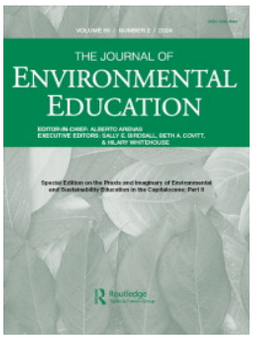

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RESEARCH ARTICLE

Appropriateness and use of civic engagement, advocacy, and behavior change techniques in environmental education across the United States

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ABSTRACT

Recent research suggests that many environmental education (EE) programs for youth in the United States focus on meeting educational standards rather than using civic engagement and advocacy techniques to promote environmental literacy. We distributed a survey to members of several EE organizations to identify which civic engagement, advocacy, and behavior change techniques a sample of EE providers feel are appropriate to use for youth at different developmental stages (grades 4–5, grades 6–8, and grades 9–12), as well as the extent to which they use them. Educators rated many techniques as less appropriate and were less likely to use them with younger age groups. We also conducted an appropriateness/use analysis to identify techniques that were deemed highly appropriate but were not used as often. The techniques related to civic engagement and advocacy for diversity, equity, and inclusion appeared underutilized. Implications of these findings for policy and practice are discussed.

KEYWORDS

environmental education; civic engagement; advocacy; behavior change; pedagogy; youth

Introduction

Environmental education (EE) aims to develop environmental literacy, which has been defined as the knowledge, skills, dispositions, and behaviors necessary to solve environmental problems (e.g., Hofstein & Rosenfeld, 1996; UNESCO, 1977). EE, as defined by the Tbilisi Declaration (1977), is interdisciplinary and should help individuals and communities "understand the complex nature of natural and built environments resulting from the interaction of their biological, physical, social, economic, and cultural aspects" (UNESCO, 1977, p. 14). Thus, a holistic approach to building environmental literacy addresses the economic, social, cultural, and political nature of environmental issues along with the biological and physical (Musters et al., 1998; Pulver et al., 2018). Further, the North American Association for Environmental Education (NAAEE) highlights the necessity for EE participants to learn "action" and civic engagement skills that will facilitate solving complex socioenvironmental problems (North American Association of Environmental Education, 2017, 2020). However, for U.S.-based EE programs geared toward youth, there are both political pressures and educational expectations for programs to meet educational standards, most commonly science standards, and to not "indoctrinate" youth to a particular way of thinking (e.g., Jickling, 2003; Warren & Breunig, 2019). This focus on science standards has led some to claim U.S.-based EE programs for youth have simply become environmental science programs that emphasize the knowledge domain of environmental literacy and address only the biological and physical aspects of socioenvironmental issues (Gruenewald & Manteaw, 2007; Warren & Breunig, 2019) despite the growth in concern over complex issues such as climate change and training efforts by NAAEE

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and others focused on techniques that build the dispositions and skills to support civic engagement and future environmental action (e.g., Johnson & Mappin, 2009; Krasny, 2020; North American Association of Environmental Education, 2020). In fact, the results of a recent national study of United States' EE programs for youth suggests that these disposition and skill building techniques are rarely used and that these programs primarily focus on meeting knowledge-based educational standards (Powell et al., 2023).

This study sought to explore this discrepancy and understand which civic engagement, advocacy, and action/behavior change (CEABC) techniques U.S.-based environmental educators believe are most appropriate for teaching youth at different developmental stages (4th–5th grades (ages 8–10), 6th–8th grades (ages 11–14), and 9th–12th grades (ages 15–18)) and how widely they use these techniques. We hypothesized that the age of the target audience will influence educators' perspectives regarding which technique is most developmentally appropriate and therefore used. Thus, the purpose of this study is to answer the following research questions:

1. Which outcomes do a sample of U.S. environmental educators seek to achieve in programming for youth at different developmental stages (4th–5th, 6–8th, and 9th–12th grades)?
2. Which CEABC techniques do these environmental educators believe are appropriate to use in programming for youth at different developmental stages (4th–5th, 6–8th, and 9th–12th grades)?
3. To what extent do these educators use these CEABC techniques in programming for youth at different developmental stages (4th–5th, 6–8th, and 9th–12th grades)?
4. Are any CEABC techniques deemed highly appropriate yet rarely used by this sample of environmental educators?

Literature review

U.S.-based environmental education programs for youth

According to the Tbilisi Declaration (1977), EE should use engaging educational techniques to impart knowledge and awareness about the environment and its associated challenges; develop skills and expertise to address these challenges; and foster positive attitudes and motivations to encourage participants to make informed decisions and take action to solve them (Ardoin et al., 2015, 2018; Emmons, 1997; Hollweg et al., 2011; Stern et al., 2014; UNESCO, 1977). In the United States, EE for youth also emphasizes meeting educational standards (Gruenewald & Manteaw, 2007; Schindel, 2015). The No Child Left Behind Act of 2001 and the subsequent Every Student Succeeds Act of 2015 require measuring student achievement in traditional content areas; aligning teacher preparation and curriculum with state academic standards; and holding teachers and schools accountable for results. These requirements have strongly influenced EE for over twenty years (Gruenewald & Manteaw, 2007; Schindel, 2015). Consequently, EE programs designed for youth in the United States still aspire to enhance environmental literacy, but have also increasingly emphasized educational standards (e.g., Gruenewald & Manteaw, 2007; Powell et al., 2019; Schindel, 2015).

Youth developmental stages and EE program outcomes

Throughout the United States, EE may aim to achieve a range of participant outcomes, including enjoyment, knowledge, attitudes, place connection, social-emotional learning, positive youth development, skills development, and behavior change (e.g., Ardoin et al., 2018, 2020; Ardoin & Bowers, 2020; Powell et al., 2019). In formal education in the United States, educational standards such as the Common Core State Standards and Next Generation Science Standards are differentiated based on developmental stages and associated grade levels: grades 4–5 (ages 8–10); grades 6–8 (ages 11–14); and grades 9–12 (ages 15–18) (National Governors Association, 2010; National Research Council, 2013, 2015). Considering the increasing diversity of U.S. students (see National Center for Education Statistics, 2023), the standards movement in the U.S. also increasingly emphasizes equity for all learners irrespective of race, ethnicity, or socio-economic status and the need for educators to develop cultural competence and appropriate skills that also take into account the background and knowledge of the student (e.g., Ghattas & Carver,

2017; Kotluk & Kocakaya, 2018; Rodriguez, 1998, 2015; Vygotsky, 1978). Similarly, the NAAEE (e.g., North American Association of Environmental Education, 2009, 2021) and others (e.g., Anderson, Stern, Powell, Dayer, et al., 2022; Stern et al., 2010, 2022; Thorpe et al., 2023; Winther et al., 2010) promote age specific and culturally responsive approaches to EE. However, what has not been established are agreed upon standards (or outcomes) educators should prioritize depending upon the youth's developmental stage and the approaches they may use to achieve those outcomes.

According to developmental psychology literature, education for ages 8–10 should focus on developing knowledge, basic comprehension and summarizing skills, valuation of information, social-emotional skills, such as impulse control and collaboration, and the beginning of developing moral frameworks for evaluating behaviors and situations (Bloom, 1956; Dewey, 1899; Jaramillo, 1996; Kellert, 2002; Kohlberg, 1979; Krathwohl, 2002; Krathwohl et al., 1956; Piaget, 1953). Scholars suggest that education for youth ages 11–14 should provide opportunities to think abstractly, analyze information, identify cause and effect, discuss complex systems and concepts (Bloom, 1956; Dewey, 1899; Jaramillo, 1996; Kellert, 2002; Kohlberg, 1979; Krathwohl, 2002; Krathwohl et al., 1956; Piaget, 1953), as well as begin to build social/emotional skills including autonomy, responsibility, conflict resolution, collaboration skills, and formulating independent moral judgements (Caskey & Anfara, 2014; Hazen et al., 2008; Kellough & Kellough, 2008; Kohlberg, 1979). This developmental period is a critical stage for forming identity, morality, environmental literacy, twenty first century skills, and connection to place and community (Kellert, 2002; Kroger, 2006). In high school, students continue to build these critical thinking and scientific skills as well as begin to develop their identities and political orientations (Connell, 1971; Hazen et al., 2008; Kroger, 2006; Lewis-Beck et al., 2008; McLean & Pasupathi, 2012; Pettifor, 2012). This suggests that education for youth aged 15–18 should provide opportunities to synthesize disparate information, evaluate data and ideas, make judgements based on evidence, and develop social-emotional skills including leadership, advanced interpersonal skills, along with the ability to make nuanced moral judgements regarding complex situations and potential scenarios (Bloom, 1956; Dewey, 1899; Jaramillo, 1996; Kellert, 2002; Kohlberg, 1979; Krathwohl, 2002; Krathwohl et al., 1956; Piaget, 1953).

Civic engagement, advocacy, and behavior-change techniques in EE

Based on criticism regarding the emphasis on educational standards, NAAEE and others have advocated for educators to incorporate civic skills-building, advocacy, and behavior change techniques into EE programming (North American Association of Environmental Education, 2017, 2020). ***Civic engagement*** involves "developing the knowledge, twenty first century skills [e.g., communication, collaboration, critical thinking, and creativity], values, and motivation to make a difference in the civic life of communities" (Bobek et al., 2009, p. 617). NAAEE's *Community Engagement: Guidelines for Excellence* (2017) identifies issue-based approaches, which include exploring and evaluating complex socio-environmental issues and developing skills and actions to address them, as key components of effective civic engagement EE programs (Hansson, 2018; Jickling, 2003). Advocacy, on the other hand, focuses on actively promoting, supporting, or favoring a specific viewpoint or action to address a socioenvironmental issue (Jickling, 2003). There has been considerable debate regarding the appropriateness of advocacy in EE with some arguing for its appropriateness and others promoting skills-building unaccompanied by the advocacy for specific stances or actions (Jickling, 2003; Johnson & Mappin, 2009). Behavior change techniques primarily stem from social-psychology theories that seek to explain the knowledge, attitudes, and beliefs that influence people to perform a particular behavior (e.g., Ajzen, 1991; Heimlich & Ardoin, 2008; Schwartz, 1977; M. J. Stern, 2018; P. C. Stern, 2000). Theories such as the theory of planned behavior (TPB), norm activation theory (NAM), and value-belief-norm theory (VBN) suggest that communications and teaching techniques that target perceived behavioral control, attitudes toward the performance of a specific behavior, subjective norms, personal norms, environmental worldview, values, awareness of consequences, ascription of responsibility, and self-efficacy may influence the performance of PEBs (Chao, 2012; Chen, 2015; Lakhan, 2018; López-Mosquera & Sánchez, 2012). Based on this literature, we hypothesize that certain pedagogical approaches and certain outcomes may be viewed as more appropriate for youth depending upon their developmental stages.

Methods

Study objectives

Although environmental literacy, including the skills and behaviors necessary to solve socioenvironmental issues, is often a desired outcome of EE programs, there is very little research on: (1) the extent to which U.S. EE practitioners actively aim to enhance particular outcomes depending upon the developmental stage of the program participants; (2) understanding which techniques U.S. EE educators believe are appropriate in programming for youth at different developmental stages; (3) and identifying which techniques these educators use in programs for youth at these different developmental stages. To address these objectives, we designed an online survey and distributed a link *via* e-newsletters to members of NAAEE and their state affiliates, the Association of Nature Center Administrators (ANCA), and the National Association for Interpretation (NAI). Clemson University's Institutional Review Board reviewed all procedures described below prior to data collection and determined that procedures were Exempt (IRB2021-0156).

Instrument development

Demographics and Context: The survey included demographic and context questions, including respondents' current job position, racial and gender identity, number of years of experience, type of organization, how many people the organization employs, how often the organization serves various age groups and underrepresented groups, the extent to which they prioritize various outcomes (on a 4-point Likert type scale) in EE programming, and which types of PEBs they aim for (if any) which was adapted from Larson et al. (2015) and Powell et al. (2008, 2009).

Appropriateness and Frequency of Use: We used NAAEE's *Community Engagement: Guidelines for Excellence* (2017) as a guide to develop items that reflect civic engagement techniques. We developed additional items focused on advocacy and behavior change based on behavior change theories, NAAEE Guidelines for Excellence (2017), current events, and current techniques within the EE field (Ajzen, 1991; Intergovernmental Panel on Climate Change, 2021; Jickling, 2003; North American Association of Environmental Education, 2020; Stern, 2018). A team of eleven EE practitioners and researchers iteratively reviewed the survey, and an additional twenty practitioners and leaders from NAAEE pilot tested the survey. We edited the content based on their suggestions to enhance survey clarity, validity, and inclusiveness.

We first asked each respondent to select the grade range with which they have the most experience and expertise: 4th–5th grades, 6th–8th grades, or 9th–12th grades. Their answer to this question determined the grade range for which they rated the relative appropriateness and their use of CEABC techniques. Survey respondents then rated the list of CEABC techniques (Table 1) based on their relative appropriateness and frequency of use within EE programs for either 4th–5th, 6th–8th, or 9th–12th grade participants on Likert type scales scored from 1 to 4 (1= Not at all appropriate; 2= somewhat appropriate; 3 = mostly appropriate; 4 = totally appropriate) and (1= Never use; 2= rarely use; 3= sometimes use; 4= often use).

Data collection procedures and sampling

NAAEE and ANCA sent e-newsletters containing a description of the survey, voluntary consent information, and a link to an online survey instrument to their members in mid-April 2021. Combined, NAAEE and ANCA have over 20,700 members. NAI sent a weblink in their e-newsletter to its 7000 members on April 30, 2021. NAI, while focused primarily on informal education techniques broadly defined, also has a subset of members who provide environmental education at nature centers, parks, museums, zoos, aquaria, gardens, and other sites. We also contacted NAAEE State Affiliate Organizations and requested that they send the invitation to their membership. Twelve state affiliates distributed the invitation to their members *via* e-newsletters, Facebook posts, email invitations, or announcements on their websites: Connecticut, Utah, Illinois, Indiana, Kentucky, Minnesota, North Carolina, South Carolina, Pennsylvania, Rhode Island, Virginia, and Wisconsin. To remind members about the survey, NAAEE and ANCA each reposted the invitation in the following months e-newsletter.

Table 1. CEABC Techniques included on the survey and corresponding (abbreviation) and code.

Knowledge and Skills Building for Civic Engagement	Code
Teaching participants about ecology/environmental science. (Teach environmental science)	A
Teaching participants about the public policymaking process. (Teach public policymaking)	B
Asking participants to identify individual and community assets that will help address a specific environmental issue. (Identify assets)	C
Taking environmental actions with participants during an EE program (e.g., clean-ups or native plantings). (Demonstrate environmental actions)	D
Facilitating discussions that welcome multiple viewpoints. (Discuss multiple viewpoints)	E
Helping participants identify common ground between sides in controversial issues. (Identify common ground)	F
Challenging participants to design novel solutions to a specific environmental issue. (Design novel solutions)	G
Asking participants to use evidence to support their proposed solutions to environmental issues. (Use evidence)	H
Values and Dispositions for Civic Engagement	
Practicing skills to build participants' confidence in their abilities to address environmental issues. (Practice skills)	I
Encouraging participants to consider that all living things have value in and of themselves. (All life has value)	J
Demonstrating that a healthy environment is vital to human health and well-being. (Healthy environment = human health)	K
Using religious doctrine to support the case for environmental protection. (Religious doctrine)	L
Communicating that it's our shared moral obligation to care for the environment. (Moral obligation)	M
Teaching that everyone has a right to clean air and water, regardless of where they live. (Right to clean environment)	N
Discussing how systemic racism is intertwined with many environmental issues. (Systemic racism)	O
Providing examples of diverse environmental role models. (Diverse role models)	P
Motivation and Action Planning for Civic Engagement	
Encouraging participants to be "conservationists" in their everyday lives. (Conservationists)	Q
Empowering participants to see themselves as change agents. (Change agents)	R
Having participants identify ways to overcome obstacles to performing a specific environmental behavior. (Overcome obstacles)	S
Asking participants to identify the benefits and tradeoffs of performing different actions to address an environmental issue. (Pros and Cons)	T
Discussing the consequences of inaction on complex environmental issues, such as climate change. (Consequences of inaction)	U
Helping participants write an action plan to address a specific environmental issue. (Action plan)	V
Following up with participants after a program to support continued behavior change. (Follow up for behavior change)	W
Empowering participants to communicate with local decision makers about environmental issues. (Communicate with decision-makers)	X
Advocacy (Unnamed on survey due to potential bias/controversy)	
Asking participants to identify key decision makers related to the issue they are most interested in addressing. (Identify decision makers)	Y
Encouraging participants to change their individual behaviors to improve the environment (e.g., using reusable water bottles). (Encourage behavior change)	Z
Advocating that participants avoid purchasing certain products because of their environmental impacts. (Avoid purchase)	AA
Using persuasive arguments to influence participants' conservation behaviors. (Persuade behavior change)	BB
Asking participants to sign a petition or pledge to support a specific environmental cause. (Sign petition)	CC
Encouraging participants to join a pro-environmental organization. (Join environmental organization)	DD
Encouraging participants to peacefully protest for a specific environmental issue. (Peacefully protest)	EE
Advocating for a specific policy to address an environmental injustice. (Advocate Policy)	FF

Despite our efforts to widely distribute the survey invitation, this type of nonrandom sampling approach presents several important limitations. First, we cannot identify the number of individuals who received the survey invitation because it was embedded into a longer e-newsletter that contained many announcements and "stories." Second, our intended sample was U.S.-based educators, however NAAEE, ANCA, and NAI have international membership, and we do not know the total number of these members in order to derive an accurate sampling frame. Third, we had no way of assessing inaccurate email addresses. As Dillman et al. (2014) and Babbie (2020) suggest, this type of purposeful sampling limits the ability to generalize results to a broader population. Thus, our sample of survey respondents comprised U.S. members of EE-related professional associations who were responsive to survey requests sent *via* the internet and who demonstrated interest in EE practices focused on engaging youth.

When the survey closed after two months of data collection, 400 individuals opened the link. Seventy-six respondents clicked on the link or read the directions but did not start the survey. Three hundred and twenty-four started the survey. Of those, 261 completed more than 50% of the survey, and 249 completed more than 90%. For our analysis, we removed the 63 respondents who completed less than 50% of the survey, leaving 261 valid responses.

Table 2. Summary of demographics ($N = 261$).

Demographic	*Percentage*						
EE Positions (non-exclusive)	Teach	Develop	Train	Manage	Hiring	Director	Fund
	81%	66.8%	62.2%	57.6%	42%	28.6%	10.3%
Experience in Years	15+	3–5.5	6–8	9–11	0–2	12–14	
	45.4%	13.4%	13.3%	13%	9.2%	5.7%	
Gender Identity	Female	Male	Non-binary				
	70.3%	18.1%	2.4%				
Racial Identity	White	Mixed	Hispanic/Latinx	Black/African Am.	Native Am.	Asian	NR
	92.3%	3.6%	2%	1%	0.5%	0.5%	10.3%
Organization Type	Nature Center/ Nonprofit/ Research Center/ Science Center	Protected Area/Park/ Gov. Agency	School/Camp/College/Residential Center		Museum/Zoo/Farm/ Garden/Aquarium		
	46.3%	24.9%	18.7%		7.9%		
Organization Size (# of employees)	<10	10–49	50–249		>250		
	43.1%	32.8%	15.1%		9.1%		
Grade Expertise	4–5th	6–8	9–12				
	55%	25.6%	18.9%				

Table 3. How often do your EE programs serve the following audiences?

Audience	Never	Rarely	Sometimes	Often
Pre-K	18.7%	26.0%	26.0%	29.4%
Grades K-3	7.2%	13.9%	20.7%	58.2%
Grades 4-5	2.1%	7.5%	22.5%	67.9%
Grades 6-8	2.9%	9.1%	40.7%	47.3%
Grades 9-12	5.4%	27.7%	32.6%	34.3%
Adults	7.9%	10.0%	38.1%	43.9%
African American or Black participants	1.7%	15.0%	45.1%	38.2%
Hispanic or Latino/Latina/Latinx participants	1.3%	9.4%	44.0%	45.3%
People for whom English is not their primary language	1.3%	28.6%	49.6%	20.5%
Participants from a lower socioeconomic background (i.e., those who qualify for free or reduced lunches)	0.0%	3.0%	37.2%	59.8%

Demographics of survey respondents

Of the 261 survey respondents, most indicated they taught EE programs (81%). Over half also indicated that they developed EE programs (66.8%), were involved with training (62.2%), and/or managed EE programs/EE employees (57.6%). Almost half (45.4%) had 15 or more years in the EE field. All respondents (100%) provided EE programming in United States. Respondents largely self-identified as white/Caucasian (92.3%) and female (70.3%) (Table 2). Roughly half of respondents (46.3%) indicated they worked at a nature center, nonprofit organization, research center, or science center (Table 2). Forty-three percent of respondents indicated they worked at a small (<10 paid staff) organization (Table 2). Respondents most commonly indicated that they had the most experience and expertise working with 4th–5th grade participants (55.5%), followed by 6th–8th (25.6%), and 9th–12th (18.9%; Table 2). Most respondents worked at organizations that served a diverse public that varies in age, race, ethnicity, and economic status (Table 3).

Data analysis

To partially answer research question 1, we used descriptive statistics to report the outcomes they prioritize in their EE programming. To answer research questions 2 and 3, we reported the mean appropriateness and frequency of use scores for each CEABC technique and for each of the three grade ranges. To fully answer research questions 1, 2, and 3, we then used the nonparametric Kruskal-Wallis H test to assess if there were statistically significant differences between multiple groups (in this case, age group expertise). The test accommodates groups with different sample sizes and can test both continuous and

1. Low Appropriateness/High Use	2. High Appropriateness/High Use
3. Low Appropriateness/Low Use	4. High Appropriateness/Low Use

Figure 1. Appropriateness-use analysis quadrants.

ordinal dependent variables (Tabachnick & Fidell, 2007). We used this test along with a post hoc Dunn-Bonferroni test with a Bonferroni correction to examine whether the desired outcomes as well as the appropriateness and use scores significantly differed between age groups. The Bonferroni correction minimizes the chance of type 1 measurement error (Tabachnick & Fidell, 2007).

Appropriateness-use analysis

To answer research question 4, we used an Importance-Performance Analysis (IPA) (Martilla & James, 1977; Oh, 2001) to compare the reported extent of appropriateness and frequency of use of CEABC techniques. Following recommendations by Martilla and James (1977), we created an appropriateness-use graph for each grade range and then plotted each CEABC technique by calculating the grand mean appropriateness of each individual CEABC technique for each grade range (X-axis) and the grand mean frequency of use of each individual CEABC technique for each grade range (Y-axis). The results are visual representations of the relative reported appropriateness and use of CEABC techniques by grade range. Figure 1 is an adaptation of the four possible results of an IPA, in this case used to compare the reported extent of appropriateness and frequency of use of CEABC techniques.

Results

Research question 1: Prioritization of EE outcomes

Based on their reported age range expertise, we asked respondents to rate the extent to which they prioritized various EE outcomes on a 4-point Likert type scale (1 = Not at all, 2 = Minor priority, 3 = Moderate priority, 4 = High priority; Table 4).

The respondents who selected 4th–5th grade participants rated enjoyment (86.3%, $M = 3.83$, SD =.47) as a high-priority outcome, followed by knowledge (66.7%; $M = 3.64$, SD = .54) and attitudes (56.8%; $M = 3.50$, SD = .64). This group also prioritized enjoyment more than the respondents that focused on grades 6th–8th or 9–12th (Table 4).

Over half (60%, $M = 3.53$, SD = .62) of respondents who selected 6th–8th grade programming rated attitudes as a high-priority outcome, and 57.6% ($M = 3.51$, SD = .65) rated skill development as a high-priority outcome. Those who selected 6th–8th grade also frequently rated enjoyment as a high-priority outcome (55.9%, $M = 3.42$, SD = .77) and personal growth (52.5%, $M = 3.31$, SD = .84) (Table 4). This group of respondents was less likely to prioritize knowledge gain and also more likely to prioritize personal growth and environmental justice than the 4th–5th grade group (Table 4).

Well over half of respondents who selected 9th–12th grade programming rated enjoyment and attitudes (64.4%, $M = 3.60$, SD = .58) as the highest-priority outcomes (Table 4). A majority also rated skill development (62.2%, $M = 3.53$, SD = .69) and knowledge (61.4%; $M = 3.50$, SD = .70) as a high-priority outcome. This group also prioritized skills development, personal growth, and environmental justice more than the respondents focused on 4th–5th grades (Table 4).

The survey asked respondents who indicated behavior change was at least a minor priority in their programming to indicate which types of PEBs they aimed to influence (yes/no; Table 5). Of those who indicated behavior change was at least a minor priority in their programming, environmental conservation behaviors were most frequently reported as a target in programming across all grade ranges (Table 5). Home conservation behaviors and reduce, reuse, recycle behaviors were also highly targeted across all grade ranges (Table 5). Environmental justice behaviors were less frequently reported as a target in programming, and it varied by grade range, with those who taught 6th–8th or 9th–12th grade participants

Table 4. Comparison of prioritization of outcomes in EE programming by grade level.

Outcome	4th–5th ($n=132$) Mean (SD) Mean Rank	6th–8th ($n=60$) Mean (SD) MeanRank	9th–12th ($n=45$) Mean (SD) Mean Rank	Overall Mean (SD)	Kruskal-Wallis Test H	(df)	p	Post Hoc w/ Bonferroni correction 1 = 4th–5th 2 = 6th–8th 3 = 9th–12th
Enjoyment: Participants' overall satisfaction with the program.	3.83 (.47) 131.92	3.42 (.77) 95.56	3.60 (.58) 106.91	3.86 (.62)	22.69	(2)	<.001	1 > 2***; 1 > 3*
Knowledge: Increasing awareness and understanding of the subject matter, environmental issues, or concepts.	3.64 (.54) 126.76	3.37 (.66) 101.42	3.50 (.70) 117.02	3.54 (.61)	7.70	(2)	.021	1 > 2*
Attitudes: Changing in attitudes toward the subject matter of the program	3.50 (.64) 116.39	3.53 (.62) 119.70	3.60 (.58) 125.72	3.52 (.62)	.839	(2)	.657	
Skills development: Improving abilities to perform specific actions relevant to the program content.	3.27 (.70) 107.67	3.51 (.65) 130.58	3.53 (.69) 134.43	3.36 (.70)	9.35	(2)	.009	1 < 3*
Behavior change: Changing participants' self-reported or actual behaviors or behavioral intentions.	3.05 (.80) 113.24	3.20 (.78) 125.18	3.22 (.82) 127.66	3.11 (.79)	2.43	(2)	.296	
Personal growth (Social emotional learning): Developing identity, self-esteem, personal awareness, or other positive emotions.	2.94 (.86) 104.37	3.31 (.84) 132.71	3.38 (.81) 138.39	3.10 (.86)	13.67	(2)	.001	1 < 2*; 1 < 3**
Outcomes are co-created: Based on constructivism, participants develop their own outcomes by reflecting upon the program and incorporating new knowledge into their "schemas."	2.76 (.88) 109.56	2.87 (.93) 118.70	2.89 (1.02) 121.24	2.81 (.92)	1.54	(2)	.462	
Environmental justice: Understanding of the connection between equity, inclusion, and diversity and environmental issues.	2.32 (.88) 98.70	2.81 (.96) 131.85	3.18 (1.01) 156.02	2.63 (.98)	29.38	(2)	<.001	1 < 2**; 1 < 3***

*$p<.05$.
**$p<.01$.
***$p<.001$ (1 = not at all; 2 = minor priority; 3 = moderate priority; 4 = high priority).

Table 5. Types of targeted behaviors.

Type of behavior	Frequency (percentage)			
	4th–5th	6th–8th	9th–12th	Overall
Environmental conservation: e.g., improving wildlife habitat, planting native species, working to improve parks in your neighborhood.	112 (84.8%)	49 (80.3%)	40 (88.9%)	208 (79.4%)
Reduce, reuse, recycle: e.g., using reusable bags or water bottles, composting, recycling, repairing old items before buying new ones.	106 (80.3%)	45 (73.8%)	28 (62.2%)	186 (71.0%)
Home conservation: e.g., reducing water and electricity use, installing photovoltaics, etc.	99 (75%)	43 (70.5%)	30 (66.7%)	176 (67.2%)
Consumer: e.g., purchasing items made from recycled materials, products from companies with environmentally responsible practices, and locally produced items.	61 (46.2%)	36 (59%)	29 (64.4%)	132 (50.4%)
Transportation: e.g., walking or riding a bicycle instead of driving, carpooling, taking public transit.	35 (26.5%)	31 (50.8%)	24 (53.3%)	91 (34.7%)
Political: e.g., urging people in positions of power to support pro-environmental practices, becoming a member of an environmental organization.	18 (13.6%)	30 (49.2%)	29 (64.4%)	82 (31.3%)
Environmental justice: e.g., working to ensure all communities have equal access to clean water, air, and green spaces; addressing social injustices, working toward justice, equity, and inclusion related to environmental issues.	17 (12.9%)	13 (21.3%)	9 (20%)	40 (15.3%)

being more likely to aim for it (Table 5). Transportation behaviors and political behaviors also varied by grade range, and respondents who worked with older audiences were more likely to prioritize them (Table 5).

Research question 2: Appropriateness of CEABC techniques

Respondents were asked to rate the appropriateness of CEABC techniques for the grade range they selected on a 1-4 Likert type scale (1= Not at all appropriate; 2= somewhat appropriate; 3 = mostly appropriate; 4 = totally appropriate; Table 6). The technique rated as most appropriate across all grade ranges was *Teaching participants about ecology/environmental science* (*M* ranged from 3.89 to 3.93; Table 6). The technique rated as least appropriate across all grade ranges was *Using religious doctrine to support the case for environmental protection* (*M* ranged from 1.37 to 1.79). Overall, the results indicated that EE practitioners thought most civic engagement techniques were mostly or totally appropriate. Two techniques were deemed only somewhat appropriate for 4th–5th graders*: Teaching participants about the public policymaking process* ($M = 2.64$) and *Discussing how systemic racism is intertwined with environmental issues* ($M = 2.70$).

Most advocacy techniques were deemed at least somewhat appropriate. Only two techniques in this category yielded mean appropriateness scores less than 2.00 for at least one of the age groups: *Asking participants to sign a petition or pledge to support a specific environmental cause* (4th–5th and 6th–8th grades) and *Encouraging participants to peacefully protest for a specific environmental issue* (4th–5th grades) (Table 6).

Kruskal-Wallis Test with Dunn-Bonferoni post hoc tests revealed that survey respondents considered many CEABC techniques to be less appropriate for 4th–5th grade audiences than for older grade ranges (Table 6).

Research question 3: Frequency of use of CEABC techniques

Mean frequency of use scores ranged from 1.15 to 3.91 (Table 7). The most commonly employed techniques (means above 3.00 across all grade ranges) were: *(1) Teaching participants about ecology/environmental science, (2) Demonstrating that a healthy environment is vital to human health and well-being, (3) Empowering participants to see themselves as change agents, (4) Encouraging participants to consider that all living things have value in and of themselves, (5) Encouraging participants to change their individual*

Table 6. Comparison of appropriateness by grade level.

Items	Appropriateness Mean (SD) Mean Rank				Kruskal-Wallis Test			Post Hoc w/ Bonferroni correction
Knowledge and Skills	4th–5th ($n=132$)	6th–8th ($n=61$)	9th–12th ($n=45$)	M	H	(df)	p	1 = 4th–5th 2 = 6th–8th 3 = 9th–12th
Teach environmental science.	3.93 (.28) 116.45	3.97 (.18) 119.55	3.89 (.42) 109.69	3.91 (.33)	2.99	(2)	.225	
Demonstrate environmental actions.	3.82 (.45) 112.44	3.75 (.65) 110.99	3.83 (.38) 112.00	3.79 (.49)	.047	(2)	.977	
Discuss multiple viewpoints.	3.66 (.67) 103.75	3.91 (.29) 121.82	3.93 (.26) 123.89	3.76 (.56)	10.92	(2)	.004	1 < 2*; 1 < 3*
Use evidence.	3.54 (.71) 98.18	3.96 (.19) 131.75	3.90 (.37) 127.58	3.70 (.63)	26.48	(2)	<.001	1 < 2***; 1 < 3**
Design novel solutions.	3.50 (.75) 100.98	3.80 (.49) 124.17	3.86 (.42) 129.11	3.63 (.67)	14.25	(2)	<.001	1 < 2*; 1 < 3**
Identify common ground.	3.32 (.86) 97.50	3.76 (.51) 128.23	3.83 (.44) 134.24	3.52 (.76)	21.44	(2)	<.001	1 < 2**; 1 < 3***
Identify assets.	3.06 (.84) 87.90	3.75 (.58) 138.75	3.83 (.44) 144.20	3.36 (.81)	47.48	(2)	<.001	1 < 2***; 1 < 3***
Teach public policymaking.	2.64 (.88) 90.77	3.29 (.79) 134.59	3.66 (.62) 160.61	2.97 (.91)	47.54	(2)	<.001	1 < 2***; 1 < 3***
Values and Dispositions								
Healthy environment = human health.	3.92 (.27) 112.80	3.96 (.19) 117.43	3.95 (.31) 118.63	3.94 (.25)	2.15	(2)	.341	
All life has value.	3.88 (.35) 115.84	3.88 (.33) 114.75	3.86 (.41) 115.43	3.87 (.36)	.034	(2)	.983	
Diverse role models.	3.72 (.66) 109.48	3.93 (.26) 123.68	3.88 (.45) 123.19	3.79 (.56)	6.90	(2)	.032	
Right to clean environment.	3.70 (.66) 108.68	3.96 (.19) 128.57	3.84 (.53) 119.24	3.79 (.56)	9.66	(2)	.008	1 < 2**
Practice skills.	3.56 (.68) 102.89	3.91 (.29) 132.36	3.91 (.29) 131.95	3.70 (.58)	20.27	(2)	<.001	1 < 2***; 1 < 3**
Moral obligation.	3.15 (.90) 108.68	3.30 (.87) 119.83	3.43 (.80) 128.35	3.24 (.87)	3.77	(2)	.152	
Systemic racism.	2.70(1.01) 92.30	3.46 (.79) 140.23	3.62 (.76) 152.15	3.06(1.00)	41.50	(2)	<.001	1 < 2***; 1 < 3***
Religious doctrine.	1.37 (.60) 103.84	1.65 (.80) 126.04	1.79 (.93) 132.65	1.52 (.74)	10.97	(2)	.004	1 < 2*; 1 < 3*
Motivation + Action Planning								
Change agents.	3.83 (.48) 112.39	3.91 (.29) 116.41	3.93 (.26) 118.57	3.87 (.41)	1.20	(2)	.549	
Conservationists	3.80 (.47) 118.84	3.77 (.47) 114.03	3.63 (.69) 107.24	3.76 (.52)	2.14	(2)	.343	
Overcome obstacles.	3.61 (.63) 105.84	3.85 (.36) 126.65	3.81 (.51) 125.62	3.70 (.57)	9.46	(2)	.009	1 < 2*
Pros and Cons.	3.47 (.71) 103.69	3.76 (.47) 127.61	3.81 (.45) 133.33	3.60 (.63)	13.62	(2)	.001	1 < 2*; 1 < 3**
Follow up for behavior change.	3.38 (.80) 105.84	3.51 (.79) 116.44	3.79 (.52) 136.06	3.48 (.78)	9.51	(2)	.009	1 < 3**
Consequences of inaction.	3.17 (.84) 97.47	3.62 (.62) 131.49	3.79 (.47) 145.37	3.40 (.77)	26.99	(2)	<.001	1 < 2** 1 < 3***
Communicate with decision makers.	3.09 (.94) 96.15	3.55 (.81) 127.62	3.90 (.30) 151.43	3.36 (.90)	32.98	(2)	<.001	1 < 2**; 1 < 3***
Action plan.	3.06 (.89) 95.48	3.62 (.71) 136.35	3.74 (.59) 145.20	3.31 (.86)	31.97	(2)	<.001	1 < 2***; 1 < 3***
Advocacy								
Encourage behavior change.	3.74 (.52) 113.02	3.76 (.54) 116.49	3.55 (.65) 96.26	3.72 (.55)	4.67	(2)	.097	
Identify decision makers.	2.77 (.90) 87.87	3.38 (.83) 130.26	3.74 (.45) 154.05	3.09 (.91)	44.39	(2)	<.001	1 < 2***; 1 < 3***
Persuade behavior change.	2.63 (.88) 104.64	2.71 (1.05) 111.36	3.03(1.08) 131.89	2.74 (.97)	5.80	(2)	.055	1 < 3*
Avoid purchase.	2.52 (.94) 102.34	2.89 (1.03) 126.90	2.76 (.91) 117.14	2.68 (.98)	6.64	(2)	.036	1 < 2*
Advocating policy.	2.02 (.97) 94.64	2.60 (1.13) 126.36	2.92(1.10) 143.88	2.34 (1.10)	23.18	(2)	<.001	1 < 2**; 1 < 3***
Join env. organization.	2.02 (.86) 99.17	2.31 (.92) 118.62	2.71(1.06) 139.83	2.23 (.95)	14.29	(2)	<.001	1 < 3**
Peacefully protest.	1.79 (.85) 96.74	2.22 (.96) 124.65	2.50(1.06) 139.29	2.04 (.97)	18.19	(2)	<.001	1 < 2*; 1 < 3***
Sign petition.	1.94 (.92) 108.16	1.91 (.94) 106.06	2.26(1.13) 124.68	2.01 (.98)	2.59	(2)	.274	

*$p<.05$.
**$p<.01$.
***$p<.001$ (1= Not at all appropriate; 2= somewhat appropriate; 3 = mostly appropriate; 4 = totally appropriate).

Table 7. Comparison of frequency of use by grade level.

Item	Frequency of Use Mean (SD) Mean Rank				Kruskal-Wallis Test			Post Hoc w/ Bonferroni correction
Knowledge and Skills	4th–5th	6th–8th	9th–12th	M	H	(df)	*p*	1 = 4th–5th 2 = 6th–8th 3 = 9th–12th
Teach env. science.	3.91 (.34) 120.78	3.82 (.43) 111.66	3.70 (.67) 107.19	3.83 (.46)	5.34	(2)	.069	
Discuss multiple viewpoints.	3.19 (.79) 98.97	3.59 (.60) 130.69	3.53 (.67) 126.70	3.34 (.74)	14.48	(2)	<.001	1 < 2**; 1 < 3*
Demonstrate env. actions.	3.16 (.75) 112.00	3.02 (.88) 103.82	3.23 (.92) 122.27	3.14 (.81)	2.27	(2)	.322	
Use evidence.	2.75 (.93) 94.75	3.43 (.72) 139.24	3.21 (1.01) 128.35	3.00 (.95)	23.75	(2)	<.001	1 < 2***; 1 < 3**
Design novel solutions.	2.71 (.87) 98.19	3.24 (.85) 135.85	3.07 (.83) 122.51	2.91 (.88)	15.93	(2)	<.001	1 < 2***
Identify assets	2.42 (.88) 87.36	3.08 (.83) 129.14	3.44 (.67) 154.27	2.78 (.94)	45.08	(2)	<.001	1 < 2***; 1 < 3***
Identify common ground.	2.51 (.89) 94.44	3.20 (.83) 140.85	3.00 (.95) 127.23	2.77 (.94)	24.79	(2)	<.001	1 < 2***; 1 < 3**
Teaching public policymaking.	1.98 (.79) 95.52	2.48 (.97) 128.83	2.90 (.88) 157.32	2.28 (.93)	33.99	(2)	<.001	1 < 2**; 1 < 3***
Values and Dispositions								
Healthy environment = human health.	3.59 (.64) 113.06	3.71 (.46) 119.87	3.56 (.70) 111.98	3.61 (.62)	.73	(2)	.693	
All life has value.	3.64 (.67) 123.85	3.40 (.78) 104.45	3.30 (.86) 99.09	3.50 (.76)	8.81	(2)	.012	1 > 3*
Practicing skills.	2.86 (.88) 94.90	3.44 (.69) 137.29	3.51 (.67) 142.51	3.14 (.85)	29.56	(2)	<.001	1 < 2***; 1 < 3***
Right to clean environment	2.95(1.00) 105.25	3.27 (.85) 125.18	3.30 (.91) 128.80	3.10 (.95)	6.83	(2)	.033	
Diverse role models.	2.60 (.90) 98.83	2.95 (.95) 121.57	3.40 (.82) 152.83	2.83 (.95)	24.63	(2)	<.001	1 < 3***; 2 < 3*
Moral obligation.	2.83(1.00) 116.20	2.75 (.89) 109.01	2.79 (1.05) 113.71	2.80 (.98)	.51	(2)	.776	
Systemic racism.	1.62 (.73) 88.72	2.44 (1.01) 139.13	2.90 (1.08) 162.67	2.06 (1.02)	55.40	(2)	<.001	1 < 2***; 1 < 3***
Religious doctrine.	1.15 (.41) 109.37	1.27 (.56) 120.54	1.29 (.55) 122.60	1.21 (.48)	4.50	(2)	.105	
Motivation + Action Planning								
Change agents.	3.39 (.74) 104.28	3.70 (.50) 129.08	3.62 (.66) 124.93	3.51 (.69)	9.20	(2)	.010	1 < 2*
Conservationists.	3.52 (.63) 120.04	3.48 (.72) 119.11	3.19 (.73) 91.84	3.43 (.69)	7.93	(2)	.019	1 > 3*
Overcome obstacles.	2.85 (.85) 105.76	3.24 (.67) 133.52	2.93 (.92) 111.71	2.96 (.84)	7.88	(2)	.019	1 < 2*
Pros and Cons.	2.63 (.86) 99.73	3.13 (.80) 134.44	3.12 (.93) 134.47	2.85 (.89)	17.26	(2)	<.001	1 < 2**; 1 < 3**
Consequences of inaction.	2.47 (.90) 99.16	2.94 (.92) 130.96	3.02 (.96) 136.33	2.68 (.95)	16.64	(2)	<.001	1 < 2**; 1 < 3**
Communicate with decision makers.	1.75 (.83) 89.13	2.58 (1.05) 138.37	3.05 (1.06) 162.38	2.21 (1.08)	52.97	(2)	<.001	1 < 2***; 1 < 3***
Action plan.	1.85 (.86) 95.58	2.45 (1.20) 127.76	2.83 (1.06) 151.40	2.15 (1.06)	28.84	(2)	<.001	1 < 2**; 1 < 3***
Follow up for behavior change.	1.95 (.86) 102.67	2.11 (.95) 112.71	2.67 (1.00) 148.05	2.12 (.95)	16.82	(2)	<.001	1 < 3***; 2 < 3*
Advocacy								
Encourage beh. change.	3.52 (.69) 113.23	3.44 (.86) 111.60	3.32 (.84) 99.75	3.47 (.75)	1.77	(2)	.412	
Persuade beh. change.	2.23 (.89) 105.63	2.31 (.99) 109.94	2.58 (1.20) 122.61	2.31 (.97)	2.23	(2)	.329	
Avoid purchase.	2.03 (.94) 99.96	2.43 (.94) 125.07	2.35 (.98) 119.51	2.23 (.98)	7.79	(2)	.020	1 < 2*
Identify decision makers.	1.68 (.80) 91.21	2.26 (1.03) 125.96	2.68 (1.02) 150.11	2.02 (.99)	33.13	(2)	<.001	1 < 2**; 1 < 3***
Join env. organization.	1.38 (.65) 96.16	1.70 (.84) 119.26	2.24 (1.13) 146.37	1.62 (.87)	25.17	(2)	<.001	1 < 2*; 1 < 3***
Advocate policy.	1.23 (.52) 90.46	1.94 (1.12) 131.11	2.24 (1.10) 148.71	1.61 (.95)	44.98	(2)	<.001	1 < 2***; 1 < 3***
Sign a petition.	1.39 (.72) 109.83	1.31 (.64) 104.48	1.58 (.89) 121.32	1.42 (.74)	2.59	(2)	.275	
Peacefully protest.	1.13 (.40) 95.51	1.48 (.72) 124.31	1.74 (1.01) 134.84	1.34 (.67)	28.46	(2)	<.001	1 < 2***; 1 < 3***

*p<.05.
**p<.01.
***p<.001 (1= Never use; 2= rarely use; 3= sometimes use; 4= often use).

behaviors to improve the environment (e.g., using reusable water bottles) (6) Encouraging participants to be "conservationists" in their everyday lives, (7) Facilitating discussions that welcome multiple viewpoints, and (8) Taking environmental actions with participants during an EE program. Overall, three of the eight most heavily utilized CEABC techniques were from the "Knowledge and Skills Building" section, two were from "Values and Dispositions," two were from "Motivation and Action Planning," and one was from "Advocacy." *Using religious doctrine to support the case for environmental protection* had the lowest frequency of use scores across all grade ranges ($M = 1.15 - 1.29$).

To test if frequency of use varied significantly based on developmental stage we used the Kruskal-Wallis Test with Dunn-Bonferoni post hoc tests, which revealed that many CEABC techniques were used less frequently for 4th–5th graders than for older grade ranges (Table 7). Only two techniques were used significantly more frequently in 4th–5th grade programming than they were in 9th–12th grade programming: (1) *Encouraging participants to consider that all living things have value in and of themselves* and (2) *Encouraging participants to be "conservationists" in their everyday lives.*

Research question 4: Appropriateness-use analyses

Are any CEABC techniques deemed highly appropriate yet rarely used by U.S. environmental educators? To answer this question we created an appropriateness-use graph for each grade range. The appropriateness-use analyses revealed that most items were in the "High appropriateness/high use" and "Low appropriateness/low use" quadrants (Figures 2, 3, and 4). No items from any grade range were in the "Low appropriateness/high use" quadrant. The quadrant that varied most by grade range was "High appropriateness/low use." Table 8 lists all items in this quadrant by grade range. Most of the techniques in the "Lower appropriateness/lower use" category across grade ranges reflect advocacy techniques (Figures 2–4, Table 8) except for *Encouraging participants to change their individual behaviors to improve the environment (e.g., using reusable water bottles).*

Discussion

This study has several potential limitations including nonrandom sampling procedures; limited sample sizes by grade range, especially for educators focused on the older grade ranges; limited diversity of respondents; and the potential for social desirability bias. However, recent studies suggest that our sample

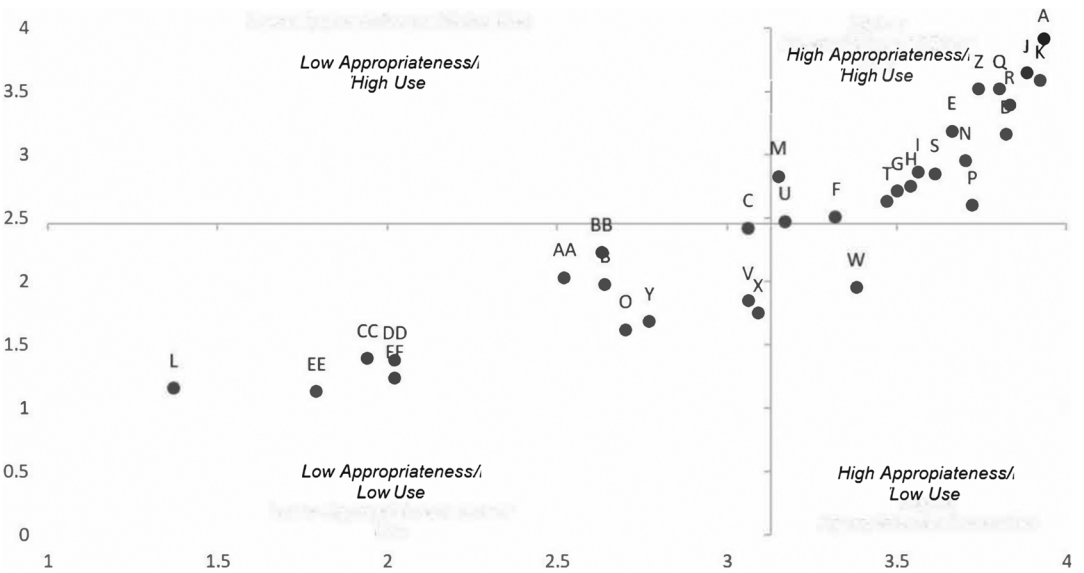

Figure 2. Appropriateness-use analysis of civic engagement and advocacy items for grades 4–5. See Table 3 for items.

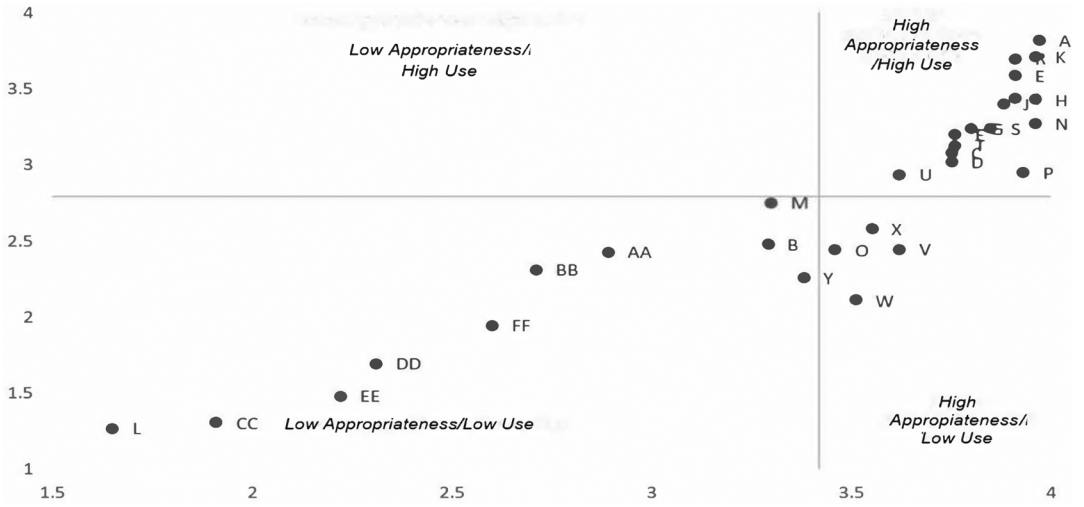

Figure 3. Appropriateness-use analysis of civic engagement and advocacy items for grades 6–8. See Table 3 for items.

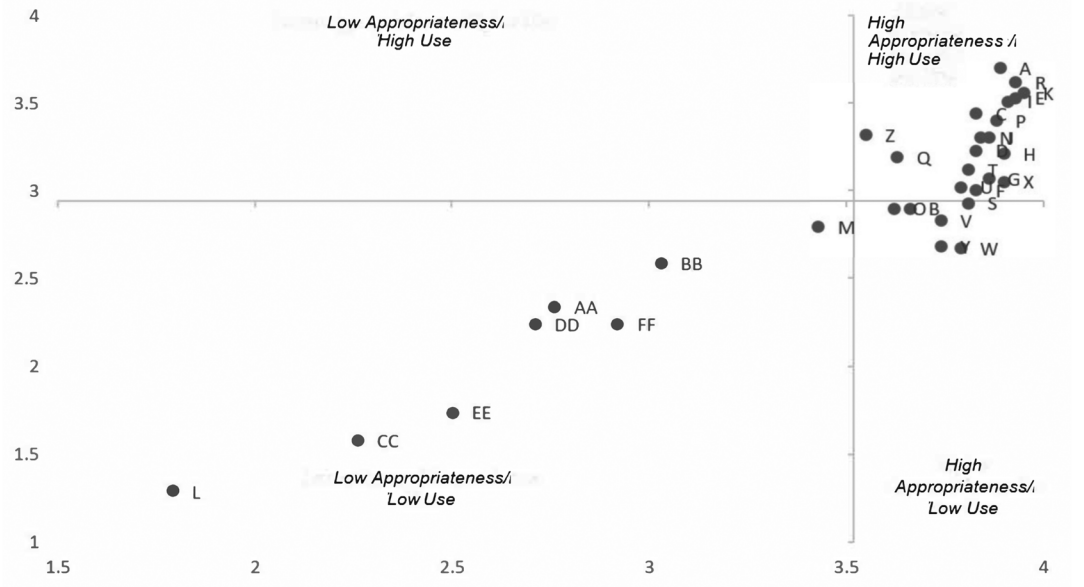

Figure 4. Appropriateness-use analysis of civic engagement and advocacy items for grades 9–12. See Table 3 for items.

Table 8. High appropriateness/low use items by grade level.

4th–5th	6th–8th	9th–12th
W) Following up to support behavior change	W) Following up to support behavior change	W) Following up to support behavior change
U) Consequences of inaction	X) Communicate with decision-makers	B) Teach public policymaking
	O) Systemic racism	O) Systemic racism
	V) Action plan	V) Action plan
		S) Overcome obstacles
		Y) Identify decision makers

largely reflects membership of U.S. EE professional organizations as being dominated by individuals who identify as white and female (e.g., Anderson, Stern, & Powell, 2022; Salazar et al., 2022; Woods et al., 2022) as well as the field's emphasis on EE for younger audiences (e.g., Salazar et al., 2022). Despite these

potential limitations, our results have important implications for the field. Our results identify (1) prioritized programmatic outcomes for different aged youth, (2) how this sample of educators rate the appropriateness and use of a range of CEABC techniques, and (3) the CEABC techniques that are viewed to be highly appropriate but underutilized for each developmental age range (i.e., where opportunities exist to increase use of age appropriate CEABC techniques).

Results suggest the extent to which a sample of educators prioritize various EE outcomes based on the age of the target audience. Enjoyment and knowledge were the most highly prioritized outcomes for 4th–5th grade programming; attitudes and skills were the most highly prioritized outcomes for 6th–8th grade programming; and enjoyment, attitudes, and skills were highly prioritized outcomes for 9th–12th grade programming (Table 4). Developmental research and theory supports the field's priorities as 1) educational experiences tend to be more successful when they build upon what students already know; 2) 4th–5th graders are just beginning to develop socio-environmental knowledge and awareness; and (3) once students reach adolescence and young adulthood (6th–12th grade), they develop both a stronger sense of their own personal values as well as an awareness of how others perceive their actions (e.g., social values) (Dewey, 1899; Kellert, 2002; Kohlberg, 1979; Krathwohl et al., 1956; McLean & Pasupathi, 2012; Piaget, 1953; Wells, 2000; Wells & Evans, 2003). In addition, most of our respondents did not teach at schools, camps, colleges, or residential centers (Table 2) and thus likely interacted with participants for a limited amount of time. Time constraints may make it difficult to prioritize more cognitively challenging and complex outcomes such as building skills and influencing behaviors.

Environmental conservation behaviors, home conservation behaviors, and reduce, reuse, recycle behaviors were the most highly desired behavioral outcomes across all grade ranges (Table 5). Prioritization of environmental justice behaviors, transportation behaviors, and political behaviors varied by grade range and were less likely to be prioritized, especially for younger audiences (Table 5). These results suggest the respondents primarily focus on environmental conservation behaviors, home conservation behaviors, and reduce, reuse, recycle behaviors that are within students' locus of control and are socially accepted.

Older participants (starting in adolescence) are also more likely to have the ability to engage in more complex behaviors and forms of civic engagement without involving adults (Caskey & Anfara, 2014; Hazen et al., 2008). They may also have more independent access to the Internet and various information sources that provide exposure to social movements such as Black Lives Matter, #LANDBACK, and #FridaysForFuture. Furthermore, older participants are developmentally attuned to the viewpoints and values of others as well as developing a deeper sense of their own values (Kellert, 2002; Kohlberg, 1979; Krathwohl et al., 1956; Piaget, 1953), thus enabling them to engage more deeply in civic discussions, more complex socioenvironmental issues, and collective or public actions.

The technique most consistently identified as appropriate across all grade ranges was *Teaching participants about ecology/environmental science*. This is in line with what both researchers and practitioners reported as one of the most common practices in EE programming in North America (Anderson, Stern, & Powell, 2022; Powell et al., 2023) and, again, highlights the strong emphasis in EE on scientific knowledge and meeting core curriculum and Next Generation Science Standards (Gruenewald & Manteaw, 2007; National Research Council, 2013). Respondents reported the least appropriate technique across all grade ranges as *Using religious doctrine to support the case for environmental protection*. This low ranking aligns with the dominant paradigm in the United States of formally aiming to separate religion from other public spheres.

Respondents thought most civic engagement techniques were mostly or totally appropriate. However, *Teaching participants about the public policymaking process* was rated less than "mostly appropriate" for 4th–5th grade participants, as was *Discussing how systemic racism is intertwined with environmental issues*. Teaching about the public policymaking process may be considered less appropriate because civics education is more likely to be emphasized for older students and is a part of the core curriculum for late middle school and high school (National Research Council, 2013). By contrast, 4th–5th grade curriculum typically includes very little discussion of civics, and younger participants are much less likely to be exposed to contentious socio-environmental issues (National Research Council, 2012, 2013), although other recent studies also suggest that EE for any age group lacks focus on civics education (e.g., Ardoin

et al., 2018; Salazar et al., 2022; Stern et al., 2014). Similarly, teaching about systemic racism may be considered less appropriate because of its complex social-cultural nature, poor alignment with educational standards, and political contentiousness especially considering current events in the United States (Gaynor & Lopez-Littleton, 2022; Harrison et al., 2021).

Advocacy techniques were, overall, deemed less appropriate than civic engagement techniques, especially for younger audiences. The advocacy techniques deemed the most appropriate generally focused on encouraging smaller, individual actions such as recycling or conserving water. These results underscore that EE practitioners may feel it is inappropriate to recommend specific resolutions or actions for issues that are more complex and potentially contentious.

We found that frequency of use scores varied more than mean appropriateness scores, ranging from never use (a score of 1.00) to often use (a score of 4.00; Table 7). The techniques that were least used were related to DEI and advocacy. This again suggests respondents were uncomfortable addressing social and political elements of environmental issues and working with students on specific actions they can take (Bonta et al., 2015; Hudson, 2001; Ladson-Billings, 1995; Simon, 2016; Warren & Breunig, 2019). Results from a recent study that observed over 300 EE field trip programs for adolescent youth in the United States suggests that many of the techniques promoted by NAAEE and by participants in this study, such as discussing multiple viewpoints, practicing twenty first century skills, evaluating the pros and cons of complex issues, identifying common ground, and encouraging behavior change, are not commonly practiced in the field (Powell et al., 2023). These results also support other recent research (e.g., Salazar et al., 2022; Woods et al., 2022) that suggests the field needs more training on DEI, advocacy, and behavior change techniques that are grounded in theory.

The appropriate-use analyses highlighted several CBEAC techniques that are supported by respondents but underutilized. *Following up with participants after a program to support continued behavior change,* falls into the "Highly appropriate/underutilized" quadrant across all grade ranges (Figures 2–4). This suggests most respondents indicated they need more time with students after a program to reinforce learning. However, these follow-up activities may require additional funding and staff. Additional techniques related to civic engagement and DEI also fell into the "highly appropriate/underutilized" quadrant for 6th–8th and 9th–12th grade audiences, which further supports unmet opportunities for more intentional engagement in complex socioenvironmental issues, especially for older audiences. To overcome this gap, EE providers may provide developmentally appropriate programming that builds skills and behavioral intentions even in a short period if they focus on student-centered learning techniques such as issue-based and project-based approaches (Ardoin et al., 2015; 2020; Stern et al., 2014) and effectively use pre-program and post-program resources and activities (Lee et al., 2020).

Conclusion

Research suggests a comprehensive approach to developing environmental literacy in participants requires practitioners to move beyond fact-only science education (Bonta et al., 2015; Brownlee et al., 2013; Hudson, 2001; Ladson-Billings, 1995; Monroe et al., 2019; Powell et al., 2023; Simon, 2016; Stern et al., 2014; Warren & Breunig, 2019). Our results suggest that what is considered appropriate in the eyes of a sample of EE practitioners varies by the age of the audience. Respondents also appeared to feel the need to meet educational standards and to tread lightly around active civic engagement and politically contentious issues. The observed gaps between appropriateness of CBEAC techniques and their use indicates either a lack of will or capacity in this sample of EE practitioners to explicitly work toward civic engagement outcomes. Future research should further investigate these apparent gaps in practice and identify mechanisms for overcoming the lack of use of CEBEAC techniques as reported in this study and others (Powell et al., 2023).

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