An Introduction to the Natural World: A program evaluation to assess nature connectedness and environmental stewardship

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Abstract

Environmental education is crucial to inspiring students to act as stewards of the natural world. Millbrook School, a coeducational boarding school located in Millbrook, New York, uses this pedagogical approach to fulfill its core value of stewardship of the natural world. The purpose of this study was to perform a quantitative evaluation of the effectiveness of Millbrook School's "Introduction to the Natural World" (INW) program for 9th graders based on student pre- and post-survey results. The surveys were composed of three anonymous, validated, and reliable psychometric tools, including Inclusion with Nature, Nature Relatedness Scale, and Environmental Stewardship Index. Descriptive statistics revealed that students did not make significant gains in the outcomes of interest in this study, a pattern that was reinforced by two-sample t-tests. These data suggest that the INW program was not associated with significant increases in student scores pertaining to two domains of environmental literacy-- environmental attitudes and behaviors. Although these results should be interpreted cautiously, the findings of this study were a helpful starting point in examining the strengths, challenges, and opportunities of the INW program.

An Introduction to the Natural World: A program evaluation to assess nature connectedness and environmental stewardship

Environmental education is crucial to inspiring students to act as stewards of the natural world (Merenlender et al. 2015), an identity that is formed out of a connectedness to place and can promote pro-environmental behaviors (Bennett et al., 2018; Enqvist, et al., 2018; Zint et al., 2013). Underpinning this educational approach are opportunities to connect with nature first-hand and experience such benefits as increased cognitive function, social relationship, creativity, academic performance, and health (Dale et al., 2020; Krasny and Delia, 2015). Environment-based education has also been shown to increase academic performance across the curriculum in comparison to traditional educational approaches, supporting high-performing schools and students (Glenn, 2000). Specifically, nature relatedness is known to positively affect happiness, well-being, and physical health (Kroufek et al., 2018). These positive experiences can build a sense of pride, satisfaction, and agency, rather than the all too common negative feelings associated with sustainability, such as guilt, fear, and obligation (Krasny and Delia, 2015).

Despite its importance, opportunities to experience nature are declining, as are connections to nature and the percentage of children who have regular contact with the outdoors (Kleespies et al., 2021; Sneed et al., 2021). Without these regular encounters with the natural world, one's emotional attachment to place and the desire to act responsibly on its behalf may also decline (Ardoin, 2006), resulting in placelessness (Johnson, 2012). This increasing disconnect has consequences for human and environmental health and well-being (Nisbet and Zelenski, 2011).

Improving the human-nature relationship through outdoor experiences is a viable pathway and prerequisite to increase pro-environmental actions and thereby environmental stewardship (Krasny and Delia, 2015; Sneed et al., 2021; Frankel et al., 2019). Pro-environmental behaviors can be viewed as the motivation, intellectual capacity, and skillset to act in an environmentally responsible manner (Corral-Verdugo, 2002) and involve applying knowledge, evaluating alternative actions, and self-reflection (Roczen et al., 2014). Strategies to develop these motivations and skills can be achieved by incorporating place-based environmental education curriculum into schools through experiential-, service-, and outdoor-learning (Ardoin, 2006; Kleespies et al., 2021; Uitto et al., 2015).

Place-based education seeks to create meaning and attachment to the local landscape through active engagement in place (Johnson, 2012) by applying the biophysical, psychological, sociocultural, and political-economic dimensions of place (Ardoin, 2006). The hallmarks of place-based education– place meaning and place attachment– can provide the opportunity for students to leave a positive legacy (Krasny and Delia, 2015). These pedagogical approaches are highly likely to include reliable predictors of stewardship behavior, including environmental sensitivity, ecological knowledge, ownership, and empowerment variables (Hines et al., 1986). This framework can be applied to schools' instructional practices to increase stewardship-based program success.

Despite the known positive effect of stewardship activities on sense of place and pro-environmental behavior (Krasny and Delia, 2015), few studies have directly examined the effects of environmental education and specific instructional methods on environmentally responsible attitudes and behaviors (Zint et al., 2014). Studies have documented less effective approaches, including single-dimension methods like knowledge comprehension, outdoor recreation, and nature appreciation, which alone have not been shown to inspire the pro-environmental behavior changes associated with stewardship (Litz and Mitten, 2013). Despite knowledge on less effective approaches to environmental education, relatively few studies identify instructional approaches that are most likely to lead to behavioral outcomes (Zint et al., 2013). Additionally, many environmental education programs focus on getting students outdoors (Ernst and Theimer, 2011) and many program evaluations have been conducted (Merenlender et al., 2015; Frankel 2018; Powers, 2004) but few investigate the ability of such programs to specifically promote nature connectedness (Lieflander et al., 2013). There is an increasing trend in environmental education research to quantify aspects of the human-nature relationship, but at present few apply a pre- and post-comparative approach and outline improvement strategies (Cartwright and Mitten, 2018).

The purpose of this study was to fill these gaps by performing a quantitative evaluation of the effectiveness of Millbrook School's "Introduction to the Natural World" (INW) program based on student pre- and post-survey results. Specifically, this study sought to answer the following comparative research question: How do student quantitative survey results about environmental stewardship change before and after the INW program? These results informed an evaluation of the program's strengths, challenges, and future opportunities in an effort to learn

from past efforts and initiate an iterative process of growth toward the ultimate goal of fulfilling Millbrook School's mission and core values of stewardship, service, curiosity, respect, and integrity.

It is hypothesized that pre- and post-survey scores will reveal an increase in nature connectedness and stewardship behaviors. Ecological behavior can be influenced by direct experiences in nature that are enjoyable and lay the foundation for a strong and empathetic connection to nature (Bissinger and Bogner, 2017; Palmberg and Kuru, 2000). Sense of place is supported by leisure activities in nature and visiting natural areas as part of formal coursework (Krasny and Delia, 2015). Stewardship activities contribute to place attachment, which is associated with pro-environmental behavior (Ryan et al., 2001). However, knowledge comprehension and outdoor recreation alone are not reliable stewardship engagement strategies (Litz and Mitten, 2013). Rather, greatest gains are seen in student-centered environmental education programs that intentionally incorporate a sense of place, care ethic, critical thinking, and ecoliteracy skills (Litz and Mitten, 2013).

Similar studies have shown gains after student participation in related programs. For example, students participating in NOAA's Chesapeake Bay Watershed Education and Training program scored significantly higher on 5 of 8 stewardship characteristics compared to peers that did not participate (Zint et al., 2014). A qualitative analysis of 23 outdoor adventure programs found that participants attributed their transformational experience to time in nature, separation from their typical routines, their program's community, and the challenging nature of the program (D'Amato and Krasny, 2011). These programs reported an increased interest and comfort with outdoor activities and learning about nature, as well as positive gains in environmental attitudes and a commitment to conservation (D'Amato and Krasny, 2011). Lastly, a significant increase in nature connectedness, measured through the Inclusion in Nature tool, was observed after a one-day environmental literacy program at a botanical garden (Bissenger and Bogner, 2017), which is in alignment with other half-day (Frankel et al., 2019) and single-day environmental programs (Sellmann & Bogner, 2013).

Methods

INW Program Background

The INW program is taught by several Millbrook School facilitators through an experiential and place-based pedagogy. Students explore the 800-acre campus through activities such as leave-no-trace camping, hiking, birding, and star gazing. They participate in a campus low-ropes course, climb the school's canopy walkway, and make clay pots from a local streambank. Lastly, students experience the time-honored traditions of "marsh mucking" and community service at the school's Trevor Zoo, campus farm, and residential recycling program. Each session includes a journaling activity, small group work, outdoor activities, and partnerships with adults, most of whom are Millbrook faculty members.

This program occurs on Saturday mornings (1.5 hours in length), as well as four community service blocks during the regular school week (2 hours total). This program is nested within other activities during the Saturday morning period to support students' transition and growth at Millbrook School. Approximately ⅓ of the instructional time is devoted to meeting goals specifically related to place-based education.

The INW program was created to introduce students to Millbrook School's core value of environmental stewardship, which dates back to the school's founding in 1931. The program was started approximately 10 years ago, however, it has undergone yearly changes and modifications as the school's schedule and faculty have changed. The 2020-2021 academic year was the first time the program fit into a formal student commitment.

Participants: Students participating in INW were enrolled in Millbrook School's 9th grade class. Participants were 14-15 years old with an even male-female ratio. 73 students completed the pre-survey, and 62 completed the post-survey. 85% were boarding students, 16% repeated 9th grade, and 0.5% were international students.

Surveys: The pre- and post-questions were composed of three anonymous, validated, and reliable psychometric tools (Cartwright and Mitten, 2018; Salazar et al., 2020). The Inclusion with Nature (Schultz, 2002) and Nature Relatedness Scale (Nisbet et al, 2009) were intended to measure the attitudinal domain of environmental literacy (Bissinger and Bogner, 2018), which is considered more effective than environmental knowledge approaches (Roczen et al., 2014). Both tools assess connection to nature, which is considered a precursor of pro-environmental behavior and actions (Kleespies et al., 2021; Roczen et al., 2014). The Environmental Stewardship Index was intended to measure the behavioral domain of environmental literacy (Stern et al., 2008;

Appendix 1). The surveys were administered electronically before the first program activity in September 2020 and after the last activity in May 2021.

The Inclusion with Nature (INS) assessment includes one visual question to evaluate the interconnectedness between oneself and nature (Schultz, 2002). This reliable tool is often used to evaluate attitudes around connectedness to nature after outdoor education programs, often with short-term increases (Bissenger and Bogner, 2017). As such, INS is a well-established and known prerequisite for pro-environmental behavior, also encompassing care, connectedness to nature (Frankel et al., 2019), and an ecocentric worldview (Palmberg and Kuru, 2000).

The Nature Relatedness Scale (NRS) contains 21 statements, which are evaluated on a five-point Likert scale (Nisbet et al, 2009). The scale is intended to capture the respondent's appreciation and understanding of their interconnectedness with the natural world. An ecocentric relationship with nature is considered from the affective, cognitive, and physical dimensions (Kroufek et al., 2018), including such constructs as biophilia, identity, and knowledge (Krasny and Delia, 2015). The statements are organized into three factors, including self, perspective, and experience. Self includes nature identification and connectedness, perspective refers to an external worldview about nature and a sense of agency, and experience includes physical comfort and familiarity with nature.

Lastly, the Environmental Stewardship Index (ESI) is a seven-item tool to measure general ecological behaviors (Uitto et al., 2015) and pro-environmental behavior intentions (Stern et al., 2008). This tool has been used to assess the influence of short-term environmental education programs (Stern et al., 2008). This tool was used to connect any attitudinal changes to behavioral changes.

Data Analysis: Descriptive statistics were performed on pre- and post-survey results by individual question, individual student score, and overall index. The Nature Relatedness Scale questions were further divided into three categories, including experience, perspective, and self and three scoring groups, including low, middle, and high (Nisbet et al, 2009). A two-sample t-test was used to determine statistical significance.

Results

Descriptive statistics revealed that students did not make significant gains in the outcomes of interest in this study, a pattern that was reinforced by two-sample t-tests. None of the three indexes showed a statistically significant increase from the pre- to post-survey (Table

1). INS average scores increased by 0.04, NRS decreased by 0.33, and ESI increased by 0.01. The pre-survey averages for all three instruments were above the mid-range (Figure 1). The average scores across all three indexes decreased from 3.83 in the pre-survey to 3.73 in the post-survey. In grouping all individual scores into low, middle, and high categories, the middle categories stayed the same, while the low category increased and the high category decreased (Table 2).

Table 1.

Pre- and post-survey results to assess Millbrook School's INW program.

	Pre-survey		Post-survey			
	Mean	SD	Mean	SD	t	p
INS	4.27	1.46	4.31	1.43	0.44	> .05
NRS	3.43	0.53	3.10	0.30	0.00	> .05
ESI	3.78	0.61	3.79	0.65	0.92	> .05

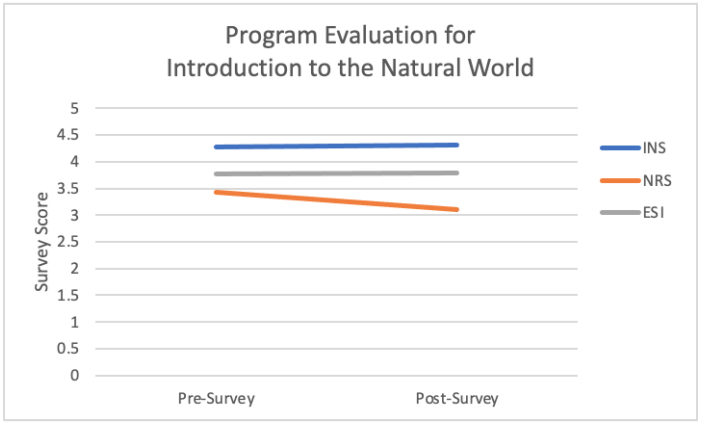

Figure 1.

Graphical representation of pre- and post-survey results to assess Millbrook School's INW program.

Table 2.

Pre- and post-survey results categorized into low, middle, and high scores to assess Millbrook School's INW program.

	Pre-survey			Post-survey		
	Low (%)	Middle (%)	High (%)	Low (%)	Middle (%)	High (%)
INS	70	64	29	6	66	27
NRS	21	66	14	35	65	0
ESI	7	48	45	10	47	44
Total	12	59	29	17	59	24

Note: The middle category included scores of 3 on a 5-point likert scale for NRS and ESI and 3-5 on a 7-point likert scale for INS.

Inclusion with Nature (INS): The pre-survey average score for all participants was 4.27 on a 7-point likert scale. The post-survey average increased by 0.04 for an overall average of 4.31 (Table 1). This increase was not a statistically significant difference. The median and mode remained at 4 for both the pre- and post-survey. In categorizing individual average scores into low (1-2), middle (3-5), and high (6-7), the middle category increased slightly from 64% to 66% of all responses, whereas the low and high categories decreased (Table 2).

The Nature Relatedness Scale (NRS): The post-survey average score for all participants of 3.33 on a 5-point likert scale decreased by 0.15 compared to the pre-survey overall average. Four of the 21 items in this scale increased in the pre- and post-survey average scores (statements 15, 17, 19, and 20). However, only statement 19 showed a statistically significant increase of 0.31. When the statements were grouped by Self, Perspective, and Experience factors average scores also declined from the pre- to post-survey (Table 4; Figure 2). In categorizing individual average scores into low (1-2), middle (3), and high (4-5), the low category increased from 21% to 35%, while the other categories decreased slightly (Table 2).

Table 3.

Pre- and post-survey results for Nature Relatedness Scale (NRS) to assess Millbrook School's Introduction to the Natural World program.

	Pre-Survey		Post-Survey			
	Mean	SD	Mean	SD	t	p
1. I enjoy being outdoors, even in unpleasant weather.	3.67	1.00	3.05	1.15	0.00	<0.05
2. Some species are just meant to die out or become extinct.	3.71	1.05	3.55	1.24	0.21	>0.05
3. Humans have the right to use natural resources any way we want.	3.79	1.07	3.60	1.17	0.15	>0.05
4. My ideal vacation spot would be a remote, wilderness area.	2.63	1.21	2.63	1.24	0.50	>0.05
5. I always think about how my actions affect the environment.	3.41	0.89	3.29	0.93	0.22	>0.05
6. I enjoy digging in the earth and getting dirt on my hands.	3.05	1.20	2.81	1.34	0.13	>0.05
7. My connection to nature and the environment is a part of my spirituality.	2.68	1.04	2.68	1.24	0.48	>0.05
8. I am very aware of environmental issues.	3.82	0.99	3.61	0.91	0.10	>0.05
9. I take notice of wildlife wherever I am.	3.64	1.03	3.42	0.92	0.09	>0.05
10. I don't often go out in nature.	3.96	1.1	3.44	1.20	0.00	>0.05
11. Nothing I do will change problems in other places on the planet.	4.00	0.94	3.47	1.10	0.00	>0.05
12. I am not separate from nature, but a part of nature.	3.51	0.82	3.37	0.89	0.18	>0.05
13. The thought of being deep in the woods, away from civilization, is frightening.	3.36	1.27	3.29	1.15	0.38	>0.05
14. My feelings about nature do not affect how I live my life.	3.32	1.19	3.18	1.11	0.24	>0.05
15. Animals, birds, and plants should have fewer rights than humans.	3.74	1.09	3.82	1.08	0.33	>0.05
16. Even in the middle of the city, I notice nature around me.	3.40	1.27	3.37	1.10	0.45	>0.05
17. My relationship to nature is an important part of who I am.	3.08	1.16	3.15	1.11	0.37	>0.05
18. Conservation is unnecessary because nature is strong enough to recover from any human impact.	4.36	0.69	3.94	1.13	0.01	<0.05
19. The state of non-human species is an indicator of the future for humans.	3.01	0.98	3.32	0.88	0.02	<0.05
20. I think a lot about the suffering of animals.	3.47	1.06	3.56	1.05	0.29	>0.05
21. I feel very connected to all living things and the earth.	3.55	0.94	3.40	0.91	0.18	>0.05
Overall	3.48	0.14	3.33	0.13	0.1	>0.05

Table 4.

Pre- and post-survey results for Nature Relatedness Scale (NRS) grouped by experience, perspective, and self factors to assess Millbrook School's INW program.

	Pre-survey	Post-survey
Experience	3.39	3.11
Perspective	3.77	3.53
Self	3.36	3.29

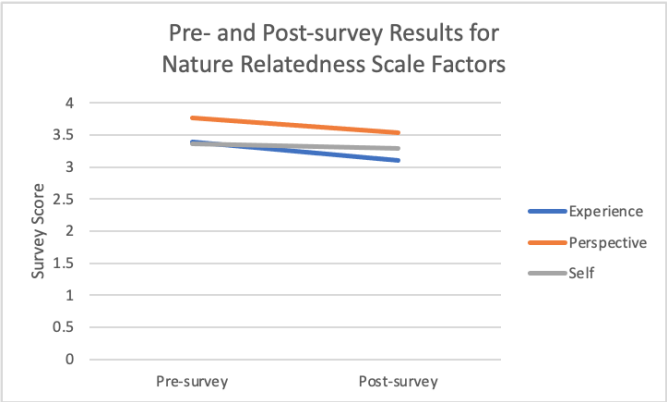

Figure 2.

Graphical representation of ore- and post-survey results for Nature Relatedness Scale (NRS) grouped by experience, perspective, and self factors to assess Millbrook School's INW program.

Environmental Stewardship Index (ESI): Of the seven statements included in this index, two increased from the pre- to the post-survey (statements 3 and 7). However, only statement 7 had a statistically significant increase of 0.05. The overall change from 3.78 to 3.79 was not a statistically significant change. In categorizing the scores into a low (1-2), middle (3), and high (4-5), the low category increased from 7% to 10% of all responses, whereas the middle and high categories decreased slightly (Table 2).

Table 5.

Pre- and post-survey results for Environmental Stewardship Index (ESI) to assess Millbrook School's Introduction to the Natural World program.

	Pre-Survey		Post-Survey			
	Mean	SD	Mean	SD	t	p
1. I feel it is important to take good care of the environment.	4.7	0.54	4.44	0.76	0.012	<.05
2. It is important to protect as wide a variety of animals and plants as we possibly can.	4.49	0.63	4.29	0.82	0.057	>.05
3. I might someday like to volunteer to work in a national park.	2.82	1.21	3.11	1.29	0.091	>.05
4. I turn the lights out when I leave a room.	4.12	1	4.05	1.05	0.337	>.05
5. I am careful not to waste food.	3.66	1.04	3.52	1.05	0.21	>.05
6. I am careful not to waste water.	3.89	0.91	3.85	0.83	0.406	>.05
7. I talk to my friends and family about the environment.	2.77	1.23	3.27	1.23	0.011	<.05
Overall	3.78	0.61	3.79	0.66	0.45	>.05

Discussion

These data suggest that the INW program was not associated with significant increases in student scores pertaining to two domains of environmental literacy-- environmental attitudes and behaviors. This outcome is unexpected in comparison to similar environmental education program evaluations that have documented short-term and long-term increases in nature relatedness after program participation (Bissinger and Bogner 2018; Frankel 2018; Merenlender et al., 2015; Powers, 2004).

These results should be interpreted with caution, as there are several limitations to this study that could account for the lack of change between the pre- and post-survey. Firstly, the 2020-2021 academic year was heavily impacted by COVID-19 in a variety of ways, ranging from a modified calendar, short periods of remote learning, and social distancing. Anecdotally, many teachers reported heavy levels of student fatigue and burn out in May, which coincided with the post-survey. Further, the pre-scores were already above the middle score of the surveys, suggesting a "ceiling effect" (Ernst and Theimer, 2011). Previous studies have documented that youth tend to provide socially desirable or overly positive responses about their environmental behavior (Uitto et al., 2015), which could have skewed their pre-survey responses. Lastly, it is possible that the survey instrument was not sensitive enough (Ernst and Theimer, 2011), but the INW program had a "foot in the door effect" that is not measurable in the short-term and may be

impactful over a longer period of time (D'Amato and Krasny, 2011), as the surveys dealt with a complex, non-linear mosaic of characteristics (Bogner, 1998) that are relatively stable in the short-term (Frankel et al., 2019). This study dealt with first and second order outcomes, defined as tangible, direct, and immediate results after a specific program and those extending beyond the program boundary and did not include third-order effects that could be latent, indirect, and intangible and manifest on a longer time scale (Krasny and Roth, 2010).

Importantly, these findings do not suggest that the INW program is flawed, low quality, or ineffective. Despite these limitations, the findings of this study are a helpful starting point in examining the strengths, challenges, and opportunities of the program (Powers, 2004). Understanding the program's achievements is an important step to guide future decision making (Ernst and Theimer, 2011).

Strengths

The strengths of INW lie at the programmatic level, including experienced facilitators and an effective pedagogical approach that follows the "happy path" toward sustainability.

Facilitators: The high-quality facilitators planning, collaborating, and implementing this program have decades of relevant experience in experiential and place-based education around the world and specifically on Millbrook's campus. Through direct observation, they uphold many of the characteristics of effective nature interpreters, ranging from authenticity to responsiveness (Stern et al., 2013). Previous studies have shown the influential role of teachers on forming student attitudes toward the environment (Kroufek et al., 2018). The importance of teachers who model their relationship to nature and stewardship competencies through instructive modeling, guided practice, and transfer training is a dominant theme in the literature (Chawla and Cushing, 2007; Ernst and Theimer, 2011). As the primary influencers, role models, and agents of change in this type of learning (Chawla and Cushing, 2007; Powers, 2004), Millbrook's INW facilitators are perhaps its greatest asset.

Pedagogy: INW employs many evidenced-based strategies to support student connectedness to nature. Small groups participating in a series of first-hand visits to a single natural area and collaborating through a hands-on and learner-centered approach matches other studies that have documented significant gains in learning outcomes (Ardoin, 2006; Bissinger and Bogner 2018). Locally-grounded learning, out-of-classroom activities, built-in reflection, and the absence of formal evaluation (Goldman et al., 2012; Powers, 2004) are in alignment with

similar programs. INW's interdisciplinary approach removes the barriers and silos of a specific academic subject with facilitators from a single discipline (Plummer, 2010). Lastly, INW engages students in an experiential learning cycle, which focuses on reflections from concrete experiences to form abstractions and conceptualizations that can be applied more broadly, particularly to a future action plan. This process facilitates meaning-making by focusing on lived experiences before abstractions and supports students as they connect to something larger than the experience in isolation (Stern and Powell, 2020; Webber, 2020).

The Happy Path: INW creates time for students to have positive contact with nature that is likely to increase individual happiness (Nisbet et al., 2009). In recent years, school sustainability initiatives have tended to focus on operations, rather than students' relationship to place and affinity to nature (Krasny and Delia, 2015), underscoring the importance of exposure to nature. INW asks students to bond with nature first through everyday life experiences before acting on its behalf (Chawla and Cushing, 2007). Establishing a bond with nature is an effective starting point for developing an ethic of care and avoiding common feelings of disempowerment and hopelessness (Chawla and Cushing, 2007). INW follows this happy path toward sustainability by bonding with nature through appreciation, empathy, and wonder, which is then expanded to include exploration and outdoor challenges (Litz and Mitten 2013).

Challenges:

The challenges involved in the continued growth of this program fall at the institutional level. Institutional culture, buy-in, and support around stewardship programs at Millbrook School is a key element in supporting faculty members, curricular development, and thus improving student learning outcomes (Powers, 2004; Stern et al., 2008).

Facilities: Historically, the school enhanced exploration of its natural setting through unique facilities, including a small cabin called the Eco Hut, a marsh boardwalk, and astronomical observatory. However, these facilities were not properly maintained and can currently not be used to their full potential, creating a significant challenge for the program to reach its full potential. The built environment provides a powerful physical stage for sense of place learning and its significance is often overlooked. Social and psychological learning cannot be fully maximized without the physical dimension. In addition to a natural area's beauty, how the setting is used and cared for has been shown to enhance student outcomes (Dale et al., 2020). Because tangible resources are paramount in program success (Powers, 2004), the greatest

challenge to the INW and Millbrook School's flagship stewardship programs are these dilapidated facilities that serve as a visible reminder of the importance of institutional level support. Full upgrades and renovations would signal to students that their stewardship efforts are taken seriously, which is essential for impactful learning to occur (Chawla and Cushing, 2007).

Planning: A lack of time for strategic program planning is another challenge. Administrator support of teachers is a critical area of attention (Wells, 2017) that can be accomplished by providing planning time for the INW facilitators to clearly articulate program themes, goals, a storyline sequence, central messaging, and strategic transitions (Wells, 2017; Stern et al., 2013; Powers 2004). Administrators can create conditions for this type of program growth by offering and incentivizing "high quality-high touch" professional development opportunities that are ongoing and embedded in the program (Wells, 2017; Powers, 2004). Millbrook already facilitates a community-based conservation professional development program that takes place in the Peruvian Amazon. All INW facilitators attending this program would help overcome this challenge. Lastly, providing facilitators opportunities to spend personal time outdoors forming their own meaningful connection to place and creating their own stories is an important aspect of program planning (Stern et al., 2013).

Evaluation: Student learning is accelerated when programs take an experimental approach to growth through monitoring and evidence-based changes as new knowledge is gained (Krasny and Roth, 2010). It is recommended that Millbrook complete a logic model for INW that links the program's goals with intended outcomes. Alternatively, a scorecard approach to evaluation is structured around people, resources, activities, and benefits (Healy et al., 2014). This process would be best informed by an annual process of learning through continued student surveys, both qualitative and quantitative (Powers, 2004). Additional institutional evaluation strategies include a needs assessment, capacity assessment, activity audit, gap analysis, and target setting initiative (Wells, 2017).

Opportunities

Environmental stewardship is not without criticism (Litz and Mitten, 2013; Welchman, 2012) and as such, it is vitally important for Millbrook School and other institutions to reframe and reinvigorate this core value to maximize its relevance in solving the unique challenges of the 21st-century. A review of alternative and multidisciplinary frameworks provides specific opportunities for broadening the lens through which this program exists (Cole, 2007) and

specific strategies that may increase the INW's effectiveness. To increase environmental stewardship characteristics, including entry-level, ownership, and empowerment variables, the most important strategies include program duration, communities of practice, and incorporation of action skills (Ernst and Theimer, 2011; Tidball and Krasny, 2011; Zint et al., 2013).

Duration: The importance of program duration is one of the most consistent themes in environmental education literature. Many studies suggest that environmental education programs are only impactful with sufficient duration over long periods of time with frequent program trips (Ardoin, 2006; Bogner, 1998; Ernst and Theimer, 2011; Frankel et al., 2019; Kudryavtsev et al., 2012; Sellman and Bogner, 2013; Sneed et al., 2021; Zint et al., 2014). Student-nature relationships are known to be malleable but only with repeated interventions over a condensed time frame (Chawla and Cushing; 2007). Despite being a yearlong program, INW instructional hours are limited in comparison to programs in previous studies. Additionally, the INW program components are interspersed with other programs, which could be reorganized to be more consistent, intensive, and consecutive (Duerden and Witt, 2010; Powers, 2004).

Integration: At present the INW time block is shared with a human health and development program for 9th graders. It is recommended that these two currently parallel tracks be integrated, given their many synergies. The existing curriculum could be restructured to include modules on caring for ourselves, our community, and our place (Cole, 2007), which connects to the concept of "one health" (CDC, 2021). Integrating a "personal ecology" and "social ecology" with ecosystem ecology can be achieved through starting with individual health and well-being, then community interactions, and finally one's place in the environment (Krasny and Tidball, 2009). This approach nests the students' lives in their place, rather than seeing them as separate (Tidball and Krasny, 2011). Program integration can occur through anchoring the program in the daily lives of students and connecting to personally relevant issues through emotional attachment to place, affective messaging, provocation, and universal connections, which can lead to a greater ethic of care and desire to protect the natural world (Ardoin, 2006; Bogner, 1998; Palmberg and Kuru, 2000; Stern et al., 2013). This integration would allow for further coupling of social and natural elements, as well as social and affective learning, adding leadership development, personal challenge, communication skills and self-reflection into the program, all of which has been associated with transformative learning outcomes (D'Amato and Krasny, 2011; Restall and Condrad, 2015). Appreciating nature and sensory-tactile experiences

(for example: mirror walk activity) are evidence-based strategies that can be employed to connect cognitive and affective competencies (Bogner, 1998; D'Amato and Krasny 2011; Roczen et al., 2014).

It is also recommended that the current program be integrated with other relevant 9th grade curriculum, including Millbrook's required course, global geography (Tuck et al., 2014). Lastly, the INW includes four community service meetings per week but students are unlikely to see all the program components are integrated and seamless. Integration may help students form the bridge between the meaningful components of the INW and behaviors beyond the program (Krasney and Delia, 2015). Integration would also create a heterogeneous learning environment with a diversity of experiences, contexts, teaching methods, and circumstances (Krasny and Roth, 2010). All told, these opportunities would focus on the three dimensions of an environmental literacy model, including knowledge, attitude, and behaviors (Bissenger and Bogner, 2018).

Community of Practice: With a longer duration and full program integration, INW can broaden its scope to include an action competence approach, which is centered upon activity theory (Jensen and Schnack, 1997; Webber, 2020). This approach focuses on collective, productive activities for a public good where learners' interactions with their social and physical surroundings are emphasized (Chawla and Cushing, 2007; Krasny and Roth, 2010). Environmental education often focuses on individual behaviors and private actions (Chawla and Cushing 2007). However, combining the individual and systems level with community and ecosystem scaled actions may be more effective (Krasny and Roth, 2010). Teacher-led activities may account for the difference between program goals and realized outcomes, as these activities tend to under emphasize critical thinking, decision making, and action competencies (Uitto et al., 2015). Focusing on the self or word "I" may lead to lower levels of connectedness to nature (Frantz et al., 2005). Students experience their place through action and a sense of belonging to a community of practise and purpose (Krasny and Roth, 2010; Krasny and Tidball, 2011). Place attachment requires active involvement, social interaction, and opportunities to contribute as a meaningful community member (Kudryavtsev et al., 2012).

Communities of practice can be formed through a shared understanding of place, shared images of place, and collective community action in place (Ardoin, 2006). Learning in community and learning for community can be broken down into discrete steps, including

learning about action, learning through action, and learning from action (Kozak and Elliott, 2014). Environmental action projects through project-based learning provides an opportunity for the INW program to create communities of practice and effectively approach stewardship through ownership variables (Litz and Mitten 2013; Zint et al., 2013). Place attachment requires active involvement, social interaction, and opportunities to contribute as a meaningful community member (Kudryavtsev et al., 2012). As such, curricula that emphasizes the social dimension through affective and participatory activities have the largest impact (Uitto et al., 2015).

Action Skills: Individual internal growth is likely to occur in communities of practice, as students develop capacity, empowerment, and self-efficacy, all of which are important influences on environmental behaviors (Bissinger and Bogner 2018, Krasny and Roth, 2010; Uitto et al., 2015). Self-efficacy refers to an individual's confidence in their ability to complete tasks and meet goals within their perceived locus of control (Uitto et al., 2015). Greater autonomy and perceived freedom, rather than an adult directed approach, may positively promote students' interactions and appreciative tendencies in nature (Bissinger and Bogner, 2018). Participation in citizen science projects has been shown to increase perceived self-efficacy, which is associated with pro-environmental behavior (Merenlender et al., 2016). Student agency and participation, along with power-sharing and decision making, are key ingredients in highly effective environmental education programs (Uitto et al., 2015). Opportunities to experience nature combined with opportunities to act are needed to create a sense of ownership and empowerment for later pro-environmental behaviors (D'Amato and Krasny 2011; Palmberg and Kuru, 2000). The development of action competencies such as self-efficacy, agency, civic identity, and prosocial skills help students move beyond fixed skills to generative skills, which are applied to changing situations and adapted with flexibility (Chawla and Cushing; 2007).

Action Component Summary

On November 4th, the preliminary findings of this study were shared with Millbrook School administrators, including the Head of School, Assistant Head of School, Director of the Trevor Zoo, and Director of Sustainability, in a group meeting to initiate a conversation about strategies to continue the growth and development of this program. Additionally, a rubric (Litz and Mitten, 2013) was used in a follow-up meeting with the program leaders of INW to further assess and evaluate strengths, challenges, and opportunities for this program (Appendix 2).

These leaders were also asked the following open-ended questions: What do you think the program's strengths are? What do you think the program's challenges are? What do you see as opportunities to improve the program and its impact on students? This feedback was incorporated into the discussion section of this paper. The final results of this project will be shared with Millbrook School administrators this winter in hopes of gaining more institutional level support for the challenges and opportunities surrounding the INW program.

Conclusion

Although this study does not suggest the INW had a significant impact on student growth, these findings are useful for identifying program strengths, challenges, and opportunities. In total, this study provides a pathway that moves beyond purely environmental experiences, which has been identified as the most frequent but least effective approach to environmental education (Uitto et al., 2015). This pathway is built on the merger of the cognitive and affective, human and social, individual and collective, stewardship and citizenship, and the local and global (Chawla and Cushing 2007; Zint et al., 2013; Wells; 2017). Integrating learning objectives of the head, hands, and heart are more likely to see transformative learning, which is an emergent property resulting in the synergies between these objectives (Sipos et al., 2008). To further these opportunities, INW can draw upon the three streams of place-based learning, including liberal, critical and land-based, to begin to capture social justice and decolonizing pedagogies (Webber, 2020). These complexities can be further explored as INW students participate in Millbrook's other stewardship offerings later in their academic careers.

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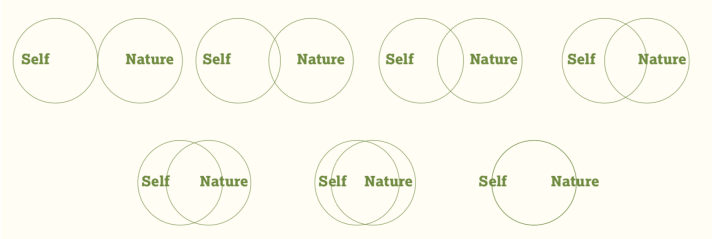
Appendix 1: Survey Questions

Inclusion with Nature (Schultz, 2002)



Nature Relatedness Scale (Nisbet et al, 2009)
For each of the following statements, please rate the extent to which you agree with each statement, using the scale from 1 to 5 (1 being strongly disagree and 5 being strongly agree). Please respond as you really feel, rather than how you think you should feel, or how "most people" feel.

- I enjoy being outdoors, even in unpleasant weather.
- Some species are just meant to die out or become extinct.
- Humans have the right to use natural resources any way we want.
- My ideal vacation spot would be a remote, wilderness area.
- I always think about how my actions affect the environment.
- I enjoy digging in the earth and getting dirt on my hands.
- My connection to nature and the environment is a part of my spirituality.
- I am very aware of environmental issues.
- I take notice of wildlife wherever I am.
- I don't often go out in nature.
- Nothing I do will change problems in other places on the planet.
- I am not separate from nature, but a part of nature.
- The thought of being deep in the woods, away from civilization, is frightening.
- My feelings about nature do not affect how I live my life.
- Animals, birds, and plants should have fewer rights than humans.
- Even in the middle of the city, I notice nature around me.
- My relationship to nature is an important part of who I am.
- Conservation is unnecessary because nature is strong enough to recover from any human impact.
- The state of non-human species is an indicator of the future for humans.
- I think a lot about the suffering of animals.
- I feel very connected to all living things and the earth.

Environmental Stewardship Index (Stern et al., 20080
For each of the following statements, please rate the extent to which you agree with each statement, using the scale from 1 to 5 (1 being strongly disagree and 5 being strongly agree).

- I feel it is important to take good care of the environment.
- It is important to protect as wide a variety of animals and plants as we possibly can.
- I might someday like to volunteer to work in a national park.
- I (will) turn the lights out when I leave a room.

- I am (will be) careful not to waste food.
- I am (will be) careful not to waste water.
- I (will) talk to my friends and family about the environment.

Appendix 2: Sample Completed Rubric (Litz and Mitten, 2013)

Rubrics

Sense of Place –

A meaningful, emotional, and spiritual bond one forms towards a place's natural, built, and cultural elements (Williams and Stewart, 1998).

Directions for educators: This rubric is designed to help you evaluate how well your program/activity/assignment/curriculum develops a sense of place in students. The rows indicate components that are fundamental for developing a sense of place. Each column includes scoring criteria, all or most of which should be included in activity to receive a particular score.

Element of Attachment	5 – Exemplary	4 -	3 – Developing	2 -	1 – Emerging
Natural	• Addresses initial feelings towards area and/or what would be necessary to build this bond. Students then experientially and thoroughly explore the area.	• Briefly explore area and discuss student's initial attachment.	• Initial feelings towards area are acknowledged, but area is not explored.	• Only the most obvious natural splendors are pointed out to students with few opportunities to explore the ecosystem.	• Landscape is nothing more than a backdrop for activity.
	• Mutual dialogue about what natural components make the area unique and opportunities to explore/investigate area's ecosystems.	• Opportunities to explore and discuss the area's unique elements and/or natural systems. Some of these may be pointed out for students.	• Discusses the observable elements that make the local ecosystem unique, including ecosystem facts; some of these may be pointed out for students.	• Little to no dialogue about what makes an area unique, its geographical history, or human impact. If these are discussed, they tend to be from an anthropocentric point of view.	
	• Experientially explore geographical history of area, including changes in geology, flora and fauna, and human inhabitance.	• Studies area's geographic past and explores the most obvious changes.	• Students are told about and area's geographical past and how it has changed in modern times.	• Students have little opportunity to explore and connect with the land. Time spent in area tends to be rushed or overly structured.	
	• Thoroughly, experientially explore/investigate area's ecosystems and the ways they impact/are impacted by people.	• Studies the major natural systems of area and discuss ways humans have impacted/are impacted by these ecosystems.	• Studies area's ecosystems and discuss human impact, but students have few opportunities to explore these experientially.		
Built/Man-made	• Holistically and experientially investigates ways man made features influence and shape local ways of life (and vice versa).	• Studies ways man made features have shaped and been shaped by local society. Some of this is experiential, some is not.	• Studies man made features, but do not explore their significance.	• Man made structures are pointed out, but students have no opportunity to explore them.	• Does not explore the significance, history, or impacts of man made features on local ecosystems and people's way of life.
	• Thoroughly explores the historical significance of man made structures on local society and culture.	• Discusses the historical significance of the area's built elements.	• Role of history on the man-made appearance of the area is briefly mentioned, but not explored further.	• Overlooks role of history in shaping the area's built elements.	
	• Comprehensively explores the impacts of man made structures on the local ecosystem.	• Studies the impacts of built structures on the local environment. Some of this is done experientially, some is not.	• Discusses interactions between built structures and local ecosystems, but no experiential exploration.	• Disregards the interplay between built elements and local ecosystems.	

Element of Attachment	5 – Exemplary	4 -	3 – Developing	2 -	1 – Emerging
Cultural	• Thoroughly and experientially identifies/examines macro and micro cultures of the area, including positive and negative ways they interact and influence the area.	• Develops a general understanding of the area's various cultures and discusses the way they influence each other and the area.	• Mentions several cultures, but focuses on mainstream culture.	• Does not explore the history, customs, traditions, and ways of life of the area's macro and micro cultures. opportunities for Lenape, Mohawk, Mohican but...	• Disregards importance of studying an area's cultures and/or demonstrates ridicule, bias, or bigotry.
	• Holistically explores the history of the area's macro and micro cultures, including an exploration of traditions, customs, and ways of life.	• Discusses the history, customs, and traditions of local cultures, but does not explore further.	• Discusses the history, customs, traditions, and ways of life of the mainstream culture.		• Investigations of the area's cultures and cultural impacts are biased, subjective, and/or one-sided.
	• Uses multiple perspectives to explore the area's macro and micro cultures.	• Studies the area's macro and micro cultures using more than one perspective.	• Objectively studies the mainstream culture.		
Emotional	• Opportunities to identify, explore, dialogue, and reflect on the ways (or lack of ways) students connect to the area.	• Opportunities to reflect on how/why students connect (or don't connect) to area. journaling Yes	• Discusses the reasons students feel connected to the area (or don't feel connected), but does not explore further.	• Does not ask students to "dig deep" about their feelings for the area.	• Disregards the importance of building an emotional bond with the area. Exploration of area is superficial or rushed.
	• Provides unstructured, but peaceful, time to self-reflect and enjoy the area. This includes meaningful and experiential exploration of the area's integral elements.	• Provides time to enjoy the area. Some of this is uninhibited, some is quite structured.	• Students superficially explore the area, but this time may be rushed, raucous, or overly controlled. ex: winter hike night walk	• Little time for self-reflection in or enjoyment of the area. Little time to explore the area's integral components.	• Provides little opportunity to experientially build a personal connection with the natural, cultural, and built elements of the area.
	• Thoroughly explores and enhances inter/intrapersonal relationships between students and the area's natural systems.	• Provides opportunities to explore relationships between students and natural systems.	• Discusses inter/intrapersonal relationships between students and the area. Does little to build rapport.	• Building relationships between students and nature is a "tag-on" to activities.	
Spiritual	• Dialogues about the diverse definitions of spirituality and spirituality's connection to nature.	• Discusses different perspectives about spirituality and its relevancy to nature.	• Students remain confused about the connection between nature and spirituality.	• Discussions about spirituality are rushed, discounted, or intolerant.	• Disregards spirituality or pushes certain views on students.
	• Experientially explores and studies the spiritual significance/history of the area.	• Studies the spiritual significance/history of the place. Some of this learning is experiential, some is not.	• The spiritual significance of the area is told to students.	• Students are told about the significance and history of the area's spirituality.	• Disregards the significance or history of the area's spirituality.
	• Builds a spiritual connection to the area through solitary, reflective time in area.	• Opportunities for reflective time in area.	• Opportunities to reflect about the area/experience are rushed or chaotic.	• Little opportunity to reflect about the area or experience.	

viewed a documentary about our place in the universe / too deep for 3rd graders?

I feel like this is "not applicable"

Critical Thinking - **A self-guided attempt to analyze and evaluate one's thinking in order to improve thought, decision making, and self improvement. This helps one live in a less biased fashion by making thinking less ambiguous, but more accurate and rational (Paul & Elder, 2008).**

Directions for educators: This rubric is designed to help you evaluate how well your program/activity/assignment/curriculum develops critical thinking skills in students. The rows indicate recommended constituents for advancing students' thinking skills. Each column includes scoring criteria, all or most of which should be included in activity to receive a particular "score."

Constituent	5 – Exemplary	4 -	3 - Developing	2 -	1 - Emerging
Problem Identification • Extent to which activity identifies and/or explores core issues and key questions	• Students accurately identify core issues and key questions.	• Students identify most of the core issues, but some of these are identified for them.	• Identifies some of the core issues/key questions for students.	• Superficially identifies core issues/key questions for students.	• Students or assignment identify irrelevant core topics.
	• Comprehensively and holistically explores key issues.	• Opportunities to thoroughly explore most of the key issues.	• Shallowly explores some of the key issues/questions.	• Briefly explores the most obvious key issue/question.	• Little to no exploration of key issues and questions.
	• Purpose, goals, and objectives are explicitly clear to students.	• Purpose, goals, and objectives are clear.	• Purpose, goals, and objectives are somewhat vague.	• Purpose, goals, and objectives are unclear and ambiguous.	• Fails to state purpose, goals, and objectives.
Problem Exploration • Presents opportunities for students to identify, assess, and analyze supporting and opposing information	• Students objectively, thoroughly, and autonomously explore information that supports and opposes activity's objectives.	• Information that supports and opposes activity's objectives is identified for students, which they then explore.	• Identifies data from all sides of issue(s) for students, but does not promote further understanding.	• Most of the provided information is weighted and may be misleading.	• Provided information and opportunities for exploration are one-sided and biased.
	• Provides opportunities for insightful, objective comparisons/contrasts.	• Students compare and contrast some conflicting information.	• Provides few opportunities to compare and contrast conflicting information.	• Opportunities to compare and contrast information are non-comprehensive and/or subjective.	• Does not provide opportunities to compare and contrast conflicting information.
	• Students utilize multiple, relevant, non-biased sources.	• Sources utilized are mostly credible and non-biased.	• Students utilize a few sources, some of which may be biased.	• Students utilize mostly non-academic sources.	• Provides information from a single or biased source(s).
Exploration of counter-arguments • Extent to which students explore different perspectives, points of view, and ideals	• Opportunities to comprehensively interpret diverse points of view and ideals.	• Students identify and briefly explore other perspectives/ideals.	• Opportunities to explore other perspectives, but interpretations may be superficial.	• Identifies only the most obvious counter-arguments for students, with incomplete explanation of reasoning.	• No opportunity for students to explore different points of view, and/or hastily dismisses counter-arguments.
	• Students systematically weigh merit of each perspective.	• Students consider merit of each perspective.	• Promotes activity's objectives, though other perspectives are considered.	• Omits opposing theories.	• Provides false information or minimizes validity of other perspectives.
	• Students identify and clarify personal preconceptions and vested interests.	• Students identify most obvious preconceptions/vested interests; others are identified by teacher.	• Students' preconceptions and/or vested interests are identified for them.	• Only identifies students' most obvious preconceptions and/or vested interests.	• Does not clarify students' preconceptions/does not identify vested interests.

Maybe within our "Frame Dev." stuff, but...

Constituent	5 – Exemplary	4 -	3 - Developing	2 -	1 - Emerging
Assumptions • Opportunities to explore how assumptions shape and are shaped by issue(s)	• Students identify and explain assumptions, their validity, data inconsistencies, and possible bias.	• Students identify some key assumptions/bias and question their validity; some are pointed out for them.	• Students recognize some assumptions, inconsistencies, and bias, but do not explore their validity.	• Students identify some assumptions, inconsistencies, and bias, but may accept others as fact.	• Fails to explain/ identify assumptions, or explains assumptions with unwarranted claims.
	• Students identify and analyze the ways personal ethics/values are shaped by and shape assumptions.	• Discuss ways personal values may be shaped and shape key assumptions.	• Connections between ethics/personal values and assumptions are pointed out for students.	• Overlooks role of personal values in shaping assumptions. And vice versa.	• Allows students to make invalid/irrelevant assumptions based on personal values.
	• Students clearly discern facts from opinions.	• Discuss facts vs. opinions.	• Line between fact and opinion somewhat blurred.	• Inconsistently distinguishes fact and opinion.	• Does not identify bias/opinions, or accepts these as fact.
Interpretations and Inferences • Extent to which assignment gives students freedom to follow where evidence and reasoning may lead (fair-mindedness)	• Students interpret information and develop insightful, consistent inferences.	• Students use information to make appropriate inferences.	• Inferences are provided for students.	• Promotes superficial understanding, as evident by students' inability to interpret information to make inferences.	• Students do not discern information from inferences and/or make erroneous inferences.
	• Promotes a holistic understanding of the issue, using real-world exploration.	• Promotes understanding of key issues, using relevant examples/exploration.	• Students understand key issues from a theoretical standpoint.	• Promotes a superficial understanding or students remain confused by information.	• Students learn false information.
	• Knowledge learned is transferrable and can be generalized by students.	• Knowledge learned is transferable.	• Some of the knowledge learned is transferable. Students may not understand how to generalize it.	• Knowledge learned is difficult for students to transfer or generalize.	• Knowledge learned does not extend to other projects or ideas.
Analyzing Results • Presents opportunities for students to identify and assess conclusions, implications, results	• Students accurately identify and explore significant and hidden implications of information (positive/negative).	• Students identify and explore significant implications; teachers/activity identifies hidden implications.	• The most obvious implications are identified for students, but these are not explored further.	• Fails to identify or explore implications of activity's information.	• Identifies only the implications that correspond with activity's objectives.
	• Students form logical, objective, and defensible conclusions and/or explanations.	• Students reach objective and defensible conclusions and/or explanations, though not all are entirely realistic.	• Students reach objective conclusions and/or explanations, but these may not be defensible or realistic.	• Students do not form logical explanations or explanation.	• Students form one-sided conclusions, using simplistic/ irrelevant explanations and unjustifiable claims.
	• Students identify and explore pros and cons of all explanations, conclusions, and solutions.	• Identifies several pros and cons of each conclusion/solution.	• Most obvious pros and cons of conclusions or solutions are identified for students.	• Pros and cons of conclusions/ solutions not addressed.	• Identifies/explores only the pros or cons that correspond with activity's objectives.

Again, difficult to gauge or assess this, I think.

To be honest we just don't meet enough (ex: like a class or sport) / to have curricular traction or scaffolding. Sorry.

Ecoliteracy - Understanding the processes and patterns by which nature sustains life (Center for Ecoliteracy, 2010). The ability to understand conservation biology while simultaneously identifying the political support necessary to advance conservation biology (Orr, 1992).

Directions for educators: This rubric is designed to help you evaluate how well your program/activity/assignment/curriculum develops ecoliteracy skills in students. The rows indicate recommended components in advancing ecoliteracy and applying it to human society. Each column includes scoring criteria, all or most of which should be included in activity to receive a particular "score."

Extent to which activity:	5 - Exemplary	4 -	3 - Developing	2 -	1 – Emerging
Advances systemic thinking	* Guides students towards systemic thinking[1] using experiential, real-world investigation.	* Discusses systemic thinking[1] and its role in the topic(s) at hand.	* Students are told about systemic thinking[1] and its role in the topic(s) at hand.	* Disregards all but the most basic systemic thinking[1].	* Does not develop systemic thinking[1], as evident by students' inability to recognize relationships and their interconnected threads.
Helps students understand networks	* Holistically explores the interconnected web of relationships in natural systems using real-world, personally significant investigation.	* Experientially explores the relationships/connectedness found in natural systems.	* Students are told about natural networks and the ways they interact and/or are connected.	* Activity labels networks, but includes little exploration or real-world application.	* Does not identify or discuss the interconnected nature of networks.
Helps students understand nested systems	* Experientially explores local, integrated systems and investigates how they are part of a larger system.	* Discusses how systems are nested within others. Explores a few local systems.	* Students are told about nested systems and discuss a few local systems.	* Students are cursorily told about nested systems; discussions tend to be abstract and non-relevant to students' lives.	* Does not identify or explore how systems are nested within others.
	* Explores how changes within an individual system affect the sustainability of nested systems (those within it and the larger system of which it is a part).	* Discuss how changes in one system will effect those associated with it.	* Students are told about interrelated changes among and between systems.	* Disregards all but the most obvious effects of changes within systems.	* Does not explore the implications of changes' effects within systems.
Helps students understand natural cycles and energy flows	* Experientially and comprehensively investigates the continual flow of energy between the sun, species, and the environment. Focuses on local systems.	* Students learn about and explore the scientific mechanism of energy flow/resource exchange, but do not explore local cycles.	* Students are abstractly told about the cycle of energy flow/resource exchange among systems.	* The cycle of energy flow and resource exchange are briefly mentioned, but not explored. Discussions tend to be arbitrary and non-relevant to students' lives.	* Resource exchange or energy flow's cycle is not included in activity.
	* Explores the connections/relationships between local ecosystems, the regional biosphere, and global networks.	* Discusses the ways local systems are connected to macro networks.	* Discuss local ecosystems and superficially explain how they are connected to regional and global networks.	* Students are told about local or global ecosystems, but do not discuss their connections.	* Focuses on a single, nongermane ecosytem and does not explore the way it is connected to broader systems.
Advances understanding of ecological development	* Experientially explores how relevant species and cycles change over time, including development, adaptations, evolution, and coevolution.	* Discuss how species and cycles change over time and explores local examples.	* Students are told how species and cycles may change over time, but controversial discussions are discouraged.	* No exploration/explanation of how species and cycles change over time; these are not explored and controversial topics may be avoided.	* Disregards or denies that species and the environment change, adapt, and evolve over time.

ex: birding activity

Extent to which activity:	5 - Exemplary	4 -	3 - Developing	2 -	1 -- Emerging
Helps students recognize/ understand the dynamic balance inherent in natural systems	* Comprehensively defines and explores feedback loops, including local examples.	* Defines feedback loops and discusses relevant examples.	* Defines or mentions feedback loops, but does not explore further.	* Students remain confused about what a feedback system, how it works, or why it is relevant.	* Fails to identify or explore feedback loops and system balance.
	* Identifies and explores the balance, fluctuations, and equilibrium of feedback loops. Students understand what induces change and why.	* Identifies the continual cycle of fluctuation/equilibrium in relevant feedback loops. Students may be less clear on why/how impacts induce change.	* Students are told about the inherent balance of feedback loops, but this is not explored further.	* The cycle of feedback loops is briefly mentioned, but students fail to understand how system balance is achieved.	* Disregards or fails to identify/explain the continuous cycle of system fluctuations and equilibrium.
	* Explores real-world examples of how this cycle offers resiliency in the face of change.	* Discusses relevant examples of how this cycle offers system resiliency.	* Mentions abstract examples of cycle resiliency. These tend to be irrelevant to students' lives.	* Does not include examples of how dynamic balance increases system resiliency.	* Does not discuss the key components for system resiliency.
Immerses students and concepts learned into the real world	* Explores locally based, realistic solutions/explanations for key issues.	* Collaboratively discuss possible solutions and explanations, many of which are locally based and pragmatic.	* Students are told of possible explanations and solutions, many of which are reasonable and locally based.	* Solutions/explanations discussed are unrealistic, extraneous, or do not involve student participation.	* No solutions/explanations are discussed or explored.
	* Collaborative decision making and co-learning are utilized in all facets of the activity.	* Students have some say in activity's direction and content. Co-learning is encouraged.	* Students' input is considered in some aspects of activity; much of activity's structure is inflexible.	* Students have little say about their learning or the activity. Educator assumes there is little for her/him to learn from activity.	* Educator dictates all facets of the activity and does not participate in co-learning. Students' input is not considered.
Material learned is applied to students' personal lives	* Holistically and objectively applies principles of ecosystems to human society, culture, and ways of life. Includes how cycles impact and are impacted by humans.	* Discusses how ecological principles relate to human society. Uses multiple perspectives to do so.	* Students are told some of the ways ecological principles affect and are affected by people. May have a biased undertone.	* Discussions regarding ecological principles' connections and/or implications to human society are disregarded or one-sided and biased.	* The principles of ecological principles are in no way applied/connected to human society and culture.
	* Content is interesting to students, and relevant to their personal lives.	* Most of content is interesting, relevant, and personally significant to students.	* Most of content is interesting, but not relevant/personally significant. Or vice versa.	* Some of content is interesting, relevant, significant, much is not.	* Irrelevant to students' lives, not personally significant, or uninteresting
	* Opportunities for students to self-reflect about their personal lives, choices, and actions in reference to these concepts.	* Some opportunities for self-reflection.	* Limited opportunities for self-reflection that are entirely facilitated by educator. Students may not understand the importance of applying concepts to their personal lives.	* Opportunities for self-reflection tend to be superficial, inaccurate, or obligatory.	* No opportunities for students to reflect on how concepts learned relate to their personal lives, values, and behaviors.

1-Systemic thinking recognizes the interconnected relationships between various systems. Effective education for systemic thinking includes the following shifts in perspective: From parts to a whole; from individual objects to the relationships between them; from objective knowledge to contextual knowledge; from quantity to quality; from structure to processes; from contents to patterns, which helps students generalize knowledge (Center for Ecoliteracy, 2010a)

Sources:
Center for Ecoliteracy. (2010a). *A Systems Perspective*. Retrieved 1/2010 from www.ecoliteracy.org/philosophical-grounding/systems-perspective
Center for Ecoliteracy. (2010b). Core Ecological Concepts. Retrieved 1/2010 from www.ecoliteracy.org/philosophical-grounding/core-ecological-concepts
Orr, David. (1992). *Ecological Literacy: Education and the Transition to a Postmodern World*. Albany, NY: SUNY.

yes, with journaling prompts

Ethic of Care - A moral code which suggests treating others in a loving, respectful, and caring manner. This includes love for self, others, biodiversity, Planet Earth, and the environment (Noddings, 2005).

This rubric is designed to analyze how well an activity/assignment/project/curriculum develops the following five constituents of an ethic of care: self, other people, culture, biotic world (flora and fauna), and the environment. As it may be cumbersome to include all constituents in all assignments, educators should use this rubric as appropriate. Each column includes most or all of the key points necessary for an activity to fall into that rating; the key points included will vary per activity.

Constituent Developed. Does all or most of the following:	5 – Exemplary	4 -	3 – Developing	2 -	1 - Emerging
Self:	* Includes fun and engaging physical activity.	* Includes physical activity, which students tend to enjoy.	* Includes some physical activity; much of the activity is sedentary.	* Most of activity is sedentary	* Includes little or no enjoyable physical activity.
	* Promotes mental well being and personal growth by ensuring activity is safe for mind and body.	* Students' physical and mental safety is a priority throughout activity.	* Students are physically safe, but may complete activity feeling criticized.	* Students seem wary, apathetic, or insecure after completing activity.	* Activity leaves students feeling belittled or unsafe.
	* Dialogues about what/why recreation[1] is revitalizing for students and incorporates feedback into activity.	* Students choose some of the recreation[1] to be incorporated into activity.	* Activity's recreation[1] is chosen for students.	* Little recreation[1] is included in activity.	* Disregards importance of recreation[1].
	* Activity instigates genuine and observable laughter and enjoyment.	* Students seem to enjoy activity.	* Emits some observable laughter and enjoyment from students.	* Students seem to enjoy some of the activity, but often seem uninterested.	* Project tends to be uninteresting and/or boring to students.
	* Supports quest for a better self through dialogue, dreaming, goal setting, and self-reflection.	* Opportunities for self-reflection and goal setting.	* Opportunities for self-reflection and personal growth may be superficial and/or rushed.	* Few opportunities for self-reflection and/or self-improvement.	* Disregards personal growth.
Other People:	* Activity includes random acts of kindness, senseless acts of beauty[2], and opportunities to engage in service for community.	* Opportunities for service work and helping others.	* Provides opportunities for service work, but may use pressure to engage students.	* Does not focus on service for community, or students view service as a "chore."	* Includes no opportunities for service or helping others. May coerce students into service work they dislike.
	* Focuses on building equal relationships with people of all ages and backgrounds.	* Provides opportunities to build relationships with classmates and relevant community members.	* Relationships focus on building friendships between classmates or group members.	* Relationships are disregarded or only encouraged among like selves.	* Does not foster relationships or ignores friendship with those of different backgrounds.
	* Opportunities to practice clear and non-violent communication skills.	* Opportunities to practice effective communication skills.	* Good communication skills are encouraged, but poor skills may be modeled.	* Disregards the importance of and/or demonstrates poor communication.	* Ineffective or deficient communication skills are allowed and demonstrated.
	* Open-mindedness towards others is integral to all aspects of assignment. Promotes understanding of differences. Avoids any and all discrimination.	* Promotes open-mindedness and avoids discrimination.	* Discourages discrimination, perspectives portrayed through activity may be biased.	* Blatant discrimination is not allowed, but assignment may inadvertently model inequity.	* Permits bigotry and/or discrimination, whether knowingly or unknowingly.
	* Holistically and comprehensively explores how current behaviors may impact other people and future generations.	* Discusses current actions and behaviors' impacts on others and on future generations.	* Impacts of current actions are told to students.	* Disregards all but the most obvious impacts of current actions and behaviors.	* Does not converse about how actions may impact others now or in the future.