International Journal of Early Childhood Environmental Education

Addressing Policy, Practice, and Research That Matters

Yash Bhagwanji, Editor

ISSN 2331-0464 (online) | Volume 10, Number 2 | Spring/Summer 2023

naaee
North American Association
for Environmental Education

International Journal of Early Childhood Environmental Education

Addressing Policy, Practice, and Research That Matters
ISSN 2331-0464 (online)

International Journal of Early Childhood Environmental Education

ISSN 2331-0464 (online), Volume 10, Number 2, Spring/Summer 2023

TABLE OF CONTENTS

International Journal of Early Childhood Environmental Education

ISSN: 2331-0464 (online)

The Effect of Interdisciplinary and Sensory-Based Programs on Preschool Children's Acquisition of the Concepts of Living and Non-Living Things

Evren Cappellaro
Akdeniz University, Turkey
Sinem Gul Aksu
General Sadi Cetinkaya Primary School, Turkey

Submitted November 17, 2022; Accepted June 23, 2023

ABSTRACT

Children's understanding of living and non-living concepts is usually interpreted by a child's degree of cognitive development. However, many studies with a different methodology include biological characteristics demonstrating that young children can distinguish between living and non-living. This research aims to examine the effect of the interdisciplinary and sensory-based education program prepared for preschool children on acquiring living and non-living concepts. A mixed method design was used, involving pre-test and post-test. Seventy-eight children, including 38 in the experimental group and 40 in the control group, participated. An education program was developed and applied to the experimental group for eight weeks. A designed questionnaire was used to collect data. According to the results, a significant difference ($p < 0.05$) existed between the pre-test and post-test of the experimental group scores of plant and non-living categories, but in the animal category, no significant difference ($p > 0.05$) was evident. In the scores of the human category, only five-year-old children's scores were found statistically significant ($p < 0.05$). The children with interdisciplinary sensory-based education explained the living and non-living things primarily through biological characteristics (growth, nutrition, and breathing). These differences were not observed in the control group expressions.

Keywords**:** preschool children, sensory-based education, living and non-living concepts

Concepts are essential in our perception and interpretation of the world. They are abstract representatives of classifications of objects, events, ideas, and behaviors. Concepts organize thoughts (Kurt, 2020) and improve learning (Hayran, 2010). Conceptualization is a cognitive skill and is a process of abstraction. During conceptualization, individuals associate their new experiences with their old ones and knowledge, and while making this association, they use synthesis, classification, and linguistic skills (Borghi et al., 2019; Stavy & Wax, 1992). According to some researchers, concept learning can explain psychological perspective and focuses on how cognitive conceptualization occurs (Brainerd, 1977; Carey, 1985; Piaget, 1929; Speece & Brent, 1984). Some researchers find the explanation in the framework of science education (Bretz, 1994; Develay, 1992; Giordan & DeVecchi, 1987). Studies focus on strategies (De Cecco, 1968; Klausmeier, 1992; Merrill et al., 1992) and models (Bhagat et al., 2016; Gilbert, 2010; Holbrook et al., 2022) of concept teaching.

Concept learning starts early and is conducted in a planned manner within the formal education system. Concepts not adequately formed at the right time can negatively affect the learning processes of children and even adults (Gordon, 1996). Children are thought to complete their lack of theoretical knowledge with misconceptions (Noureddine & Zouhaire, 2017; Ozgur, 2018; Yagbasan & Gulcicek, 2003). Incorrectly learned concepts can sometimes cause new concepts to be learned improperly. Therefore, it is necessary to evaluate and support children's concept development in their early life stages. Preschool education is fundamental and critical. During this

period, children are curious and more sensitive about their environment (French, 2004). The concept development of a child gains a more systematic structure during the preschool period.

Interdisciplinary and Sensory-based Education as a Teaching Concept

A particular scientific discipline does not shape preschool children's concepts; they perceive concepts as a whole (Yurttas et al., 2020). Therefore, learning activities within preschool can be designed to take an interdisciplinary approach. The National Academy of Science (2004) defines interdisciplinarity as "a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice" (p.26). In interdisciplinary learning, the teaching contents are much more engaging and relevant. This approach helps develop children's thinking skills and helps them learn and explore many complex ideas (Dinuta, 2015). Moreover, it adds fun to children's lives and learning without being limited to disciplinary knowledge (Bhise, 2020). Studies in preschool education also illustrate that this approach is useful (Cengizhan & Balci, 2022; Convertini, 2020; Gulay-Ogelman & Durkan, 2014).

In order for concept learning to occur, first of all, observations and experiences should be realized. Children's concept acquisition through experiences can only occur when they use all their senses in their observations, enabling them to connect the objects and events (Suryaratri & Prayitno, 2019). The number of sensory organs involved in learning eases concept acquisition (Fleming & Levie, 1979; Tan & Temiz, 2003). Sensory-based activities allow children to explore their environment using more senses (Tekerci & Kandir, 2017). Sensory-based education is an approach to helping children develop their skills and knowledge from the first years of their lives (Besir, 2020; Uyanik Balat et al., 2005; Yaswinda & Yulsyofriend, 2019). This step increases the child's mental capacity and expands their abstract-thinking skills (Cosgrove & Ballou, 2006). According to Celik (2010), "It is known that the information and skills are perceived more easily and take place in the human brain more permanently via the approaches that appeal to more than one sense" (p. 779). Hence, one can say that sensory-based education creates a more successful learning process than other teaching approaches (Shams & Seitz, 2008). This phenomenon occurs when the studies conducted with this educational approach are primarily used in educating disabled children (Henry, 1998; Yildirim Dogru & Cetingoz, 2017) or language education (Birsh, 2005; Hayran, 2010). Some studies addressed preschool children's environmental perceptions (Ozdemir & Uzun, 2006; Xu et al., 2022; Yaswinda & Yulsyofriend, 2019), scientific process skills (Tekerci & Kandir, 2017; Yaswinda, 2016), development of sensory experiences (Besir, 2020), and creative thinking skills (Koyuncuoglu, 2017). Yaswinda and Yulsyofriend (2019) studied the cognitive skills of 4–5 years old children and reported increased cognitive skills by implementing a project approach in science learning based on multisensory-ecology. Xu et al. (2022) revealed that visual, auditory, tactile, and olfactory sensations were significantly ($p<0.05$) correlated with children's behavioral experiences aligning with these results.

Children's Conceptions about Living and Non-Living Things

One of the essential concepts taught in science education during preschool is the concept of living and non-living things. In education, living and non-living things are usually regarded as concepts showing children's cognitive development levels (Piaget, 1929; Laurendeau & Pinard, 1962; Rosengren et al., 1991; Backscheider et al., 1993). Piaget's (1929) research on movement criteria is the most critical research on children's cognitive development and concept of living things. Many researchers following Piaget's theory also argues that children cannot distinguish it before age 10 (Laurendeau & Pinard, 1962; Jahoda, 1958; Bayraktar & Kuvvet, 2017; Ozgur, 2018; Ozturk & Tulum, 2021). However, studies conducted afterward showed that children benefit from many biological characteristics ((1) growth, (2) reproduction, (3) respiration, (4) nutrition, (5) excretion, (6) irritability, and (7) locomotion) while explaining the concept of living (Carey, 1985; Gasparatou et al., 2020; Gelman et al., 1983; Hatano & Inagaki, 1997; Leddon et al., 2009; Looft, 1974; Margett-Jordan et al., 2017). These studies illustrate that children have intuitive biological knowledge through observation and apply it when asked to classify objects as living or non-living. These researchers accentuate that teaching these concepts at an early age must be based on the biological characteristics of living things. Inagaki and Hatano (1996), in their research with 5-year-old children, proved that children made fewer mistakes when the questions were based on biological characteristics (nutrition, growth, etc.). In parallel,

Gasparatou et al. (2020) saw that children aged between 4 and 5 had no difficulty defining living and non-living things using biological features after participating in “Philosophy for Children” as a learning environment.

The concept of living and non-living things is a vital science study subject. Despite being educated about the concept, young children have difficulty attributing the characteristics of life to a particular object. Studies have revealed that human beings are the first to emerge as the concept of living things, animals the second, and plants the third (Laurendeau & Pinard, 1962; Richards & Siegler, 1984; Yorek et al., 2009). These studies posed that children of all age groups had difficulty identifying plants as living things and considered them conceptually living things in the real sense between ages 6 and 7. However, Inagaki and Hatano (1996) conducted a study with children aged between 4 and 5 based on biological characteristics and used growth from biological characteristics. They found that children could classify plants as living things. The research conducted on nature and pollution by Tarman and Kent Kukurtcu (2022) with the same age group of children demonstrated similar results.

The literature review demonstrates that existing data seem controversial due to the complexity of the concept, the methodologies, and the research contexts (Zogza & Papamichael, 2000). However, it seems possible for preschool children to learn the concepts of living and non-living things with adequate educational intervention (Bakar et al., 2020; Gasparatou et al., 2020). The acquisition of the living concept occurs when the biological characteristics of plants, animals, and humans can be generalized to all living things. It is necessary to include observations by which children can recognize and distinguish biological characteristics while developing language skills effective in acquiring concepts.

Our study aims to determine whether the interdisciplinary and sensory-based education program affects learning the concepts of living and non-living things in children aged 5 to 6 years. The following research questions were sought:

- Is there any difference between the acquisition of the concept of living and non-living things in the experimental and control group children before and after the application of an interdisciplinary and sensory-based education program?
- Is there any statistically significant difference between the experimental and control groups' pre-test and post-test mean scores?
- Is there any statistically significant difference between the experimental group's pre-test and post-test mean scores?
- Is there any difference between the expressions used by the experimental and control group children to describe plants, animals, humans, and non-living things before and after the educational program?

METHOD

The study was designed in a mixed research model combining qualitative and quantitative data. Experimental research was conducted with a pre-test-post-test control group model. The experimental and control groups were randomly distributed, and a data collection tool was administered to the participants before and after the education.

Study Group

In this study, two groups were formed with 5-year-olds (48–60 months) and 6-year-olds (60–72 months) as experimental groups and two other groups as control groups, also divided into the same age groups. The study participants comprised 78 preschool children, with 38 in the experimental and 40 in the control group, attending two public preschool institutions located in Turkey. A consent form was sent to the families via the school

administration, complying with the permission from the Minister of Education (B.08.4.MEM.07.20.02-605.01 / 11116). Children whose families agreed were included in the study.

Similarities of the experimental and control groups were evaluated with the questionnaire form used to increase the study's internal validity and determine the effect of the education program. The results obtained from this evaluation showed no significant differences ($p > 0.05$) between the experimental and control groups.

Data Collection Tool

The data collection tool was a questionnaire developed by the researcher. The previous questionnaires applied to preschool and elementary school students were analyzed to determine the data collection process and the questionnaire format (Bahar et al., 2002; Lorenzi et al., 2013; Ozgur, 2018; Yesilyurt, 2003; Zogza & Papamichael, 2000). According to Ozcelik (1982), the most effective way to measure concept development is with words and visual forms closely related to the names of the concepts that need to be acquired. Color photographs and two open-ended questions were used in the questionnaire because color photographs are the closest materials to reality, and concrete pictures substantially increase credibility (Nalcaci & Ercoskun, 2005). Two education specialists and a preschool teacher selected the color photographs. The following questions were included: "What do you see in this picture?", "Do you think it is alive, not alive?" "Why is it alive? Why is it not alive?" The questionnaire was presented to ten preschool children to test whether they were comprehensible.

Many studies accentuated that children's perceptions of life differ regarding the four categories: plants, animals, humans, and non-living things (Leddon et al., 2009; Ozturk & Tulum, 2021; Richards & Siegler, 1984; Yorek et al., 2009). Therefore, these four categories were considered to determine the education program's effectiveness precisely. The children's misconceptions, daily lives, school activities and usage in the previous studies were considered in selecting the things. In the final form of the questionnaire, the following categories were used; in the non-living category: robot, sun, moon, doll, and table; in the plant category: seed, violet, pine tree, carrot, and apple; in animal category: butterfly, snail, fish, chick, and cow; and human category: baby, child, adult, and old man pictures.

The Research Process

Before the experimental process, the questionnaire was applied as a pre-test to experimental and control groups. During the study, the concept of living and non-living things was taught in the experimental group with educational activities based on interdisciplinary and sensory-based education for eight weeks. However, the education was given following the Ministry of National Education's instructions in the control group. At the end of eight weeks, the same questionnaire was used as a post-test, and the experimental process was finalized.

Design of Interdisciplinary and Sensory-based Education Program

An instructional design model helps educators organize their pedagogical activity optimally for their educational objective (Branch, 2009). Several models can be used in different settings, such as ADDIE (Analysis, Design, Development, Implementation, Evaluation), ASSURE (Analyze learners, State objectives, Select methods, Utilize media and materials, Require learner participation, and Evaluate), and the Dick, Carey and Carey model (Ozdemir & Uyangor, 2011). Among these models, the ADDIE was the most suitable for the present research's purpose and characteristics. ADDIE approach model comprises five stages: analysis, design, development, implementation, and evaluation.

In the first stage, needs analysis, determination of the program's objectives, content, and subjects, and analysis of the existing research and student characteristics in the field were accomplished. The human resources and time planning were planned in the program's design phase. Subsequently, the topics to be included in the program, the objectives for these topics, and the teaching methods to be used were decided. While determining the program's goals, basic biological characteristics were considered, such as movement, growth, nutrition, respiration, and

reproduction. These five vitality traits were chosen because they were basic, concrete, observable, and suitable for the children's cognitive development participating in education.

In the curriculum development phase, these themes were arranged according to teaching principles (Sunbul, 2010) and listed as a weekly theme. The activities were grouped into human, animal, plant, and non-living things. Determining activities for the five senses (smell, taste, touch, hearing, and sight) were prepared for each category. Each activity addressed one or more senses. Therefore, an interdisciplinary approach was considered. In addition, the program's goals and contents were also arranged according to the psychomotor, social-emotional, and language skills defined in the official curriculum in Turkey. Various methods and techniques were used to prevent uniformity in the activities. At each weekend, general activities supported the new theme learned. Table 1 depicts the weekly schedule of the education program. The sensory organ used in the activities was coded as S: Sight, H: Hearing, Sm: Smell, Tc: Tactile, and T: Taste. Afterward, the discipline of the activity was written: PD: Play and drama, Sn: Science-nature, V: Visual arts, and Tu: Turkish. Finally, numbers indicate the order of activity.

Table 1
Weekly plan of the education program

Week	Subject	Activities
1	General activities related to movement, nutrition, growth, respiration, and reproduction	SHPD1 Living or non-living? SmPD1 Sick Dog TcSnV1 Let us Touch HSn2 What sound? SPDV1 Hardworking Ants
2	Nutrition	TSn1 How does it taste? SPD1 Who ate it? SPD1 Where are the livings one? STu2 My Garden
3	Growth	SHSn1 From Caterpillar to Butterfly SHPD2 Dance with Butterflies SV1 I am making my Butterfly SPD2 Guess what
4	Movement	STPDSn1 What jumps? STPDSn2 Touch it, so it closes/turns off SHPD2 Fun Train SmTu2 Beautiful and Bad Smelling Plant
5	Respiration	STuSn2 Fish in the Classroom SHPD3 Let us Breathe SVSn1 My Respiratory Organs SmSn1 Scent Carts
6	Reproduction	SHTuSn Whose Cub? SPD3 Emperor Penguins SHSn2 How are babies made? SV2 Baby Animals Farm
7	General activities related to movement, nutrition, growth, respiration, reproduction	SPD4 Find Your Move SHV1 Animate or Inanimate Rolls SHSn3 Getting to Know the Animals

8	General activities related to movement, nutrition, growth, respiration, and reproduction	STcSn2 Sweating Flowers SmPDTu1 What Does This Corner Smell? STcSn1 Touch Living or Non-Living

The researcher regularly explained the activity outcomes and steps to the experimental group teachers during the application. The program was applied to the experimental groups for eight weeks, two days a week, at least 60 minutes a day, and at most 75 minutes. Evaluations were made at different times and for various purposes. The first of these tests was the questionnaire before and after the application to determine the children's progress. The second was the evaluation made with teachers to assess the application's deficiencies while the program was implemented.

Data Analysis

Quantitative data were analyzed using children's responses. The Kolmogorov-Smirnov test was used to check whether the difference between the pre-test and post-test total scores of the experimental and control groups was normally distributed. According to normality test values, the data belonging to the experimental and control groups of 5-year-olds [D (38) = 0.178, p > .05] and 6-year-olds [D (40) = 0.200, p > .05] were normally distributed because both p-values exceeded the critical value of 5%.

Before the education, the independent sample t-test was performed to determine if the two groups' concept levels were similar. The pre-test scores of 5-year-olds experimental and control group children were as follows: plant [t (38) =.28, p < .05], animal [t (38) =. 64, p < .05], human [t (38) = 1.60, p < .05], and non-living [t (38) =.49, p < .05]. Then the pre-test scores of 6-year-old experimental and control group children were the following: plant [t (40) =. 25, p < .05], animal [t (40) = 1.78, p < .05], human [t (40) =. 70, p < .05], and non-living [t (40) = .66, p <.05]. No significant difference (p>.05) was detected in the experimental and control groups' pre-tests.

Two-factor ANOVA was used to analyze the difference between the experimental and control groups' pre-test and post-test total scores. Single-factor ANOVA (repeated measures ANOVA) test was used to compare the experimental group's pre-test and post-test.

The questionnaire involved qualitative data from the questions "Why is it alive? Why is it not alive?" According to Bozkurt (2018, p. 7), conceptual development and the development of language skills function as a process of working separately and unitedly. Considering that concept learning and language skills develop together, the expressions used in education were assumed to describe living and non-living things. After the education program, they would also be improved. Therefore, content analysis methods were used. The interviews conducted with children were transformed into written texts. Two researchers read the answers and collected them under specific categories. Finally, the answers given were grouped into seven categories: movement, biological characteristics, behavior, physical characteristics and their relationship with the environment/living things, animism, and others. Table 2 depicts the examples.

Table 2
Sample answers for categories

Categories	Sample answers
Movement	Because it walks, because it moves, it cannot move.
Biological characteristics	Because it is growing, because it is being fed; as it has a baby, as it is not feeding, it does not have a baby.
Behavior	Because it talks, because it laughs because it feels pain.

Physical features	Because it has eyes, has no eyes, because it has feet, it has leaves, it has flowers.
Its relationship with the environment/living things	Because it is food, because birds eat it, it lives in the soil.
Animism	It has been sought only in expressions used when describing inanimate things: as it has eyes, as it has face, as it talks.
Other	Because I like it, as it is wood because I picked it because it is beautiful because it is old.

It is thought that the rapid development of preschool children may affect the study's validity. Internal validity was targeted by making post-test measurements immediately after the education, minimizing this effect.

Findings

Comparison of Experimental and Control Groups' Pre-test and Post-test

The data were collected separately for plant, animal, human, and inanimate pictures to compare the pre-test and post-test total scores. A Two-Factor ANOVA was performed to analyze the differences between the pre-test and post-test total scores of 5 and 6-year-old experimental/control groups, and Table 3 presents the results.

Table 3
ANOVA test results regarding experiment/control groups' pre-test and post-test scores

	Source	SS	Df	MS	F	p
Plant 5 y	Between Groups	21.053	1	21.053	9.345	.004*
	Within Groups	32.895	1	32.895	15.131	.000*
Plant 6 y	Between Groups	42.050	1	42.050	12.938	.001*
	Within Groups	28.800	1	28.800	10.190	.003*
Animal 5 y	Between Groups	3.368	1	3.368	.531	.471
	Within Groups	.000	1	.000	.000	1.000
Animal 6 y	Between Groups	5.000	1	5.000	3.279	.078
	Within Groups	.050	1	.050	2.000	.165
Human 5 y	Between Groups	14.329	1	14.329	9.308	.004*
	Within Groups	3.803	1	3.803	2.973	.093
Human 6 y	Between Groups	.112	1	.112	.456	.504
	Within Groups	.312	1	.312	1.179	.284
Non-living 5 y	Between Groups	16.118	1	16.118	2.281	.140
	Within Groups	1.066	1	1.066	6.025	.019*
Non-living 6 y	Between Groups	9.113	1	9.113	1.376	.248
	Within Groups	2.813	1	2.813	13.073	.001*

When one examines Table 3, the group effect was significant for the experiment and control groups' pre-test and post-test mean scores related to plant and non-living categories. This difference is primarily due to the difference between the average scores of experimental groups' pre-tests and post-tests. The same effect was also observed in the scores of the 5-year-old experimental and control groups regarding the human category.

No significant difference existed in pre-test and post-test scores regarding the animal category. Similarly, no significant differences existed between the pre-test and post-test measurements of 6-year-olds regarding the human category. Therefore, these results depict the effect of education on acquiring the concepts regarding the animal category for 5 and 6-year-olds. However, the human category for 6-year-olds was not statistically significant.

Findings Regarding the Comparison of Experiment Groups' Pre-test – Post-test Test Scores

One-factor ANOVA was performed to compare the experimental groups' pre-test and post-test; Table 4 illustrates the results.

Table 4

Findings of one-way ANOVA test results for 5 and 6-year-old experiment groups' pre-test and post-test

	Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	p
Plant 5-year-olds	Treatment	84.351	2	42.175	29.39	.000*
	Error	51.649	36	1.43		
	Total	172.14	56			
Plant 6-year-olds	Treatment	86.800	2	43.400	23.61	0.00*
	Error	69.867	38	1.839		
	Total	185.65	59			
Animal 5-year-olds	Treatment	0.105	2	0.053	0.073	0.93
	Error	25.895	36	0.719		
	Total	105.368	56			
Animal 6 y-year-olds	Treatment	0.233	2	0.117	0.241	0.79
	Error	18.433	38	0.485		
	Total	68.983	59			
Human 5-year-olds	Treatment	12.772	2	6.386	7.69	0.02*
	Error	29.895	36	0.83		
	Total	59.93	56			
Human 6 y-year-olds	Treatment	0.433	2	0.217	0.712	0.5
	Error	11.567	38	0.304		
	Total	18.933	59			
Non-living 5-year-olds	Treatment	14.982	2	7.491	9.741	.000*
	Error	27.684	36	0.769		
	Total	161.719	56			
Non-living 6 y-year-olds	Treatment	16.633	2	5.317	7.123	0.03*
	Error	39.367	38	1.562		
	Total	177.333	59			

***p < .05**

Table 4 illustrates a significant difference between the experimental group children's pre-test and post-test about plants and non-living things. In addition, 5-year-old children's post-test mean scores ($\overline{X}$ =9.68) were higher than pre-test mean scores ($\overline{X}$ =7.15). Similar results were obtained for 6-year-olds. Children's post-test mean scores ($\overline{X}$ =9.65) were higher than their pre-test mean scores ($\overline{X}$ =7.15). No significant difference was found between

children's pre-test and post-test in the animal category. The 5 year-old-children's pre-test ($\overline{X}$ =9.05) and post-test ($\overline{X}$ =9.10) values and 6-year-old children's pre-test ($\overline{X}$ =9.45) and post-test ($\overline{X}$ =9.5) values were close. A significant difference was found regarding the 5-year-old experimental group children's pre-test and post-test about the human category. Moreover, post-test ($\overline{X}$ =9.91) mean scores were higher than pre-test mean scores ($\overline{X}$ =7.36). No significant difference existed between the 6-year-old experimental group children's pre-test ($\overline{X}$ =9.68) and post-test ($\overline{X}$ =9.93) scores. All these findings pose that the experimental group children's acquisition of living and non-living concepts increased significantly for the post-test than the pre-test.

Findings Regarding the Expressions Used by Experiment and Control Group Children to Describe Living and Non-Livings Things

This section includes the findings obtained via the descriptive analysis method. Table 5 contains the analysis of the experimental and control group children's expressions to explain why plants were living or non-living things.

Table 5
Expressions used by children to define plants

Plant	5-year-olds				6-year olds			
	Experimental		Control		Experimental		Control	
	Pre %	Post %	Pre %	Post %	Pre %	Post %	Pre %	Post %
Movement	14	6	15	19	26	8	23	20
Biological characteristics	25	75	39	46	21	82	24	27
Behavior	5	13	11	7	4	5	5	5
Physical features	19	1	16	16	14	1	14	16
Its relationship with the environment/living things	21	3	18	10	22	10	28	29
Animism	-	-	-	-	-	-	-	-
Other	14	1	1	1	14	1	7	5

When the experimental and control group children's answers in the pre-test were examined, both groups were seen to use expressions belonging to the categories of "biological characteristics" (25%), "their relationship with living things" (21%), and "physical features" (19%). Within the answers in the category of biological characteristics, the statements were primarily related to "nutrition" and "growth."

When the post-test results of the experimental groups were examined, a significant increase was found regarding the expressions in the "biological characteristics" category (Age 5: 75%; Age 6: 82%). The same situation was not seen in the control group, and the difference between the pre-test and post-test percentage values was insignificant ($p>0.05$). The answers in the post-tests for this category were mainly related to "nutrition" and "growth," as in the pre-tests, followed by "respiration" and "reproduction." However, the expression "breathing" was not expressed in the pre-test. In the post-test of the experimental group, children used expressions such as "breathing," "breaths," and "breathes in and out" for plants.

Table 6 presents children's expressions in the experimental and control groups about why the animal was living or non-living things.

Table 6
Expressions used by children to define animals

Animal	5-year-olds				6-year-olds			
	Experimental		Control		Experimental		Control	
	Pre %	Post %	Pre %	Post %	Pre %	Post %	Pre %	Post %
Movement	36	18	50	60	42	18	41	37
Biological characteristics	18	74	13	7	21	70	10	13
Behavior	4	-	3	4	-	1	5	3
Physical features	34	6	16	23	17	6	27	28
Its relationship with the environment/living things	3	2	4	3	7	3	8	6
Animism	-	-	-	-	-	-	-	-
Other	5	-	14	3	13	2	9	13

When the answers by experimental and control group children in the pre-test were examined, different categories emerged regarding experimental and control group children's expressions about animals living or non-living. The common and prominent ones in the pre-tests were the categories of "movement" followed by "biological characteristics." When experimental and control group children's post-test results were examined, a significant increase was found in the expressions of the "biological characteristics" category for experimental group children (Age 5: 74%; Age 6: 70%). In addition, while expressions existed related to nutrition and growth in the pre-tests regarding living things belonging to the "biological characteristics" category, children also used respiration and reproduction concepts in post-tests. The same situation was not seen in the control group, and the answers given in the post-test did not differ markedly from the pre-tests.

Table 7 contains the children's expressions of why humans were living or non-living things.

Table 7
Percentage distributions of the expressions used by children while describing the humans

Human	5-year-olds				6-year-olds			
	Experimental		Control		Experimental		Control	
	Pre %	Post %	Pre %	Post %	Pre %	Post %	Pre %	Post %
Movement	32	23	31	40	31	21	40	36
Biological characteristics	12	70	13	9	15	60	6	12
Behavior	4	2	5	12	5	2	4	12
Physical features	43	5	35	26	34	6	40	25
Its relationship with the environment/living things	-	-	-	-	-	-	-	-
Animism	-	-	-	-	-	-	-	-
Other	9	1	16	13	15	1	10	15

Children's answers in the pre-test were gathered in the "physical features" (Age 5: 43%; Age 6: 34%) and "movement" (Age 5: 32%; Age 6: 31%) categories in Table 7. The answers given in the post-test by the experimental group differed substantially. These differences were related to the category of "biological characteristics" (Age 5: post-test 70%; Age 6: post-test 60%). Children used growth, nutrition, reproduction, and respiration concepts. In this category, the pre-test and post-test answers of the control group did not change.

Table 8 contains the children's descriptions of the pictures of non-living things.

Table 8

Percentage distributions of the expressions used by children while describing the non-living things

Non-living things	5-year-olds				6-year-olds			
	Experimental		Control		Experimental		Control	
	Pre %	Post %	Pre %	Post %	Pre %	Post %	Pre %	Post %
Movement	11	18	10	12	19	20	42	39
Biological characteristics	10	74	-	-	4	58	-	-
Behavior	16	1	19	-	22	5	22	16
Physical features	39	2	29	18	44	6	28	39
Its relationship with the environment/living things	4	-	6	39	-	-	-	-
Animism	10	5	10	8	10	1	7	5
Other	10	-	26	24	9	-	4	3

Their explanations in the pre-test regarding non-living things varied according to age and control and experimental groups. For example, 5-year-old experimental and control group children's expressions were gathered in the "physical features" (Experiment: 39%; Control: 29%). The same category of "physical features" was formed for the 6-year-old experimental group (44%) and the 6-year-old control group children's "movement" (42%). The expressions found in 5-year-old experimental and control group children's answers in the pre-test (experiment: 10%; control: 10%) decreased in the 5-year-old children experimental group after the application (post-test: 5%; retention: 1%). In post-tests, children used "biological characteristics" to explain non-living things. It is because "no aspiration/it is not breathing," "it does not have a baby," "it is not growing," and "it is not eating" were the expressions to show that non-living things did not have these characteristics.

Conclusion and Discussion

Using interdisciplinary and sensory-based education programs, we examined children's acquisition of living and non-living things concepts. Furthermore, we divided the concept into four categories of plants, animals, humans, and non-living things to better detect the differences in conceptual learning. The results of the research are discussed below, considering these categories.

Children's Recognition of Living and Non-living Things

No significant difference ($p > 0.05$) existed between the experimental group children's answers to the pictures about plants regarding their pre-test and post-test scores. This result indicates that the experimental group children's identification of plants as living things increased significantly in the post-test than in the pre-tests. This result differs from those in many studies conducted with children of this age group (Leddon et al., 2009; Yorek et al., 2009), even though these studies accentuated that the concept of living things for plants is acquired later (Opfer & Siegler, 2004). Applying interdisciplinary and sensory-based education programs demonstrated that children could develop these concepts early. They readily described plants as living things after the education-based biological characteristics. As a specific example, the grain was recognized as a living being, 9% for 5-year-olds and 11% for 6-year-olds before education. After education, children easily identified grains as living things (82% for 5-year-olds and 91% for 6-year-

olds). This result aligns with previous research based on biological characteristics. In a study by Inagaki and Hatano (1996) on the concept of growth with 4 to 5-year-old children and another study conducted by Hickling and Gelman (1995) with the concepts of reproduction and growth through seeds, it was stated that after recognizing the characteristics of living things, children could more easily distinguish between living and non-living things.

The children's scores on the pre-test in the animal category were comparatively high, and the research results did not reveal a statistically significant difference. It depicts that children at this age could easily define animals as living things even before education. This result supports previous research findings that children recognize the animals' biological characteristics better than plants' (Keilen & Roy, 1995; Springer et al., 1996; Springer& Keil, 1991). Keilen and Roy (1995) asked children aged between 6 and 13 about the life situations and biological characteristics of animals and plants to examine the acquisition of life concepts. The results obtained in present research about animals and humans were due to children's interest in moving things (Piaget, 1929; Laurendeau & Pinard, 1962; Looft, 1974) and having pets (Hatano and Inagaki, 1994). Children naturally follow the development and skills of many animals with great curiosity.

When the answers belonging to the human category were examined, no significant difference ($p>0.05$) existed between the 6-year-old experimental group children's answers regarding pre-test and post-test scores. However, a significant difference (p-value?) was observed for 5-year-olds in the same category. Considering children's cognitive development, humans should be the first to emerge as a living thing, and animals should be the next (Yorek et al., 2009). Nevertheless, in the answers given in the pre-test, children defined animals as living things better than humans. This situation is thought to be caused mainly by children's reactions to images of older people and babies. Some children could not identify the older man with a cane and the sleeping baby alive. As justification, they stated that neither of them could walk. This result supports the studies' findings, accentuating that the movement feature is dominant in defining living things, especially for 5-year-old children (Piaget, 1929; Poulin-Dubois & Heroux, 1994).

Findings revealed that the experimental group children's acquisition of non-living things concept increased significantly ($p < .05$) in post-test than pre-test measurements. According to other research results, children make fewer mistakes when questioned about stones, toys, household appliances, and cars (Looft, 1974; Richards & Siegler, 1984). However, when children are asked about concepts such as clouds and rivers, children are seen to attribute living characteristics (animism) to them (Laurendeau & Pinard, 1962; Zogza & Papamichael, 2000). Research results in the non-living category aligned with many researchers studying living things' concepts (Inagaki & Hatano, 1996; Gutheil et al., 1998; Taborda-Osorio & Cheries, 2017). They found decreased children's misconceptions when questions and activities were based on biological characteristics (Hatano & Inagaki, 1994).

Children's Description of Living and Non-Living Things

Because concept acquisition and language skills develop together (Birsh,2005) the children participating in the research were also asked why they defined that as living or non-living. We checked whether a change occurred in their expressions after the education. When the experimental group children's answers in the pre-test for the plants, they primarily used the expressions belonging to the categories of "biological characteristics," "relationship with living things," and "physical features." Children used the physical features of plants as living things, similar to the other research results (Villarroel & Infante, 2014). In addition, the frequency of expressions used to explain biological characteristics increased significantly ($p < .05$) in the post-test. While in the category of biological characteristics in the post-test, more expressions about growth, reproduction, respiration, and nutrition concepts after the educational program were evident. For example, they used expressions related to respiration, such as "breathing," "breathing in and out," and "aspirates" for plants. This situation is thought to be caused by the activity of "evapotranspiration flowers" during education. Planting and irrigating the seeds, watching them grow, and observing the flowering process used growth, reproduction, and respiration concepts effectively while defining them as living things. These findings align with the studies of Hickling and Gelman (1995), examining the perspectives of 4-4.5-year-old children on the life cycle of the plant world. In this study, while taking the children's opinions about where the seeds originated, their perception of growth, flower, and fruit concepts was also examined by establishing causal connections. No misconceptions were determined about growth in plants. In the current education program, planting seeds and including plant-growing activities in the classroom allowed children to observe the changes.

These activities enabled them to benefit from the expressions of reproduction, respiration, and biological characteristics, such as growth and nutrition, in explaining plants as living things.

Results obtained from animal and human categories are similar. In the pre-test results of the 5 and 6-year-old groups, expressions were gathered under the categories of “movement” and “physical features.” In some studies, children were said to define everything that moves as alive, and that movement was the first vitality characteristic that appeared in children’s minds (Bahar et al., 2002; Laurendeau & Pinard, 1962; Poulin-Dubois & Heroux, 1994; Yorek et al., 2009). While describing animals and humans as living things, they also used physical features, such as “having hands and arms,” “having eyes,” and “having feet.” It is because it is easier for children to use similarities between humans and animals. Carey (1985) stated that a learned feature about humans can easily be transferred to the animal world. Bahar et al. (2002) reported that children observed animals more daily. In the post-tests, expressions were gathered under “biological characteristics” and “movement.” When the expressions used by the experimental group were examined, children benefited from the butterfly's movement feature to identify it in pre-tests. However, in the post-test, they also mentioned their biological characteristics, such as nutrition, growth, respiration, and reproduction.

Another remarkable example is fish. While explaining the fish as living things, children included nutrition and respiration more in their expressions after the educational program. For example, expressions such as “it has gills,” “breathes in the water,” and “aspirates” were encountered in the post-test. It is thought to be due to the "Fish in the classroom" and “Respiratory organs” activities, examining how fish and people breathe. In addition, the frequency of the expressions they used about why animals are living things doubled after the education.

When the expressions about non-living things were examined, the “physical features” category excelled in the pre-test. After the education, the expressions were gathered under “biological characteristics.” While the animism category was seen in the pre-test, these expressions decreased in the post-test. The results obtained from the study’s pre-test parallel those in many studies (Bahar et al., 2002; Noureddine & Zouhaire, 2017; Yesilyurt, 2003; Zogza & Papamichael, 2000). Bahar et al. (2002) determined that half of the preschool children considered the sun a living thing. The reason was the sun’s movement (sunrise and sunset), heat, and sunlight. Noureddine and Zouhaire (2017) also identified the concept of movement as a major obstacle in teaching the living concept.

Yesilyurt (2003) conducted a study and found that children express the sun’s physical features using expressions such as “it gives us heat and light.” Moreover, evidently, while children argue that the sun is a living thing, they make statements about its biological characteristics. They said, “the sun was moving, breathing, and dying.” While children belonging to both age groups defined the beings as non-living things after education, they used the biological characteristics by giving answers such as “the robot is not feeding,” “not being able to grow,” “not having a baby,” and “not breathing.” Therefore, they indicated that the things they learned during their education did not have the same characteristics as the ones shown. For instance, the results obtained for the robot concept in this study are similar to those in Inagaki and Hatano (1996). The researchers showed pictures of robots, plants, and dogs to 4–5-year-olds and asked which one could grow; the children chose the plant and dog pictures. Wellman and Gelman (1998) conducted a study with 3–4-year-old children and found that most could distinguish a living entity from its non-living copy. Rosengren et al. (1991) found that children understood that animals grew over time, but toys did not. In another study on the same theory, many children in the age group of 4 stated that plants and animals could heal and grow independently. However, those toys did not have this feature (Backscheider et al., 1993). According to post-test results, children described non-living things using expressions belonging to the “biological characteristics” category. The results obtained from the research demonstrate that when children’s activities are based on biological characteristics, their misconceptions decrease.

In closing, interdisciplinary and sensory-based education is very effective in 5 and 6-year-olds’ acquisition of living and non-living things concepts. Similarly, Yaswinda and Yulsyofriend (2019) also found an increase in the cognitive skills of 4–5-year-old children in multisensory-ecology projects. Mustonen et al. (2009) also stated the importance of multisensory education and the permanence of the behaviors and attitudes gained through this education.
Participation in more than one sense of the learning process makes learning more effective (Shams & Seitz, 2008). For example, Xu et al. (2022), in their study based on children's multisensory experiences, concluded that visual,

auditory, tactile, and olfactory senses are significantly related to children's behavioral experiences. Therefore, new teaching programs should be prepared for different concepts enabling preschool children to develop sensory skills and learn more effectively.

Unlike the studies following Piaget's approach of teaching the concept of living and non-living, in this research, no difference existed in concept acquisition between 5 and 6-year-olds after implementing multisensory education. This result poses that this concept can be acquired early. As Birsh (2005) and Bozkurt (2018) accentuated in their research, concept teaching, and language skills developed together, and new words were acquired easily. In this study, paralleling with the results of other studies (Gasparatou et al., 2020), children used more biological characteristics in their expressions after education. The average number of biological characteristics rose in the post-test, and their quality also improved. Our results suggest that interdisciplinary and sensory-based education should be applied in different areas of preschool education.

Statements and Declarations

We declare that there is no competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

We state that the data was collected in accordance with the standards and guidelines of the human subjects review board (or equivalent body) at my home institution. All the required official permissions and ethics form were approved by the Ethics Committee at Antalya of Minister of Education (B.08.4.MEM.07.20.02-605.01 / 11116), a consent form was sent to the families via the school administration.

References

Backscheider, A. G., Shatz, M., & Gelman, S. (1993). Preschoolers' ability to distinguish living kinds as a function of regrowth. *Child Development, 64,* 1242-1257.

Bahar, M., Cihangir, S., & Gozun, O. (September, 2002). Okul oncesi ve ilkogretim cagindaki ogrencilerin canli ve cansiz nesneler ile ilgili alternatif dusunce kaliplari. [Alternative thought patterns of pre-school and primary school students about living and inanimate objects] *V. Ulusal Fen Bilimleri ve Matematik Egitimi Kongresi*, ODTU, Ankara.

Bakar, F., Avan, C., Seker, F. & Aydinli, B. (2020). Plant and Animal Awareness in Nature Education Perspectives: Where is Blindness?. *International Electronic Journal of Environmental Education.*10(*2*),122-136.

Bayraktar, S., & Kuvvet, Z. (June, 2017). *Preschool children's ideas about living things*. 2nd İnternational Baltic Symposium on Science and Technology Education: BalticSTE2017, Siauliai, Lithuania.

Besir, H. (2020). *Bebek kutuphanesinde verilen ''duyusal deneyimler'' egitim programinin bebeklerin gelisim alanlarina ve duyu gelisimine etkisinin incelenmesi*. [Investigation of the effect of the "sensory experiences" training program given in the baby library on the development areas and sensory development of infants]. (Unpublised thesis), Karabuk Universitesi, Karabuk.

Bhagat, K. K., Chang, C. N., & Chang, C. Y. (2016). The impact of the flipped classroom on mathematics concept learning in high school. *Educational Technology & Society, 19*(3), 134–142.

Bhise, C. (2020). Water literacy in preschool education: A resource unit. *International Multidisciplinary E- Research Journal, 236*,109-112.

Birsh, J. R. (2005). *Multisensory teaching of basic language skills* (2nd ed.). Baltimore: Brookes.

Borghi, A. M., Barca, L., Binkofski, F., Castelfranchi, C., Pezzulo, G., & Tummolini, L (2019) Words as social tools: language, sociality and inner grounding in abstract concepts. *Physics of Life Revewiews.* 29, 120–153.

Bozkurt, B. U. (2018). Kavram, kavramsallastirma yaklasimlari ve kavram ogretimi modelleri: Kuramsal bir derleme ve sozcuk ogretimi acisindan bir degerlendirme [Concepts, conceptualization approaches, and concept teaching models: A theoretical review and an evaluation in terms of teaching vocabulary]. *Language Journal, 169*(2), 5-24.

Brainerd, C. J. (1977). Cognitive development and concept learning: An interpretative review. *Psychological Bulletin. 84*(5), 919–939. https://doi.org/10.1037/0033-2909.84.5.919

Bretz, S. (1994). *Learning strategies and their influence upon students' conceptions of science literacy and meaningful learning*. (Unpublished doctoral dissertation), Cornell University, İthaca, NY.

Carey, S. (1985). *Conceptual development in childhood.* Cambridge: Mit Press.

Cengizhan, S. & Balci, S. (2022). Evaluation of students', teacher's, parents' views on interdisciplinary preschool education teaching on science practices. *Cumhuriyet İnternational Journal of Education, 11*(1), 164-176. https://doi.org/10.30703/cije.975249

Convertini, J. (2020). An interdisciplinary approach to investigate preschool children's implicit inferential reasoning in scientific activities. *Research in Science Education, 51*, 171– 186. https://doi.org/10.1007/s11165-020-09957-3.

Cosgrove A. S., & Ballou R. A., (2006). A complement to lifestyle assessment: Using Montessori sensorial experiences to enhance and intensify early recollections. *The Journal of İndividual Psychology, 62*(1), 47-58.

Celik, B. (2010). Piyano egitiminde video kamera kullanimi [Video camera use in piano instruction]. *Gazi Egitim Fakultesi Dergisi, 30*(3), 785-800.

De Cecco, J. P. (1968). *The psychology of learning and instruction: Educational psychology.* Englewood Cliffs, NJ: Prentice-Hall.

Develay, M. (1992). *De l'apprentissage à l'enseignement* [From learning to teaching]. Paris: ESF.

Dinuţa, N. (2015). Methodical aspects regarding the interdisciplinary approach of mathematical contents in preschool education. *Procedia- Social and Behavioral Sciences, 180*, 780-787. https://doi.org/10.1016/j.sbspro.2015.02.203.

Fleming, M., & Levie, W. H. (1979) *Instructional message design. Principles from the behavioral sciences.* (2nd ed.) Englewood Cliffs, New Jersey

French, L. (2004). Science as the center of a coherent, integrated early childhood curriculum. *Early Childhood Research Quarterly, 19*(1), 138-149. https://doi.org/10.1016/j.ecresq.2004.01.004

Gelman, R., Spelke, E., & Meek, E. (1983). What preschoolers know about animate and inanimate objects. In D. Rogers & J. Sloboda (Eds.), *The acquisition of symbolic skills* (pp. 297-326). New York: Plen

Gilbert, J. K., Bulte A. M.W. & Pilot A. (2011). Concept development and transfer in context-based science education. *International Journal of Science Education, 33*(6), 817-837. https://doi.org/10.1080/09500693.2010.493185

Giordan, A., & DeVecchi, G. (1987). *Les origines du savoir* [The origins of knowledge]. Neuchatel, Switzerland: Delachaux.

Gordon, J. (1996). Tracks for learning: Metacognition and learning technologies. *Australian Journal of Educational Technology. 12*, (1), 46-55.

Gasparatou, R., Ergazaki, M. & Kosmopoulou, N. (2020): Using Philosophy for Children to introduce the living/non-living distinction in kindergarten. *International Journal of Early Years Education*, 1-17. https://doi.org/10.1080/09669760.2020.1848522

Gutheil, G., Vera, A., & Keil, F. C. (1998). Do houseflies think? Patterns of induction and biological beliefs in development. *Cognition, 66,* 33–49.

Gulay Ogelman, H., & Durkan, N. (2014). Toprakla bulusan Cocuklar: Kucuk Cocuklar icin toprak egitimi projesinin etkililigi [Children meeting with the soil: efficiency of soil education project for young children]. *Uluslararasi Sosyal Arastirmalar Dergisi, 7*(31), 632-638.

Hayran, Z. (2010). Cok uyaranli egitim ortamlarinin ogrencilerin kavram gelisimine etkisi [The impact of multi stimuli educational environment on concept development of students]. *Egitim ve Bilim, 35*(158), 134-139.

Hatano, G. & Inagaki, K. (1994). Young children's naive theory of biology. *Cognition 50*, 171–88.

Henry, M.K. (1998). Structured, sequential, multisensory teaching: The Orton legacy. *Annals of Dyslexia, 48*, 3–27**.**

Hickling, A. K., & Gelman, S. A., (1995). How does your garden grow? Evidence of an early conception of plants as biological kinds. *Child Development 66*, 856–876.

Holbrook, J., Chowdhury, T.B.M., Rannikmäe, M. (2022). A Future Trend for Science Education: A Constructivism-Humanism Approach to Trans-Contextualisation. *Education Sciences*. *12*(6), 413. https://doi.org/10.3390/educsci12060413

Inagaki, K., & Hatano, G. (1996). Young children's recognition of commonalities between animals and plants. *Child Development, 67*(6), 2823–2840.

Jahoda, G. (1958). Child animism: a critical survey of cross-cultural research. *Journal of Social Psychology, 47*, 197-212.

Keilen, M., & Roy, C. (1995). Developpement du concept de vie à propos des animaux et des plantes [Development of the concept of life about animals and plants]. *Enfance*, *48*(4), 435-442.

Klausmeier, H. J., Harris, C. W., Davis, J. K., Frayer, D., & Ghatala, E. (1968). *Strategies and cognitive processes in concept learning* (Final Report, Cooperative Research Project No. 2850, U.S. Department of Health, Education, and Welfare). Madison: University of Wisconsin, School of Education

Koyuncuoglu, B. (2017). *Anasinifina devam eden dort bes yas cocuklarin yaratici dusunme becerilerine duyu egitim programinin etkililiginin incelenmesi*, [Investigation of the effect of sensory training program on the creative thinking abilities of four and five-year-olds preschool children] (Unpublised thesis), Hacettepe Universitesi Saglik Bilimleri Enstitusu Cocuk Gelisimi ve Egitimi Programi, Ankara.

Kurt, E. (2020). Okul oncesi ogretmenlerinin dil gelisimi ile ilgili kavram gelistirmeye yonelik gorusleri [Pre-School teachers' views on developing concept related to language development]. *Ana Dili Egitimi Dergisi, 8*(4), 1332-1342. https://doi.org/10.16916/aded.788195

Laurendeau, M., & Pinard, A. (1962*). Causal thinking in the child: a genetic and experimental approach*. New York: International Universities Press.

Leddon, E.M., Waxman, S.R., & Medin, D.L. (2009). Unmasking "alive:" Children's appreciation of a concept linking all living things. *Journal of Cognition and Development* 9, *(4)*, 461–473.

Looft, W. R. (1974). Animistic thought in children: understanding the "living" across its associated attributes. *Journal of Genetic Psychology, 124*, 235-240.

Lorenzi, C., Labrell, F., Ronchi, C., Tatano, C.M., & Perucchini, P. (2013). Children's Conceptions About Animals, Plants and Nonliving Things Before and After Instruction. *In Conference Proceedings New Perspectives in Science Education*. *2*, 211–214.

Merrill, M.D., Tennyson, R.D. & Posey, L.O. (1992). *Teaching concepts: An instructional design guide* (2nd Ed.). Englewood Cliffs, NJ: Educational Technology Publications.

Mustonen S., Rantanen R., & Tuorila H. (2009). Effect of sensory education on school children's food perception: a 2-year follow-up study. *Food Quality and Preference Food Quality and Preference, 20,* 230–240.

Nalcaci A., & Ercoskun M. H. (2005). İlkogretim sosyal bilgiler derslerinde kullanilan materyaller [The materials used in primary education social studies lesson]. *Kazim Karabekir Egitim Fakultesi Dergisi, 11*, 141-154.

National Academy of Sciences. (2004). *Facilitating interdisciplinary research*. National academies of science, national academy of engineering, and institute of medicine of the national academies. Washington, DC: The National Academies Press.

Noureddine, Z., & Zouhaire, L. (2017). Study of middle school students conceptions regarding the living concept. *International Journal of Environmental & Science Education*, *12*(3), 475-484.

Opfer, J. E. & Siegler R. S. (2004). Revisiting preschoolers' living things concept: A microgenetic analysis of conceptual change in basic biology. *Cognitive Psychology 49*(4), 301–332.

Ozcelik, D. A. (1982). 3.-11. sinif ogrencilerinde gorulen bicimiyle kavram (Soz Dagarcigi) gelisimi [Concept (Vocabulary) development as seen in 3.-11.grade students]. Ankara: Hacettepe Universitesi.

Ozdemir, O. & Uzun, N. (2006). Yesil sinif modeline gore yurutulen fen ve doga etkinliklerinin ana sinifi ogrencilerinin Cevre algilarina etkisi [The effect of science and nature activities carried out according to green class model on preschool student's environment perception*]. Cocuk Gelislimi ve Egitimi Dergisi, 1*(2),12-20.

Ozgur, S. (2018). A study on young Turkish students' living things conception. *Educational Research and Reviews*, *13*(5), 150 165.

Ozturk, E. & Tulum, M. (2021). A Study on Perception of Life of 60–72-Month-Old Children: What Do Children Think About Living and Non-Living Things*?. Temel Eğitim Araştırmaları Dergisi*, *1*(1), 40-53, https://doi.org/10.29228/mutead.4

Piaget, J. (1929). *The child's conception of the world.* London: Routledge & Kegan Paul.

Poulin-Dubois, D., & Heroux, G. (1994). Movement and children's attributions of life properties. *International Journal Of Behavioral Development 17*(2), 329–347.

Rosengren, K., Gelman, S. A., Kalish, C., & Mccormick, M., (1991). As time goes by: Children's early understanding of biological growth. *Child Development, 62*, 1302–1320.

Richards, D. D. & Siegler, R. S. (1984). Children's understanding of the attributes of life. *Journal of Experimental Child Psychology, 42*, 1–22.

Springer, K., & Keil, F. C. (1991). Early differentiation of causal mechanisms appropriates to biological and nonbiological kinds. *Child Development, 62*, 767-781.

Springer, K., Ngyuen, T., & Samaniego, R. (1996). Early understanding of age- and environment related noxiousness in biological kinds: evidence for a naive theory. *Cognitive Development, 11*, 65–82.

Speece, M. W., & Brent, S. B. (1984). Children's understanding of death: A review of three components of a death concept. *Child Development, 55*(5), 1671–1686. https://doi.org/10.2307/1129915

Sunbul, A. M. (2010). *Ogretim ilke ve yontemleri* [Teaching principles and methods]. (4th ed.). Konya: Egitim Akademi Yayinlari.

Suryaratri, D.R. & Prayitno, E.H. (2019). The Implementation of Multi-sensory Learning at Elementary Schools in Jakarta. *Jurnal Pendidikan Usia Dini*. *13*(1), 100-114. https://doi.org/10.21009/10.21009/JPUD.131.08

Stavy, R. & Wax, N. (March, 1992). Language and children's conceptions of plants as living things. Paper presented at the *Annual Meeting of the National Association for Research in Science Teaching* Boston, MA.

Taborda-Osorio H., & Cheries EW. (2017) Developmental origins of biological explanations: The case of infants' internal property bias. *Psychonomic Bulletin & Review, 24*, 1527-1537.

Tan, M., & Temiz, A. (2003). Fen ogretiminde bilimsel surec becerilerinin yeri ve onemi [The importance and role of the science process skills in science teaching]. *Pamukkale Universitesi Egitim Fakultesi Dergisi, 13*(13), 89-101.

Tarman, I. & Kent Kukurtcu, S. (2022). The Perceptions of the Children Attending the Preschool Education about Nature and Nature Pollution. *International Electronic Journal of Elementary Education*. *15*(1), 53-64. https://doi.org/10.26822/iejee.2022.278

Tekerci, H., & Kandir, A. (2017). Effects of the sense-based science education program on scientific process skills of children aged 60–66 Months. *Eurasian Journal of Educational Research*, *17*(68), 239-254.

Uyanik Balat, G., Deretarla Gul, E., & Celebi Oncu, E., (2005). *Okul oncesi donemde duyu egitimi ve etkinlikleri* [Sensory education and activities in preschool period]. İstanbul: Kare Yayinlari.

Yaswinda, Y. (November,2016). Science Learning Model Based on Multisensory-Ecology in Early Childhood Education: A Conceptual Model. *In 3rd International Conference on Early Childhood Education* (ICECE 2016), 463-469. Atlantis Press.

Yaswinda, Y., & Yulsyofriend, Y. (December, 2019). Project Approach in Science Learning Based on Multisensory-Ecology for Children 4-5 Years old in the Era of Industrial Revolution 4.0. In 5th International Conference on Education and Technology (ICET 2019),467-470. Atlantis Press

Wellman, H. M. & Gelman, S. A. (1998). Knowledge acquisition. In D. Kuhn and R.S. Siegler (Eds.), *Handbook of Child Psychology: Vol. 2. Cognition, perception, and languag*e (5. ed., p. 523–573). New York: Wiley

Villarroel, J. D., & Infante, G. (2014). Early understanding of the concept of living things: An examination of young children's drawings of plant life. *Journal of Biological Education, 48*(3), 119–126.

Xu, J., Chen, L., Liu, T., Wang, T., Li, M., & Wu, Z. (2022). Multi-Sensory Experience and Preferences for Children in an Urban Forest Park: A Case Study of Maofeng Mountain Forest Park in Guangzhou, China. *Forests*, *13*(9), 1435. https://doi.org/10.3390/f13091435

Yagbasan, R., & Gulcicek, A. (2003). Fen ogretiminde kavram yanilgilarinin karakteristiklerinin tanimlanmasi [Describing the characteristics of misconceptions in science teaching]. *Pamukkale Universitesi Egitim Fakultesi Dergisi, 13*(13), 102-120.

Yesilyurt, S. (2003). Ana sinifi ogrencileri ve ilkogretim birinci sinif ogrencilerinin canli ve cansiz kavramlarini anlama duzeyleri uzerine bir arastirma [A study on understanding levels of live and non-live concepts of kindergarten and first year primary school students]. *Erzincan Egitim Fakultesi Dergisi 5(2), 83-94.*

Yildirim Dogru, S, Cetingoz, D. (2017). Duyu egitiminin otistik cocuklarin alici dil gelisimine etkileri [Evaluation of sensorial education on receptive language development of autistic children]. *Kastamonu Egitim Dergisi, 25*(5), 1819-1834.

Yorek, N., Sahin, M., & Aydin, H. (2009). Are animals 'more alive' than plants? Animistic anthropocentric construction of life concept. *Eurasia Journal of Mathematics, Science & Technology Education, 5*(4), 369-378.

Yurttas, A., Erdas Kartal, E., & Caglar, A. (2020). Okul oncesi ve sinif ogretmenlerinin disiplinlerarasi yaklasimin temel egitimde kullanimina yonelik gorusleri [Preschool and elementary school teachers' views on the use

of interdisciplinary approach in basic education]. *İBAD Sosyal Bilimler Dergisi, 8*, 226-243. https://doi.org/10.21733/ibad.731825

Zogza, V. & Papamichael, Y. (2000). The development of the concept of alive by preschoolers through a cognitive conflict teaching intervention. *European Journal of Psychology of Education,* 15*(2),* 191–205.

Evren Cappellaro is a Lecturer in the Department of Elementary Education, Akdeniz University, Turkey. She can be reached at evrenne@gmail.com.

Sinem Gul Aksu is a Preschool Teacher at General Sadi Cetinkaya Primary School, Turkey. She can be reached at sinemgulaksu11@gmail.com.

International Journal of Early Childhood Environmental Education

ISSN: 2331-0464 (online)

Indigenous Knowledge Sharing and Botanical Literacies in Early Childhood Education

Kimberley Beasley
Sandra Hesterman
Judy MacCallum
Murdoch University, Western Australia

Libby Lee-Hammond
Purnululu Aboriginal Community School, Western Australia

Submitted July 14, 2022; Accepted March 13, 2023

ABSTRACT

This study contributes to the research in Early Childhood Education for Sustainability (ECEfS) by exploring a case study of two Western Australian early childhood education classes who welcomed an Indigenous Elder to share their expertise about the native plants in the schools' bush space. The findings from this study demonstrate the impact Indigenous perspectives had on teacher's and children's relationship with the bush and the development of their botanical literacies. Indigenous peoples in Australia, and across the world have botanical practices that have existed for tens of thousands of years. This study acknowledges botany as a settler colonial practice and contemplates changes to botanical practices and pedagogies that include Indigenous ways of knowing, being and doing.

***Keywords*:** botanical literacies, early childhood education, indigenous knowledges, native plants, plant knowledge

South-west Western Australia is a one of only 34 biodiversity hotspots in the world (Bellard et al., 2014). The population of this area is 3.9% Indigenous (Australian Bureau of Statistics, 2016). After over 230 years of British colonisation, the Indigenous[1] languages of Australia have either become extinct or are severely endangered (Sivak et al., 2019). With this decline in Indigenous languages, comes a loss of words and stories that encode specific information about the local habitats, flora and fauna, including plant uses and medicinal information (Kimmerer, 2013; Merritt et al., 2021). Also endangered, are the vast number of plants in the area, with 40% of these plants being classified as at risk of extinction (Bradshaw, 2012; Cochrane et al., 2010) The Traditional Owners of the land on which this study took place are the Noongar people, like other Aboriginal and Torres Strait Islander people, they have developed systems and practices that have enabled them to live with a deep interconnectedness with 'Country' continuously for more than 60,000 years, making them the oldest continuing living culture on earth (Sivak et al., 2019). The knowledge that this connection brings is vital for the care and protection of local environments, therefore should be embedded in the curriculum of local schools. Pedagogical systems and scientific practices often represent the values of the society where they were developed. In Australia, such systems have developed predominantly to reflect Western European ways of knowing and understanding over other ways of knowing and understanding

[1] The authors acknowledge that the term Indigenous is a term introduced to Australia through legislation and is not the original or preferred name of the first inhabitants. Similarly, Aboriginal is a word that is used in this paper. We acknowledge the Traditional Owners and many language groups that make up the diverse peoples who are the first Australians.

(Kinzel, 2020; Pacini-Ketchabaw, 2013). An example of this is the overlaying of European seasons on Australian landscapes without reference to local knowledges. We need to ensure local, Indigenous ways of knowing remain strong and continue to be passed on to future generations. In Australian early childhood education (ECE), a commitment to embedding Aboriginal and Torres Strait Islander histories and cultures in the curriculum is mandated by the Australian Government through the Australian Curriculum (Australian Curriculum and Reporting Authority, 2019) and the Early Years Learning Framework (Department of Education and Training, 2019). These documents recommend that the practice of embedding Indigenous perspectives should occur through consultation and partnerships with Aboriginal and Torres Strait Islander people. Consultation can be problematic however, with some researchers suggesting that inviting a Traditional Owner into an ECE program to share Indigenous knowledge could be seen as tokenistic to fill a 'need' of the curriculum rather than meaningfully embedding Indigenous knowledge systems (Grace & Trudgett, 2012; Kinzel, 2020; Merritt et al., 2021; Miller, 2015).

Early Childhood Education for Sustainability

There has been a recent international focus on teaching Early Childhood Education for Sustainability (ECEfS) through practices involving interactions with First Nations People (Elliott & Davis, 2009; Ritchie, 2017). Lived experiences within a particular place enables humans to gain a deeper understanding of, and connection with that place (Rowan, 2017). In Australia, this has been reflected by a movement towards bush kindergarten and On Country Learning in Early Childhood Education (ECE) (Beasley et al., 2021; Elliott & Chancellor, 2014; Jackson-Barrett & Lee-Hammond, 2018).

Early Childhood Education for Sustainability (ECEfS) involves the understanding that different people have different connections with the land and waterways and that any separation between land, people, and culture is a false separation (Ritchie, 2017). From this perspective, learning is integral to being and knowing. On Country Learning (OCL) shares a similar perspective and offers a framework for engaging in environmental education that opens more inclusive social, cultural, spiritual, and ecological spaces for educational practice. Country is more than 'the natural environment'. It is better understood as an interconnected web of social, ecological, and spiritual relationships (Jackson-Barrett & Lee-Hammond, 2018; Johnston, 2020; Somerville et al., 2019; Whitehouse et al., 2014).

In Australia, a study of young Aboriginal children partaking in OCL in metropolitan Perth was able to reflect the reciprocity of the relationship between nature and humans as the program was led by Traditional Owners and focused on the children's connection to Country, identities and cultural knowledge (Jackson-Barrett & Lee-Hammond, 2018). The research measured the wellbeing of six Aboriginal children both in the early childhood education classroom and 'on Country' using the Laevers' Wellbeing and Involvement Scale (Laevers, 2015) and demonstrated significantly higher levels of involvement when the children were learning outdoors. This study recommended a rethinking of the way the curriculum is delivered in Australian schools (Jackson-Barrett & Lee-Hammond, 2018). Although the above research involves learning on Country with Traditional Owners, there has been little research about the specific teaching of plants or botany with Traditional Owners in Australia.

Botanical Literacies in Early Childhood Education

The term 'botanical literacy' was first described by Uno (2009, p. 1753) in his development of four progressive levels of knowledge around botanical concepts, terms and behaviours, which he framed through research focused on his United States college botany students. These levels were further developed for use with young children in a study in Perth, Western Australia, which suggested a shift in the term to 'botanical literacies' (Beasley et. al., 2021), recognising young children as learners who create meaning using a diverse range of modes and materials, thus the term botanical literacies recognises young children's 'multiliteracies' (Hesterman, 2013). Beasley et. al. (2021) adapted Uno's levels and derived the following table to describe botanical literacies in ECE:

Table 1
Levels of Botanical Literacies in ECE

Nominal (some ideas)	Functional (many relevant ideas)	Relational (linked ideas)	Multi-dimensional (extended ideas)
• Names 5 or less plants • Some misconceptions	• Names more than 5 plants • Memorized facts but not understood	• Explains plants and concepts in their own words • Undertakes botany without prompting • Curious and intrinsically motivated to understand botany	• Explains plants as a part of a larger eco-system • Curious and intrinsically motivated to understand botany • Makes ethical decisions relating to plants

Source: Beasley et al., 2021 p. 10

To complement these levels of botanical literacies in ECE, the researchers (Beasley et. al., 2021) also established a framework for the ideal conditions for the development of botanical literacies, which included regular time in nature, hands-on, sensory exploration and inquiry, having a 'botanically interested' and passionate adult with the students and including Indigenous Knowledges in the curriculum (Beasley et. al., 2021).

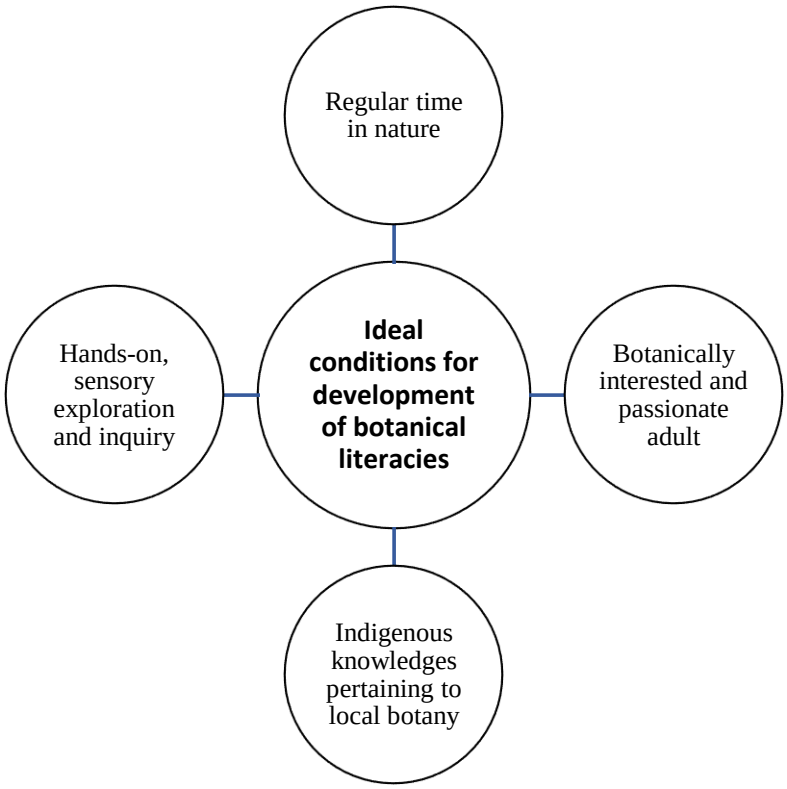


Figure 1. Framework for Developing Botanical Literacies in ECE (Beasley et.al., 2021)

This model reflects previous research around the importance of repeated visits to a specific local environment and Indigenous Knowledge sharing to enable children to learn about and form relationships with local flora and fauna (Otto & Pensini, 2017).

Indigenous Knowledges in the Australian Curriculum

The infusion of Indigenous Knowledges with the formal school curriculum has been endorsed by the United Nations in the Declaration on the Rights of Indigenous Peoples (United Nations, 2007) and is recognised in Australia in the Alice Springs (Mparntwe) Education Declaration (Education Council, 2019) as well as the Australian Curriculum (Australian Curriculum and Reporting Authority, 2019). Despite these initiatives, Indigenous Knowledges are still marginalised in the Australian Curriculum (Somerville et al., 2019; Whatman et al., 2017). At the same time, Indigenous Knowledges are being supported in some remote communities, through stories, language and local research as communities adapt to present day understandings and changes in environments (Sammel & Whatman, 2018). These knowledges are local and specific to each region, reflecting the cultural and linguistic diversity of peoples and the biodiversity of environments. In Australia, environmental scientists often work alongside local Traditional Owners to solve local environmental problems. For example, Ranger programs employ Traditional Owners who combine cultural experience and traditional land care practices to protect sacred sites and care for Country through land management (Jones et al., 2018). A similar model can be applied by teachers concerned with sustainability and have a desire to use cross-cultural collaboration to develop a respect for the natural environment (Corsiglia & Snively, 2001; Johnston, 2020).

Indigenous Knowledges recognise an inter-connection between all living and non-living things, cultivating respectful, reciprocal relationships between humans and all other elements of nature (Corsiglia & Snively, 2001; Johnston, 2020; Sammel & Whatman, 2018). In the Australian Curriculum, Aboriginal and Torres Strait Islander histories and cultures have been mandated as a priority to be taught across all learning areas and teaching resources have been developed to support teachers to do this in consultation with Indigenous education experts (ACARA, 2019). In the science curriculum, the elaboration for this priority provides context for an inquiry-based learning process that engages with Aboriginal and Torres Strait Islander histories and cultures by:

- *Acknowledging the scientific knowledge and skills of Aboriginal and Torres Strait Islander Peoples*
- *Consulting with Aboriginal and Torres Strait Islander Communities in the planning or evaluation of scientific investigations; and*
- *Collaborating with Aboriginal and Torres Strait Islander communities in mutually beneficial scientific research.* (ACARA, 2019. p. 5)

In many cultures of the world, including Australian Aboriginal and Torres Strait Islander cultures, plant knowledge has been traditionally passed down through generations of family members or Traditional Owners (Hansen & Horsfall, 2016; Taylor, 2013). The effects of colonisation in Australia have led to some of this knowledge being lost, including the names for some plants, which have been replaced with common English names and Latin botanical names (Tsing, 2005). Along with the Indigenous name for a plant, comes a vast body of intricate knowledge of the properties of the plant, its healing capabilities, its relationship to the seasons, as well as its relationship to animals and people. This body of plant knowledge is significant, and effort should be made to preserve this knowledge and educate all people about the plants native to the land where they live (Hansen & Horsfall, 2016). In an effort to infuse Indigenous Knowledge and embrace Aboriginal and Torres Strait Islander histories and cultures, it is essential to educate all Australian children on the traditional uses and names for their local native plants.

The Current Study

This study was part of a broader PhD research project to develop a framework for teaching botanical literacies in ECE (Beasley et. al., 2021). The part of the study reported in this article, pertains to the impact of Indigenous

Knowledges on botanical literacies for young children and their teachers. There has been no previous study in Australia that has examined Indigenous Knowledges in teaching botanical literacies in ECE.

Methodology

The approach taken in this research was qualitative, fitting within an interpretivist-participatory paradigm, where the understandings participants attributed to their experiences and environments were explored (Creswell, 2014). We required an approach that reflected a human experience in a specific environment under specific conditions. The aim to make meaning from these particular conditions fits within qualitative research as there were no pre-conceived variables to be measured and we sought to create an understanding of these conditions, instead of explaining certainties (Willig & Stainton Rogers, 2017).

Research Design and Recruitment

Using a multi-site case study design (Yin, 2014), this research involved two ECE classes from two separate schools in metropolitan Perth, Western Australia. Both classes and their teachers were visited fortnightly by the first author over the period of a school year, with a total of 16 visits conducted with each class. There was one two-hour visit from a Traditional Owner to each class towards the end of the research fieldwork period. The school year in Australia begins in February and continues until December. As the research was undertaken in 2020, there was a lockdown period for COVID-19, which resulted in an eight-week gap between visits to each class (April and May), between the fifth and sixth visits to the classes. The researchers do not feel COVID-19 has significantly affected the outcome of the findings due the large amount of data collected during the non-lockdown period.

Each school was chosen because they had a large area of *bush* within the school grounds that the classes already visited as a part of their regular curriculum. In Australia, the term *bush* refers to an area of natural environment that is mainly untouched by humans, and usually consists of trees, bushes and scrub (Elliott & Chancellor, 2014). Bush Hills Primary School (pseudonym) was situated in the Perth hills area with rich soil and bush consisting mainly of large trees, almost like a forest setting. Banksia Beach Primary School, situated near a beach, had sandy soil and was mainly Banksia (a local native small tree) scrub and low bushes with few trees. The diversity in the bush spaces allowed for comparison of the knowledge of specific local plants and their uses.

Using the Mosaic Approach (Clark, 2017), the lead researcher was able to elicit children's knowledge, understandings and ideas through the use of drawings, maps, tours of the bush space and conversations. This pedagogy of listening (Edwards et al., 2012; Rinaldi, 2006) enabled the researcher and teachers to listen to the children's ideas and questions about plants and then use an inquiry-based learning approach (Murdoch, 2015) to explore the bush space as well as undertake research to answer the children's questions. As an example, Banksia Beach Primary School had many Banksias in their bush space, which had dropped hundreds of Banksia seed pods on the ground. The children collected pods at different stages of growth (Figure 2) and used these to formulate inquiry questions, such as: "How do the pods grow?", "Why are the pods furry?", "How long does it take for the mouths to open?" and "How does the pod know when to open?"

A Traditional Owner was invited to visit each class to answer some of the children's questions from their inquiries and explain about Indigenous uses of the plants specific to each school's bush space. The Traditional Owner was specifically chosen for his knowledge of native plants and their traditional uses and his experience in working with school children. For ease of reading, the pseudonym Maarman (Uncle) will be used for this paper to identify the Noongar Traditional Owner. To choose Maarman, the lead researcher undertook an internet search for local Indigenous-owned businesses who provided incursions to school children with the purpose of sharing Indigenous Knowledges. In choosing a Traditional Owner who was already employed in this role, it ensured the person had experience teaching young children, had a working with children check and police clearance, and had a passion and interest in the work that was required for the purpose of this research. A business was found that offered school

Figure 2. Banksia seed pods collected by Banksia Beach students

incursions focused on plants. Marmaan was then chosen by the business he worked for to be involved in the research because of his specific knowledge around native plants on Noongar Country. The business Maarman was employed by was paid their regular rate for an incursion visit to a school, by the lead researcher. Using a local Indigenous-owned business could make this research model transferable to other locations, as there are many Indigenous-owned businesses around Australia that offer similar services and are available to schools.

Data Collection

The children's and teacher's experiences and learning before, during and after visits with Maarman were documented and analysed. Data were collected during visits to the school's bush space, through teacher interviews and from strategies such as children's drawings drawn from the Mosaic Approach (Clark, 2011; Clark, 2017). Interviews with the two teachers were undertaken both before the school year began and at the end of the school year. These interviews enquired about the teacher's plant knowledge and prior experiences, their teaching practices in the bush space. The final interview also reflected on the impact Maarman's visit. The questions in both sets of interviews were relatively the same to enable a comparison of the teacher's knowledge and understanding before and after the research project implementation. Maarman's conversations with the children and teachers during the visit were audio recorded and later transcribed.

Data Analysis

To critically reflect on the impact of Indigenous perspectives on children's botanical literacies, comparisons were made between the children's observed behaviours in the bush space before Maarman's visit and after the visit. Transcripts from Maarman's visit with the children as well as the data from the children's bush visits before and after their time (2-3 hours) with Maarman were read and then revisited for the author's familiarisation. The teachers collaborated by confirming the accuracies of the transcripts and the data collected from the children. The second and third author were involved in discussions around changes in children's observed behaviours and understandings of the plants in the bush space before and after Maarman's visit.

To analyse the qualitative data in terms of changes in botanical literacies, codes developed by Beasley et. al. (2021), as explained in Table 2, were applied to the data.

Table 2
Revised Levels of Botanical Literacies for ECE (Beasley et al., 2021) with Codes

	Level 1. Nominal (some ideas)	Level 2. Functional (many relevant ideas)	Level 3. Relational (linked ideas)	Level 4. Multi-dimensional (extended ideas)
Knowledge (K)	Names 5 or less plants (K1)	Names more than 5 plants (K2)	Explains plants and concepts in their own words (K3)	Explains plants as a part of a larger eco-system (K4)
Understanding (U)	Some misconceptions (U1)	Memorized facts but not understood (U2)	Undertakes botany without prompting (U3)	Makes ethical decisions relating to plants (U4)
Behaviours (B)	Seems disinterested (B1)	Seems mostly disinterested (B2)	Curious and intrinsically motivated (B3)	Curious and intrinsically motivated Excited (B4)

Children's and teacher's understandings were coded and analysed to examine different levels of learning and understanding and changes in behaviour towards plants over the course of the research period. This enabled us to record any observable changes in botanical literacies in the children and the teachers. Table 3 provides an excerpt from the coded interview with the teacher from Bush Hills Primary School at the end of the research. The teacher explained her plant knowledge had 'vastly improved'. She shared that she enjoys plants and photographing plants she has not seen before for pleasure, demonstrating she is curious and intrinsically motivated, which is a level 4, multi-dimensional behaviour in relation to her botanical literacies.

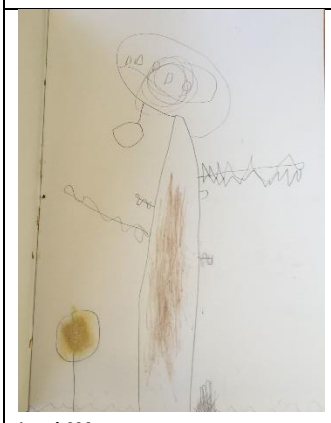
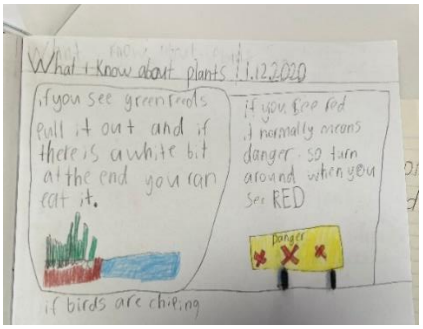
Table 3
Excerpt of Coded Interview with the Teacher from Bush Hills Primary School

Transcript	**Coding**
R: Okay. So can you tell me about your plant knowledge now compared to the beginning of the year?	
Teacher: Vastly improved plant knowledge. I think I've mostly connected more of the groupings than the names. Like being able to see that even though I might not know their Latin name or their proper name that they all belong—You know the wattles in particular just by the little yellow flower. That there are different wattles within.	**K3**
R: Yeah, yeah.	
Teacher: So I think that's been the biggest learning for me. So yeah. I think I'm able to identify quite a lot of the plants now.	**Explains improvement in K**
R: How do you feel about plants in general?	
Teacher: Well I love plants. Always have loved plants. My family, they get quite annoyed with me when we go on our bush walks because I'm always stopping. "Hurry up Mom. Hurry up Mom." Because I'm taking photos of something that's flowering or something I haven't seen before. So yes. I do very much enjoy the plants.	**B4**

Table 4 displays three children's drawings and verbal descriptions from the first visit on what they knew about plants with drawings and verbal descriptions from the last visit on what they knew about plants. The detail in the drawings of each child demonstrated a deeper understanding of plants at the end of the year. Levi for example, has explained knowledge that came from the Maarman about surviving without food and water and looking for green reeds for sustenance. Raffy has developed his knowledge from being able to name some familiar fruit to understanding the

life cycle of a plant, including that carnivorous plants can consume insects for food. These children were initially coded as having nominal botanical literacies and at the end of the year, they were demonstrating relational and multi-dimensional levels of botanical literacies.

Table 4. *Bush Hills Primary School Children's Drawings and Descriptions.*

Drawings from first visit- What do you know about plants?	**Drawings from last visit- What do you know about plants?**
 Plants make fruit- Raffy **K1**	 "This is a seed, then a stem, then a leaf on both sides. Then a flower and then the plant dies. Then the seeds make lots more plants. Plants need food and nutrients. For food, some plants eat flies and insects. Plants give love, they are beautiful." Raffy- (December) **K3, U4, B4**
 Golden Honey Flowers- Maddie **K1**	 "This is a climbing sundew and the bug is coming so the plant can eat it." *(n.b. the sundew is a carnivorous plant)* Maddie **K4**
 Levi **K1**	 "If you see green reeds, pull it out and if there is a white bit at the end, you can eat it. If you see red, it normally means danger, so turn around when you see red." Levi **U4**

Findings

This section presents the data that addresses the research question "What impact does the inclusion of Indigenous Knowledges have on the botanical literacies of children and teachers in ECE?" The data are then analysed to examine the levels of botanical literacies for ECE developed by Beasley et. al. in 2021.

Maarman's Visit

Maarman held the two classes entranced for over an hour with his pedagogy of story-telling and hands-on demonstrations before walking through the bush space with the children for another hour. The stories for each plant spanned time with examples from before colonisation, stories during colonisation as well as current uses of the plants. Hands-on and visual examples were provided for the uses of some of the plants. To respect the stories told by Maarman about each plant, and with his permission, the research findings will reflect some of the plants discussed by Maarman and the stories communicated, as well as the changes in the children's and teachers understandings, attitudes and behaviours about the following native plants.

Balga

Maarman explained that to the Noongar people (the language group to which he belongs), the *Balga* (Grass Tree) is the most important plant for supporting human life. It provides water, shelter, fire, and medicine that cures bites from venomous snakes. Maarman demonstrated how to take the fronds from the plant to suck the inner white ends to find water if water was unavailable elsewhere. He also used his own fire sticks made from the Balga flower stem to demonstrate to the children how fire has been made by Noongar people for tens of thousands of years. Maarman also explained that Balga trees are slow growing and most of the plants in the school's bush spaces were over 100 years old. In explaining this, he said that in extreme emergencies, if a person was bitten by a poisonous snake, the centre of the Balga plant has a white mixture that can be used as a medicine to heal the person, but this use of the medicine would also kill the plant. After the visit, the children from Bush Hills Primary School initiated a retelling of the story of the Balga and its uses to each other during their self-initiated and self-directed dramatic play. They made shelters under the bigger Balgas in their playspace. There were some children who wanted to pick a leaf frond to taste it for the water at the base, but other children were quick to explain that the plants should only be used when no water is available and reminded peers to look after the plants.

Marri

The *Marri* (Red Gum) trees in the bush space of Bush Hills Primary School were very large and there were many of them. During the first two visits of the school year, the Marri trees were in flower and the children referred to these as 'honey trees' due to the strong smell of the flowers. Later in the year the trees produced large gumnuts, locally referred to as 'Honkey Nuts'. The children used these in their play as counters and had also noticed the local native Black Cockatoos like to eat the nuts. Maarman told the children about the medicinal uses of the Marri sap, one of the uses was applying it to the skin as a remedy for eczema. One of the children in the class suffered from Eczema and every visit to the bush after Maarman's visit, he would go to the tree, take sap from the tree with a stick and apply it on to his eczema. During the last visit to the school, the child proudly showed the lead researcher that his eczema had disappeared and he explained the "Marri sap made it go away".

Djop Born

In Banksia Beach Primary School, there were many *Djop Born* (Soap Bush) plants in the bush space. Maarman put some water in a cup, rubbed the leaves of the soap bush plant in his hands with water and the water foamed, like soap. He explained soap bush was used by Noongar people to wash themselves and the animal skins that were worn as clothes. Following Maarman's visit, this class regularly would make soap from the plant as part of their play and demonstrated to other children in the school how to do this.

Biara

Banksia Beach Primary School had mostly *Biara* (Banksia) scrubland for their bush space. At the beginning of the year, the teacher and children commented that the Banksia trees looked dead. They were blackish and drooping with no visible flowers. There were lots of black Banksia pods on the plants and scattered on the ground. The children used them as a part of their play and would collect them into piles which would be 'owned' by different groups of children in a kind of competition to see who could collect the most. During Maarman's visit, he explained that the Banksia pod was vital for carrying fire from camp to camp during the winter and through the rain. Noongar women would carry these Banksia pods in a bag and carry fire on one of them, transferring the fire to another seed pod as each one burned out. This way the Noongar people would not need to relight a fire every time they made a new camp.

During the children's investigations about the Banksia, they also learned that Banksias need fire to open the follicles and release the seeds, in this way, the Noongar people were also helping to propagate the seeds of Banksia as they travelled. The children were interested to replicate this and see the follicles open for themselves, so together with the researcher and the teachers, the children baked some Banksia seed pods in a conventional oven at a high temperature to release the seeds as fire would. This was somewhat successful as some of the follicles opened and the children were able to see the seeds from inside. Maarman also explained that the flowers of the Banksia can be mixed in water to make a cordial drink during the warmer months. The children were also eager to try this once the flowers were at the right stage, but this did not occur during the data collection period.

Wanil

The *Wanil*, (Weeping Peppermint) tree was found in the bush space of Bush Hills Primary School. Maarman took some leaves and rubbed them between his hands, crushing the leaves to release a strong peppermint smell. He explained to the children this is good for smelling and rubbing of your chest when you have a cough. He also explained it is good for cooking with fish for extra flavour and can also be tied in a certain noose and used to attract and catch Marron (a local freshwater crayfish). The children were observed pretending to use plants to catch Marron and fish in a subsequent visit based on this advice. Some children had also explained they advised their parents to cook fish with the Wanil leaves for extra flavour.

Analysis of Botanical Literacies as a result of Maarman's visit

Considering the levels of botanical literacies in ECE listed above (Beasley et. al., 2021), there are three criteria that are observed in the highest level of botanical literacy, the multi-dimensional level:

a. Children can explain plants are a part of a larger, interconnected ecosystem;
b. Children are curious and intrinsically motivated to understand plants and botany; and
c. Children make ethical decisions relating to plants.

The narratives above demonstrate children meeting all three of these criteria. Before Maarman's visit, the botanical learning in the bush space had been based on the children's inquiry-based questions and had been about naming, identifying the plants and observing the changes in the plants through the seasons. Their plant understanding had developed, but they had not clearly demonstrated an understanding of interconnectedness until Maarman's visit. Through his powerful and engaging stories, Maarman introduced the children to traditional uses of the plants, and this changed the way the children interacted with the plants during their bush visits. They were more hands-on with the plants, touching, taking sap, making soap, crushing and smelling. Their conversations shifted from what a plant's name is, when it flowers and what it looks like, to how it is connected to people and how it is useful. These demonstrated that children understood that plants are part of an interconnected system and humans rely on plants for food, fire, shelter, and medicine. Some examples of the children's comments about plants after Maarman's visit were:

> *"Green reeds only grow where there's fresh water. If you're in the bush and you're lost, if you find a green reed and you're very thirsty then you can use the reeds to find water."* (Ruby, aged 8 years)

> *"They (Banksias) start off as that and then they grow into the furry things and then they grow into the green stalk. Then eventually they flower and then they die and turn into brown things. Then when it's hot enough, the seeds will pop out. They can be carried for fire…..Banksias are so special"* (Evie, aged 8 years)

Before Maarman's visit, the children's curiosity was about the variety of plants and why and how they grow, and they were motivated to observe the changes in the plants physically. After Maarman's visit the children were curious about the uses of the plants and they were motivated to interact with the plants and 'try out' what they learned from Maarman. Figures 3 and 4 show the changes in the children's botanical literacy behaviours, including curiosity, after visit 14, which was Maarman's visit. The codes on the vertical axis are displayed in Table 2.

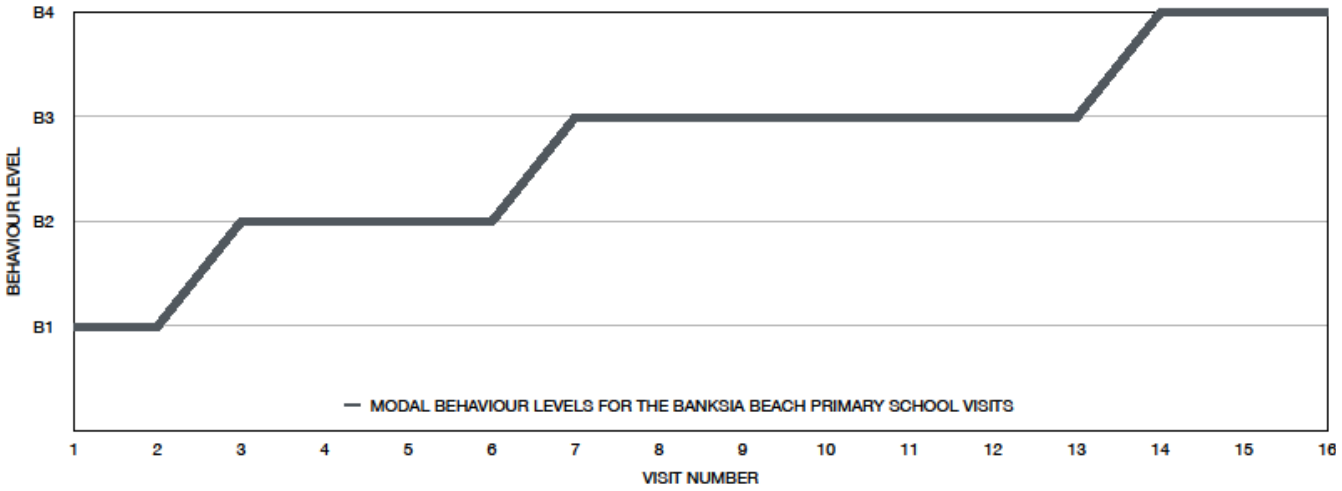


Figure 3. Changes in Botanical Literacy Behaviour in Children from Banksia Beach Primary School over 16 visits

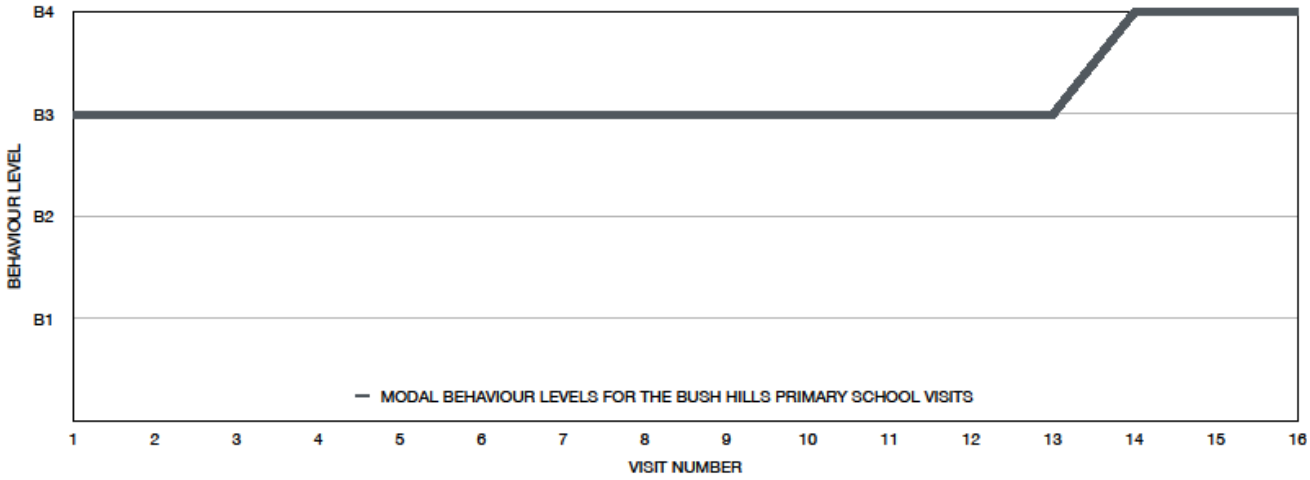


Figure 4. Changes in Botanical Literacy Behaviour in Children from Bush Hills Primary School over 16 visits

In terms of the third criteria for the multi-dimensional level of botanical literacies, it was not as clear that the children were making more ethical decisions relating to the plants. Before the visit, the researcher and teachers had discussed

with the children about not touching the plants and only looking, as they are living things and we must care for them. After Maarman's visit, the teachers were nervous the children were utilising the plants too heavily for their play and exploration so we had conversations with the children reminding them of Maarman telling the class to 'only take what you need'. Some children understood this immediately and told other children not to pick the plants. A balance was needed between the children being able to have a turn and explore the uses of the plants and making ethical decisions around their use. This balance of using the plants, whilst also caring for them is an important concept connected to cultural practices and sustainability. The teachers introduced the plants to the children as something only for looking at and instructed the children only to use parts of the plants that had fallen to the ground. The Traditional Owner instructed the children to touch, smell, pick and use if required. Through observation and guided participation by adults from different cultural backgrounds, the children are learning that different people have different cultural practices or '*constellations of cultural practices'* a termed used by Rogoff (2018) to describe??in their use of plants.

Discussion

It has been cited in previous research that inviting an Indigenous Elder to participate in an ECE program to speak on one topic could be seen as tokenistic or providing fragmented cultural practices rather than embedding Indigenous Knowledge systems (Miller, 2015). The narrow topic of this current study of botanical knowledges lends itself to the possibility of filling the researcher's 'need' in the curriculum for an Indigenous perspective. An Indigenous Elder was sought for the specific purpose of sharing their knowledge of the local native plants in the bush space. However, we believe that because this knowledge was shared as a part of a year-long study on botanical literacies and in the bush space with the children. The Indigenous Knowledge enriched the curriculum, the teachers' and children's knowledge and had a strong impact on the way the children and their teachers interacted with the plants in the bush after Maarman's visit. The Indigenous Knowledge provided new ways for the children to interact with the plants and new understandings about the history and importance of the plants in their local environment. These new understandings developed from the Elder's visit clearly supported botanical literacies to be attained at the highest level of multi-dimensional botanical literacies, whereby the children were able to explain that plants are part of a larger, interconnected eco-system (Beasley et. al., 2021).

It is important to note that the pedagogies used by Maarman during his two visits contrasted the pedagogies used by the researcher and teachers during the other fieldwork visits. During the researcher's visits, the botanical practices included observing plants, drawing, mapping and identifying plants and flowers. It became obvious during the analysis that the researcher's pedagogy of inquiry and the botanical practices used were aligned with Western systems of knowledge, stemming from settler colonial contexts which placed the humans as separate from the plants (Ritchie, 2017). In contrast, Indigenous pedagogies used by Maarman which included storytelling and hands-on experiences, demonstrated to the children that humans are inextricably intertwined with nature (Pacini-Ketchabaw, 2013). This contrast in cultural practices is reflective of the multi-cultural Australian context. Rogoff (2018) suggests that instead of trying to dissect cultural contexts into separate factors, we view the context as a *constellation of cultural practices*. The context in Australia, is that children are living and learning on unceded Aboriginal land, which has a complex history. Teaching practices infused in educational environments need to reflect this context.

Conclusion

The inclusion of Indigenous Knowledges from a Noongar Elder in this study on young children's botanical literacies demonstrated that Indigenous Knowledges can strongly support children to develop the highest level of botanical literacies. The authentic stories and hands-on, engaging pedagogies of the Elder awakened the children and teachers to the interconnectedness of humans and nature.

Indigenous Knowledges are shared and relived on that specific Country and hence the learning is local; it is produced in context, time and place. Thus, the specific learning from the children and teachers in this study cannot be replicated across other schools. What can be replicated, is the authentic invitation for an Indigenous person to share their knowledge and perspectives with the children on specific topics that are relevant to the curriculum at the time of the visit. This study showed it was beneficial for the children to already have a strong foundational knowledge of

plants, so the learning was relevant and meaningful. As the children and teachers had prior knowledge and lived experience with specific plants in a unique bush space, they were able to make authentic connections between themselves, the environment and Indigenous Knowledges.

In this study, the children's and teachers' prior knowledge of plants was evaluated through the Framework for Developing Botanical Literacies (Beasley et. al., 2021), which placed the classes in the bush spaces once a fortnight for the duration of the school year and included regular time in nature, hands-on, sensory exploration and inquiry as well as having a 'botanically interested' and passionate adult with the students as essential practices for developing botanical literacies. These practices, in addition to including authentic Indigenous Knowledges can hopefully be replicated in any early childhood setting.

This research study also opened new possibilities for bridging the gap between Western systems of thinking around botany and Indigenous pedagogies. The study set out to research the impact of including Indigenous perspectives when teaching botanical literacies. We found the infusion of Indigenous Knowledges in botany and ECE teaching using the Mosaic Approach to be effective for increasing plant knowledge and understanding, but in analysing our practise, we also realised that colonial epistemologies are embedded in traditional botanical practices, including naming plants, mapping native bushland and seeing plants as a human resource. This reflects what has been found to occur in Australian classrooms (Somerville et al., 2019) and implores nature-based researchers and teachers to explore new methods to entangle and infuse their pedagogies with Indigenous ways of knowing, being and doing (Jackson-Barrett et al., 2019; Johnston, 2020; Martin & Mirraboopa, 2003; Martin, 2017) on Country, not just looking at and studying plants and nature as separate from humans.

References

Australian Bureau of Statistics. (2016). Estimates of Aboriginal and Torres Strait Islander People. https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples/estimates-aboriginal-and-torres-strait-islander-australians/jun-2016

Australian Curriculum and Reporting Authority. (2019). *Australian Curriculum*. ACARA. https://www.australiancurriculum.edu.au/resources/

Beasley, K.D, Lee-Hammond, L., & Hesterman, S. (2021). A Framework for Supporting the Development of Botanical Literacies in Early Childhood Education. *International Journal of Early Childhood*, 1-19. https://doi.org/10.1007/s13158-021-00291-x

Bellard, C., Leclerc, C., Leroy, B., Bakkenes, M., Veloz, S., Thuiller, W., & Courchamp, F. (2014). Vulnerability of biodiversity hotspots to global change. *Global ecology and biogeography*, *23*(12), 1376-1386. https://doi.org/10.1111/geb.12228

Bradshaw, C. J. A. (2012). Little left to lose: deforestation and forest degradation in Australia since European colonization. *Journal of Plant Ecology*, *5*(1), 109-120. https://doi.org/10.1093/jpe/rtr038

Clark, A. (2011). Breaking methodological boundaries? Exploring visual, participatory methods with adults and young children. *European Early Childhood Education Research Journal*, *19*(3), 321-330. https://doi.org/10.1080/1350293X.2011.597964

Clark, A. a. (2017). *Listening to young children : a guide to understanding and using the mosaic approach* (Expanded third edition.. ed.). Philadelphia : Jessica Kingsley Publishers.

Cochrane, J. A., Barrett, S., Monks, L., & Dillon, R. (2010). Partnering conservation actions. Inter situ solutions to recover threatened species in South West Western Australia. *Kew bulletin*, *65*(4), 655-662. https://doi.org/10.1007/s12225-010-9233-0

Corsiglia, J., & Snively, G. (2001). Rejoinder: Infusing indigenous science into western modern science for a sustainable future. *Science education (Salem, Mass.)*, *85*(1), 82-86. https://doi.org/10.1002/1098-237X(200101)85:1<82::AID-SCE11>3.0.CO;2-Q

Creswell, J. (2014). *Educational research: planning, conducting, and evaluating quantitative and qualitative research* (Fourth, Pearson new international ed.). Pearson. https://go.exlibris.link/mLz2qq0w

Department of Education and Training. (2019). *Belonging, being and becoming; The early years learning framework For Australia*.

https://docs.education.gov.au/system/files/doc/other/belonging_being_and_becoming_the_early_years_learning_framework_for_australia_0.pdf

Edwards, C. P., Gandini, L., & Forman, G. E. (2012). *The hundred languages of children: the Reggio Emilia experience in transformation* (3rd ed.). Praeger.

Elliott, S., & Chancellor, B. (2014). From forest preschool to bush kinder: An inspirational approach to preschool provision in Australia. *Australasian Journal of Early Childhood*, *39*(4), 45-53. https://doi.org/10.1177/183693911403900407

Elliott, S., & Davis, J. (2009). Exploring the resistance: An Australian perspective on educating for sustainability in early childhood. *International Journal of Early Childhood*, *41*(2), 65-77. https://doi.org/10.1007/BF03168879

Grace, R., & Trudgett, M. (2012). It's not rocket science : the perspectives of Indigenous early childhood workers on supporting the engagement of Indigenous families in early childhood settings. *Australasian Journal of Early Childhood*, *37*(2), 10-18. https://doi.org/10.1177/183693911203700203

Hansen, V., & Horsfall, J. (2016). *Noongar bush medicine: Medicinal plants of the south-west of Western Australia*. UWA Publishing.

Hesterman, S. (2013). Early childhood designs for multiliteracies learning. *The Australian journal of language and literacy*, *36*(3), 158-168.

Jackson-Barrett, E., Lee-Hammond, L., & Murdoch, U. (2019). From Pink Floyd to Pink Hill : Transforming Education From the Bricks in the Wall to the Connections of Country in Remote Aboriginal education. *The Australian Journal of Teacher Education*, *44*(10), 35-51. https://doi.org/10.14221/ajte.2019v44n10.3

Jackson-Barrett, E. M., & Lee-Hammond, L. (2018). Strengthening identities and involvement of Aboriginal children through learning on country. *Australian Journal of Teacher Education (Online)*, *43*(6), 86-104. https://doi.org/10.14221/ajte.2018v43n6.6

Johnston, M. a. (2020). *Working two way : stories about cross-cultural collaboration from Noongar country / Michelle Johnston, Simon Forrest*. Singapore : Springer Nature Singapore.

Jones, R., Thurber, K. A., Wright, A., Chapman, J., Donohoe, P., Davis, V., & Lovett, R. (2018). Associations between participation in a ranger program and health and wellbeing outcomes among aboriginal and torres strait islander people in central Australia: A proof of concept study. *Int J Environ Res Public Health*, *15*(7), 1478. https://doi.org/10.3390/ijerph15071478

Kimmerer, R. W. (2013). *Braiding sweetgrass* (First ed.). Milkweed Editions.

Kinzel, C. (2020). Indigenous Knowledge in Early Childhood Education: Building a Nest for Reconciliation. *Journal of Childhood Studies (Prospect Bay)*, *45*(1), 19-32. https://doi.org/10.18357/jcs00019397

Martin, K., & Mirraboopa, B. (2003). Ways of knowing, being and doing: A theoretical framework and methods for indigenous and indigenist re-search. *Journal of Australian studies*, *27*(76), 203-214. https://doi.org/10.1080/14443050309387838

Martin, K. L. (2017). It's special and it's specific: understanding the early childhood education experiences and expectations of young Indigenous Australian children and their parents. *Australian Educational Researcher*, *44*(1), 89-105. https://doi.org/10.1007/s13384-017-0231-1

Merritt, E., Peterson, A., Evans, S., Marston, S. A., & Zuiker, S. (2021, 2021 March-April). Learning About Culture and Sustainable Harvesting of Native Plants: Garden-based teaching can foster appreciation of indigenous knowledge. *Science and Children*, *58*(4), 69+.

Miller, M. G. (2015). Consultation with Aboriginal and Torres Strait Islander people in early childhood education: the impact of colonial discourses. *Australian Educational Researcher*, *42*(5), 549-565. https://doi.org/http://dx.doi.org/10.1007/s13384-015-0186-z

Murdoch, K. (2015). Beyond topics : what's worth inquiring into? In *The Power of Inquiry : teaching and learning with curiosity, creativity and purpose in the contemporary classroom*.

Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Global environmental change*, *47*, 88-94. https://doi.org/10.1016/j.gloenvcha.2017.09.009

Pacini-Ketchabaw, V. (2013). Frictions in Forest Pedagogies: Common Worlds in Settler Colonial Spaces. *Global Studies of Childhood*, *3*(4), 355-365. https://doi.org/10.2304/gsch.2013.3.4.355

Rinaldi, C. (2006). *In dialogue with Reggio Emilia: listening, researching and learning*. Routledge. https://go.exlibris.link/z64q1Hr2

Ritchie, J. (2017). Fostering Eco-Cultural Literacies for Social, Cultural and Ecological Justice: A Perspective From Aotearoa (New Zealand). *International Journal of Early Childhood*, *49*(3), 287-302. https://doi.org/10.1007/s13158-017-0198-0

Rowan, M. C. (2017). Rethinking relationships with curriculum by engaging with foxes and sharing stories in early childhood spaces. *Global Studies of Childhood*, *7*(2), 131-147. https://doi.org/10.1177/2043610617703833

Sammel, A., & Whatman, S. (2018). A novel approach to developing literacies in Indigenous knowledge systems and western science knowledge: Lessons from primary school students in Australia. *Journal of Australian Indigenous Issues*, *21*(1-2), 40-60.

Sivak, L., Westhead, S., Richards, E., Atkinson, S., Richards, J., Dare, H., Zuckermann, G. a., Gee, G., Wright, M., Rosen, A., Walsh, M., Brown, N., & Brown, A. (2019). "Language Breathes Life"-Barngarla Community Perspectives on the Wellbeing Impacts of Reclaiming a Dormant Australian Aboriginal Language. *International journal of environmental research and public health*, *16*(20), 3918. https://doi.org/10.3390/ijerph16203918

Somerville, M., Powell, S., & Trist, N. (2019). Being-Country in Urban Places: Naming the World Through Australian Aboriginal Pedagogies. *Journal of childhood studies (Prospect Bay)*, *44*(4), 98-111. https://doi.org/10.18357/jcs444201919215

Taylor, A. (2013). Caterpillar childhoods: Engaging the otherwise worlds of central Australian Aboriginal children. *Global Studies of Childhood*, *3*(4), 366-379. https://doi.org/10.2304/gsch.2013.3.4.366

Tsing, A. L. (2005). *Friction: an ethnography of global connection*. Princeton University Press.

United Nations. (2007). *United Nations Declaration on the Rights of Indigenous Peoples*. United Nations. https://humanrights.gov.au/our-work/un-declaration-rights-indigenous-peoples-1

Whatman, S., Quennerstedt, M., & McLaughlin, J. (2017). Indigenous knowledges as a way to disrupt norms in physical education teacher education. *Asia-Pacific journal of health, sport and physical education*, *8*(2), 115-131. https://doi.org/10.1080/18377122.2017.1315950

Whitehouse, H., Watkin Lui, F., Sellwood, J., Barrett, M. J., & Chigeza, P. (2014). Sea Country: navigating Indigenous and colonial ontologies in Australian environmental education. *Environmental Education Research*, *20*(1), 56-69. https://doi.org/10.1080/13504622.2013.852655

Willig, C. e., & Stainton Rogers, W. e. (2017). *The SAGE handbook of qualitative research in psychology* (2nd ed.). SAGE Publications.

Yin, R. (2014). *Case study research: Design and methods*. Sage Inc.

Kimberley Beasley is an Associate Lecturer in the College of Science, Health, Engineering and Education, Murdoch University, Western Australia. She can be reached at Kimberley.beasley@murdoch.edu.au.

Sandra Hesterman is Director of Early Childhood Education, Murdoch University, Western Australia. She can be reached at S.Hesterman@murdoch.edu.au.

Judy MacCallum is Emerita Professor in Education, Murdoch University, Western Australia. She can be reached at J.MacCallum@Murdoch.edu.au.

Libby Lee-Hammond is Principal at Purnululu Aboriginal School, Western Australia. She can be at principal@purnululuschool.wa.edu.au.

International Journal of Early Childhood Environmental Education

ISSN: 2331-0464 (online)

Journey to Reconceptualization of Children in Nature: Going Beyond the Fences

Michelle McMichael
Ministry of Education, Ontario, Canada

Submitted July 14, 2022; Accepted June 24, 2023

ABSTRACT

Forest school and nature-based pedagogy have grown in popularity in recent years. Previously, I examined the perspectives of parents who chose to enrol their children within these programs to learn and understand why. As I furthered my studies, I became concerned about how these forest and nature schools connect to Indigenous ways of knowing, teaching, and learning, as many claim. I wanted to examine how Forest school pedagogy and Indigenous perspectives of education may connect or not, and how these land-based pedagogies intertwine with Indigenous perspectives of land as first teacher. This work is a storying of my educational journey about land-based pedagogy, environmental education for children and how children are viewed within nature. The aim of this story is to ask what might happen when Forest pedagogies, Indigenous peoples, and their epistemologies and ontologies are assembled? The secondary purpose is to ignite pedagogical conversations amongst educators and inform about Forest School programs and how they connect to Indigenous perspectives or do not connect at all.

***Keywords*:** Forest School, Common Worlds, early childhood, indigenous, nature, nature/culture

My story begins with me finding myself as a student after working in early childhood education for nearly 20 years. I returned to school to complete a Bachelor of Early Childhood Leadership the year before I turned 40. In my teaching and practice, I viewed outdoor education as spending time on the playground with the children within my program. Then I was asked to read Last Child in the Woods (Louv, 2008) for my child development class, and it began to open my mind and eyes to what might happen if we take children beyond the fences.

I have chosen to tell this story of my reconceptualization of children in nature because I am currently living it. Cajete 2000, states, “Storytelling is a very important aspect of Native America. It is not just the words and the listening but the actual living of the story (p. xii). Storytelling is a powerful way to teach and inform, and as I explored Indigenous perspectives throughout my research, sharing it as a story seemed fitting. I must begin by situating myself. I am not Indigenous, which may be a limitation. I am a white Early Childhood Educator of settler-colonial ancestry. I am relying solely on the educational perspective of the Indigenous scholars I have been reading with to explore these perspectives more deeply.

I am in the process of coming to know Indigenous science as, up until now, I have viewed the world with a Western lens. “Native science is born with a lived and storied participation with the natural landscape. To gain a sense of Native science, one must participate with the natural world” (Cajete, 2000, p. 2). Westernized culture is what is familiar; however, this coming to know process is allowing me to begin viewing the world through a different lens, the lens that has been shown to me through my reading and research of Indigenous scholars and their perspectives.

> Native traditions have been viewed and expressed largely through the lens of Western thought, language, and perception. The Western lens reflects all other cultural traditions through filters of

> the modern view of the world. Yet, in order to understand Native cultures, one must be able to see through their lenses and hear their stories in their voice and through their experience (Cajete, 2000, p. 4).

After reading with Richard Louv and exploring his ideas and theories as an undergraduate student, I knew that I wanted to explore outdoor education, specifically Forest Schools, in more depth and gain a sense of the perspectives of parents who choose these programs. As a graduate student I continued this journey to learn and think more critically about the world and land-based pedagogy and practice. I began learning more about Indigenous ways of knowing and decolonization. Forest Schools and their pedagogy intrigue me. My wonderings grew to include how these forest and nature schools connect to Indigenous ways of knowing, teaching, and learning or perhaps do not connect at all. I am asking you, the reader, to take this journey with me as I story where my perspectives regarding outdoor education began, where they are now and where they are headed. I acknowledge that the land on which I am taking this journey is the land traditionally cared for by the Haudenosaunee, Anishinaabe and Neutral Peoples. I acknowledge the enduring presence and deep traditional knowledge and philosophies of the Indigenous People with whom I share this land today. I also acknowledge my western settler perspective and that I am continuing to decolonize this perspective and my practice as I explore this topic further. I aim to take this journey with an open mind and heart and to listen with all my senses as I seek to deeply investigate Forest School pedagogy and the voices of Indigenous scholars I am reading with. I will share their viewpoints, on which I recognize I am not an expert, nor do I have the authority to speak to them. I invite you to travel this path with me with openness as together we come to know.

> "Coming to know" (Cajete 2000) is a way of describing distinct Indigenous views on the process of learning via more intuitively connected pathways. Indigenous ways of coming to know respect the individual's relationship with and the responsibility for what is being learned and explore stories and other diverse approaches to the subject at hand, learning pathways that appeal to diverse learning styles in non-prescriptive ways. Coming to know ultimately invites us to explore our emergent learning process as part of our own journey, rather than challenging us to enter into externally imposed, isolated theme areas. (Anderson et al. 2017, p. 59).

Truth and Reconciliation

I feel it is imperative to include a short but fundamental section about The Truth and Reconciliation Commission of Canada: Calls to Action (2015). This report outlines 94 Calls to Action for non-Indigenous governments, institutions, and individuals to strive toward reconciliation. Education is mentioned repeatedly throughout the information within the Calls to Action, which has moved educational systems to include Indigenous content and teaching methods in their curriculums. Something that stood out to me as I engaged with my learning and the Calls to Action is that residential schools still existed as recently as 1997, when finally, the last federally funded residential school, Kivalliq Hall in Rankin Inlet, closed. I graduated high school this same year, and yet I do not recall hearing much about this triumphant event; however, I am uncertain if I genuinely did not hear this in the news or if it did not impact me in the same way it does today because I was ignorant to such things. Perhaps due to my westernized upbringing or my westernized education, which failed to include such topics within the curriculum. I am immensely proud that my children have been exposed to education which provides history of Indigenous peoples and residential schools. I am also proud of my work in learning the truth and educating myself. I have participated in taking Indigenous education programs offered by the University of Alberta and the University of Toronto. Non-Indigenous citizens have a responsibility "to learn the truth and to actively work toward reconciliation and the decolonization, at the very least, of our thinking and of our educational institutions" (Johnston, 2020, p. 230).

A Journey to Coming to Know

The concept of "coming to know" is a term used to describe the process of developing understanding in Indigenous Science. Coming to know reflects the idea that understanding is a "journey, a process, a quest for knowledge and understanding" with all our relations (Cajete, 2000, p. 66) and there are responsibilities attached to the application and sharing of this deep understanding. The journey to understand the reality of existence and harmony with nature

is acquired by quietening the mind, listening deeply, and achieving a give and take of human and more-than-human consciousness.

"Coming to know" has required me to personally reflect upon and conceptualize the balance between my own Western worldviews and the views presented in Indigenous epistemologies. As we take this journey together, I am asking you to step carefully and with an openness to reflection. The process of reconceptualization of children and nature has come with challenges for me. The challenge of letting go of what I have learned and having an openness to re-learn comes with feelings of discomfort, and a need to become comfortable with the uncomfortable.

I have become comfortable with the acceptance of how influenced I and the field of Early Childhood Education are by Rosseau's theory of 'negative education' and the assumptions I began this journey with. I believed land-based pedagogy and environmental education were universal but have come to know that it is not. It is culturally specific and can be different for different people based on their cultural views and values. I have had to admit to my views of children in nature and nature itself being romanticized. Finally, I have reflected upon questions and wonderings such as whether land-based pedagogy and environmental education are about stewardship or if this is part of the problem and do forest and nature programs incorporate an Indigenous perspective, or do they only provide only an illusion of indigeneity?

This journey is a quest for knowledge and understanding. As I take this quest with you, together we will explore romanticized notions of children in nature, dig deeper into common worlds conceptual framework, investigate the theory of new materialism, and perhaps come to know a reimagined view of children in nature and forest pedagogies.

The Literature

There are several bodies of literature I am drawing on, and as I have been reading, I have pictured a dinner party where I invite the guests and engage in lively and rich dialogue. On one side of the table are the romantics who have greatly influenced my perspective regarding nature and children. On the other side of the table are the scholars whose work has challenged and shifted my thinking away from these romanticized notions of children and nature and who share a common worlds conceptual framework. At each end of the table, I have placed Indigenous scholars who will share their perspectives regarding Indigenous science and decolonizing education. Together we will tackle how we might articulate the relationship between childhood and nature beyond the nature/culture divide.

The Romantics

Affica Taylor (2013) explores rethinking human place and agency and what it means to be human. Taylor suggests that although well-meaning, stewardship pedagogies are outdated as they do not allow humans to rethink their place and agency within the world. It places humans as primary agents of change and environmental stewards. They can lead to the idea that humans can improve upon nature and can exploit the earth's resources. This thinking comes from the modern western epistemological nature-culture divide. Let's take a closer look at the romantics and how they have influenced early childhood education, perceptions of children and nature and each other.

Jean-Jacques Rosseau has been given the title of 'father of early childhood education' due to the dominant impact his work and ideas have had on how children and childhood is viewed. During the eighteenth century, Rosseau's viewpoints changed parenting practices. He contended that children were inherently innocent. He believed that all humans were born pure and innocent and should be protected from the adverse effects of society and civilization. Rosseau's work Emile, or Treatise on Education (1762), was central to the change in parenting practices and how childhood was understood. He argued that children are innocent until they are corrupted through experience with the world. He believed his method of raising children would maintain innocence by having children develop naturally in nature and following their natural instincts, resulting in well-adjusted adults who will also be good citizens.

I find the impact Rosseau's theory has had on early childhood education mildly amusing as Rosseau himself lacked the credentials necessary to be seen as an expert regarding raising children or education. He was not a practising

educator, nor was he successful as a parent. In fact, he surrendered his own children as infants into what was referred to at the time as a foundling home; a place for children who had been abandoned by their parents and were being cared for by others, similar to what we might refer to as an orphanage. Yet, despite his lack of first-hand experience, Rousseau's famous fictionalized philosophical treatise about the ideal natural education of a boy in the countryside gained sufficient credibility and traction to become immensely influential on childhood and education.

This feels like a good time to stop, sip some wine, and offer you the reader a chance to reflect. How is it that Rosseau's theories of education have had such a profound influence on early childhood practices when he was not even an educator himself; he was just a man with an intense distaste for societal influences…

Rosseau held nature in high regard and passionately argued his aversions to European society, which are powerful psychological forces behind his thinking. His romanticized notions played into the division between nature and culture.

> Rousseau's figurations of Nature as a perfect child and a perfect teacher were not only shored up by the nature/culture divide but were the products of his emotional investment in reproducing the binary logic of good nature as opposed to evil culture (Taylor, 2013, p. 9).

Rosseau sought to purify and rescue childhood by implementing ideas of Nature's child and Nature as teacher to carry out this work. "These figures allowed him to rescue childhood from the degenerative 'hands of man' and return it to Nature (Taylor, 2013, p. 11). Rosseau inspired two of the most renowned romantic writers with his theory. As a result of this influence, William Wordsworth and Henry David Thoreau would connect childhood with nature and often refer to nature as a mother and teacher in many nature-worshiping works of poetry. The land is essential to Indigenous peoples as they can view the patterns and cycles of animals, plant life, seasons, and cosmic movements. Just as the romantics refer to 'mother nature,' the Indigenous peoples see all that the land provides and that "All of this happens on the Earth; hence, the sacredness of the Earth in the Native American mind. The Earth is so sacred that it is referred to as "Mother," the source of life" (Cajete, 2000, p. xi).

My Heart Leaps Up
My heart leaps up when I behold
A rainbow in the sky:
So was it when my life began;
So is it now I am a man;
So be it when I shall grow old,
Or let me die!
The Child is father of the Man;
And I could wish my days to be
Bound each to each by natural piety.
William Wordsworth (1802)

Wordsworth's writing projected romanticized beliefs connecting nature and childhood. In his poem My Heart Leaps Up When I Behold (1802), Wordsworth writes about what appears to be the beauty of a rainbow. However, an in-depth analysis reveals a deeper meaning. The poet suggests that people should maintain their sense of childlike wonder into adulthood and old age. In this poem, Wordsworth is writing of his feelings of joy and happiness when he is reminded of his childhood by a rainbow in the sky. He worried about the loss of childhood and a direct connection to nature as people grow into adulthood; he believed that people could only truly see nature's beauty during childhood.

Henry David Thoreau was part of the North American Transcendentalist movement, an intellectual and literary movement concentrated in the New England region where he lived. They followed suit with Rosseau's value of nature; the Transcendentalists supported the vital goodness of nature and opposed the risks that urban industrial society posed to it.

Driving ahead Rosseau's visualization of figure of Nature as Teacher, Thoreau spoke about what he learnt from nature in his book Walden; or Life in the Woods (1854). By returning himself to nature, Thoreau sought to find vital truths about 'man' in nature that he felt were missing within society and cultural practices. Thoreau argues that a person who lacks being moved by the beauty of things is one who does not understand reality because they do not possess a proper awareness of the world or a connection to it. Like the other Romantics, he closely associated childhood with nature, and like Rousseau and Wordsworth before him, he bemoaned the lack of time that children spend in nature and advocated a return to nature as the remedy for this untimely 'weaning' (Taylor, 2013, p. 14).

Nature
O Nature! I do not aspire
To be the highest in thy quire,—
To be a meteor in the sky,
Or comet that may range on high;
Only a zephyr that may blow
Among the reeds by the river low;
Give me thy most privy place
Where to run my airy race.
In some withdrawn, unpublic mead
Let me sigh upon a reed,
Or in the woods, with leafy din,
Whisper the still evening in:
Some still work give me to do,—
Only—be it near to you!
For I'd rather be thy child
And pupil, in the forest wild,
Than be the king of men elsewhere,
And most sovereign slave of care:
To have one moment of thy dawn,
Than share the city's year forlorn.
Henry Thoreau (1895)

It is important for me to break a moment and share that reading *Last Child in the Woods* (Louv, 2008) is a crucial part of my story. It is where my story began. This book directly fed into my understandings of childhood and nature which I see as these understandings have grown and changed; they were romanticized. My thinking about nature and children has been challenged and changed since my initial reading of this book. I do feel Louv has some valid arguments, as do all the romantics; however, I also see how Rosseau's theories still impact environmentalists and early childhood education today and directly contribute to nature/culture divide.

In *Last Child in the Woods* (Louv, 2008) the central message is that society is losing its sense of interaction with nature, especially today's children. He argues that children do not play outdoors in today's world. As a result, they lack social interactions, a loss of imagination in play, and less time being active overall, which can lead to obesity, literacy problems and mental illnesses. Louv's target audience is parents, educators, and communities. He aims to create awareness amongst the targeted audience of the consequences of losing our connection to nature. He also presents concerns about the advancement of technology and how it has changed the way children play and see the world, as well as how educators teach.

I will pass the salad to Louv now and offer that I agree technology has fundamentally changed the way I and other educators teach. It has become commonplace to walk into an early years classroom and find an educator using an iPad to play music, or to record children's learning in some way. In my experience, I have found that some educators get so caught up in photographing children's learning that they often miss out on the aspect of co-learning alongside the child. It is almost like when you go to a concert or show, and you see everyone in the crowd holding up their phones to record the performance while viewing it through the small screen. Imagine how different the performance

would be if we put the phone down and really listened with our whole selves to the music. How much richer would the experience be?

The theory of Nature Deficit-Disorder is introduced by Louv and he contends that the barriers society faces contribute to a decrease in the amount of time children spend outdoors in nature. Louv claims society has become so technologically driven that it is losing its connection to the natural world. He offers solutions as to how parents, educators and communities can promote a healthier, greener future which he feels will bring new hope to mending the fragmented bond between children and nature. I must pause and acknowledge that Louv's claim regarding technology may have some truth. I recall being 10 years old and excitedly receiving my first video gaming system of the time. I remember leaving behind my running shoes, and my bike becoming quite dusty from lack of use as I spent days trying to master level one of the game. I became so enthralled that I even dreamt about the game at night. It became all I could think about.

Louv's arguments have been accepted wholeheartedly by those involved in nature education and offer a modern-day twist on Rosseau's Nature's Child and Nature as Teacher. Louv offers romantic notions of nature and scientific theories to create a movement to return children to nature. These arguments and theories have given new life to Rosseau's thesis of negative education. "Rousseau was the first to famously declare the innocence of natural childhood to be threatened by 'man' and his books, and this has become a recurring historical theme, usually linked to the advent of each new communication technology" (Taylor, 2013, p. 51).

As I top up everyone's wine, I would like to invite the Indigenous scholars who are joining us for this dinner to share some of their perspectives thus far, regarding returning children to nature.

Global warming, pollution, rapid urbanization, destruction of forests, unsustainable growth, and consumption on the part of the overdeveloped world are all cause for concern that environmental degeneration will become normalized, resulting in children not having access to nature and facing the possibility of never having nature experiences or developing the ability to respond appropriately to environmental degeneration and crisis. Adopting Indigenous perspectives and incorporating these into ecological education is essential to include rather than just returning children to nature as suggested by the romantics. Teaching children to appreciate the land and view it in a different way will allow them to establish a harmonious relationship with nature; "to understand it, to see it as the source of one's life and livelihood, and the source of one's essential spiritual being" (Cajete, 2000, p. 179). Indigenous people viewed the land and place where they lived as being in a perfect state.

> But in the minds of many Europeans…The people indigenous to this land were never truly understood for who they were and are: a people who, in a variety of ways and with all their heart and being, tried to establish a direct relationship with nature, which they understood as the essence of the Great Mystery that guides and breathes life into all things (Cajete, 2000, p. 180).

Embracing Indigenous ways of knowing and teaching children about appreciating the land could help children to see the land as "full of spirit, full of life energy [and learn to] live with their environment in a holistic way" (Cajete, 2000, p. 180).

When my interest surrounding Forest Schools first began, I had the opportunity to speak with parents of children who chose to enroll their children to gain insight into their reasoning why. Many spoke of their distaste for mainstream education practices and their preference for their children to be taught outside within nature and from nature. Many shared with me that they felt their child could learn everything they needed within a nature-based program. I found myself entirely on board with what I was learning throughout this research project and began to advocate for children to be educated in and from nature; however, Taylor (2013) makes a good point when she states:

> Those that advocate for children to be educated directly in and from nature, as opposed to about nature, position themselves as counter voices to mainstream schooling. In fact, their arguments for returning children to nature, like Rousseau's treatise three centuries earlier, are defined by

> their opposition to the status quo and their appeal to a Romantically-inverted valuing of the nature/culture divide (p. 46).

Once again, I was faced with accepting the immense influence Rosseau has had not only on me but also on parents and the field of early childhood education, as well as how his theories contribute to nature/culture divide. The romantic belief that children have an innocent and unique relationship with nature has been passed on from Rosseau and reiterated by many.

This romantic belief continues to be shared by Nature Education advocates who "all passionately advocate (like Rousseau) that the best kind of learning comes from children's direct, rather than mediated, nature experiences, and (yet again like Rousseau) they all bemoan the loss of these experiences" (Taylor, 2013, p. 50).

Everyone at the table has listened to the romantics share their images and views of the nature of childhood and their concerns for the fate of children due to societal influences. I think the romantics heavily invested in providing symbols of childhood because they believed childhood to be a natural state. Under this romantic gaze childhood, like nature became a place of purity and innocence. Childhood represented for the romantics, what they hoped for the human condition. Growing up meant growing away from the evils of man if they could maintain a closeness to nature. As we prepare for the second course of this meal, I will turn the conversation away from the romantic notions of nature/culture divide and move towards common worlds conceptual framework.

Common Worlds Conceptual Framework

"Common worlds is a conceptual framework developed to reconceptualize inclusion in early childhood communities. Common worlds take account of children's relations with all the others in their worlds — including the more-than-human others" (Taylor & Giugni, 2012, p. 108).

This idea of common worlding has changed and shifted my thinking about how children relate to nature and the world. Common World's framework could be seen as a decolonizing response that disrupts romanticized and decontextualized correlations between children and nature as part of outdoor pedagogies. It repositions the child from the centre of the pedagogy and allows for the more-than-human aspects of the world to have a sense of agency.

Nxumalo (2019) rethinks children in nature and challenges forest and nature school pedagogies to move away from viewing nature as a return to innocence for children. Nxumalo draws upon the perspectives of Indigenous thinkers and Black feminists and offers a coherent critique of anthropocentrism in contemporary Western education models. She points out that the dominant discourse in environmental education for children, particularly in forest schools, often encompasses colonialist and modernist binaries between humans and nature. This occurs "through positioning nature as something (certain) innocent children need to be returned to" (Nxumalo, 2019, p. 1). When Nxumalo refers to 'certain' children, she refers to the exclusions that seem to be normalized. She explores the potential of decolonizing practice through the disruption of the Westernized normalization of these exclusions that "occur when predominately white middle- and upper- class children participate in North American nature or Forest schools and become positioned as future earth saviours and stewards" (Nxumalo, 2019, p. 1).

I will pass the potatoes to Nxumalo along with an acknowledgement that looking into who has access to these Forest and nature school programs should be taken into consideration. The programs can be expensive and do not always allow for subsidized payment of fees. This means that these programs which claim to include Indigenous perspectives are not accessible for many Indigenous children who could benefit from them. These programs could offer significant benefits to Indigenous children by providing culturally relevant education, promoting opportunities for inter-generational knowledge transfer, and creating safe spaces for healing and learning. I do think non-Indigenous children should also have access to these programs because changing the relationship that many non-Indigenous people have with the land, has the potential to lead to a healthier Earth for all.

What can we do? What can I do? These are questions that have continuously come to mind as I have embarked on this journey. Then I read Unsettling the Colonial Places and Spaces of Early Childhood Education (Pacini-Ketchabaw

& Taylor, 2015). In chapter 4 Emily Ashton examines assumptions of a social pedagogical approach and how curriculum strengthens dominant settler discourse by silencing Indigenous voices. In this chapter, Ashton recounts a story about how during her master's degree, a visiting professor gave a talk about the perpetual colonization of Indigenous education.

> Following his talk, a fellow class member asked, "What can we do"? The professor stood and spoke back, "I am not here to tell you how to fix the mess you've had a part in causing." Deafening silence ensued. The presentation abruptly reached its end. At the time, I was shocked, but years later – after hearing that same question posed again and again to the same people – I understand differently. This is not a claim to empathize in a walk-in-your-shoes kind of way but an indication that I have become more attuned to the expectations underlying such questions: That those who endure the violence of settler colonialism also somehow bear the burden of resolving it for those who most profited from it. (Ashton in Pacini-Ketchabaw & Taylor, 2015, p. 83).

This story significantly impacted me and brought me back to my question, what can I do?. I realized that although I wanted to build connections with Indigenous communities to help me to decolonize and change my practice, it is not the responsibility of these communities to tell me how.

Ashton analyzes the inclusion of an Indigenous colleague, Bear Nicholas, to help review the curriculum within the Early Childhood Centre at the University of New Brunswick as a form of "enclosure" and containment—a nod to multiculturalism, including Indigenous pedagogies and principles within their already established Eurocentric framework. She notes that Bear Nicholas "refused to let her work be commensurated into a "honey-do list for white people" (Tuck, 2007, p. 154) …and instead used the forum to speak to issues of perpetual settler colonialism" (Ashton in Pacini-Ketchabaw & Taylor, 2015, p. 85).

The common worlds framework prompts us to remain open to human differences and to extend beyond them. Common worlds is an inclusive notion that resists the division between human society as separate from nature and other more-than-human living things and embodies post-enlightenment western thinking. It allows us to have an alternative way of thinking about the world and the kinds of relations that compose our experiences within it.

> Instead of rehearsing the nature/culture binary, or the 'Great Divide' as Latour (2005) calls it and seeing ourselves as living in exclusively human societies – somehow separated from the 'natural' world because of our exceptional human qualities – the notion of common worlds encourages us to move towards an active understanding of and curiosity about the unfolding and entangled worlds we share with a host of human and more-than-human others (Taylor & Giugni, 2012, p. 111).

Reading with these scholars is when my journey took an abrupt turn away from the romanticized ideals of children and nature I was grasping so tightly and made me begin to move to a place of 'natureculture'. In this place 'natureculture' is so tightly interwoven that it cannot be separated into nature and culture. 'Natureculture' is the inseparable and messy entanglement of humans and everything else. It is time for the next course of this dinner- dessert- and everyone has their own slice of the pie.

New Materialism

As I continued to think with Common Worlds framework, I began to explore the pedagogy of new materialism. "New materialism calls for a reconceptualization of play (Holmes and Jones, 2014; Lenz Taguchi, 2014), in which places, children and objects intra-act with each other. When children play with place, place and objects 'play back'" (Procter & Hackett, 2017, p. 22).

I was interested in children's relationships with the land and materials (the more-than-human) and how they interact with each other. I began to explore placing less agency on the child and the development of skills and focusing on the more-than-human materials having a participatory role and what they were teaching the child.

To demonstrate this for the educators I worked with, I provided each person with a piece of clay and asked them to play with it in their hands as we talked. We discussed where the clay came from and that it was a gift from the earth. I asked the educators to share what they would document if they were observing a child playing with clay. They immediately began to focus on the skills (fine motor and hand-eye coordination). I then asked them to think about what the clay is teaching the child. They paused for a few moments, and then new ideas began to emerge. Clay teaches them about tactile and visual feedback as they explore how it feels, smells, sounds and changes. It illustrates that it has limitations; it can be hard and tough to work with and then become soft and easy, and it lets the child know that their actions have consequences. The clay is teaching them that it can be invigorating yet soothing and that it is not perfect. The children learn a sense of calm, curiosity, imagination, and accomplishment. As they began to switch their thinking to allow the clay to have agency, the clay started to reveal the many things it could teach.

"Horton and Kraftl (2006: 73) have described material objects as 'acting back,' and Hultman and Lenz Taguchi (2010) have suggested that sand plays with children just as much as children play with sand" (Hackett, 2017, p. 3). This decentering of the human gives the more-than-human a participatory role and opportunity to teach the child about what it can do in the world.

This exercise I engaged my educators in is only the beginning of understanding and igniting a conversation about transforming how we as educators might begin to look at materials in a way that they can act back. Still, after this brief encounter, I began to see the pedagogical documentation they were producing take on a new narrative that included the materials being given a participatory role in the learning giving it more meaning and authenticity.

I connect this thinking to land-based pedagogy. By listening deeply, we can begin to understand and see what the land is teaching us. As part of my previous research, I had the opportunity to visit forest school programs within the area I live. During my observation at one program, the children at the end of their class were invited to participate in what they called a 'sit spot.' A sit spot is a time to sit in nature and listen with all your senses. As the children engaged in this, I noticed they were all silent, which is unusual for three- and four-year-olds. After a few minutes, the children were invited to share what they noticed during their sit spot. One child shared that they felt the wind on their skin and that it showed them that it could be gentle but strong. Another child spoke about the light rain they felt and how the earth needed it to grow. One child said they heard a squirrel rustling in the woods and that they must be collecting nuts to feed their babies. As I listened to these children, it became clear that if we open our minds and allow ourselves to listen, the land around us can teach us many things.

> This land has a voice, the sea around the land has a voice, and the resources within have a voice. The voice comes from the people who live off of the land and sea; the people whose ancestors fought to ensure that the future generations would have a place to call home, as well as the resources they would need for survival. (Pokiak, 2013 via Rowan, in Pacini-Ketchabaw & Taylor, 2015, p. 198).

I would like to take a moment to share with you a photograph of my favourite 'sit spot'.

(Sit Spot at Laurel Creek, Waterloo, Ontario, Canada)

After observing the children participating in their sit spots, I was inspired to give this activity of connecting and listening to land a try. This is a spot I visit often. I sit quietly and listen with my whole self. Sometimes I will journal what I see, hear, feel, taste and occasionally I will draw. When I draw, I sometimes sketch what I call a sound map. I put myself in the middle and then add drawings or words of what I discover with my senses around me.

Rowan (2015) speaks about developing pedagogies to enable children to acquire voices informed by the land, water, ice, and snow. Rowan explores how thinking with land, water, ice, and snow might offer a way to enact and live Inuit knowledge and practices in early childhood education and nurture relationships. She proposes that:

> thinking through land, water, ice, and snow provides a way forward through the massive challenges of past/ongoing/future colonization and climate change. In Inuit nunangat pedagogies, the central thesis is that "things to learn [are] the lessons that come from interacting with the land" (Price, 2008, via Rowan in Pacini-Ketchabaw & Taylor, 2015, p. 198).

Rowan shares the details of a learning story. A learning story is a story produced from individual and collective reflection to document children's learning and plan future learning activities. She shares this story to "highlight pedagogies that think with land, water and ice" (Rowan, in Pacini-Ketchabaw & Taylor, 2015, p. 203).

This story takes place on a winter's day. The educator/Elder Elisapi Weetaluktuk took the children and some recently acquired wooden snow knives outside to the playground. Elisapi began to carve the snow with the wooden knife while the children watched becoming intrigued by what she was doing. The children wanted to know what she was carving. Elisapi admitted to the children that she did not know, but told them the figure would become recognizable as she continued to skillfully use the knife to shave and shape the snow. "In this encounter, however, it was not just Elisapi's skill that produced the carving. The qualities of that particular chunk of snow also co-determined the shape of the final figure". (Rowan in Pacini-Ketchabaw & Taylor, 2015, p. 204-205).

The children continued to watch as a waterfowl emerged and then later a bunny. A child named Nowra then selected a toy wooden pana (snow knife) and another child named Minnie chose a wooden ulu (a woman's knife) with which to work. Nowra looked at the snow as he considered how he would approach this task based on observing how Elisapi had completed her carving. When he completed his carving, he placed it on display for everyone to see. "Nowra had learned, first by watching and then by doing, about carving snow with a wooden pana" (Rowan in Pacini-Ketchabaw & Taylor, 2015, p. 204-205).

Using his recent observation of the educator's demonstration, this child learned about their relationship with the snow and the wooden carving knife.

> Thinking with snow takes time and practice. The snow exerts its agency on the child within their interaction, as well as vice versa. The snow is teaching the child about its carveability – it is affording certain kinds of carvings to emerge. It is a co-production involving snow, tool, and child. This is different from the Western notion of a child learning about snow in which the objective is for the child to master the snow (Rowan in Pacini-Ketchabaw & Taylor, 2015, p. 205).

This story and interaction with the snow demonstrate Inuit knowledge and how learning comes from interactions with the land. It provides an example of how local place-based learning plays an intricate role in educating children despite ongoing colonialism within Western conceptualizations of education.

This brings a close to our dinner party. We enjoyed good food, wine, and conversation. I want to recognize all the perspectives brought forth and thank you the reader for opening your mind and listening deeply to each one. Have I let go of the romanticized view of nature and children in nature that I began with? No, not completely; however, Cajete (2000) defines worldview as "a set of assumptions and beliefs that form the basis of a people's comprehension of the world" (p. 62). I can honestly say that my assumptions and beliefs have been challenged and this is changing my comprehension of the world.

Continuing Coming to Know

Forest School is an educational approach and program delivery. Forest School is not a new concept but has begun to become growingly popular in recent years within Canada. Histories of Indigenous peoples that have come to light within the last few years have contributed to outdoor education and land-based pedagogy becoming an upward concern within the early years sector. Forest School is a form of regular outdoor learning which draws on the outdoor Kindergarten practices of Denmark, Sweden, and Scandinavia. Europe, China, Australia, New Zealand, the United States and Canada have all embraced the idea of outdoor education programs. Forest School can be referred to by many names; in Canada, two prominent names are taking hold: Forest School and Nature School.

Children attend forest school outdoor learning sessions regularly and repeatedly, either weekly or bi-weekly, for a minimum of six weeks and possibly extending throughout the school year. Children have the freedom to engage in activities such as fire lighting, nature crafts, climbing, fishing, and building with items they find in nature. Children are encouraged to learn through an emergent play-based curriculum.

> Forest school is described as 'constructivist education' (O'Brien 2009) with children constructing meaning through interaction with each other and the natural environment. The outdoor learning environment is seen to provide a flexible social space with multiple opportunities for learning and interacting with others (Harris, 2017, p. 275).

An assumption I began this journey with was to think that Forest Schools, due to being situated within the forest and nature, would have much in common with Indigenous ways of knowing, being, teaching and learning. This seemed like a reasonable assumption because, on the surface, certain aspects of Forest Schools draw upon and are inspired by Indigenous education perspectives. However, I quickly learned, as I explored this theory more, I came to know that there are understandings outside the realm of both my view and the Western view. I surveyed some literature about forest schools and Indigenous perspectives of education to gauge where they meet and vary.

Newbery (2012) states, "part of the work of environmental education must be to confront the traumatic traces lingering in a nation born through colonization" (p. 30). Environmental educators emphasize the land, and in doing so, there is a need to slow down and listen to allow themselves and the students within these programs to "develop a sense of place, a respect for this more-than-human world" (Newbery, 2012, p. 30).

I wonder how many environmental educators within the growing popular forest schools truly embrace this philosophy. Newbery's (2012) Canoe Pedagogy article challenged and altered my thinking about children and nature. I look less at nature as a romanticized open space waiting to be explored while not acknowledging the erasure of the people who were removed from their land and the destruction of languages, cultures, families, and histories.

Newbery (2012) argues that outdoor education pedagogy should include the history of Indigenous peoples on the land and the history of colonialism.

I continue to wonder how many educators within outdoor education programs genuinely understand and know the history of the land on which they teach and work to include this within the curriculum.

Although Forest Schools are located within nature, they continue to be "socially and culturally constructed" (Harper 2017, p. 320) western forms of education. Newbery, 2012, says, "colonial histories and legacies always exist in the background of Canada, and the more we ignore this, the less we are able to create something better in the present" (p. 32). Newbery also suspects that a failure to acknowledge the connections between colonialism and pedagogy may be a factor that has led "to the stereotypical representation of Aboriginal peoples and the appropriation of cultural practices in some outdoor education programs" (p. 31).

In Canada, where I live, many are working diligently to build relationships with Indigenous communities and educators, and educational institutions are genuinely working towards weaving Indigenous perspectives into their programs and curriculums.

On their website, the Child and Nature Alliance of Canada, 2022 states that "relationship with Land is the heart of what we do, and this Land is Indigenous Land". They go on to acknowledge that the Child and Nature Alliance of Canada and Forest School Canada are "rooted in white settler thinking and approaches" and it is led by white settlers. They admit to having imposed a "settler colonial way of being with the Land" due to their programs not being developed with Indigenous people. They go on to speak to wanting to repair their relationship with Indigenous communities and acknowledge that it will take work to establish trusting, safe and reciprocal relationships with the Indigenous people they have harmed. "In doing that, we hope that Indigenous and Western worldviews will have equitable voice and space in our programs so that they are safe, meaningful, and culturally relevant for all participants" (Child and Nature Alliance of Canada, 2022).

This is a much different message than the message previously offered by the organization. In the past they have boasted similarities between Forest school pedagogy and Indigenous perspectives. Their new message suggests that the similarities within Forest school pedagogy were only assumptions as it was never co-created with Indigenous peoples. They have claimed that when educators use Aboriginal pedagogy in their classrooms, "it helps create an atmosphere of mutual respect and sharing, it helps Aboriginal children and their families to feel more welcome in the school" (Forest School Canada, 2014, p. 13).

I am not sure that Indigenous children would feel the same. Reading this made me wonder how true this is, considering the great amount of work that still needs to be done towards truth and reconciliation.

Leanne Simpson (2014) speaks to her experience of education as being "one of coping with someone else's agenda, curriculum, and pedagogy, someone who was neither interested in my well-being, nor interested in my connection to my homeland, my language or history, nor my Nishnaabeg intelligence" (p. 7).

Reading this perspective on education from an Indigenous person who experienced this throughout their educational career, increases further my hope that the changes proposed from organizations such as the Child and Nature Alliance of Canada and the development of new curriculum within western education to include Indigenous perspectives does come to fruition.

In general, the premise of Forest School pedagogy is to spend time playing outdoors; ideally, activities are child-led and involve inquiry and place-based learning. The activities can be planned or spontaneously occur from children's curiosity, wonders, and questioning (Harper, 2017). Forest School pedagogy touches on "ecological systems theory, and approaches to human development can be taught through observing biological systems, participating in group development (Forest School Canada, 2014) and discovering nature as a reflective and restorative place" (Harper, 2017, p. 321). Mainstream education typically does not allow for this type of discovery, and experimental learning, which, as we learn more about land-based pedagogy and Indigenous educational perspectives, becomes evident why many children (as I found in my previous research) do not cope well within Western Euro-centric educational settings. Western worldviews have removed the spiritual, emotional, physical and intellectual connection to land from our education systems. This connection stems from Indigenous perspectives of land as first teacher. "The idea of land as first teacher considers the interconnectedness and interdependency of relationships, cultural positioning and subjectivities that extend beyond the borderlands of traditional mainstream conceptualizations of pedagogy" (Styres, 2011, p. 722).

Risk, Resilience and Environmental Stewardship

The recent movement to return children to nature suggests that children are spending less time playing within natural environments than in the past, which also means children are not reaping the many benefits of playing in nature that the literature suggests. Outdoor education is said to provide opportunities to learn about the environment and to support personal development. Spending time in nature is believed to allow children to not only experience and learn about nature but also participate in taking risks, develop resiliency from facing these risks and challenges, as well as "…develop teamworking and negotiating skills, engage in creative thinking, critically analyze situations, and develop problem-solving skills" (Harris, 2015, p. 274).

Forest schools support engaging in risky play, and it seems to be something that makes it appealing. Returning to Louv (2008) and his argument that many children do not spend enough time in nature due to fears, one fear being the risk of injury, makes the thought of children participating in controlled risky play within Forest School programs a selling point for parents as they offer the "antidote for the risk-averse society" (Johnston, 2020, p. 233). Harper (2017) defines risk as "the potential for loss or harm, yet risk can also present opportunities for gain" (p. 318). He argues that risk builds resiliency, a necessary component for child development.

Indigenous perspectives regarding what risk and resilience mean are very different from what Forest School pedagogy offers. Hansen and Antsanen (2016) share a much more complex view of the meaning behind risk and resilience for Indigenous people through a study conducted with Cree and Dene Elders from Saskatchewan. Throughout the study, the Elders spoke about learning skills such as using a knife to cut meat, hunting, harvesting and fishing by observing their grandparents and through experiential learning on their own. Experiential learning is seen as connected to "lived experience," as in learning by doing, through observation and imitation that occurs as part of daily family and community.

These are all skills which include elements of risk but skills that were required to be learned to survive and have a good life. These risks were a natural part of their education, and in comparison, how we define risk within forest school programs is very different. Thinking about risk from an Indigenous perspective means that risky play is a socially, culturally, and colonial constructed notion.

I struggle with the word resilience. Within Forest School pedagogy, it is used positively and thought to come as a result of risky play. Still, resilience has a different and more profound meaning when thinking with Indigenous views. It means long-suffering and enduring a colonial state. Culture and language through colonization have been stolen from Indigenous peoples. They were subjected to being taken from their families and suffering unspeakable violence and harm. As a result, they could not share their education with younger generations which has created a substantial risk of this knowledge ever being shared and a loss of their language completely.

The resilience that comes from risky play within forest schools cannot be associated with the resilience required of Indigenous peoples at the hands of ongoing colonization. For forest school programs to connect to Indigenous worldviews acknowledging the use of language such as risk and resilience and what these concepts truly mean within Indigenous culture needs to be included.

> Resilience in education can be developed through Indigenous constructs such as identifying and re-examining traditional teachings, which can be accomplished by discussions with Elders. For the Elders, culture and language are crucial to Indigenous resilience in education (Hansen & Antsanen, 2016, p. 14).

Forest Schools are marketed to encourage children to develop environmental awareness and responsibility for caring for the earth by becoming "well-informed and caring stewards of the natural world" (Forest School Canada, 2014, p. 16).

Forest school pedagogy speaks to children developing empathy and appreciation for nature through repeatedly visiting the same place in nature. Taylor 2017 argues that while environmental pedagogies place agency on the human, positioning learners as potential environmental saviours and stewards of the earth, they do acknowledge the importance of avoiding anthropocentric attitudes towards the environment. The value seems to be placed within these programs on learning in and about nature rather than the focus being on learning with the land and developing a balance and an interconnectedness with the more-than-human.

Although awareness of nature feels like a positive aspect of Forest Schools, when considering Indigenous worldviews of the environment, they are deeply rooted in the land and involve more than awareness. Land is understood to be the source of knowledge and first teacher (Simpson, 2002; Styres, 2011). Understanding land in this way creates the need for more than awareness but for a relationship with the land.

> Consistent with the Anishinaabe teachings is the spiritual connection to the land, and this relationship is reflected in the Dene language. The Dene word "ne holt hi ne" translates as the "one who created the land," which suggests the spiritual relationship the Dene people have with the land (Antsanen, 2014 as cited in Hansen et al., 2016, p. 3).

The theory of new materialism speaks to the spiritual connection Indigenous peoples have with the land. When we consider how the land and the more-than-human objects around us speak to and teach us about what they can do and how they are in the world, this connects to the Indigenous worldview that everything has a spirit. Adopting this view creates a relationship and connectedness to all that exists within the natural world. Silencing spirituality in the classroom creates a gap in learning. Exploring traditional spirituality is not about putting forward a religious agenda. It is about calming the mind and developing an awareness of one's wholeness and interconnectedness.

When incorporating Indigenous views into the Forest School curriculum, it is essential to consider spiritual connection to land and acknowledge whose land it is. Recently, every time I attend a meeting or gathering, a land acknowledgement is given. I have also begun to incorporate land acknowledgements into meetings and classes I facilitate but have been attempting to go beyond this and include discussions about the history of the land, our connections to land and gratitude for what the land provides and teaches us.

For Forest School programs to align with Indigenous perspectives, acknowledging the land should be included, and relationships must be built with Indigenous peoples to learn about the land and the history of it. Recognizing that spiritual connection with land is not part of the western worldview and working also to include this in Forest school practice will have a profound impact on not only creating awareness of nature and land but also on how children respect it by having a deeper connection to it.

Forest School Pedagogy and Indigenous Perspectives: Two-Eyed Seeing

As I started this journey of reconceptualization, I approached it with what I thought was a solid understanding of Forest School pedagogy and the misconception that I would indeed find that there were connections to Indigenous perspectives of knowing, learning, and teaching. As I explored further, I did find that some of the topics I encountered did have some commonalities on the surface. I came to know that there is less truth to that thought as I consider them in the realm of settler colonialism.

I have been recently investigating the idea of two-eyed seeing, an approach in which people view the world with an Indigenous perspective lens on one eye. In contrast, the other eye sees the world with a Western lens. I have yet to find more information and research as to how this might be possible or how to incorporate this into practice, but Bartlett et al. (2012) offers the idea of "Two-eyed Seeing" (p. 331) to weave together Indigenous knowledge with western knowledge to solve environmental issues. I began to think with this more, and I wonder how we might weave together Indigenous ways of teaching, learning, and knowing with Forest School Pedagogy.
Bartlett et al. 2012, offer the following:

> We believe an important question must be asked when encouraging or attempting to weave indigenous and mainstream knowledges together within today's educational curricula, namely: what can curriculum developers do to ensure that efforts remain true to the ways of knowing and knowledge systems of Indigenous peoples? This is exceedingly important because, as Elder Albert points out, there is great temptation today for some people to "just make it up" and so "validation, by recognized community Elders and Knowledge Holders, of that which is brought forward is exceedingly important." (p. 332).

The above quote made it clear to me that building relationships with Indigenous communities and involving them in developing curriculum for Forest and nature-based programs is a place to start. This is precisely what the Child and Nature Alliance of Canada stated on their website that they intended to do, so perhaps the idea of two-eyed seeing is not so far-fetched.

Conclusion

The word conclusion indicates that this story is over, but that is not the case. I would describe this storying of my journey as progressing, developing and evolving-to what? - I am still unsure. I began this story feeling like I was heading somewhere and that my story was not starting, but it was continuing to grow just the same as my perspectives and understandings have.

I began this trek with familiarity with Forest Schools and a trace of knowledge about Indigenous ways of knowing, teaching, and learning. However, as I harrowed into how Forest School pedagogy and Indigenous perspectives of education may connect or not, I determined that I was unable to truly find an answer. I discovered that there is still much work to be done to build the relationships necessary to create the type of connection I was hopeful of finding.

For me, listening deeply and learning from Indigenous scholars and knowledge keepers will be the next part of my path, and I would like to think more with the approach of 'two-eyed seeing' to help me navigate how to incorporate Indigenous perspectives into my practice and the practice of the educators I lead. I still have a passion for Forest School pedagogy, and I am confident that if those who work within these programs are dedicated to creating relationships with the Indigenous community, connecting Forest School pedagogy and Indigenous perspective can be possible. Elders and knowledge keepers will play a key role in making this a possibility as they are without question the source of Indigenous knowledge and teachings and are highly respected because of a lifetime of acquiring wisdom and knowledge through continuous experiences and apprenticing with their ancestors. They know the stories, ceremonies and values of the community and are seen as teachers, leaders, and spiritual guides. Elders and knowledge keepers will be a crucial component to identifying methods of teaching and learning according to an Indigenous worldview and to help students feel a part of the curriculum as well as set goals for future generations.

The path toward adapting Forest School pedagogies to include Indigenous perspectives will require educators to see themselves as representing different worldviews and cultural constructions from within their worlds. It will come with a need to be open to seeing their own limits and boundaries of knowing and understanding and to approach 'coming to know' with an open mind, heart, and spirit.

Although I am grateful for the knowledge I have learned thus far, I also respect that I began it with a realization that I was coming to know, and I am continuing to come to know and work towards reconceptualizing children in nature.

> …the more humans know about themselves—that is, their connections with everything around them— the greater the celebration of life, the greater the comfort of knowing, and the greater the joy of being. This relationship to space and time, and between living and nonliving things, is not just physical, but psychological and spiritual, in that it involves dreams, visions, knowing, and understanding beyond the simple objectified knowledge of something. In other words, it is inclusive of all the ways that humans are capable of knowing and understanding the world. (Cajete, 2000, p. 75-76).

Recently I had the opportunity to attend a workshop with an Indigenous knowledge keeper. It came to the time of the workshop to open the floor to questions. It did not take long for the question I am guilty of repeatedly asking myself to be asked. "What can we do? What can we, as non-Indigenous educators, do? The response given was much different than in the story shared by Ashton that I highlighted earlier. He said the one thing we can do is keep Indigenous languages alive.

From an Indigenous perspective, all languages are born on a piece of land and are connected to identity and culture. Language is how Indigenous peoples make sense of the world and share cultural knowledge from generation to generation. Language is the carrier and application of knowledge. It acts as a source for all the collective knowledge and experiences that a people, a society, or a nation has (Little Bear, 2009). Indigenous languages contain unique ways of interpreting the world, and they are seen as critical to the maintenance of Indigenous knowledge systems (Hebert, 2000).

I have taken up bringing Indigenous language into our learning environments by providing dual language literature for the educators to share with the children. I have committed to doing my part to help keep Indigenous languages alive in the best way I know how. I feel it is important because, for many Indigenous peoples, loss of language is often associated with loss of spirit (Cajete,1999). Edōsdi Judy Thompson, a Tahltan scholar emphasizes that:

> Language and land are interconnected; language is a connection to the land through our ancestors. Our ancestors have named our land—in our language. Through our language, we can hear the voices of our ancestors and their teachings about our culture and our relationship with the land (2012, p. 19).

I would like to close by saying "chi-miigwech," which means "**big thank you**." Thank you for taking the journey with me towards a re-imagining of children in nature that perhaps leaves behind the notion of nature/culture divide of the romantics and embraces 'natureculture' forests that allow for forest pedagogies and the epistemologies of Indigenous peoples to meet. A place for children to learn with the land, materials, and the more-than-human beyond the fences.

References

Anderson, D., Comay, J., & Chiarotto, L. (2017). Natural curiosity 2nd edition: A resource for educators: The importance of indigenous perspectives in children's environmental inquiry (2nd ed.). Toronto: The Laboratory School, Dr. Eric Jackman Institute of Child Study, Ontario Institute for Studies in Education, University of Toronto.

Bartlett, C., Marshall, M., & Marshall, A. (2012). Two-eyed seeing and other lessons learned within a co-learning journey of bringing together indigenous and mainstream knowledges and ways of knowing. Journal of Environmental Studies

Cajete, G. (1999). A people's ecology: Explorations in sustainable living. Clear Light Publishers and Sciences, 2(4), 331–340. https://doi.org/10.1007/s13412-012-0086-8

Cajete, G. (2000). Native science: Natural laws of interdependence. Clear Light Publishers.

Child and Nature Alliance of Canada. (2018). What are forest and nature schools? http://childnature.ca/about-forest-and-nature-school

Forest School Canada. (2014). Forest and nature school in Canada: A head, heart, hands approach to outdoor learning. http://www.forestschoolcanada.ca/wp-content/themes/wlf/images/FSC-Guide_web.pdf

Hansen, J. G., & Antsanen, R. (2016). Elders' teachings about resilience and its implications for education in Dene and Cree communities. International Indigenous Policy Journal, 7(1). https://doi.org/10.18584/iipj.2016.7.1.2

Harper, N. J. (2017). Outdoor risky play and healthy child development in the shadow of the "risk society": A forest and nature school perspective. Child & Youth Services, 38(4), 318–334. https://doi.org/10.1080/0145935X.2017.1412825

Harris, F. (2017). The nature of learning at forest school: Practitioners' perspectives. Education 3-13, 45(2), 272–291. https://doi.org/10.1080/03004279.2015.1078833

Hébert, Y. (2000). The state of Aboriginal literacy and language education. In M. B. Castellano, L. Davis, & L. Lahache (Eds.), Aboriginal education: Fulfilling the promise (pp. 55-75). UBC Press.

Johnston, L. (2020). Forest school pedagogy and indigenous educational perspectives. Handbook of Theory and Research in Cultural Studies and Education, p. 227–239. https://doi.org/10.1007/978-3-319-56988-8_63

Latour, Bruno (2004) Politics of nature: How to bring science into democracy, trans. Catherine Porter. Harvard University Press.

Little Bear, L. (2009). Naturalizing Indigenous Knowledge: Synthesis Paper. Saskatoon, SK: University of Saskatchewan Aboriginal Education Research Centre and First Nations and Adult Higher Education Consortium.http://www.afn.ca/uploads/files/education/21._2009_july_ccl-alkc_leroy_littlebear_naturalizing_indigenous_knowledge-report.pdf

Louv, R. (2008). Last child in the woods. Chapel Hill: Algonquin Books of Chapel Hill.

Newbery, L. (2012). Canoe pedagogy and colonial history: Exploring contested spaces of outdoor environmental education. Canadian Journal of Environmental Education, 17, 30–45.

Nxumalo, F. (2019). Decolonizing place in early childhood education. Routledge.

Pacini-Ketchabaw, V., & Taylor, A. (2015). Unsettling the colonial places and spaces of early childhood education. Taylor & Francis.

Procter, L. & Hackett, A. (2017). Playing with place in early childhood: An analysis of dark emotion and materiality in children's play. Contemporary Issues in Early Childhood. 18. 213-226. 10.1177/1463949117714082.

Rousseau, J. (1762). Emile, or education. J. M. Dent.

Simpson, L. B. (2014). Land as pedagogy: Nishnaabeg intelligence and rebellious transformation. Decolonization: Indigeneity, Education & Society, 3(3), 1–25. https://jps.library.utoronto.ca/index.php/des/article/view/22170/17985

Simpson, L. (2002). Commit to and respect indigenous knowledge-before it's too late. Biodiversity, 3(3), 32–32. https://doi.org/10.1080/14888386.2002.9712600.

Styres, S. D. (2011). Land as first teacher: A philosophical journeying. Reflective Practice, 12(6), 717–731. https://doi.org/10.1080/14623943.2011.601083.

Taylor, A. (2013). Reconfiguring the natures of childhood. Routledge.

Taylor, A. (2017). Beyond stewardship: Common world pedagogies for the anthropocene. Environmental Education Research, 23(10), 1448–1461. https://doi.org/10.1080/13504622.2017.1325452

Taylor, A. & Giugni, M. (2012). Common worlds: Reconceptualising inclusion in early childhood communities. *Contemporary Issues in Early Childhood*, 13(2), 108-120.

Thompson (Edōsdi), J. C. (2012). Hedekeyeh Hots'ih Kāhidi – "Our ancestors are in us": Strengthening our voices through language revitalization from a Tahltan worldview. Doctoral dissertation, University of Victoria. http://hdl.handle.net/1828/4213

Thoreau, H. D., In Salt, H. S., In Sanborn, F. B., & Chamberlain, J. C. (1895). Poems of nature. Houghton Mifflin & Co.

Thoreau, H. D. (2016). Walden. MacMillan Collector's Library.

Truth and Reconciliation Commission of Canada. (2015). Calls to action. http://www.trc.ca/websites/trcinstitution/File/2015/Findings/Calls_to_Action_English2.pdf

Wordsworth, W. (1802) My heart leaps up. *Poetry.com.* https://www.poetry.com/poem/42279/my-heart-leaps-up

Michelle McMichael is a Program Advisor at the Ministry of Education, Ontario, Canada. She can be reached at info@michellemcmichael.com.

International Journal of Early Childhood Environmental Education

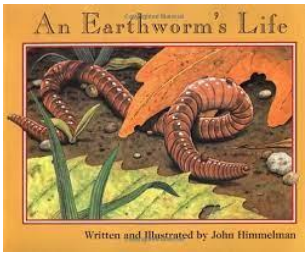
ISSN: 2331-0464 (online)

CHILDREN'S BOOKS AND RESOURCES REVIEW

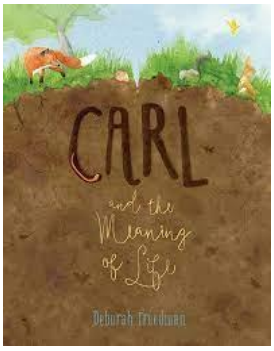
Carla Gull
Merry Lea Environmental Learning Center of Goshen College, USA
Book and Resource Review Editor

Worms, Glorious Worms!

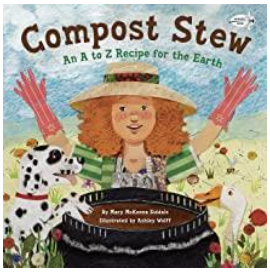
As children dig in the earth and rain pounds down on our outdoor spaces, it is inevitable that worms are discovered by small hands. Live animals, even like the earthworm, delight children as we hear squeals of wonder and interest. Worms are one of nature's recyclers. Worms have no bones, lay eggs, and are hermaphrodites (both male and female). Worm castings (poop!) are often sold as a soil amendment product. Vermicomposting can be a great way to explore worms and recycle fruit and vegetable waste. How do worm experiences happen in your space? Here are a few books and resources that may be helpful:



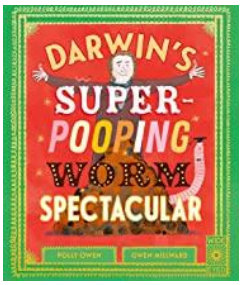
An Earthworm's Life by John Himmelman
Part of *The Nature Upclose Series*, this simple book beautifully illustrates the life cycle of the earthworm from one spring through two more springs. The earthworm is faced with dangerous predators such as a mole and robin, along with the reality of too much rain. The book shows how the worm eats, creates an egg case, and creates tunnels. With only one to two sentences per page, the information is basic enough to read with younger children, keeps their attention, and builds knowledge and vocabulary. The book includes words to know at the back, such as burrow, castings, egg case, mole, and soil.



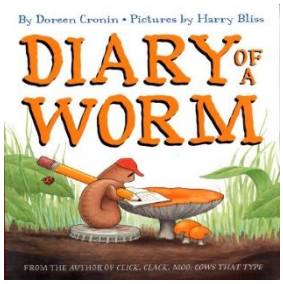
Carl and the Meaning of Life by Deborah Freedman
Carl, the worm, questions the meaning of digging tunnels after a mouse asks why. While Carl ponders the meaning of life, he stops digging. Slowly, the soil around him dries up and becomes hard. His other animal friends move on to new spaces as the land by Carl becomes more barren. Carl realizes how important his tunnels and starts digging again. The animal friends return as the soil becomes fluffy and light once more. Watercolor illustrations add to the experience.



Compost Stew: An A to Z Recipe for the Earth by Mary McKenna Siddals
This rhyming ABC book explores all the interesting things that can go into our compost including wriggling worms! This is a simple book with just a handful of words per page, suitable for younger children. Kitchen scraps, oatmeal, paper shreds, tea bags, and more can go into the compost pot to rot. A chef's note at the end shows how flexible composting can be, along with what to avoid, such as meat or dairy. Diverse skin color representations.

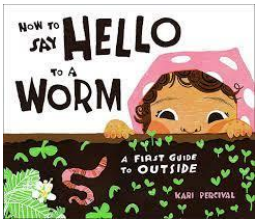


Darwin's Super-Pooping Worm Spectacular by Polly Owen
This brand-new book highlights Charles Darwin's worm studies and explorations as he is on a quest to show others the importance of worms which were considered pests at the time. He figured out that worms are blind (and have no eyes!). We learn about Darwin's studies and worms at the same time in an engaging story. The last couple of pages share wormy facts and the future of worms, with a caution on the impact of pesticides and loss of habitat. This would work best for early elementary students.



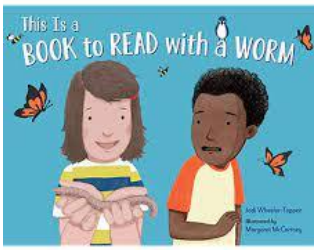
Diary of a Worm by Doreen Cronin
This is a funny journal of an earthworm. While it can be informative, understanding certain aspects about worms make it easier to understand the humor, such as when the worm eats its homework and needs to write sentences which he then promptly eats. The worm also doesn't need to go to the dentist—no teeth! There is a slight hint at the importance of earthworms as well.

Hello, Garden Bugs: A High Contrast Book by duopress labs
This black and white book with high contrast is meant for infants. While an earthworm is briefly mentioned, the infants also find other garden friends, such as a spider, dragonfly, bee, snail, and caterpillar. The animals are more cartoony in style than other books listed but do provide a brief introduction to these garden critters.

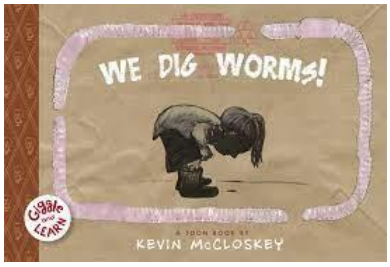


How to Say Hello to a Worm: A First Guide to Outside by Kari Percival
In this simple book, a few children plant lettuce, peas, and other garden plants. As they water and interact with the soil, worms come up to the surface. With an emphasis on the benefits of worms and being gentle, this is a basic introduction to worms and gardening. The children make mud, a trellis for the peas, explore bees, pick strawberries, and harvest vegetables. Backmatter focuses on tips and gardening with toddlers. Diverse skin color representations.

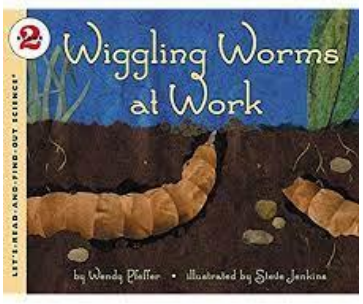
The Worm: The Disgusting Critters Series by Elise Gravel
The cartoon drawn illustrations support a humorous thread through this informational book. Learn about different types of worms and how they live while being entertained by cartoon worms and speech bubbles. Recommended for early elementary classrooms, though some younger children may enjoy it as well.



This is a Book to Read with a Worm by Jodi Wheeler-Toppen
While preschoolers could benefit from this book (and/or us as educators), this book is better suited for K-3 students. The book follows two children as they find worms, get to know the worm and its body parts, and gently explore the worm through simple exercises, such as finding the worm's face, investigating its reaction to light and rubbing alcohol, and visualizing the digestive system. With a labeled diagram of the body parts and invitation to get to know the worm, I found this book helpful for me as I was guiding worm experiences with younger children as well. The book encourages responsible investigations, including putting the worm back where it was found. Back matter includes questions and answers about worms, along with further resources. Diverse skin color representations.

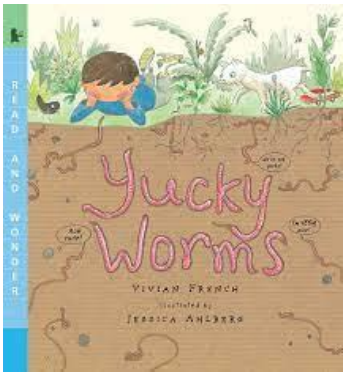


We Dig Worms by Kevin McClosky
This book starts by recognizing the many different types of worms. I enjoyed the illustrations, such as the page that mentioned that worms had no eyes or nose, the worm became the mouth on a face. Whimsical touches make this a fun book. Simple illustrations, such as a map of the worm, help teach about worm characteristics. The friendly and silly question and answer format with the worm and nearby humans and animals makes the book engaging and informational, as the worm moves quickly away from the bluebird who wants to eat it for lunch. The worm illustrations are painted on recycled grocery bags to keep things eco-friendly.



Wiggling Worms at Work by Wendy Pfeffer
The cut paper illustrations show the segments of worms, tunnels, and parts of the life cycle. With an emphasis on the usefulness and characteristics of worms, this book gives good, detailed information. Educators might read through the book and then tell longer pages in their own words if using with younger children. Backmatter includes activities to investigate a worm on your own through examining a worm and experimenting with worm castings.

Worm Weather by Jean Taft
This book for younger children features great rhyming sounds words as worms come up in the rain. The children put on rain gear to explore the rain, grab pizza as it starts lightening, and return to the outside to play some more as the rain lets up. Worms appear throughout during "worm weather" when we often find worms and have a chance to play in the rain.



Yucky Worms by Vivian French
This book follows a conversation between a child and grandmother in the garden as they encounter a worm. The boy learns from his grandmother and interacting with worms more about this marvelous animal. The main text includes 2-5 sentences per page, with additional details and speech bubbles about the worms. Interesting text features, like fun facts along the worm's tunnel, give many ways to explore the book. Backmatter gives details on becoming a wormologist and an index. Cautions to be respectful toward the worm and wash hands are included.

Additional Resources

The Worm Project by Illinois Early Learning Project
Follow how preschoolers found worms on the playground and launched a worm investigation, with children's questions, related graphing, creating composting and observation bins, conducting research and sensory play. Personal stories of two children add to the discovery.
https://illinoisearlylearning.org/pa/projects/worm-project/

The Worms are Dancing by Alissa Lange, Lynn Lodien, and Anna Lowe in *Science & Children*
Worm investigations in a preschool classroom including drawing, literacy, math, science, and technology connections.
https://www.ecstemlab.com/uploads/4/0/3/5/40359017/langelodienlowe.pdf

Growing Up Wild—Wriggling Worms by Project Wild
This 2-page spread of worm related curriculum shares related standards, books, websites, activities, math connections, ways to help, art projects, extensions, and a song and poem.
https://www.fishwildlife.org/projectwild/growing-wild/resources/wiggling-worms

Earthworm Digging Activity for Kids by Tinkergarten
This quick how to shares one approach to looking for worms with children, using a string circle, water, the ground, and tools for digging. Empathy, discovery, and safely returning worms to their home are emphasized.
https://tinkergarten.com/activities/friends-in-low-places

The Adventures of Herman by University of Illinois Extension
This website, in both English and Spanish, shares interactive elements for elementary students (and teachers) around earthworms. It includes fun facts, jokes, and directions for creating a worm bin for vermicomposting. The site has a printable certificate for studying worms, along with questions and answers for educators.
https://web.extension.illinois.edu/worms/

Worms, Glorious Worms podcast episode by Loose Parts Nature Play
This podcast episode shares practical approaches to investigating worms with young children in an indoor or outdoor space, along with related resources.
https://loosepartsnatureplay.libsyn.com/worms-glorious-worms

Invasive Worms—While worms in the US are typically from early European settlers, the Asian Jumping Worm is one worm to watch out for as it processes the dead organic matter more quickly than typical earthworms, making it hard for plants to set roots firmly in the soil. These worms are moving into more natural areas of the Northeast and Midwest. Avoid spreading these worms and report any activity you encounter. Find more details at: https://www.invasivespeciesinfo.gov/terrestrial/invertebrates/asian-jumping-worm

A special thanks to the *Nature Preschool Community* and the *Nature-Inspired Children's Books & Storytelling* Facebook groups for additional books to consider. If you have ideas or would like to contribute book or resource reviews, please contact Dr. Gull at insideoutsidemichiana@gmail.com.
If you have ideas or would like to contribute book or resource reviews, please contact Dr. Gull at insideoutsidemichiana@gmail.com.

International Journal of Early Childhood Environmental Education

E-ISSN: 2331-0464 (online)

INTERNATIONAL JOURNAL OF EARLY CHILDHOOD ENVIRONMENTAL EDUCATION (IJECEE)
Addressing Issues, Policies, Practices, and Research That Matter

Information for Authors

The journal has two broad visions:

(a) To encourage thoughtful sharing of information about important ideas, conceptualizations, and frameworks, as well as effective practices and policies in early childhood environmental education; and

(b) To reach an extensive global readership in order to maximize the impact of the thoughtful information.

Thoughtful information may manifest through book reviews, description of educational approaches and programs, research investigations, and development or interpretation of theoretical perspectives. Associations among and between the following will be emphasized:

- Young children
- Family circumstances
- Community opportunities
- Policy mandates or recommendations
- Environmental activities, education, or experiences
- Mechanisms or processes related to knowledge acquisition
- Attachment or maintenance of affective dispositions
- Abilities, behaviors, or skills development related to good decision making in a range of environmental contexts; and
- Cognitive, economic, and social influences or impacts.

In order to reach an extensive global leadership, the journal will be available electronically, at no cost. NAAEE will permanently post all issues of the journal on the *Publications* link on its website. Translation of the articles into other languages is encouraged.

SUBMISSION PROCEDURES

Manuscripts, along with email notes, should be submitted to the IJECEE Executive Editor (ybhagwan@fau.edu). Manuscripts must follow APA formatting style, including a cover page, and attached as Microsoft Word documents. Once received, authors will be acknowledged with a manuscript code to be used in consequent communication. The editorial board will also prepare the manuscripts for a blind peer-review process. It is estimated that the review process may take between 12-16 weeks to complete.

In the email note, please indicate the author name(s), provide contact information, and a statement that permissions or releases have been obtained for all pertinent aspects in the articles (e.g., consent for research studies, illustrative renderings, photographs).

Although copyright of articles is maintained by the authors, IJECEE requests the right to be the first publisher of the articles. Along with the first serial publication rights, authors are required to indicate the following statement in the email note:

"All authors confirm that the manuscript has not been published previously and all permissions related to the attached manuscript have been obtained. (The co-authors and) I indemnify NAAEE and IJECEE against any violations of copyright or privacy right, as well as against any claims, damages, and legal suits. (The co-authors and) I provide IJECEE the first right to publish the manuscript in an electronic format on its website and on electronic education databases published by others receiving our permission."

The submission of the email note itself will serve as proof of the author signing off on the confirmation, as well as the date of virtual signature.

Please contact any one of the IJECEE Executive Editors (ybhagwan@fau.edu or borasimmons@gmail.com) with further inquiries or questions.

naaee

North American Association
for Environmental Education

1725 DeSales Street, NW, Suite 401, Washington, DC 20036

naaee.org

NAAEE is the professional organization for environmental educators in North America and beyond.

The Natural Start Alliance is NAAEE's program to advance early childhood environmental education.

To find out more, go to **naturalstart.org**.