Focuses on the process of learning rather than grades or other academic outputs.	'Giving them the tools to gather their own information and interpret the data and come to their own conclusions'
	Self-Actualization		Wants students to have real world skills. Recognizes students as people/humans and makes sure their voices are heard. Focuses on the 'big picture' and nurturing students for more than just academia	'Making sure that they're hearing everyone's voices…Especially middle school students really, really need that support'.
	Social Responsibility		Mentions civic engagement and social change. Relates course material to global issues. Wants to help students become 'good people'	'I can't save the world and the animals on my own, so let's inspire younger generations to do that with me'. 'We expect respect'
	Ecological Integration		Experiential learning and other non-traditional practices, talks about sparking interest or passion. Local context. Caters course content to students	'I think students learn the most and are most engaged when you can incorporate their own interests'.

(*Continued*)

Theme	Sub-Theme	Sub-sub Theme	Definition	Example
Pedagogical Motivations			Why the participant pursued teaching as a career	'He just got kids excited about nature and science. And I wanted to be able to do something similar'. '[I] realized I was missing the interaction with the kids so I went back and got my teaching license'
Pedagogical Behaviors	Place-Based Education		Teacher's presented definition of 'place-based education'	'learning and knowing about where we live, but then applying it to the rest of the world' 'utilizing the students and their understandings and their experiences, along with the resources that are around you'
	Implementation		Teacher's examples of lessons or activities in which they implemented PBE	'when we're doing a weather unit we Have students go outside of the classroom and sit and actually Look around' 'there are a lot of geese around…I've shown like a video about geese and talking about like, why they're here in the middle of winter and, or anything that I can work it in'
	Importance/ Benefits		Teacher's presented benefits and importance of implementing PBE	'I think students learn the most and are most engaged when you can incorporate their own interests' 'I think it helps open their eyes to we have all that really cool stuff right here. They might just not have noticed it before'.
Address Environmental Topics through NGSS	Disciplinary Core idea	Interdependent Relationships in Ecosystems	Teacher frames discussions of wildlife and the environment through a lens of system-level ecological connectivity and interdependence, key word being 'ecosystem'	'even when we don't see the animals all around us like they're there and the trees and the grass and it's all connected' 'It's like learning about ecology, food chains and food webs and like understanding each organisms role in the environment'
		Human Impacts on Earth Systems	Teacher frames discussions of wildlife and the environment around human interactions with and their impact on the environment	'I think bringing that into the human impacts on the environment is what are we taking out and how is that effecting our system' 'It can help open up the eyes of students to like, realizing the real impact on environment every single day'
		Organization for Matter and Energy Flow in Organisms		'So I try and bring it in, in different ways. So we talked about, like biological mechanisms, like how geese maintain body temperature for homeostasis'
		Natural Selection / Adaptation		'We talked about it with genetics. And genetic diversity and talking about like, life history and life strategies for different animals. I'd like to bring in some examples of like, super inbred communities or different things. I do a lesson with evolution and classification. related'.
	Practice	Analyzing and Interpreting Data	Teacher uses discussions of wildlife and the environment as an opportunity to focus on inquiry, defining problems, and what it means to be a scientist	'I like the data speaking for itself, rather than me just saying, Well, climate change is climate change' 'Anyone from any background can be a scientist if they've got the passion for it'
		Asking Questions and Defining Problems	Teacher uses discussions of wildlife and the environment as an opportunity to have students analyze and interpret data, such as interpreting graphs	'We look at [an experiment] and say, "What did we learn?" And then, "What questions do we have now?" That's an approach that I use all the time'.