Education that Fosters Environmental Literacy

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Abstract

This study was conducted to examine the effects of exploratory play in nature combined with locally based, environmental education (EE), on the environmental literacy (EL) of students in a lower elementary Montessori classroom. The study included one lower elementary Montessori classroom consisting of 24 students of which there were 12 girls and 12 boys, ranging from six to nine years of age. Activities consisted of environmental games, environmental art, lessons and activities that were designed to develop knowledge of the flora and fauna in and around the school. Lessons were followed with opportunities to write/draw reflections on lesson content or complete additional research. Data included questionnaires completed by students before and after the study, parent surveys, student interviews, teacher observations, and samples of student work. Though there were limitations of cold weather and time period, data demonstrated an increase in environmental literacy during the course of the study.

Keywords: environmental education, environmental literacy, Montessori

Environmental Education:

Education that Fosters Environmental Literacy

Literature Review

Environmental education, as defined by the North American Association for Environmental Education (NAAEE), is a process to inform individuals about the environment and to teach the skills necessary to address the needs of the natural world ("environmental education," n.d.). The Minnesota Association for Environmental Education (MAEE) states that the goal of environmental education is to create environmentally literate citizens. Environmentally literate people have emotional connections with the natural world, are aware of environmental concerns, and will demonstrate responsible actions to care for the needs of the environment ("create environmentally", n.d.) Environmental literacy requires an emotional commitment that will motivate and justify the time and resources needed to accomplish the task. For this type of inspiration, developmentally appropriate practice is required. Children, ages 6-9 should be called to first, build upon their empathy for the natural world and then further develop this empathy through exploration of the environment (Sobel, 1996). This research will explore developmentally appropriate games, activities, and curriculum that can positively affect the environmental attitudes and actions of elementary students.

Evoking Emotional Connections to the Natural World

There is much education in the classroom about the dangers of losing our natural resources around the world. Children are taught about the shrinking of the rainforests, the reckless killing of many animals that is leading them to extinction, and how our landfills are

increasing. However, is this type of education the answer to these growing problems? David Sobel, senior faculty member in the education department at Antioch University and a well-known author and speaker on the subject of environmental education, has also addressed this question. He feels that our push to have children educated about the very real and threatening environmental issues around the world has caused them to shut down, a sort of dissociation towards something that feels too large and too distant to touch (Sobel, 1996). This type of environmental education places an emphasis on a reactive, rather than a preventative approach. Too much of our classroom environmental education is problem centered and negative in its' tone (Song, 2008). Richard Louv, author, co-founder, and chair of the Children and Nature Network, also addresses these issues and concerns. Louv interviewed parents, children, and community groups across the country and noticed the changes that had occurred over the years in the relationships between children and nature. Sobel quotes Louv in saying "While children do seem to be spending less time physically in natural surroundings, they also seem to worry more about the disappearance of nature-in a global sense-than my generation did…As a boy, I was intimate with the fields and the woods behind my house, and protective of them. Yet, unlike these children, I had no sense of any ecological degradation beyond my small natural universe" (Sobel, 1996, p. 5). Sobel believes that this weight that we have placed on young children about "ecological degradation" is only pushing them further away.

Factors that Affect Environmental Literacy

How then, do we inspire children to connect with and care for the environment without weighing them down? It is imperative to understand the factors that influence positive environmental behaviors. Experts in ecopsychology recognize that children are born with

nature-based genetic coding and instincts. Therefore, they are born with a connectedness to the natural world. This connection should be nurtured at an early age. Providing regular exposure to and play in the natural world can positively impact a young child's connection with and attitudes towards nature. (White, 2011 as cited by Kemple, Kenney, and Smith-Bonahue, 2016) Experts such as Chawla and Sobel indicate that many ecologists recount their early childhood exposure to nature as a leading factor to their journey into their field. According to Chawla (1999) and Sobel (2012), this exposure is often more open ended and may even be destructive play in nature (cited in Laired, McFarland-Piazza, and Allen, 2014). Two surveys were distributed to approximately 73 parents and educators designed to qualify their connection to nature and compare this to their childhood experiences in nature. The results of this study concluded that positive childhood experiences in nature have a positive impact on adult environmental attitudes and actions (Laired, McFarland-Piazza, and Allen, 2014). On the other hand, children that grow up without such exposure can begin to see themselves as separate from the natural world. According to White (2011) and Sobel (1996), this can cause a disconnect with nature and can grow into unhealthy use and abuse of our environment (cited in Kemple, Kenney, and Smith-Bonahue, 2016).

Children are, however, limited in their exposure to nature by the adults who care for them. Our current day society brings about new concerns for parents and, as a result, children are often "bubbled wrapped" for protection. There are more eye catching and even addictive indoor activities available for children today which are a significant competition to outdoor play. The responsibility relies on the adult to intervene and facilitate such outdoor exposure. You do not have to be an environmental expert to provide these types of outdoor experiences. As suggested by Young Imm Kang Song (2012), children can be invited into "seeing differently"

while in nature by looking up high, upside down, or intensely at a small object or piece of ground. In Rachel Carlson's book, *The Sense of Wonder* (as cited by Song, 2012) it is suggested that rather than a series of facts, children are drawn to the positive feelings and experiences of the adults in their lives. Based on this concept, Song (2012) suggested that teachers start by sharing a memory of a special place in nature, maybe one that she visited as a child. The teacher then guides the students to share their own special places. She might use guiding questions that would tap into their senses and lead to stronger descriptions. This activity might then facilitate and deepen the emotional connections to their special place.

In the article "Children's Connection to Nature," factors that influence a child's affective attitude towards nature were measured. Data from surveys of 1432 students from Brevard County, Florida, was collected to measure these factors. The results demonstrated that proximity of natural environments near the home, knowledge about the environment, and previous experience in nature all were positively associated with their connection to nature. Another key factor that contributed positively was family values. This research concluded that children's feelings of connection to nature would positively affect their interest in nature based activities and environmentally friendly practices (Cheng & Monroe, 2012).

In another study seeking to isolate additional factors that influence environmental literacy in students, Tayci and Uysal (2012) conducted a study of 418 eighth grade students from schools in Corlu, Turkey. The focus of their study was to explore the effects of gender, demographics, and levels of parental education on environmental knowledge, consciousness and attitudes. The research completed indicated a significant difference in the environmental consciousness and attitudes with girls carrying a higher score than boys. The results also indicated that middle and higher socio-economic groups scored higher on environmental knowledge and consciousness.

This was attributed to greater opportunities and access to outings, opportunities, and resources. In addition, analysis of results indicated that educational levels of parents significantly impacted student scores. This data suggests a responsibility of the school to provide equal opportunities for all students regarding exposure to nature and environmental education. This research also draws attention to the emotional differences between children, whether differentiated by gender or otherwise, as an additional factor influencing environmental literacy.

Place-Based Education

While there are many factors that influence the child outside of the classroom that are important to keep in mind, the factors we have the most control over are what we provide within the classroom experience. There have been several studies that have addressed this topic in attempts to find curriculum and techniques that will achieve the much needed goal of fostering environmental literacy. One method is place-based education. "Place-based education is the process of using the local community and environment as a starting point to teach concepts in language arts, mathematics, social studies, science and other subjects across the curriculum" (Sobel, 2004, p. 6). The purpose of this method of education is to step out of the classroom and creating meaningful, real-world experiences that support developmentally appropriate, educational goals. A study was conducted by Teresa Shume (2016) focused on the concept of place-based learning. Students in this study were taken to a nearby regional science center where they collected, planted, and transplanted seeds for a prairie restoration project. The data collected from teacher observations and student artifacts demonstrated this project was an effective curriculum for inspiring and enticing students towards environmental literacy.

Empathy between the child and the natural world is fundamental in environmental education. Sobel states. “What’s important is that children have an opportunity to bond with the natural world, to learn to love it, before being asked to heal its wounds” (Sobel, 2012, p. 13). A study was conducted by Dr. Jürgen Drissner, Prof. Dr. Hans-Martin Hasse, and Dr. Katrin Hille of the University of Elm, Germany, on promoting empathy and increasing positive attitudes towards small animals. In this study, a group of children spent time in a Green Classroom. They were invited to explore small animals in the environment, gently capturing them, observing and drawing them before safely returning them to the environment. The results of this study showed an increase in positive attitude towards utilization of the environment as well as a rise in intrinsic motivation towards learning about animals in the environment (Drissner, Hasse, and Hille, 2017). This conclusion supports Sobel’s previously mentioned stance that a child must connect with the natural world in meaningful ways before they will feel a responsibility to protect it.

Art and Nature

While going out into the community has many benefits, there is education within the classroom that can also foster environmental literacy. In a study conducted by Susan Britsch of Purdue University, Indiana, (2001), the links between science activities and literacy were observed in the classroom, with the intent of determining how they affect the child’s ability to learn about the environment. This half-day program provided lessons and activities to kindergarten children who, in turn, expressed their learning through drawings or writing. Data was also gathered through videotaping the activities and informal interviews. The data demonstrated that, through these hands on, developmentally appropriate lessons, children were able to create non-narrative, graphic representation of their interpretation of change in the

environment. Using art to express their learning may have created additional emotional connections to the world around them. This connection was also seen in Young Imm Kang Song's study on Art in Nature and Schools. In this study, Nils-Udo, an artist, was interviewed and his work was analyzed. Nils-Udo, originally a painter, later turned to using natural materials such as stones, berries, leaves, and bamboo sticks in his work. Song refers to Elliot Eisner who has written extensively on the subject of art and nature. "Eisner suggests that children can use art to question and reflect on sensory information from their daily lives, and from this reflection develop insight, awareness, and critical thinking skills" (as cited in Kang Song, 2010, p. 2). Creating art with natural materials has the potential of building meaning and usefulness of our natural world. Maxine Greene (as cited in Kang Song, 2010, p. 3) reinforces the idea that "aesthetic understanding can be deeply engaging to learners and can highlight things that had previously gone unnoticed, thus providing new insights in the life of the viewer." Art not only engages the senses, it also engages the emotions, giving children the opportunity to be positively impacted by the natural world around them.

It is a significant challenge to determine the success of the efforts put forth to connect young children to nature, when they are still developing their higher reasoning. The skill of higher reasoning allows for the ability to think critically, analyze, and verbalize these connections. In addition to utilizing art to build connections to nature, art has also been used as a tool in attempts to discern what feelings young children have about the natural world. As young children often do not have the words to describe what they think and feel, art is often a means for a child express herself. In a study conducted over a period of four years, children were invited to draw pictures through five different strategies. This study was developed in a cyclical manner where one strategy was built off of the previous successes or challenges. The results of this

study determined that inviting children to create a picture of their environment, for a live audience, on a small postcard sized piece of paper was an effective way to see the world through their eyes. To utilize the artwork to draw qualitative data about their connections to nature was possible through content, interpretative, and developmental analysis. It was acknowledged that there is still a level of subjectivity involved in such analysis yet there was still promise in this form of data collection and should be further studied (Sorin, Brooks, & Haring, 2012).

Indirect Impacts of Nature on the Student

There are other ways that children can be positively affected by the natural world that may not even be on a conscious level. A study completed by Jacob Benfield, Gretchen Rainbolt, Paul Bell, and Geoffrey Donovan, looked at the effect of nature views and natural lighting, on students in the classroom. This study compared surveys and grades of students in two identical designed classrooms with an identical curriculum. One significant difference, however, one classroom had a view of a stone wall while the other classroom had a nature view. The set of classes that were housed in a classroom with a large window that framed an open grassy area containing blossoming trees, produced higher test scores and commented more favorably about the course and its instruction. (Benfield, Rainbolt, Bell & Donovan, 2015) There have been many other studies completed at various schools, covering wide age ranges that demonstrate positive effects of natural lighting and nature views on academic performance and hormone levels. This type of factor is more indirect but prompts a new question. Would the presence of such natural lighting in combination with views of the natural world, also positively affect the emotional connection to nature? As children become more aware of the natural world around them, it would be appropriate to consider that they may be drawn to noticing the flora and fauna just

outside of their classroom. These types of observations might lead them to greater discovery and research of these elements of life.

Literature Review Conclusion

If we are to be good stewards of our world, environmental education is a needed element of any classroom today. But is it enough? Knowledge about how the environment functions and the needs that are present today are useless if action does not follow the knowledge. Caring for the needs and the future of our environment takes effort, commitment, and often sacrifice. If there is not a deep set feeling of value for the world we live in, such effort will not feel warranted. However, if we can provide young children opportunities for playful exploration in nature, building emotional connections to the natural world, and have them begin to value and feel the need to support the environment; our world has a better chance. As Sobel said, "Knowledge without love will not stick. But if love comes first, knowledge is sure to follow" (Sobel, 1996, p. 13).

Goals of Study

The goal of this study was to evaluate the impact that playful outdoor exploration and environmental education would have on the attitudes and actions of children age 6-9. It is understood by experts in the field that a foundational element of developing environmentally literate individuals begins with building emotional connections to nature through locally based education and outdoor experiences. The Montessori philosophy and curriculum supports the concepts that all life is interconnected and that our lives today have been impacted by those that have gone before us while at the same time, what is happening today will have an impact of the future. The study seeks to explore how playful exploration, in combination with environmental

education, affects the environmental literacy of children in a Montessori lower elementary environment. Additionally, this study will explore the effects of: parental environmental connections and actions, gender, art, and natural surroundings on the environmental literacy of the focus group.

Methodology

Participants and Setting

The study was conducted at a public, charter Montessori school in a midwestern suburban area. The school houses 221 students grade 1-8 with three lower elementary classrooms (grades 1-3), three upper elementary classrooms (grades 4-6), and 1 adolescent program (grades 7-8.) The participants of this study were a class of 24 lower elementary students, grades 1-3. There were 11boys and 13 girls. The classroom has their own garden patio area connected to their classroom with direct outdoor access from the classroom. The view out the classroom window overlooks a wooded area. Behind the school, a wooded area and a creek run along the border.

Figure 1. – Backyard Area

Figure 2. – Backyard Area

Figure 3. – Classroom Environment

Materials

The materials used for this project were a combination of standard Montessori curriculum in combination with other standard and cross curricular materials.

- Montessori zoology nomenclature
- Montessori botany nomenclature
- Owl pellets
- Fiction and non-fiction books supporting botany and zoology topics
- Nature journals
- Aero garden with lettuce seeds
- Composting experimental pack
- General art supplies
- iPad and video camera for videos and pictures
- Water and nutrients for plant care
- Water and food for animal care

Procedures

Student Survey

The researcher created a survey for students to complete both before and after the study. This survey was an attempt to measure the students interests in being outdoors as this is seen as a key element to impacting later positive environmental attitudes and actions. The following questions were given to the participants. When needed, dictation was provided and clarifying questions were asked for younger students.

1. What is your favorite outdoor activity? _____
2. Have you ever: (circle all that apply) gone fishing, camped, gone on a nature walk (not at School), gone hiking, visited waterfalls, state parks, etc.
3. How do you feel when you go on a nature walk?
4. If you spent an hour in the woods what would you do?
5. Have you seen animals outside of your home? yes no What kind of animals have you seen?
6. Have you seen animals outside of your school? yes no What kind of animals have you seen?
7. Where do you prefer to play inside or outside? (Circle one) Why?

8. What do you do to help protect our earth?

Scoring:

1. 1 point for a nature related activity or an activity that required being outdoors
2. 3 points for having experienced 5 or more outdoor activities, 2 points for 3-4 activities, and 1 point for 1 or 2 activities.
3. 1 point for a positive feeling
4. 1 point for a nature related activity
5. 1 point if animals were seen, 1 point for naming wildlife
6. 1 point if animals were seen, 1 point for naming wildlife
7. 1 point for preferring outside play
8. 1 point for naming an environmentally literate action

Student Journaling

At the beginning of the study, students were asked to complete two journal entries. The first was to respond to the question, "Would you prefer to play inside or outside?" Respondents were to support their opinion with three reasons. The second journal entry was to respond to the prompt, "If I spend a day in the woods, I would…"

Nature Walks

The participants took several nature walks throughout the study. While on the nature walks, the participants would look for signs of animal life through tracks, sounds, and animal excrement. The first walk was guided by a specialist from a local nature center. Additional walks were with the researcher who invited discovery by not specifying what participants should look for.

Figure 4. – Findings of animal life

Figure 5. - Winter walk through the woods

Going Outs

During the course of the study, the participants were given an option to complete some research on ice fishing and earn an opportunity to go on an ice fishing trip. If and how the participants conducted research was individually chosen; though a deadline was given. It was noted by the researcher that even participants that said they preferred playing indoors in the winter, chose to earn this trip. The ice fishing trip was a half day trip that included a nature walk on snowshoes.

Figure 6. Students on the lake with pop up huts for ice fishing

Figure 7. Students in pop up huts fishing with fish finding radar

Classroom Environmental Activities

There are many elements to the Montessori classroom that support the value and appreciation of the natural world. Plants and animals are important elements in the classroom and the children are called to care for them. As they recognize that their actions directly affect the wellbeing of the plants and the animals, it reinforces the interconnectedness of humans and the natural world. These concepts are built into the Montessori classroom environment. Over and above this element of the environment, the researcher conducted the following activities:

- Growing lettuce in an Aero Garden
- Composting
- Study on owls: life cycle, habitat, external parts
- Study on deer: types of, habitat, factors that affect population
- Nature meditations

Growing plants.

In addition to the regular plants that are located within the classroom, lettuce seeds were also planted in an Aero garden. The setup of this particular system allows for a faster growth period which supporting the timing of this research. The class was able to see the seeds grow to full plants within 3 weeks. They needed to watch for the lights on the system to tell them when the plants needed water and/or additional nutrients. They were invited to draw pictures of the growing lettuce in their nature journals. After the plants were large enough, the lettuce was cut and the students made salad cups for snack.

Figure 8. – Beginning seed pods

Figure 9. – Full grown plants

Composting.

Another in class activity was to discuss composting including the benefits, and how they could participate. The researcher set up a composting experiment in the classroom. A container was filled with soil. On one side was placed a plastic cup. On the other side was placed a banana peel. The participants observed the container over the next several weeks to see which item would compost first. They noticed that not only did the banana compost first, it also sprouted a seedling. The cup, on the other hand, did not compost at all.

Figure 10. – Composting experiment

Figure 11. – Composted banana

Owl study.

During the course of the research period, several units were introduced with regards to local animal life. A study of owls was conducted in which students were given lessons on the life cycle, habits, and characteristics of barn owls. Owl pellets were dissected in small groups and games regarding the habits of owls was played as a large group. The students each conducted independent work to research and learn more about owls.

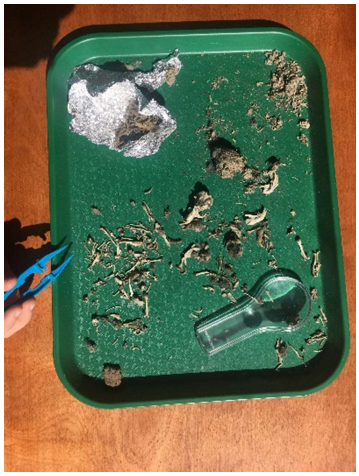

Figure 12. Owl Pellets

Figure 13. Student dissecting owl pellets

Deer study.

A study on deer was also conducted during this research period. Books that taught about the habits and characteristics of deer were read to the class and independent research was

conducted by students. A game called "Oh Deer" was played by the participants to teach about the factors that affect the deer population. A select number of students played the role of a deer and needed to search for their primary needs: food, water, and shelter. These "needs" were passed out to the remaining students. Each deer selected which need they were searching for and sets out to find it. If they didn't find it, they died. Certain influences were also put into the game such as a drought. Any deer looking for water during the drought would die.

Figure 14. – Oh Deer game

Figure 15. – `the "deceased" deer

Nature meditations.

Understanding the need for emotional connections to be built to the natural world, the researcher conducted regular "nature meditations." These meditations took the participants on an imaginary walk through nature in various times of day and weather. At the conclusion of each meditation the students were invited to draw a picture or write about what they experienced, thought about, or imagined during the meditation. At the conclusion of the research period, students were asked to write their own nature meditation.

Figure 16.

Student drawings following nature meditation

Parent Survey

A survey was distributed to parents through Google Forms to gather information about their attitudes towards nature. A pre-existing survey was used. This survey, the Nature Relatedness Scale, was created by Dr. Elizabeth K Nisbet of Trent University. The survey was designed to measure adult connections to the natural world. Several attempts were made to have at least one parent from each family participate in this online survey. The following questions were asked, and the following scale was given:

1	2	3	4	5
Disagree strongly	Disagree a little	Neither agree or disagree	Agree a little	Agree strongly

1. I enjoy being outdoors, even in unpleasant weather.
2. Some species are just meant to die out or become extinct.
3. Humans have the right to use natural resources any way we want.
4. My ideal vacation spot would be a remote, wilderness area.
5. I always think about how my actions affect the environment.
6. I enjoy digging in the earth and getting dirt on my hands.
7. My connection to nature and the environment is a part of my spirituality.
8. I am very aware of environmental issues.
9. I take notice of wildlife wherever I am.
10. I don't often go out in nature.
11. Nothing I do will change problems in other places on the planet.
12. I am not separate from nature, but a part of nature.
13. The thought of being deep in the woods, away from civilization, is frightening.
14. My feelings about nature do not affect how I live my life.
15. Animals, birds and plants should have fewer rights than humans.

16. Even in the middle of the city, I notice nature around me.

17. My relationship to nature is an important part of who I am.

18. Conservation is unnecessary because nature is strong enough to recover from any human impact.

19. The state of non-human species is an indicator of the future for humans.

20. I think a lot about the suffering of animals.

21. I feel very connected to all living things and the earth.

(Nisbet, Zelenski, & Murphy, 2009)

Figure 17. Parent Survey

Student Video Interviews

Working with young children can make gathering information challenging as their writing and reading abilities are limited. Therefore, to gather more fluent information, students were individually interviewed at the end of the study and asked the following questions:

1. Do you enjoy playing outside in nature?

2. What do you like to do?

3. What, if any, nature activities have you liked doing at school?

The interviews were videotaped for ease of recording the participants answers.

Student Written Nature Meditations

At the end of the study, students were also asked to write a nature mediation in a similar manner to the meditations that had been read to them. Some students chose to write more than one but a minimum expectation of one meditation was given.

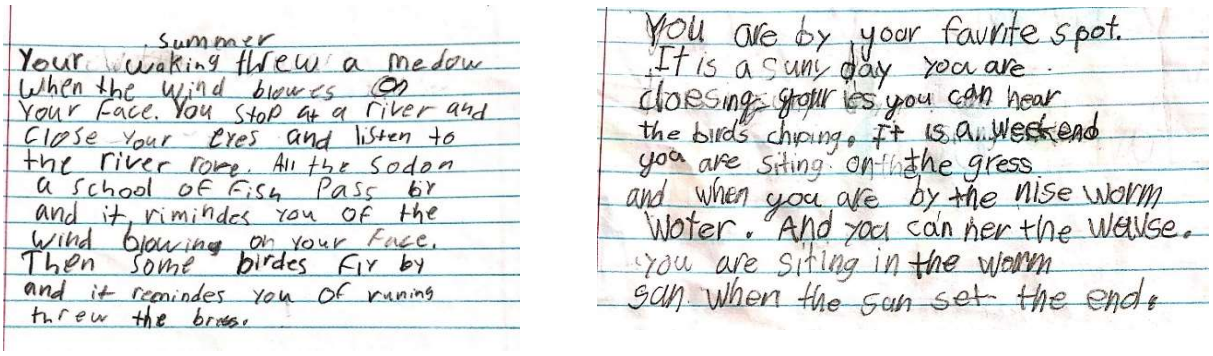

Figure 18. Samples of student written nature meditations

Student Work

Students were invited on several occasions to draw pictures of nature. These opportunities came after nature walks, after nature meditations, and on one occasion as a drawing prompt. This prompt was to draw a picture of what they would like to see when they looked out the window. The result was a wide range of pictures from ocean views to wooded landscapes to more fantasy style drawing such as unicorns. In most circumstances, some level of nature was represented even if it was embellished with fantasy. Below are a few examples of this drawing prompt.

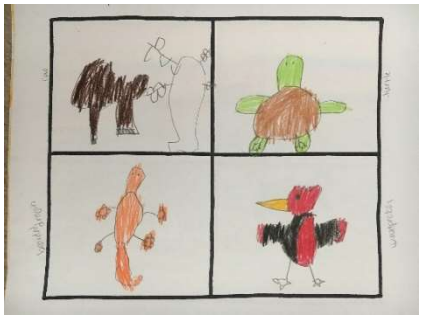

Figure 19. A picture of a "bearded dragon, a cow, a turtle, and a woodpecker."

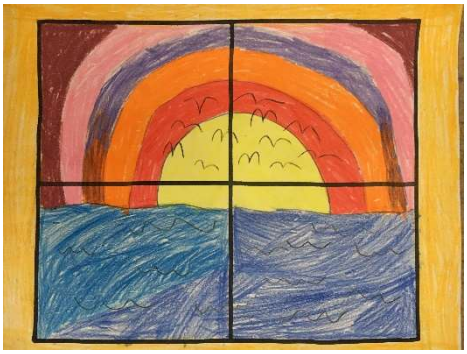

Figure 20. “As the sunset breaks, I’m watching the colors fill the sky over the ocean. The light makes the ocean glimmer, it’s like I’m looking at a rainbow.”

The students were given nature journals to draw pictures of the nature we saw on our outings, the nature that was in the classroom, and pictures of learning that was happening in regards to nature. Some students were very detailed in their work and others used them more for occasional sketching.

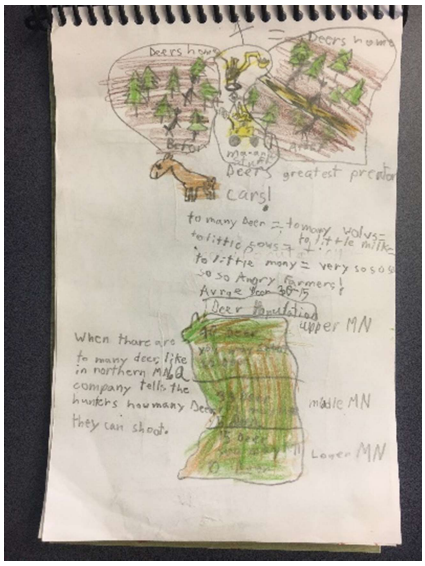

Figure 21. Description of what affects the deer population

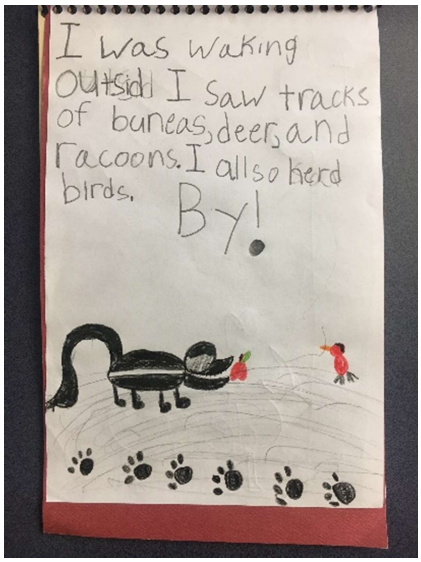

Figure 22. Description of nature walk

Exploring the Data/Results and Findings

Parent Surveys

The parents of all the students were invited to complete the Nature Relatedness Survey. This survey measures an individual’s environmental attitudes. Of the 24 families, 20 students

had one or more parents that responded. The table below compares the student score to the parent score to evaluate the possible influence that caregivers can have on a person's environmental literacy.

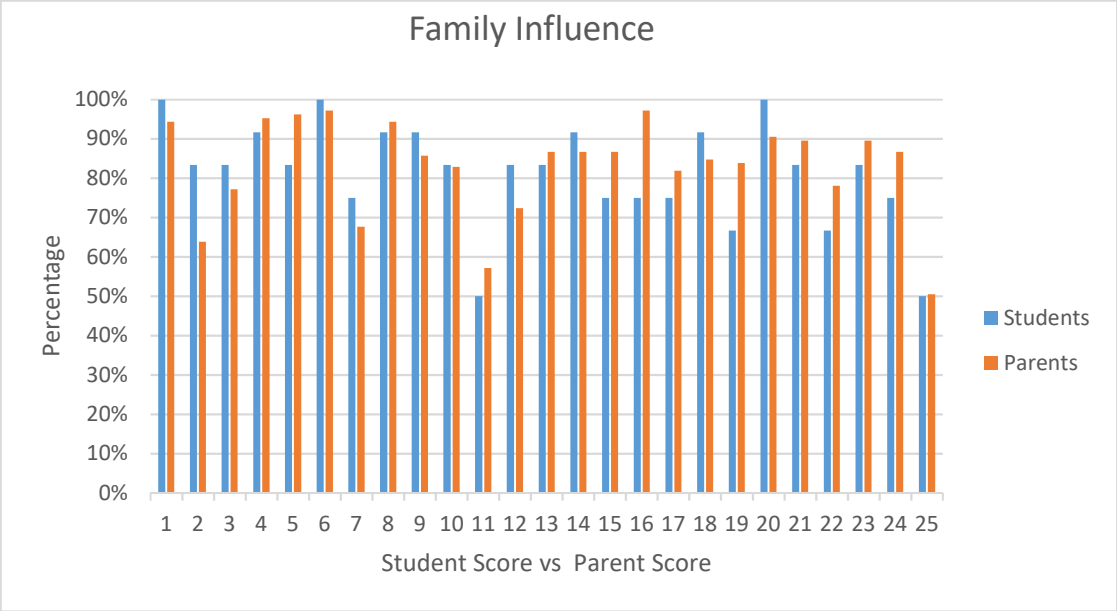

Figure 23. Family influence

The table below demonstrates the differentiation between the student's environmental literacy score and the parent's Nature Relatedness score. Each color represents an individual student/parent differentiation score. The range of differentiation of student to parent, ranges from -17% to 8% with an average difference of -2%. The proximity of scores indicates a positive correlation between the environmental literacy of a parent and the environmental literacy of the child. This finding would support that parental environmental opinions and practices impact their child's environmental literacy.

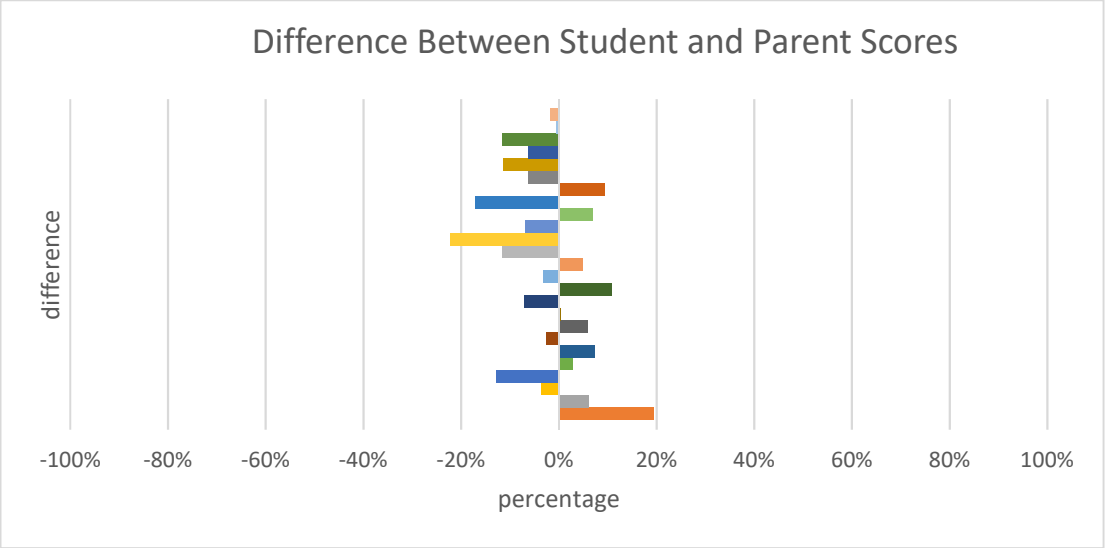

Figure 24. Difference between student and parent scores

Student work

The window drawing was guided with a drawing prompt: Draw a picture of what you would like to see if you looked out the window. A time limit was given to complete the drawing. The pictures were sorted into three categories according to the elements that were in the pictures. Below is a table outlining the results.

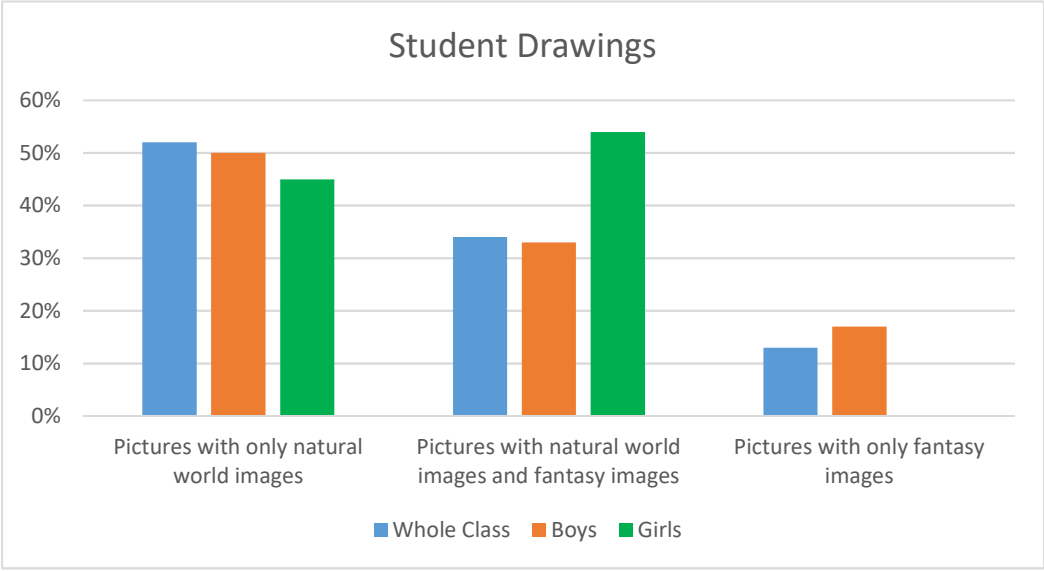

Figure 25. Student drawings

Student Surveys

The students completed a survey to evaluate their environmental literacy. The completed one survey at the beginning of the research period and again at the end of the research period. The table below demonstrates the change in their survey score from beginning to the end of the research period.

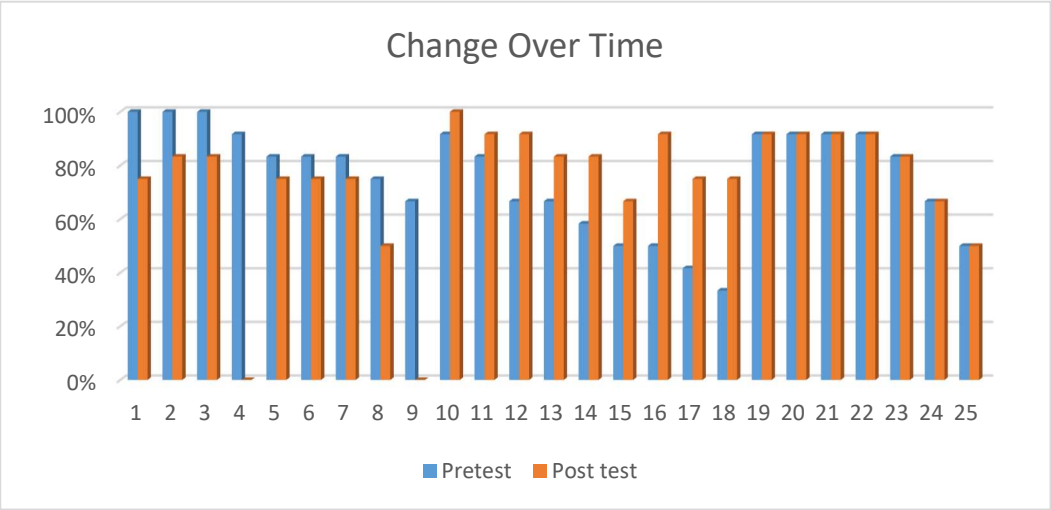

Figure 26. Change over time A

In a summary of the change from the pre-test to the post-test, 64% of the students either increased their environmental literacy score or stayed constant. In addition, 36% of the students decreased their environmental literacy score during the research period.

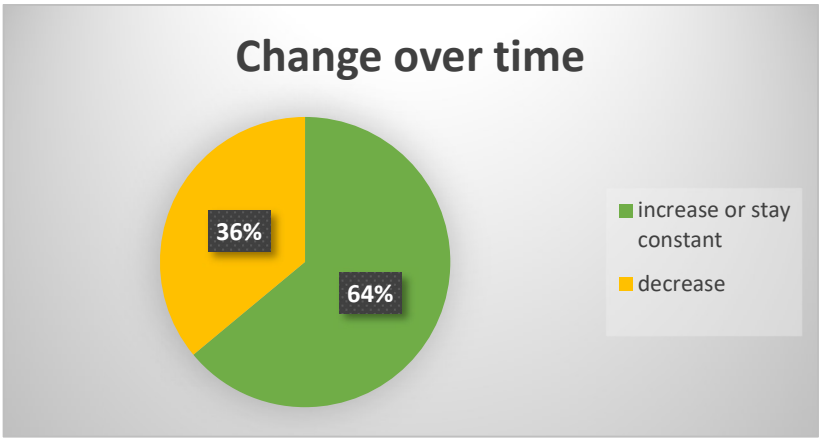

Figure 27. Change over time B

Based on previously mentioned studies, it was found that girls would tend to build stronger emotional connections to nature as they are more relationally focused. Therefore, the researcher compared the final environmental literacy scores of the students to their gender. As seen in the table below, the rate of score to gender are almost identical. In this study, gender was not a contributing factor to environmental literacy.

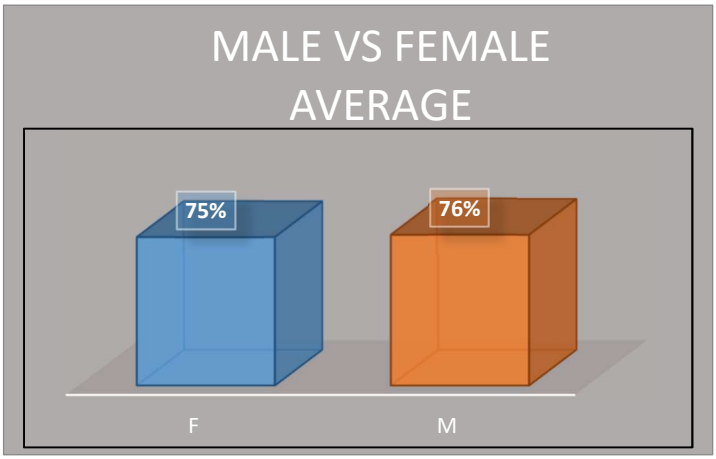

Figure 28. Male vs female

Student Interview Videos

While there was still a split of children that preferred to play inside over playing outside, in the student interviews, 100% of students said they enjoyed playing outside. When asked what they enjoyed doing outside, 45% of the children gave examples of specific ways they enjoyed interacting with nature. Of the 45%, 36% were boys and 63% were girls. Some of the examples given were: playing in the snow, looking for animal tracks, climbing trees, and watching deer.

Limitations and Action Plans for Further Research

While there were many successes involved in this research project, there were also many limitations. The time frame for which the study took place was during the coldest time of the year. This prevented the researcher from completing some of the outdoor activities that would

have been desirable to engage in. There were many days throughout the research period that the cold weather required indoor recess, further limiting the students' ability to explore and follow up with activities orchestrated by the researcher.

The most significant limitation was the time period. As research has shown, the emotional connections that are built during childhood are a foundational element in developing environmental literacy. Fostering a change in emotional connection takes great care and, if genuine, happens over longer periods of time.

Additional limitations are seen with regards to the age grouping of the participants in the study and an accurate means of measuring environmental literacy. There are many different means of measuring environmental literacy, however most are not designed for young children who are still learning basic reading and writing skills, and how to verbalize their thoughts and emotions.

All the activities included in this study were successful in providing opportunities to explore and learn about nature. Extending these types of activities across all seasons will provide more experiences as well as greater depth to students understanding of the world around them. Following specific natural elements through the seasons, such as the creek that runs behind the school, would also broaden the students experience. In warmer months, added additional nature walks to listen to the animals, that are quieter in the winter, and stopping along the way to look at the natural word from different angles or draw a picture are additional activities to try. As the snow melts away and the flora comes alive again, gathering natural elements for art becomes a greater possibility and another means of making connections. Bringing in local environmentalists that specialize in working with young children would also be valuable. On a campus with such a rich wooded area, having a specialist to guide in knowledge

of local flora and fauna would further facilitate the student's connection to the natural world that exists all around them.

Conclusion and Reflection

The purpose of this action research was to determine if exploratory play and environmental education in a lower elementary Montessori classroom would have an impact on environmental literacy. While there were many limiting factors, the data from the student surveys indicate a neutral or positive change in the majority of participants. The impact of additional factors such as gender, family influence, environmental art, and exposure to natural views were also examined.

The environmental literacy scores, when broken down by gender, did not carry significant differences. The drawings of the window scene also did not carry significant differences between boys and girls that included only natural images in their pictures. However, when you combine natural images with natural and fantasy images, the girls percentage is higher. In addition, the student interviews revealed a stronger percentage of female students that chose to interact with nature. While there are some trends, it is inconclusive whether gender has a significant impact on environmental literacy.

Parents took the Nature Relatedness Survey and the scores were compared to the final scores of their child's student survey. The proximity of the corresponding scores demonstrated a positive correlation indicating that family attitudes and actions do have an impact on their child's environmental literacy.

In the course of the study, the researcher conducted observations to listen for increased awareness of the natural world as seen through the large windows in the classroom. There was not a noticeable difference during the research period that would indicate a greater awareness of

the natural world as seen from the classroom. A potential reason for this lack of change could be related to the cold winter and the minimal wildlife seen during this time. As the seasons change, the researcher can continue to observe for increased awareness as the animals begin to come out again and inhabit the wooded area around the school.

The addition of art activities to the environmental education activities was one that the researcher observed to be enjoyed by most all of the participants. When coming back from nature walks or after playing outside, they were eager to draw about their activity. Several students chose on their own to draw in their nature journal about the growing plants in the room or the lessons they were learning about the environment. While this is difficult to quantify, based on students' positive responses, it would seem that art in connection with environmental education connects positively to emotions. With that understanding, therefore, it can be said that art has a positive impact on supporting emotional connections to nature.

Providing environmental education in the classroom is a moral responsibility of teachers for the betterment of our world. However, the way to bring about real change is to tap into the heart of the child, to fuel the emotional connections, and provide meaningful exploration in the natural world. The efforts placed today may not have an immediate impact on the environment but will bring about longer lasting affects if properly nurtured over the early years of a child's life having a greater impact later in life. This way of educating is truly "education for life."

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