Using the Arts to Teach Environmental Education through Self-Directed Learning

Utilizzare l'arte per insegnare l'educazione ambientale attraverso l'apprendimento autonomo

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ABSTRACT
To enhance students' environmental knowledge, art helps to transcend the classroom while incorporating academic content in multithemed lessons that integrate and meet academic standards. According to Inwood, this approach expands creativity and applies real world critical thinking skills to environmental problems, issues, and future sustainability. This study describes interdisciplinary instruction using environmental arts education, which encourages students to help community and local environments. The authors frame this experience for the youngsters by showing them how to create their own art so they can make immediate and personal connections to the natural environment. While participating in the educational lessons, students learn how their actions affect the environment, and through their own artistic contributions, they essentially become "environmental artists" who enrich the world at large. As remarked by Grava and Pole, students apply their understanding of these issues through self-directed learning experiences and they discover direct connections between themselves, others, and the environment.

Nell'incrementare la conoscenza ambientale degli studenti, l'arte contribuisce a trascendere il contesto classe incorporando, allo stesso tempo, contenuti accademici in lezioni multi-tematiche che soddisfano e complementano gli standard accademici. Secondo Inwood, tale approccio espande la creatività e applica le abilità di pensiero a compiti di realtà che riguardano le questioni ambientali e della sostenibilità futura. Questo studio illustra la formazione interdisciplinare attraverso l'educazione artistica, la quale incoraggia gli studenti ad aiutare le comunità e i contesti ambientali locali. Gli

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autori inquadrano l'esperienza dei piccoli mostrando loro come creare la propria arte, affinché possano stabilire connessioni personali e immediate con l'ambiente locale. Nel partecipare alle lezioni di questo genere, gli studenti apprendono come le proprie azioni influenzino l'ambiente; attraverso i propri prodotti artistici, diventano, essenzialmente "artisti ambientali" che arricchiscono il Mondo. Come osservato da Grava e Pole, gli studenti rendono applicativa la propria comprensione delle questioni ambientali attraverso esperienze di autoapprendimento e scoprono le connessioni dirette tra il sé, gli altri e l'ambiente stesso.

KEYWORDS
Environmental education, Visual art education, Early childhood environmental education
Educazione ambientale, Educazione visiva, Educazione ambientale dell'infanzia

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1. Introduction

Visual artists have been inspired by their natural environment throughout history. By observing every detail and interpreting the world around them, artists provide a unique view and visual interpretation of life, culture, and society. One such group of artists that intentionally work to affect society involves environmental art are environmental artists, and they have made an impact on mainstream society through the ages. Take note of the cave artists who creatively used the natural rock surface to depict realistic movement of animals, which shows how everyday life impacted their society. Consequently, it is social action in visual art that inspired this project which was conducted at an environmentally geared elementary school in the southeastern United States. Specifically, individuals can impact others through visual art with a focus on environmental issues and ultimately, raise environmental consciousness for sustainability. This concept provides the impetus for the project described in this paper. The work of John Grande also inspired this project by asking this question about environmental visual art: «In what way does this kind of art imply a commitment to social change and the betterment of human culture in the city, its local history or the broader context of nature with whose resources we change, alter and construct our city environments?» (Grande, 2004, p. 13). It is this commitment to change for a better future that inspired this project with young children.

Many educators focus on thematic lessons, including topics such as environmental issues (Inwood, 2015). Often educators focus on the themes of recycling, the water cycle, habitats, natural resources, energy, pollution, or other environmental issues that connect visual arts to other concepts that are taught in the elementary classroom (Ulbricht, 1998). Commonly, these thematic lessons generalize ecological concerns that focus on global society, rather than concen-

trating on the students' immediate lives and their abilities to impact change. Educators expect students to make the real-world connections, but often at the elementary school level, students are unable to analyze concepts and interpret ideas that can apply to their lives without assistance. Teachers must guide students to make these connections; thus, transfer of knowledge and schema can occur as part of the lesson (Fogarty et al., 1991; Kim & Burkhauser, 2021). Self-directed learning is part of this type of lesson planning because it provides the learning strategies for students to use independently, and it contextualizes the information on their own terms. A focus on personal meaning making that is unique and guides the learners to make their own decisions through individual self-directed learning plays a part in this type of instruction. Thus, learning becomes directly relevant to the learners on their own terms (Grava & Pole, 2021).

Creative problem solving in authentically complex situations that involve working with others towards a common learning goal is another aspect of this type of teaching (Costa & Kallick, 2004). Also, a shift in philosophy about how visual art education is approached in the elementary school is needed. If educators teach as if «nature is the art of which we are a part», then art and life become connected for the students (Grande, 2004, p. 36). It is this connection that helps to create independent learners. If the students know it is important to understand and apply to their lives, then the motivation for learning is internalized. Self-efficacy is born out of this shift in teaching and learning philosophy. Also, group work can lead to real comprehension and learning, and may even be transformative as learners in the group must come to a consensus of understanding and dialogue about their own places in the environment (Illeris, 2012).

2. Overview of the project

In this project, participants were second grade students at an elementary school in the southeastern part of the United States. This school of 883 students was chosen as the project site because it partners with the local university as well as a highly regarded Environmental Education Center. Both the elementary school and environmental center focus on environmental education for children (kindergarten through fifth grade) using active engagement and self-directed learning activities. This project was developed to determine the impact, if any, of the self-directed learning activities involving visual art and environmental issues (Grava & Pole, 2021; Inwood, 2015). The two classes of second grade students answered pre-activity and post-activity questionnaires that described their feelings about the environment before and after the project was undertaken.

The two second grade teachers also answered pre-activity and post-activity questionnaires and observed the researchers' instruction during the student self-directed learning activities. Photographs of the artwork made by the students are included in this paper to illustrate the results of their endeavors. The data from the questionnaires were analyzed for common themes and were compared to show the impact of the self-directed learning activities on students' conceptual awareness of environmental issues and art (Vasko, 2016). The findings and conclusions of the study will be discussed in this paper with regard to the implementation of possible approaches to teaching young children environmental issues integrated with art.

2.1 Problem Statement and Objectives

Research in this area is needed to continue to explore best practices for teaching and learning to promote critical and creative thinking skills in a constructivist manner. The researchers are interested in understanding what these second grade students and their teachers consider environmental art to be, and how to actively engage learners in activities concerning environmental issues and visual art. By engaging in environmental art, and through guided questioning by their teachers, these youngsters will be able to explore through their own visual and artistic expression and make conclusions about how and why certain things happen in the environment. Hopefully, with this guided artistic environmental learning, the students will grow to have better understanding of their environment and will become sensitive, informed decision makers of the future.

In sum, the primary objectives of this project are

1. to determine the knowledge level of visual art concepts that are integrated with environmental issues;
2. to determine how visual art integration affects the leaning process for these students;
3. to discover the perceptions of the second grade classroom teachers of the targeted student group at the elementary school. The objectives of the project and the problem statement will be further discussed in the findings and conclusions section of this paper.

2.2 Purpose of the study

The purpose of this study is to discover the depth and perception of understanding of environmental art concepts, and how these concepts affect their lives. A wider rationale and purpose of the study involve the issue of teaching environmental issues to elementary school students to promote life-long commitment to preserving the environment. A sense of ownership, agency, and belonging to the community can be the result of early intervention using environmental art.

Why is it important to teach environmental education connected to visual art? It is important because the world that we live in is finite and we have a limited amount of resources present. We need to promote sustainable development and healthy maintenance of our precious planet. It is our duty as educators and citizens of the earth to help create healthy, positive attitudes in the students we instruct and to promote a level of respect and concern for our natural world. «If we respect the diversity that exists around in nature, we discover a greater depth of knowledge and experience. This is the key to an art of the future» (Grande, 2004, p. 65).

The significance of the research is that information gathered and disseminated contributes to the larger creative learning field, thematically, including environmental education and visual arts integration. Information from this research can be used to plan and implement integrated curriculum in other educational settings. Another aspect of the significance of this study concerns the placement site itself. This elementary school is the first "green" school (i.e., a school that supports global sustainability and voluntarily commits to conserve and protect natural resources) to be built in this school district in the state of Florida. Along with the collaboration of the Environmental Education Center, which provides community

programs and is part of the educational unit of the university, this school site provides a unique look at how environmental issues affect elementary aged students and is a model for other schools.

3. Materials and methods

3.1 Study sample

Second grade students aged seven to eight years old from two classes formed the basis of this study population. The two classrooms were self-selected through a collaborative decision by the principal, and the second grade team of teachers. The students in each class were given the option to participate, and parental and child consent forms were used. In classroom A, fifteen students ($N_a = 15$) participated in the study. In classroom B, fourteen students ($N_b = 14$) participated in the study. A total of twenty-nine ($N_{tot} = 29$) second grade students participated in the study. Both teachers of each class participated in the study.

3.2 Procedures

The initial visit to the school provided an opportunity for introductions and allowed the researchers to share the basic idea of the project to the teachers and students. The reasons for the research were explained, as well as how we could all benefit from the findings. Consent forms were provided and students, parents, and teachers were allowed to ask questions after reading the consent forms. For the students, the researchers read the consent form aloud and verbally explained what the study involved. Students were allowed to ask questions during this initial visit. After collecting the signed consent forms, the researchers returned to each classroom and guided the students through a series of learning activities.

The students completed a questionnaire prior to the instructional visit. The questionnaire included the following ten questions, which are addressed in this paper:

1. Question #1: The Environment is the World Around Me.
2. Question #2: Habitats Are Where Creatures, Like People, Plants, and Animals Live.
3. Question #3: Habitats Provide Food, Water, Shelter, and Space for Living Creatures in a Specific Climate.
4. Question #4: Pollution Is a Problem in Our Environment.
5. Question #5: Living Creatures like People, Animals, and Plants Depend Upon Each Other to Survive.
6. Question #6: I Can Help the Environment.
7. Question #7: Artists Can Make Art about the Environment.
8. Question #8: Artwork Can Help the Environment.
9. Question #9: Looking at Other People's Artwork Can Help Me to Make My Own Artwork.
10. Question #10: I Am an Artist.

During the first instructional session, the researchers presented a lecture and images that showed various artists who focus on the environment within their art-

work. As mentioned, historically, artists have represented their relationship to nature in artwork, starting from cave art to contemporary times. While some artists focus on the environmental concerns and how to make things better, other artists are using the natural materials or depicting scenes of nature in the artwork. Grande (2004) discusses several ideas that frame this study, the primary idea being a shift in artistic understanding that focuses on nature as «the art of which we are a part» (Grande, 2004, p. 36). Nature is no longer just the subject of art. It is a part of the artistic process and creation. The main idea of environmental artwork is «a profound respect for our ecosystem» (Grande, 2004, p. 18). After the discussion about various artists, using crayons, the students drew pictures of natural scenes from memory on paper (see *Figures 1 and 2*). The students selected the topic for their drawings but were asked to consider the concepts discussed earlier in the session. After completing the drawings, the students orally explained their pictures to the class.

During the next instructional session, the work by artists who painted outdoors were discussed. The researchers demonstrated strategies for painting with watercolor in the classroom. Next, the students walked to a natural area on the school campus (see *Figure 3*). Experiences in the natural environment support the development of the students' ecological awareness (Vasko, 2016).

The researchers demonstrated how to compose a section of the natural area for a painting on watercolor paper and demonstrated different watercolor techniques. Students selected their own view of the natural area. Using the techniques of their choice, they created watercolor paintings (see *Figures 4 & 5*). The paintings were discussed and students explained their decisions in composition and watercolor technique and described how this related to what they were painting.

The next instructional session involved a discussion of artists who use natural materials to make their artwork. Then as a group, they created a "mandala" from natural materials (see *Figures 6–8*). A mandala is a circular design that often has an emotional and spiritual connection to the artists. Mandalas have been created throughout history and in contemporary times as religious rituals and spiritual icons across world cultures (Jung, 1959). The researchers guided students through the natural areas discussing various plant life and evidence of animal life. They emphasized that changes in the natural environment affect all the creatures that depend upon that habitat for survival. This includes movement of leaf litter on the floor of the natural area and use of any branches or plants. It was important for students not to damage the environment by creating the group artwork. As a class, the students gathered debris from the ground that included interesting textures and colors. The mandala was inspired by what the students were thinking at that moment about the environment. As a group, decisions were made about where to create the circle, how large it should be, what type of materials would make up the outside of the circle and what would be placed inside the circle to create the design (see *Figures 6, 7, and 8*).

The researchers and classroom teachers allowed the students to make these decisions without adult intervention. The only guidance provided by the researchers and teachers involved ensuring the students stay within a prescribed location. After the class decided that the mandala was complete, the researchers guided a group discussion about what items were used and where the items were placed. The overall design was interpreted by the students orally explaining the meaning of each item. At the end, the mandala was left for nature to dismantle organically. The mandala installation was fleeting and temporary, but the experience in the students' minds continued to fuel further exploration of visual art, na-

tive cultures, and the environment. Finally, the students completed a post-instruction questionnaire. Students were encouraged to ask the researcher questions before completing the study.

4. Results: data from the questionnaires

The following tables summarize the date from the pre- and post-activity questionnaires. Each table totals the student responses for classroom A and B based upon a Likert-like scale. Also included are tables for the teachers' responses on both the pre- and post-activity questionnaires.

4.1 Pre-activity questionnaire

Classroom A Pre-Test										
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
A5	13	15	11	15	11	15	12	4	6	12
A4	2	0	2	0	3	0	2	2	2	0
A3	0	0	2	0	0	0	1	3	3	3
A2	0	0	0	0	0	0	0	1	1	0
A1	0	0	0	0	1	0	0	5	3	0

Table 1. Classroom A Student Responses

Classroom B Pre-Test										
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
A5	11	8	11	8	6	12	10	6	8	11
A4	2	1	2	2	3	1	1	1	3	2
A3	0	3	1	3	5	1	2	2	2	1
A2	1	0	0	0	0	0	0	3	1	0
A1	0	2	0	1	0	0	1	2	0	0

Table 2. Classroom B Student Responses

Classroom A Pre-Test: Teacher Responses										
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
A5	X	X			X				X	
A4			X	X		X	X	X		X
A3										
A2										
A1										

Table 3. Classroom A Teacher Responses

Classroom teacher A answered extended response questions by writing the following:

- Question # 11: *I've collaborated with art teachers in the past. For example, if their theme for the month is the rainforest and that was a unit I was teaching, I would make sure I taught the unit at the same time.*
- Question #12: *A lesson idea would be to talk about the how and the ways we can protect ocean life. The children can draw a clean ocean and ways to protect the ocean.*

Classroom B Pre-Test: Teacher Responses										
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
A5	X	X	X	X		X		X	X	
A4					X		X			X
A3										
A2										
A1										

Table 4. Classroom B Teacher Responses

Classroom teacher B answered the extended response questions by writing the following:

- Question #11: *I worked with the art teacher on a project to teach about sand hill cranes and how to help them. The artwork was sold at Blowing Rocks (a barrier island sanctuary and conservation preserve) to raise money for an organization.*
- Question #12: Design a fish with recycled materials and show its adaptations.

4.2 Post-activity questionnaire

Classroom A Post-Test										
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
A5	14	13	11	14	12	13	11	5	8	14
A4	1	0	2	1	2	2	2	2	6	0
A3	0	1	2	0	0	0	2	4	1	1
A2	0	1	0	0	1	0	0	0	0	0
A1	0	0	0	0	0	0	0	4	0	0

Table 5. Classroom A Student Responses

Classroom B Post-Test										
	Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
A5	14	8	11	11	11	13	12	5	12	12
A4	0	3	0	1	1	1	1	2	1	1
A3	0	2	2	1	2	0	1	5	0	1
A2	0	1	1	0	0	0	0	0	1	0
A1	0	0	0	1	0	0	0	2	0	0

Table 6. Classroom B Student Responses

Classroom A Post-Test: Teacher Responses										
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
A5	X	X	X	X	X				X	
A4						X	X	X		X
A3										
A2										
A1										

Table 7. Classroom A Teacher Responses

Classroom teacher A answered extended response questions by writing the following:

- **Question #11:** Same answer from pre-test.
- **Question #12:** Same answer from pre-test.

Classroom A Post-Test: Teacher Responses										
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
A5	X	X	X	X		X		X	X	
A4					X		X			X
A3										
A2										
A1										

Table 8. Classroom B Teacher Responses

Classroom teacher B answered extended response questions by writing the following:

- **Question #11:** Same answer as the pre-test.
- **Question #12:** Same answer as the pre-test.

4.3 Visual evidence

Figure 1. Crayon drawing of a lily

Figure 2. Crayon drawing of flowers in the rain

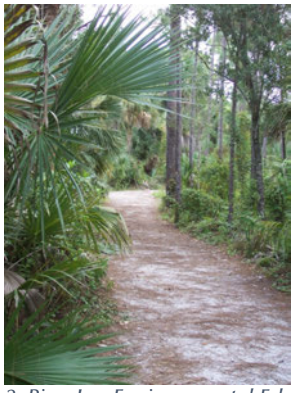

Figure 3. Pine Jog Environmental Education Center Natural Area with Trail

Figure 4. Student watercolor painting of trees using wash technique

Figure 5. Student watercolor painting of trees using crayon resist technique

Figure 6. Gathering the natural items for the mandala creation

Figure 7. Group 2 mandala decisions

Figure 8. Group discussion of mandala

5. Analysis and discussion

5.1 Comparability between the two classes in terms of dispersion

Given the pre-test questionnaire's frequencies of *Tables 1* and *2*, it is possible to tell that the two classrooms are very different in terms of qualitative variance. *Table*

9 illustrates the pre-test Index of Qualitative Variance (IQV) of each classroom for each of the administered questions and the mean IQV for each classroom.

Class-room (pre-test)	Q#1 IQV	Q#2 IQV	Q#3 IQV	Q#4 IQV	Q#5 IQV	Q#6 IQV	Q#7 IQV	Q#8 IQV	Q#9 IQV	Q#10 IQV	Mean IQV
A	0.289	0.000	0.533	0.000	0.522	0.000	0.422	0.944	0.922	0.400	0.403
B	0.446	0.753	0.446	0.753	0.804	0.319	0.574	0.906	0.753	0.446	0.620

Table 9. IQV per administered question and mean IQV for each class

The closer the IQV index is to 1, the higher the dispersion of data. This analysis gives a clue as per how homogeneous each group's sentiment is in regard to each question: dispersion is evidence of disagreement. In general, it could be argued that classroom B was more dispersed than classroom A. More specifically, a measure of the disagreement of each classroom is obtained. *Table 10* shows which questions featured the most significant disagreement. For illustrative purposes, the IQV has been divided into five tiers: negligible (0 ″ IQV ″ 0.199); low (0.2 ″ IQV ″ 0.399); moderate (0.4 ″ IQV ″ 0.599); high (0.6 ″ IQV < 0.799); very high (0.8 ″ IQV ″ 1.0).

Question #	Classroom A's disagreement	Classroom B's disagreement	Contiguous range?
#1	Low	Moderate	Yes
#2	Negligible	High	No
#3	Moderate	Moderate	Yes
#4	Negligible	High	No
#5	Moderate	Very High	No
#6	Negligible	Low	Yes
#7	Moderate	Moderate	Yes
#8	Very high	Very high	Yes
#9	Very high	High	Yes
#10	Moderate	Moderate	Yes
Mean dis-agreement	*Moderate*	*High*	*Yes*

Table 10. Disagreement rates per question and per classroom

The purpose of *Table 10* is to identify, at the pre-test stage, for which questions the two classrooms could be grouped together. The authors argue that only questions for which both classrooms enjoy contiguous disagreement rates are comparable. That is, Questions #1, #3, #6, #7, #8, #9, #10. Instead, Questions #2, #4, and #5 shall be addressed by considering each classroom separately.

Consequently, we could argue that, for the

5.2 Pre-test and post-test: which sentiment was shaken the most by the teaching activity?

At a general level, it could be asked whether the activity was effective in changing the sentiment of groups in regard to issues captured by particular items. Individual variation is a thing, but the collective dimension should be furtherly taken into account when classroom activities are the scope of the investigation. A first way to analyze this is by asking whether a classroom, in itself, experienced significant changes when compared with the changes that affected all participants. Assuming Likert responses could be rendered as a linear scale going from 1 to 5, for an St.dev of 0.230 calculated on the entire sample, the sub-sample constituted by Classroom A experienced significant shifts in the average scores only in relation to art. Such shift was positive and, at least in the items related to artistic self-efficacy (Questions #9 and #10), it is matched by a significant increase in group homogeneity. This means that not only some students reported increased self-efficacy, but that such attitude change is reflected by increased group cohesion. Instead, Classroom B experienced heavy gains in all items except those that could be clustered in terms of helpfulness (Questions #3, #6, and #8). That is matched by significant gains in terms of homogeneity: Classroom B experience increased cohesion regarding the beleifs addressed by the questionnaire. This means that, on average, as mean scores increased for most items, Classroom B experienced less disagreement.

#	Item	Classroom A						Classroom B						All participants					
		Average score			IQV			Average score			IQV			Average score			IQV		
		Pre-test	Post-test	Gain	Pre-test	Post-test	Gain	Pre-test	Post-test	Gain	Pre-test	Post-test	Gain	Pre-test	Post-test	Gain	Pre-test	Post-test	Gain
1	The Environment is the World Around Me.	4.87	4.93	0.07	0.289	0.156	-13.3%	4.64	5.00	0.36	0.446	0.000	-44.6%	4.76	4.97	0.21	0.369	0.083	-28.5%
2	Habitats Are Where Creatures, Like People, Plants, and Animals Live.	5.00	4.67	-0.3	0.000	0.300	30.0%	3.93	4.29	0.36	0.753	0.753	0.0%	4.48	4.48	0.00	0.443	0.562	11.9%
3	Habitats Provide Food, Water, Shelter, and Space for Living Creatures in a Specific Climate.	4.60	4.60	0	0.533	0.533	0.0%	4.71	4.50	-0.21	0.446	0.446	0.0%	4.66	4.552	-0.10	0.493	0.499	0.6%
4	Pollution Is a Problem in Our Environment.	5.00	4.93	-0.1	0.000	0.156	15.6%	4.14	4.50	0.36	0.753	0.459	-29.3%	4.59	4.724	0.14	0.443	0.312	-13.1%
5	Living Creatures like People, Animals, and Plants Depend Upon Each Other to Survive.	4.53	4.67	0.13	0.522	0.422	-10.0%	4.07	4.64	0.57	0.804	0.446	-35.7%	4.31	4.655	0.35	0.728	0.443	-28.5%
6	I Can Help the Environment.	5.00	4.87	-0.1	0.000	0.289	28.9%	4.79	4.93	0.14	0.319	0.166	-15.3%	4.90	4.897	0.00	0.163	0.232	6.8%

7	Artists Can Make Art about the Environment.	4.73	4.60	-0.1	0.422	0.533	11.1%	4.36	4.79	0.43	0.574	0.319	-25.5%	4.55	4.690	0.14	0.502	0.437	-6.5%
8	Artwork Can Help the Environment.	2.93	3.27	0.33	0.944	0.911	-3.3%	3.43	3.57	0.14	0.906	0.880	-2.6%	3.17	3.413	0.24	0.954	0.904	-5.1%
9	Looking at Other People's Artwork Can Help Me to Make My Own Artwork.	3.47	4.47	1	0.922	0.689	-23.3%	4.29	4.71	0.43	0.753	0.319	-43.4%	3.86	4.586	0.72	0.865	0.580	-28.5%
10	I Am an Artist.	4.60	4.87	0.27	0.400	0.156	-24.4%	4.71	4.79	0.07	0.446	0.319	-12.8%	4.66	4.828	0.17	0.434	0.238	-19.6%

Table 11. Mean scores and IQVs comparisons. St.dev for the sample's IQV is 15% (0.15) and St.dev for the sample's average score gain is 0.230. Results exceeding such values have been highlighted.

For example, almost complete agreement was reached on the definition of the environment (Question #1), and striking reductions in the diversity of opinions were achieved in items that gathered data on the understanding of interdependence: between different elements of the environment (Question #5) and between other artists and the students (Question #9). A peculiar case is represented by Classroom A with regard to Questions #2, #4, and #6. Average scores did not change substantially, but students seem to have swapped places, which resulted in significant increase in the diversity of reported opinions. Yet, as mentioned above, this did not affect the group means. Such analysis is illustrated in *Table 11*.

5.3 Student responses in detail

Question #1: The Environment is the World Around Me. 28 of the students on the pre-activity questionnaire answered "strongly agree" or "agree" to Question #1. All 29 of the students on the post-activity questionnaire answered "strongly agree" or "agree" to Question #1. This indicates that only one of the students changed their minds after the activities. The researchers believe that the students had prior knowledge that affected the answer to Question #1. This possibly indicates that the curriculum emphasized this concept and students understand this concept from previous instruction. Although no gain was detected in mean scores for Question #1, increased group homogeneity exceeded the standard deviation of variations in IQVs for all the considered items (St.dev = 0.15).

Question #2: Habitats Are Where Creatures, Like People, Plants, and Animals Live. 24 of the students on the pre-activity questionnaire answered "strongly agree" or "agree" to Question #2. On the post-activity questionnaire, 24 of the students either strongly agreed or agreed to Question #2. Two students disagreed with Question #2 on the post-activity questionnaire. Similar ratings on both the pre- and post-activity questionnaires indicated little change in student knowledge during the study. The student answers indicate that a majority of the students understand the basic concept of a habitat.

Question #3: Habitats Provide Food, Water, Shelter, and Space for Living Creatures in a Specific Climate. 26 of the students either strongly agreed or agreed to Question #3 on the pre-activity questionnaire. Two students strongly disagreed to question #3 on the pre-activity questionnaire. 24 students either strongly agreed or

agreed to Question #3 on the post-activity questionnaire. One student disagreed with Question #3 on the post-activity questionnaire. Similar ratings on both the pre- and post-activity questionnaires indicated little change in student knowledge during the study. Much like in Question #2, the majority of the students' answers indicate that students understand the basic concept of a habitat. Lack of variation suggests that the activity does not enhance the understanding of such notion.

Question #4: Pollution Is a Problem in Our Environment. 25 students either strongly agreed or agreed to Question #4 on the pre-activity. One student strongly disagreed to Question #4 on the pre-activity questionnaire. Twenty-seven students strongly agreed or agreed to Question #4 on the post-activity questionnaire. One student strongly disagreed to Question #4 on the post-activity questionnaire. Similar ratings on both the pre- and post-activity questionnaires indicated little change in student knowledge during the study. The researchers believe that the students had prior knowledge that affected the answer to Question #4. This possibly indicates that the curriculum emphasized this concept and students understand this concept from previous instruction. Although sample variation was not significant, Classroom B reported significant increase in awareness concerning the dangers of pollution. However, further studies are needed to establish whether this is due to the demographics of the Classroom or to other variables.

Question #5: Living Creatures like People, Animals, and Plants Depend Upon Each Other to Survive. 22d students either strongly agreed or agreed to Question #5 in the pre-activity questionnaire. One student strongly disagreed to Question #5 in the pre-activity questionnaire. 26 students either strongly agree or agree to Question #5 in the post-questionnaire. One student disagreed to Question #5 in the post-questionnaire. This indicates that the concept that creatures are dependent upon each other to survive was clear to most students after the activities. Again, as seen in *Table 11* Classroom B leads the change in the sample, thus increasing the overall homogeneity of the group.

Question #6: I Can Help the Environment. 28 of the students strongly agreed or agreed to Question #6 in the pre-activity questionnaire. All 29 of the students strongly agreed or agreed to Question #6 in the post-activity questionnaire. Prior knowledge and experience affected the ratings of the pre-activity questionnaire. The post-activity questionnaire responses indicate that all students believed that they can positively affect or change the environment. Although not a clearly demonstrated result of the study, this concept is enlightening and encouraging for the researchers in general. The responses may indicate that the curriculum at this school site is affecting attitudes of change towards the environment. Further research in this area is needed to define student attitudes and changes in attitudes over time after instruction towards this concept of being an agent of change for the environment.

Question #7: Artists Can Make Art about the Environment. 25 students strongly agreed or agreed to Question #7 on the pre-activity questionnaire with one student who strongly disagreed. Twenty-six students strongly agreed or agreed to Question #7 on the post-activity questionnaire with none of the students rating as disagree. This indicates that one student changed their mind about environmental art, but also possibly indicates that prior knowledge and the students' previous art experiences may have been linked to environmental art. Further research in this area is needed to confirm students' previous art experiences and the focus on environmental art in the curriculum.

Question #8: Artwork Can Help the Environment. 13 students strongly agreed or agreed to Question #8 on the pre-activity questionnaire. 11 students disagreed or strongly disagreed with Question #8. 14 students strongly agreed or agreed to Question #8 on the post-activity questionnaire and six students strongly disagreed. The activities changed some of the students' understanding that artwork can help the environment. This concept of social activism through the artwork or the act of making artwork is an important part of the philosophical shift the researchers were emphasizing. Although six students still strongly disagreed with the concept, the researchers understand that changing basic philosophy and beliefs takes time. It is encouraging to see that activities can be planned to affect philosophical change as indicated on the post-activity questionnaire by fourteen student responses of strongly agree and agree, and the movement of five student responses from the rating of strongly disagree or disagree by comparing pre- and post-activity questionnaire responses. More research in this area is needed to better understand students' thoughts about artwork and how the artwork itself can be an agent of change. It is interesting to the researchers that the responses from Question #6 about the students being agents of change were very different from the responses to Question #8. A closer look at each individual student, including interviews, would be interesting to discover how students view the role of artwork concerning environmental change. A most likely explanation is that there were changes in the perception of self-efficacy: this is highlighted by the fact that Question #8 resulted in mean score gains for the entire sample, and yet no change was detected in terms of overall sentiment diversity. That scenario is typical of situations in which a small subset of the sample greatly increased their attitude in face of another subset that consolidated their views.

Question #9: Looking at Other People's Artwork Can Help Me to Make My Own Artwork. 19 students strongly agreed or agreed with Question #9 on the pre-activity questionnaire. Five students disagreed or strongly disagreed to Question #9 on the pre-activity questionnaire. 27 students strongly agreed or agreed to Question #9 on the post-activity questionnaire. One student disagreed on Question #9 on the post-activity questionnaire. This indicates that most students found that looking at others' artwork affected their own artwork during the study. That is the only Question in which the mean Likert score increased greatly: 1.00 point for Classroom A and 0.43 points for Classroom B. Cohesion developed as a result: the overall IQV variation was -28.5%, and the negative number stands for enhanced homogeneity in the sample's reported opinions. This was one concept that was emphasized each time the researchers worked with the students. This is an encouraging sign that purposeful modeling lessons that focus on environmental artists can possibly affect student artwork.

Question #10: I Am an Artist. 25 of the students strongly agreed or agreed to Question #10 on the pre-activity questionnaire. 27 of the students strongly agreed or agreed to Question #10 on the post-activity questionnaire. This indicates that the majority of the students had a strong previous concept of themselves as artists. It could be theorized that, since Classroom A led the change in terms of perception of other people's artwork as viable sources of inspiration, this might have triggered even greater self-efficacy in the involved youngsters—as shown in *Table 11*.

5.2 Analysis of responses within each classroom

The researchers also considered shifts in responses from the pre-activity questionnaire to the post-activity questionnaire within each classroom. In Classroom A, students shifted their responses minimally to all the questions. Although minimal, a noticeable shift in responses in classroom A concerned question #9. Five students who responded on the pre-activity questionnaire either strongly disagree or disagree shifted their answers on the post-activity questionnaire. On the post-activity questionnaire for question #9, none of the students responded "strongly disagree" or "disagree". It is interesting to note that, in Classroom A, students were affected by the study and changed their minds about how viewing other peoples' artwork can change their own artwork. Further research on how this change occurs is suggested for the future.

In classroom B, students shifted their responses minimally to all the questions. The noticeable shift of three students on the pre-activity questionnaire to the post-activity questionnaire for question #8 from disagree to neutral may indicate that some students did not fully understand the questions but this assumption cannot be considered conclusive. Overall, the ratings for both classrooms A and B were consistent when comparing pre- and post-activity questionnaires.

5.3 Analysis of teacher responses

Both teachers either strongly agrees or agrees to all questions on the pre-activity questionnaire and the post-activity questionnaire. This indicates that the concepts and teaching approach of the teachers are similar to what the researchers initially expected. The extended responses on the pre-activity questionnaire were interesting, but brief. The researchers were disappointed to see the extended responses for both teachers on the post-activity questionnaire were to refer to the pre-activity questionnaire. Although the teachers were allowed to write as much as they wished, both teachers kept the answers. The written examples of arts integration in the classroom did not provide enough detail for the researcher to evaluate. Further research that includes interviews and review of lesson plans would provide more data to better understand the teachers' role.

6. Conclusion

The researchers are encouraged by the study in that students understand basic concepts about environmental issues and can relate these to visual art. It is also encouraging to see that students consider themselves to be artists and that through a series of lessons, they believe that their artwork can positively affect environmental change. This idea of being an agent of change is important for students as this leads to self-reliance, self-confidence, and self-efficacy. The students are able to make their own decisions and feel confident in their decision-making process. As these second graders grow into adults, they will take these experiences with them into their lives and workspaces of the future. The researchers believe it is our duty as citizens of the earth to help create positive and healthy attitudes in students and to promote a level of respect and concern for the natural world. And finally, the evidence suggests that even young children can be guided to become sensitive to the needs of the environment, which will help them per-

sonally to develop compassion for nature, their communities, and the world at large.

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