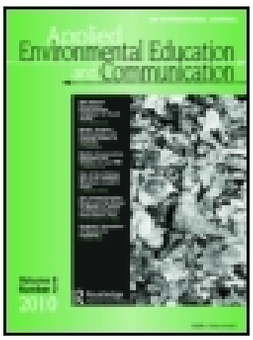

Applied Environmental Education & Communication

ISSN: 1533-015X (Print) 1533-0389 (Online) Journal homepage: https://www.tandfonline.com/loi/ueec20

Outcomes of art-based environmental education in the Hudson River Watershed

Andrew J. Schneller, Laura M. Harrison, Julia Adelman & Shannon Post

To cite this article: Andrew J. Schneller, Laura M. Harrison, Julia Adelman & Shannon Post (2019): Outcomes of art-based environmental education in the Hudson River Watershed, Applied Environmental Education & Communication, DOI: 10.1080/1533015X.2019.1617805

To link to this article: https://doi.org/10.1080/1533015X.2019.1617805

Published online: 22 May 2019.

APPLIED ENVIRONMENTAL EDUCATION & COMMUNICATION
https://doi.org/10.1080/1533015X.2019.1617805

Outcomes of art-based environmental education in the Hudson River Watershed

Andrew J. Schneller[a], Laura M. Harrison[b], Julia Adelman[c], and Shannon Post[d]

[a]Environmental Studies and Sciences, Skidmore College, Saratoga Springs, New York, USA; [b]Southern New Hampshire University, Manchester, New Hampshire, USA; [c]New England Aquarium, Boston, Massachusetts, USA; [d]Saratoga Independent School, Saratoga Springs, New York, USA

ABSTRACT

This mixed methods case study research evaluates the outcomes of a place-based experiential environmental education curriculum that incorporated environmental art and muralism to teach fifth to sixth graders about the Hudson River Watershed, environmental issues, and ecosystem recovery. Students showed a statistically significant improvement at post-test for environmental knowledge. While environmental attitude scores for Preservation and Utilization increased, they showed no statistically significant improvement. Qualitative findings highlight environmental art as an effective component for student understanding. This research adds to the handful of empirical research that evaluates the outcomes of incorporating environmental art into a suite of place-based experiential education pedagogies.

Introduction

The pedagogical tools available for teaching environmental education (EE) are varied, allowing for innovation in classroom practice and instruction. The purpose of this mixed methods case study was to better understand the multiplicity of outcomes of art-based EE in relation to changes in environmental knowledge and attitudes of a sample of primary school students. The environmental art components of the curriculum incorporated sculpture, drawing, and muralism (painting), to enhance students' understanding of the social, cultural, environmental, and economic aspects of the Hudson River Watershed in New York State. Peer-reviewed academic research on art-based EE is sparse, with little focus on quantitative measurement of knowledge and attitudinal outcomes. This exploratory study was intended to address the gaps in the literature and to instigate future research into the outcomes of art-based EE pedagogies.

CONTACT Andrew Jon Schneller aschnell@skidmore.edu Environmental Studies and Sciences, Skidmore College, 815 N. Broadway, Saratoga Springs, NY 12866, USA.
Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/ueec.

Environmental educators are tasked with developing students' sense of connection to the natural world, as well as instilling environmental knowledge and pro-environmental attitudes, insofar as to sufficiently motivate the adoption of pro-environmental behaviors (Sobel, 2008; UNESCO, 1977). Song (2008) wrote that art-based EE can form such bonds, including an enduring emotional connection to nature, and "sense of shared responsibility for" the natural environment that can drive pro-environmental behaviors (p. 13). Various authors (Gray & Birrell, 2015; Inwood, 2008; Song, 2008) suggest that art-based EE is well-suited to provide students with a conducive experience for developing a relationship with the natural environment and becoming emotionally invested in its care.

The interdisciplinary union of the arts and EE is useful for *place-based* pedagogies that may be meaningful for teaching students who have not been reached by the more traditional approaches of science education (Chawla & Cushing, 2007; Gardner & Hatch, 1989; Inwood, 2008). Gardner's Theory of Multiple Intelligences suggests that overemphasizing linguistic and logical–mathematical instruction styles, to the exclusion of other pathways (such as visual-spatial, affective, and kinesthetic), is an oversight and limitation of traditional pedagogy that reduces its effectiveness with many learners and limits its real-world applicability (Gardner & Hatch, 1989). Art-based EE "promises an innovative approach to ecological education and EE, one that balances the traditional roots of these disciplines (found in the cognitive, positivist approaches of science education), with the more creative, affective, and sensory approaches of art education" (Inwood, 2008, p. 58). The arts foster creativity, critical thinking, and problem-solving skills; connect students to bioregions; and offer affective formats for conveying information and knowledge integration (Locke, Russo, & Montoya, 2013; Song, 2012; Ward, 2013).

Numerous authors espouse that adding art-making to EE can provide a means of taking topics within EE and enhancing the affective experience of learners, which is viewed as conducive to the practice of pro-environmental behaviors (Boeckel, 2015; Gurevitz, 2000; Hilager, 2017; Inwood, 2008; Locke et al., 2013; Song, 2012; Ward, 2013). Gurevitz (2000) posited there is a tendency to romanticize the connection that children share with the natural world simply by experiencing it, and that it is important to utilize more affective means to establish emotional investment in the environment within young learners. Specifically in relation to this emotional connection, Gray and Birrell (2015) qualitatively investigated the ability of an art- and place-based EE program to aid students in forming such a connection with the natural world, and reported encouraging results.

Prior research has investigated using art to evaluate children's environmental attitudes and knowledge. Baker, Loxton, and Sherren (2013) utilized

art as an assessment tool for a climate change curriculum for third and fourth graders, to evaluate changes in knowledge, attitudes, and program outcomes, and found it to be an effective and accurate measurement tool. Flowers, Carroll, Green, and Larson (2015) found art to be an effective evaluation tool for measuring children's pro-environmental attitudes and awareness when compared to the results of the Children's Environmental Perceptions Scale.

While research on Science Technology Engineering Art and Math (STEAM) is emerging, it does indicate that educators are beginning to value the potential of the arts to enhance the more traditional Science Technology Engineering and Math (STEM) disciplines (Burnard et al., 2017; Guyotte et al., 2015). Marshall (2014) argued that art can be infused into curricula across disciplines as it holds the potential to "transform teaching and learning" (p. 1). Guyotte et al. (2015) looked at the choice of not adding art to STEM, but adding STEM classes to an art curriculum—and found this provided rich opportunities to engage in creative problem solving and helped to develop teamwork skills. Burnard et al. (2017) qualitatively explored the impact of combining transdisciplinary STEAM methods with sustainability education and found that the art components enhanced both teacher and student understanding of the subject matter through the affective and hands-on components, while fostering innovation. Although the literature clearly espouses the benefits of art-based EE pedagogies and draws connections between art-making and the ability to evaluate environmental knowledge and attitudes, there still remains a lack of empirical evidence related to student outcomes.

Methods

The purpose of this mixed methods research was to (a) contribute to the growing body of research that addresses the outcomes of art-based EE on various attributes of participants and (b) contribute to the better understanding and documentation of innovative environmental learning pedagogies that depart from traditional didactic teaching styles. We addressed this by answering the following research questions:

- What are the environmental knowledge and attitude outcomes of a watershed education curriculum that incorporated environmental art lessons?
- What aspects of the environmental art components were most meaningful to students, and to what extent did these components help contextualize the lesson themes?

- To what extent do adolescents participating in art-based watershed education become more aware of environmental issues facing their community and environment?

Program description and participants

Participants

Two upstate New York private schools participated in the study during the Spring of 2017. The treatment group respondents (n = 14) were students from a private local independent school in a fifth and sixth grade combined class. This school does not implement NY State standardized tests. Students ranged in age from 10 to 12 and were 64% female and 36% male. Their average age was 10.64 years. The control group respondents (n = 14) included students of ages 10–11 from a different local private school. The control group was 30% female and 70% male (average age 10.35 years).

The treatment group participated in indoor and outdoor watershed lessons, environmental art, all knowledge pretests and post-tests, the pretest and post-test "2-MEV" scale (Bogner & Wiseman, 1999), and focus groups. The control group did not receive any of the watershed curriculum, but did receive all of the pretests and post-tests. Other participants in the assessment process included a sampling of seven treatment group parents and the primary school teacher, all of whom received semi-structured interviews or participated in a focus group.

Program description

Professors and students from an upstate New York liberal arts college worked with a muralist, an independent school teacher, and a local nature center/park to design and implement place-based lessons about the Hudson River Watershed that incorporated art and hands-on classroom and outdoor components. Nine lessons were taught to the treatment group over the course of nine weeks. The curriculum designed for this study was focused on the Hudson River Watershed and ecosystem. Students also visited Hudson Crossing Park (Hudson Crossing Park, 2017), the local educational nature center. The curriculum incorporated original lessons and art—developed by faculty and students in a year-long upper division EE research course—as well as a sampling of adapted existing EE lesson plans. These altered/adapted lesson sources included Project Wild (2007), Project Aquatic Wild (2014), Potomac Highlands Watershed School (Cacapon Institute, 2018), Project Learning Tree (2015), and the Missouri Department of Natural Resources (2018).

Table 1. Hudson River Watershed curriculum: Three overarching themes and underlying teaching topics Hudson River Watershed - Human/Animal River Interactions - Pollution.

Watershed components	Sustainable civilizations	Point vs. nonpoint source pollution
River morphology	Commerce and transportation	Hands-on water testing (temperature, turbidity, pH, and dissolved oxygen)
Tidal estuaries	Ecosystems and restoration	Laws and regulations
Modeling watersheds	Recreation	Industry, PCBs, and remediation
Animal habitat and endangered species	Development and planning	Environmental and human health

The curriculum was organized around the Hudson River Watershed, Human/Animal/River Interactions, and Pollution (Table 1). Broadly, the lessons addressed historical and more recent positive and negative outcomes of anthropogenic influences on the river. The Hudson River is a diverse ecosystem which was historically utilized by Native Americans for fishing and hunting, has been heavily utilized (and polluted) by commerce and transportation activities since industrialization, is home to threatened and endangered species, and is a vast and popular recreational area that stretches 315 miles from the mountains of the Adirondack State Park to the Atlantic Ocean.

The lessons were taught at the treatment group school, inside and outside, and at Hudson Crossing Park.[1] The environmental art components consisted of three main projects: (a) students sculpted watersheds; (b) students drew and painted their own ideas and perceptions of, and relationship to the Hudson River; and (c) later these art pieces and ideas were incorporated into the design of the large canvas mural (Figure 1). During the design and creation of the 55×50 inch portable mural, treatment group students, college students, parents, college faculty, and the muralist painted together. The mural was displayed on the wall of the educational building at the entrance to Hudson Crossing Park, as well as inside the private school. The intention was to create an educational mural that could be used as a teaching tool for years to come, and to encourage protection of the watershed.[2]

Environmental knowledge instrumentation

We developed a 20-item (29 points possible) environmental knowledge test that was pilot tested with public school fifth-grade students unrelated to our treatment or control groups.[3] The knowledge instrument was edited

[1]See hudsoncrossingpark.org for more information on this location.

[2]Schneller and Irizarry's (2014) research in Baja California Sur, Mexico found that sea turtle murals (designed and painted by students) displayed in public spaces helped to foster public environmental knowledge, community support for conservation and recovery efforts, and encouraged pro-environmental attitudes.

[3]Cronbach's Alpha in knowledge test was 0.90.

Figure 1. Hudson River Watershed mural.

for clarity and content (Creswell, 2016). The questions were designed to specifically adhere to the nine-lesson curriculum which was used in this study. The test incorporated multiple choice, fill in the blank, open-ended short-answer questions, and drawing watershed diagrams. The knowledge pretests were distributed among the treatment and control group classes before any EE was taught to the treatment group. Knowledge post-tests were administered to both groups two weeks after the final (ninth) lesson had been taught to the treatment group.

Environmental perception instrumentation and the 2-MEV

Bogner and Wiseman's Model of Ecological Values (2-MEV) was utilized to measure changes in students' environmental attitudes contributing to an individual's Preservation (P) *and* Utilization (U) values (Bogner & Wiseman 1999, 2002, 2006). The 2-MEV was specifically designed to tap the environmental values of children (Schneller, Johnson, & Bogner, 2015). Students who show a preference toward environmental preservation have more of a biocentric perspective, whereas students who lean more toward utilization have more of an anthropocentric viewpoint (Bogner & Wiseman 2006). Johnson and Manoli (2008) validated the 2-MEV to measure

changes in the environmental attitudes of adolescents. The researchers used scores from The Environment Questionnaire (TEQ), consisting of 16 Likert questions broken into: intent of support, care with resources, enjoyment of nature, human dominance, and altering nature. Researchers found the 2-MEV to be valid and reliable (Johnson & Manoli, 2008). The 2-MEV was administered to both treatment and control groups by their classroom teachers at the same time as the environmental knowledge test. The changes in student knowledge and attitude between groups (control vs. treatment) were tested using independent samples *t*-test and the Mann–Whitney *U* test. Changes in student knowledge and attitude within groups were tested using a Wilcoxon signed rank test, a nonparametric test procedure for the analysis of matched-pair data.

Qualitative instrumentation and content validity

Qualitative data methods triangulation included semi-structured interviews, focus group discussions, and participant observations of field trips, art projects, and classroom lessons. Focus groups were designed to incorporate the life-history technique to uncover the extent to which lessons affect lives of students (Bertaux, 1981). Focus groups were conducted during school hours in a quiet classroom that was not being used by a class. Both the focus groups and the participant observations were conducted by an investigator who did not teach the lessons to the students.

Data source triangulation was accomplished via semi-structured interviews with the treatment group teacher and seven parents. Two focus groups were conducted with treatment group students. Interviews/focus groups were audio-recorded and coded for analysis (Creswell, 2016).

Findings

Environmental knowledge

Using an independent samples t-test at pretest, there was no statistical difference found between the knowledge scores of the treatment and control groups ($p = 0.417$). At pretest, the treatment group scored an average of 11.07 points and the control group scored an average of 10.07 points.

At post-test, utilizing a Wilcoxon signed rank test, a nonparametric test procedure for the analysis of matched-pair data, we found that the difference within both the treatment and control groups was statistically significant. Out of 29 points, the treatment group scored an average of 22.21 points ($Z = -3.300$, $p < 0.001$), and the control group scored an average of 12.64 points ($Z = -2.887$, $p < 0.004$). While both the treatment and control group scores significantly improved, the treatment group environmental

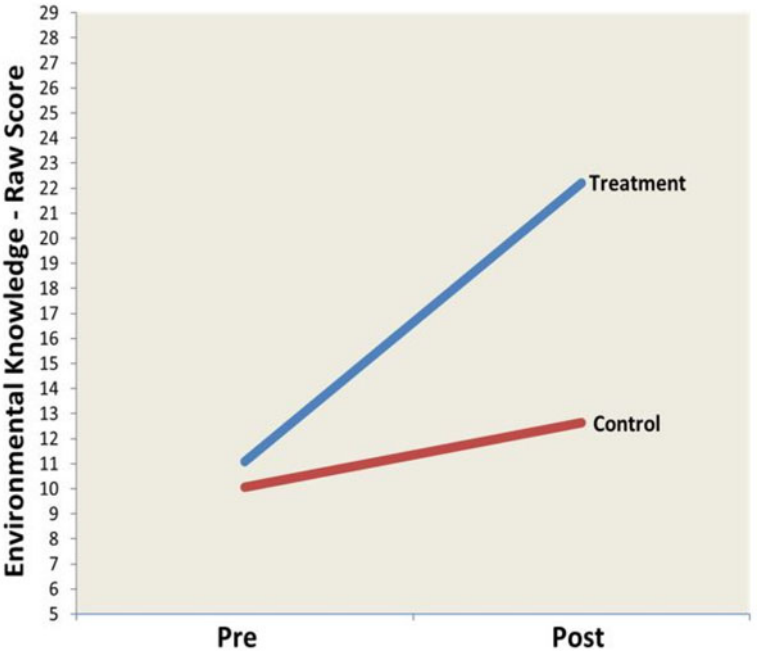

Figure 2. Environmental knowledge scores pretest vs. post-test.

knowledge scores improved by 100% (11.14 points) while the control group scores only improved by 25% (2.57 points) (Figure 2). After discussing reasons for the control group's statistically significant score improvement in environmental knowledge, the control group teacher informed us that students may have learned some of the knowledge from outside of his classroom. Using an independent samples t-test at post-test, we found the treatment group knowledge scores were statistically significantly different than those of the control group ($p = 0.000$).

Environmental attitudes: 2-MEV

At pretest using a Mann–Whitney test, we found the treatment and control groups did not differ in a statistically significant way for Preservation, Sig. (two tailed) p value 0.203. The results for Utilization showed no statistical significance at pretest, Sig. (two tailed) p value 0.145.

While the treatment group improved at post-test for both Preservation and Utilization, no statistically significant change was found. At post-test, the control group scores declined (got slightly worse) for both Preservation and Utilization, yet no statistically significant change was found. While both preservation and utilization were discussed in the curriculum, the lack of statistically significant effect may be due to a ceiling and floor effect whereby students scored high on preservation attitudes and very low on utilization attitudes during the initial pretest, thus leaving little room for

Table 2. Representative student quotes by theme.

Intergenerational learning	Environmental behaviors	Learning preferences	Lesson outcomes	Student perceived outcomes of environmental art
My Grandfather had no idea what watersheds were, so I taught him about that.	After this class I started recycling as much as I can … even my dog's food cans … I'll wash it out and put it in the recycling bin. I want to recycle as much as I can.	The art really showed you what it was like … it actually gave you a visual aid that was really helpful in a lot of ways. It explains it more, and it is easier to remember.	When we set up the rivers that we designed in the classroom it really showed how pollution will affect the river from up and down stream.	I'm hoping the art raises awareness of what's happening. People are going to look at it and be like 'whoa we should change this.' I'm hoping that it makes an effect.
I have four younger siblings and I would tell them 'oh today we learned about point and nonpoint pollution.' And I told them that point pollution would be like when you can tell them 'oh there's an oil spill at this one place,' and 'nonpoint pollution if fertilizer is coming off of 80 different farms, you don't know which one it came from.'	I think I'm going to start throwing my apple cores in (the compost). I also think that we used to do compost at school, and we should have that job again where someone goes out with a teacher and puts it back together.	I feel like we grow ideas more when we're talking as a group. When we're in a group as a whole class we have more ideas.	Now if we're driving and we see a sign saying watershed "X" … I know exactly what it is, and why the sign is there. There's one that say Ballston Lake Watershed.	I think people will learn that the Hudson River is polluted! We should be more careful about that because we've only got one Hudson River. We have to be careful that it doesn't get too polluted as there are some animals that only live there.
I told my mom and dad about point and non-point pollution, like what each one is, and the difference.	I feel like I should be able to swim or fish in the river. It really bothered me [that it's polluted].	When we made models of the watershed and then we could actually see what a real watershed would be like instead of just reading about it, we could actually do it and see it in action.	Doing the mural painting helped you get a visual of what it could look like in a natural water place.	The mural can really help you realize kind of what's really going on in the watershed.
I told my mom and dad about the Hudson River Watershed, and I think they learned that trees benefit the watershed.	Now I clean up more trash when I'm on trails sometimes. I did it a little bit before, but I definitely do it more now.	I feel like I learn the most from models, like the watershed model we did. I think it is better than just reading from a textbook.	If more people knew about [pollution] they would not pollute, or not pollute as much.	We drew a place with natural resources near our houses and then we drew the same place 3,000 years later with no natural resources, and it was really interesting to see how the world is actually going to change if we don't do anything about it.

improvement post-treatment. These existing attitudes could be further explained by the strong environmental ethos present in the school and/or in the student homes.

Qualitative research findings

Environmental art and experiential education

During focus groups with the treatment group, all 14 students discussed their preference to continue utilizing environmental art as a part of EE. Students explained that the mural and art projects helped them to understand how humans can affect the watershed, and to visualize and contextualize environmental issues within the watershed, especially related to appreciating endemic species, and pollution from PCBs, agriculture, and historical transportation and industrialization. In addition, students explained how they hoped the mural would serve as an educational tool and impetus for action for community members and students (Table 2).

Parent and teacher interviews corroborated the student responses and student conceptual awareness:

> Parent: When I asked what our purpose was today, I knew about the mural, and I figured she would discuss that part of the project, but she said that we were here to learn how to encourage people to keep the Hudson River clean … it went beyond the art, which is great.
>
> Parent: I think the art is a great idea, and we all learn differently, so I can envision that for children the art component would help motivate them and potentially even retain information in a way that's different than if they didn't have the interactive art component … it's wonderful.
>
> Parent: She understands that art is a medium where you can express yourself. She cares about the environment and animals so much that she'll find a way to use art to do that. I think it'll definitely have an impact on her.
>
> Teacher: I heard kids making connections, telling me that they've seen things, like they saw an animal or something that lives in the Hudson or noticed something about storm sewers. I've been hearing some of their conversations like, 'hey guess what I saw?' that relates to the curriculum … I do think there's been an increase in awareness of the Hudson River ecosystem.

Of the 14 students in the focus groups, 85% (12/14) said they preferred the experiential and hands-on components of the curriculum, 14% (2/14) of students said they had no preference, and 7% (1/14) reported to prefer wanting fewer experiential components.

Unexpected outcomes

Student focus groups and parent interviews showed that students unexpectedly engaged in intergenerational learning with siblings, parents, and

grandparents. The majority of students spoke with family members about endemic species, features of watersheds, and pollution in the watershed. As the mural was designed to show impacts to the river, it is possible that the art components carried over into discussions in the homes. As parents explained:

> Parent: I've never heard of the American Eel before and I wasn't sure it was in this ecosystem! But it does live here, it lives in the Hudson, yeah … that was new to me.

> Parent: She'll make comments about things, and I noticed that there's been a lot of increase in her interest in giving me facts or asking me if I know what a watershed is. So I'll say to her, 'well I have some idea, but why don't you tell me.' She's concerned about how polluted it is and she said to me, 'Oh, is that the Hudson?' and I said, 'Yes' and she said, 'Oh it's just so sad how polluted it is.' She told me about the PCB cleanup and removing sediment from the bottom, which I didn't know.

Finally, although the curriculum did not focus on directly demonstrating/teaching pro-environmental behaviors, our participant observations during the art projects and field trips, as well as interviews with parents and the teacher, corroborated the student descriptions of the efforts they were taking to protect the Hudson River Watershed, as described in the quote chart.

Conclusion

As a component of an experiential EE curriculum, environmental art and muralism are but two hands-on tools within a suite of pedagogical possibilities. Our case study research showed that although novel, this style of teaching was effective enough to statistically (significantly) advance the treatment group's environmental knowledge scores compared to the control group. While we cannot say that the environmental art components were solely responsible for the improvement in knowledge scores, the difference in scores between pre- and post-test responses to some of the open-ended knowledge questions and diagram drawing questions were notable. For instance, students were asked to draw a watershed, label the components, and describe two water features. Every student at pretest left this question blank or wrote "I don't know." The EE curriculum incorporated watershed modeling, drawing diagrams of watersheds, and ultimately, the design of a mural about the Hudson River Watershed. At post-test, all 14 students had the ability to draw a watershed and described and labeled between two and six features. Elements from the group designed mural were found in the post-test responses. As such, it is likely that the in-class lessons, when coupled with the artistic experiences, were closely tied to the growth in student knowledge and understanding.

While the treatment group 2-MEV scores improved slightly, we found inconclusive evidence as to whether this curriculum resulted in statistically significant changes in environmental attitudes. Due to the possibility that attitudinal measurements may have been constrained by small sample size, short duration, and ceiling and floor effects, future research could be conducted with environmental art, evaluating larger and more diverse samples for longer periods of time.

The qualitative portions of our research revealed that the pedagogy helped students form a sense of connection to, and care for ecosystems and watersheds. The environmental art components of the curriculum were meaningful to the students. The student design, painting, and public display of the mural added creative and advocacy elements to the curriculum. Students described the hands-on lessons (such as constructing a model watershed), and the mural painting process, as helping them not only to contextualize the environmental science of the broader Hudson River Watershed, but also for better understanding their relationship to the river, heightening their awareness of environmental issues, appreciating endemic species, sharing knowledge with the public/students/family, and questioning the public's relationship to the Hudson River. The art-based aspect of this program also provided a means through which the students executed a pro-environmental action. This was in the form of public education through the creation of a mural that was subsequently displayed in a local park with the (student) chosen theme "How do you impact the Hudson River Watershed?" The mural could potentially help to instigate environmental protection and recovery efforts. Prior research by Schneller and Irizarry (2014) found that publicly accessible environmentally/marine themed murals (in Baja California Sur, Mexico) helped to instigate viewer pro-environmental behaviors and bolstered community engagement in marine and endangered sea turtle conservation efforts.

Environmental art, when implemented within a suite of experiential EE lessons, has positive outcomes that can be realized by environmental educators. Despite the fact that the treatment group school does not implement NY State standardized testing, environmental art components could still be utilized widely in a public school setting, as it has proven to aid in students' understanding of social, environmental, and scientific concepts, and the development of pro-environmental attitudes and behaviors. Public school teachers working within the Next Generation Science Standards are already teaching the Framework core idea *Influence of Engineering, Technology, and Science on Society and the Natural World* (Next Generation Science Standards , 2013). As this encompasses life sciences, earth system sciences, etc., there is a fertile ground for incorporating various forms of art. While science and art teacher collaboration would be an

ideal avenue for implementing the practice, possible challenges to its implementation could include the need for extra time, lack of financial, equipment, and spatial resources, or possibly a lack of administrative support due to the regimen/pressures of standardized testing.

In light of these findings, we advocate for implementing a diversity of environmental art and media projects to help students understand complex environmental concepts. This will allow students to innovate and create in line with their personal strengths and interests. Recommendations for future studies include a longitudinal follow-up with the same students and parents, to better understand long-term retention of knowledge, pro-environmental attitudes, and behaviors. Researchers could also teach an EE curriculum with, and without environmental art, to isolate the effect of art on student learning. Further, conducting research in a public school with other age groups may provide information to build upon the results presented here.

ORCID

Andrew J. Schneller http://orcid.org/0000-0003-2756-7034

References

Baker, J., Loxton, J., & Sherren, K. (2013). Using art elicitation to deliver and evaluate a grade 4 climate change instructional module. *Applied Environmental Education & Communication*, *12*(2), 130–142. doi:10.1080/1533015X.2013.824248

Bertaux, D. (1981). *Biography and society: The life history approach in the social sciences*. Beverly Hills, CA: Sage.

Boeckel, J. V. (2015). At the heart of art and earth: An exploration of the practices in arts-based environmental education. *Environmental Education Research*, *21*(5), 801–802. doi:10.1080/13504622.2014.959474

Bogner, F. X., & Wiseman, M. (1999). Towards measuring adolescent environment perception. *European Psychologist*, *4*(3), 139–151. doi:10.1027//1016-9040.4.3.139

Bogner, F. X., & Wiseman, M. (2002). Environmental perception of pupils from France and four European regions. *European Journal of Psychology of Education*, *17*(1), 3–18. doi:10.1007/BF03173201

Bogner, F. X., & Wiseman, M. (2006). Adolescents' attitudes towards nature and environment. *The Environmentalist*, *26*(4), 231–237. doi:10.1007/s10669-006-8660-9

Burnard, P. A., Dragovic, T., Jasilek, S., Biddulph, J., Rolls, L., Durning, A., & Fenyvesi, K. (2017). *The art of co-creating arts-based possibility spaces for fostering STEAM practices in primary education. Arts-based methods in education around the world*. UK: University of Cambridge.

Cacapon Institute. (2018). Potomac Highlands Watershed School. Retrieved from: http://www.cacaponinstitute.org/e_classroom.htm

Chawla, L., & Cushing, D. F. (2007). Education for strategic environmental behavior. *Environmental Education Research*, *13*(4), 437–452. doi:10.1080/13504620701581539

Creswell, J. W. (2016). *Qualitative inquiry & research design choosing among five approaches*. London, UK: Sage Publications.

Flowers, A. A., Carroll, J. P., Green, G. T., & Larson, L. R. (2015). Using art to assess environmental education outcomes. *Environmental Education Research*, *21*(6), 846–864. doi: 10.1080/13504622.2014.959473

Flowers, A., Carroll, J., Green, G., & Larson, L. (2015). Using art to assess environmental education outcomes. *Environmental Education Research*, *21*(6), 846–864. doi:10.1080/13504622.2014.959473

Gardner, H., & Hatch, T. (1989). Multiple intelligences go to school: Educational implications of the theory of multiple intelligences. *Educational Researcher*, *18*(8), 4–10. doi: 10.2307/1176460

Gray, T., & Birrell, C. (2015). 'Touched by the earth': A Place-based outdoor learning programme incorporating the Arts. *Journal of Adventure Education and Outdoor Learning*, *15*(4), 330–349. doi:10.1080/14729679.2015.1035293

Gurevitz, R. (2000). Affective approaches to environmental education: Going beyond the imagined worlds of childhood? *Ethics, Place, and Environment*, *3*(3), 253–268. doi: 10.1080/713665905

Guyotte, K. W., Sochacka, N. W., Costantino, T. E., Kellam, N., Kellam, N. N., & Walther, J. (2015). Collaborative creativity in STEAM: Narratives of art education students' experiences in transdisciplinary spaces. *International Journal of Education & the Arts*, *15*(16), 39. Retrieved from https://ijea.org/v16n15/v16n15.pdf

Hilager, A. (2017). Using art to enhance environmental education Master's thesis). Retrieved from Hamline University (digitalcommons.hamline.edu).

Hudson Crossing Park. (2017). Welcome to Hudson Crossing Park. Retrieved from: https://www.hudsoncrossingpark.org/

Inwood, H. (2008). Mapping eco-art education. *Canadian Review of Art Education: Research and Issues*, *35*, 57–74. Retrieved from https://files.eric.ed.gov/fulltext/EJ822675.pdf

Johnson, B., & Manoli, C. C. (2008). Using Bogner and Wiseman's model of ecological values to measure the impact of an Earth Education Programme on children's environmental perceptions. *Environmental Education Research*, *14*(2), 115–127. doi:10.1080/13504620801951673

Locke, S., Russo, R., & Montoya, C. (2013). Environmental education and eco-literacy as tools of education for sustainable development. *The Journal of Sustainability Education*, *4*, 1–13. Retrieved from http://www.jsedimensions.org/wordpress/?p=2285

Marshall, J. (2014). Transdisciplinarity and art integration: Toward a new understanding of art-based learning across the curriculum. *Studies in Art Education*, *55*(2), 104–127. doi: 10.1080/00393541.2014.11518922

Missouri Department of Natural Resources. (2018). Water resources. Retrieved from: https://dnr.mo.gov/education/water/

Next Generation Science Standards. (2013). Science, Technology, Society and the Environment Retrieved from http://www.nextgenscience.org/sites/default/files/APPENDIX%20J_0.pdf

Project Aquatic Wild. (2014). Texas: Council for Environmental Education.

Project Learning Tree. (2015). Washington: American Forest Foundation.

Project Wild. (2007). Washington: Association of Fish & Wildlife Agencies.

Schneller, A. J., & Irizarry, A. (2014). Imaging conservation: Sea turtle murals and their effect on community pro-environmental attitudes in Baja California Sur, Mexico. *Ocean & Coastal Management*, *89*, 100–111. doi:10.1016/j.ocecoaman.2013.12.009

Schneller, A. J., Johnson, B., & Bogner, F. X. (2015). Measuring children's environmental attitudes and values in northwest Mexico: Validating a modified version of measures to test the Model of Ecological Values (2-MEV). *Environmental Education Research*, *21*(1), 61–75. doi:10.1080/13504622.2013.843648

Sobel, D. (2008). *Childhood and nature: Design principles for educators*. New Hampshire: Stenhouse.

Song, Y. K. (2008). Exploring connections between environmental education and ecological public art. *Childhood Education*, *85*(1), 13–19. doi:10.1080/00094056.2008.10523051

Song, Y. K. (2012). Crossroads of public art, nature and environmental education. *Environmental Education Research*, *18*(6), 797–813. doi:10.1080/13504622.2012.670208

United Nations Education, Scientific, and Cultural Organization (UNESCO). (1977). The Tbilisi Declaration: Intergovernmental conference on environmental education. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000156393

Ward, K. S. (2013). Creative arts-based pedagogies in early childhood education for sustainability (EfS): challenges and possibilities. *Australian Journal of Environmental Education*, *29*(2), 165–181. doi:10.1017/aee.2014.4