



Awe and wonder, science, mathematics and the outdoors

 WING YI, CHU (2308275)

Total: 4386 words

Portfolio

This is the outlining of the outdoor environment to promote and support children's scientific and mathematical thinking.

Part 1 Outdoor Photograph



(Source:Chu, 2024)

Part 2

Learning Journey

Age Group: 4-5 years

Time Slot: 10:00 AM - 12:00 PM

Theme: Connecting Nature with Mathematics and Science

It's a sunny morning at Park, and a group of 4–5-year-olds have gathered for a fun and engaging session at the outdoor. The outdoor environment is alive with possibilities for learning mathematics and science concepts in a playful and engaging way. Today's learning journey focuses on integrating mathematics and science using the natural environment.

Learning Focus:

Mathematics: Counting, understanding shapes and patterns in nature.

Science: Exploring life cycles, growth of plants, and the concept of measurement.

By the end of the session, children will have explored basic mathematical concepts like counting, shapes and patterns in nature, while learning scientific principles such as plant growth and observing life cycles.

Activity

1

Counting Nature's Treasures

The children walk over to the park, where I have prepared a set of small baskets for each child. Their task is to count and collect small natural objects like pebbles, leaves, seeds, little stick or pine corn etc.

Teacher: "Let's each collect 10 special nature treasures from the garden. As we gather, count how many you have. You can pick up pebbles, leaves, seeds, little stick or pine corn but remember—only 10!"

Children: (Start gathering the objects)

After a few minutes, they return with their baskets full of treasures. I gather the group together.

Teacher: "Now let's see how we did! Who has exactly 10 treasures in their basket?"

Child 1: "I have 5 sticks, 2 pine corn and 3 pebbles!"

Child 2: "I have 6 leaves and 4 seeds!"

Teacher: "That's wonderful! You used counting to make sure you had exactly the right number. Now, let's line up your treasures in a row."

Teacher: "We can practice our mathematic skills by making patterns! Look at my treasures (we are sitting on the log): I have one leaf, then one pebble, then one seed. Can you make a pattern too?"

Child 3: "I have a pattern: leaf, leaf, pebble, leaf, leaf, pebble!"

Teacher: "Great job! Patterns are a part of mathematics that helps us see how things repeat. Nature loves patterns too, just like you!"

Teacher: "Let using all your collecting items to make a bug hotel together."

Children: Awe how to make a bug hotel craft. One of the child try to stand on the log, they enjoy the moment take a little break time here.

The group moves to the garden area.

Teacher: "Now let's become scientists! Scientists like to measure things to learn more about them. I brought some rulers, and we're going to measure how tall the plants are. Let's find out which plant is the tallest and which one is the shortest!"

Teacher hands out rulers, and the children begin measuring the plants. Some children work together to measure the larger plants, while others focus on the smaller ones.

Teacher: "Who found a tall plant? Can you tell me how tall it is?"

Child 4: "This one is 20! 20 something!"

Teacher: "Let's look at your ruler. It says 20 centimetres! That's how tall your plant is."

Child 5: "My plant is only 5!"

Teacher: "You found the shortest plant. Good job measuring, scientists!"

Activity 2

Measuring in the Garden

Activity

3

Finding Shapes in Nature

Teacher: Now, let's find some shapes! Do you see the leaves on these plants? What shape do they look like?"

Child 3 : "Some are round, and some are like ovals!"

Teacher: "Good observation! And can you find others different shapes of different leaves?"

All the children: look up and find different shapes of leaves.

Child 1: "I can see the leave like heart shape on that tree."

Teacher: "Exactly! Nature loves shapes. Have you ever noticed how many things in nature are symmetrical? Let's find something else that has the same pattern on both sides."

*The children run off to find leaves, noticing the symmetry of their veins, and compare different plant patterns.

After measuring the plants, teacher leads the children to visitor centre - little green house where they can see a variety of seeds and small plants.

Teacher: "Now let's think about how plants grow. It all starts with a tiny seed, just like these. Do you see how small they are?"

Children: (Nod their head)

Teacher: "Can you guess what happens when we plant them in the ground and give them water?"

Child 5: "They grow!"

Teacher: "That's right! And guess what? Plants need sunlight, water, and good soil to grow, just like how we need food and rest to grow tall and strong. Let's plant some seeds and watch them grow over the next few weeks."

The children are given small pots with their names, soil, and seeds. They each plant a seed and water it then we will bring them back to nursery.

Teacher: "We'll take care of these seeds every day,

Activity4

The Science of Seeds

just like scientists do. And soon, we'll see how big they get. Can you guess how tall your plant might grow?"

Child 1: "Maybe as tall as me!"

Activity

5

The Bug Hunt

Teacher: "Now it's time to go on a bug hunt! Bugs help the garden in many ways. Let's see if we can find some and talk about what they do."

The children are given magnifying glasses and explore the garden, searching for insects.

Child 2: "I found a ladybug!"

Teacher: "Good job! Did you know that ladybugs are friends of the park? They eat tiny bugs that could hurt our plants."

Child 3: "I found an ant! Look at it go!"

Teacher: "Ants are very busy insects. They help by digging tunnels in the soil, which lets air and water reach the roots of plants."

Child 5: "We made a bugs hotel for them to rest when they feel tired."

The children watch as ants move tiny pieces of leaves and soil, fascinated by their teamwork.

Teacher gathers the children on the grass for a reflection session.

Teacher: "Now that we've explored the park, counted nature's treasures, measured plants, and found insects, let's finish with a song! This is the 'Growing Plants Song' to help us remember what plants need to grow."

Teacher leads the children in a song that goes to the tune of "Twinkle, Twinkle, Little Star":

"Sun and water, soil and air,

Help the plants grow everywhere!

First a seed and then a sprout,

Conclusion

Wrapping Up the Journey

Roots grow deep and leaves stretch out.

Sun and water, soil and air,

Help the plants grow everywhere!"

You all did such a wonderful job today! We counted plants, measured how tall they are, looked at the patterns in leaves, and even found some helpful bugs. What was your favourite part?"

Child 5: "Measuring the plants!"

Child 2: "I liked finding the ladybug!"

Teacher: "I'm so glad to hear that! Remember, mathematics and science are everywhere, especially here in nature. You can always explore and learn new things when you go outside."

(Source: The Empowered educator, no date)



In this learning Journey that provides a rich and integrated learning experience for young children, touching on multiple areas of development that are highlighted in the Early Years Foundation Stage (EYFS) Statutory Framework. This Framework is designed to ensure that children in early year education have access to high-quality teaching and learning experiences that foster their holistic development (Department for Education, 2024).

In the activity 1, children are encouraged to count and select their objects independently, helping them gain confidence in their abilities

and decisions. By working together to make a “bug hotel”, the children develop their teamwork and cooperation skills. This activity foster those bonds by encouraging shared goals and mutual support.

That related with the Personal, Social and Emotional Development (PSED) area of learning in the EYFS framework.

Children can directly supports mathematical development by count objects, create patterns, and manipulate physical items to understand numerical relationships, all of which are part of Mathematics gols of the EYFS framework.



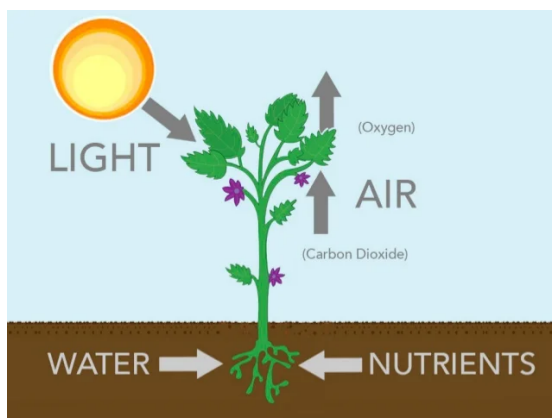
(Source: Sarah, no date)

That allows children to explore nature and engage with natural materials, thereby helping them understand the world through hands-on experiences.

In activity 2, which verbal interactions are crucial for developing children communication and language skills. I use a dialogue helps model language, while children respond by sharing their findings, such as Child 4 said: "This one is 20! 20 something!" This contributes to their understanding and use of new vocabulary to enhancing their ability to describe and articulate their observations. According to the EYFS Statutory Framework, practitioners should provide opportunities for children to "speak and listen in a range of situations" (Department for Education, 2024). The interaction between me and the children reflects the importance of adults scaffolding children's learning through meaningful dialogue and open-ended questions.

In activity 3, "Finding shapes in nature" ties into multiple areas of the EYFS statutory framework, supporting the holistic development of children across mathematics, understanding the world, communication and language and personal, social and emotional development. Furthermore, the exploration of natural shapes, symmetry and patterns fosters curiosity and inquiry, key components of early childhood learning.

(Source: multidict.net, no date)



In activity 4, "The Science of Seeds" children explore the concept of plant growth by planting seeds, watering them and observing their progress over time. Children develop awareness of living things, their growth cycles, and the natural world which contributes to their knowledge and understanding of the world around them. This activity helps children begin to grasp basic scientific concepts about plant life, the process of growth, and the factors that influence it – like light, water and soil.

In activity 5, "The Bug Hunt" allows children to move freely and practice gross motor skills by running around in the garden, while the use of magnifying glasses requires fine motor skills as they focus and manipulate the tools to observe tiny details. This aligns with EYFS for physical development. Creation of a "bug hotel" is a imaginative thinking and creativity in this activity. The bug hotel is a form of art and design, using elements from the natural world to solve a problem.

Part 3

Risk Benefit Assessment

Activity	How will young people BENEFIT from this activity?	Hazards and associated risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk after precautions Rating: L/M/H
Activity 1 Counting Nature's Treasures	- Counting objects helps children practice basic maths skills that related with children's cognitive development. - Picking up small objects like pebbles	- Children could trip on uneven ground or tree roots while walking through the park. - One child is standing on a log, which presents a risk of falling and	Children	- Teacher can closely supervises the children, especially when they are standing on the log or moving around uneven terrain. - Clear instructions are given to avoid standing on logs or walking in dangerous areas. - Ensure a first aid kit is available for any cuts, scrapes, or insect	Low to Medium

	and seeds helps strengthen hand-eye coordination and fine motor skills. - Crafting a bug hotel encourages creativity and imagination, as children think about how to use their treasures to make something useful for insects. - Time spent outdoor in nature promotes relaxation, reduces stress, and enhances overall	injury. - Children might pick up sharp objects, such as sticks and cut themselves. - Some children may have allergic reactions to certain plants or insect bites. -		bites that may occur. - Be aware of any children's allergies (to plants or insects etc.) and take necessary precautions, keeping children away from known allergens. - When make making the bug hotel, teacher ensures they are not using hazardous items. - Ensure children wear appropriate footwear to avoid slipping or tripping	
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	mood.				
Activity 2 Measuring in the Garden	- Children practice measuring using rulers, enhancing their understanding of numbers and units. - When children looking for the tallest and shortest plant, that engage in observation and comparison. This is a foundational skills in scientific inquiry. - Some children work together to measure larger	- Risk of children being scratched or developing allergic reaction. - Risk of children trips and falls in the garden area, especially when children focus on measuring rather than their surroundings. - Handling plants or soil may expose children to germs, leading to potential health risks.	Childrn	- Teacher should monitors and guide children how to safely measure plants. - Teaching children the proper way to handle rulers and the importance to being gentle with plants to avoid hurting themselves or damaging the plants. - Teacher should ensure that the plants being measured are safe, non-toxic. - Encourage children to wash their hands after the activity to prevent infection from soil or plants.	Low

	plants, promoting teamwork and communication. - The activity encourages children to interact with the natural environment, fostering curiosity about plants and the outdoors.				
Activity 3 Finding Shapes in Nature	- Children will enhance their observation and critical thinking skills by identifying different shapes and patterns in	- Children could trip, or slip while exploring the area. - Some leaves or plants might have thorns or sharp edges that could cause cuts or	Children	- Ensure that children are under constant adult supervision while exploring. - Teacher should check the area of hazardous plants, insects or uneven terrain before the activity. - Encourage children to wear long	Low

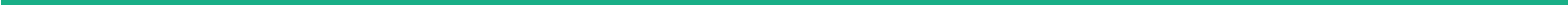
	nature. - By recognizing shapes (round, oval , heart-sharp) children build basic geometry and spatial awareness. - As children share their observations with on another, they engage in collaboration and communication.	scratches. - Exposure to certain plants may cause allergic reactions like poison ivy, pollen. - Outdoor areas may have insects that could bite or sting the children. -		sleeves, trousers, and hats to protect them from the sun, insects and sharp plants. - Keep a first aid kit nearby in case of minor injuries. - Ensure hydration breaks to prevent dehydration.	
Activity4 The Science of Seeds	- Children will gain a better understanding of plant life, growth cycles, and the	- Soil may contain harmful bacteria or allergens that could lead to illness or allergic reactions. - Young children	Children	- Ensure children wash hands before and after handling soil to minimise exposure to bacteria and allergens. - Teacher will supervise the use of	Low

	needs of living things. - Watching seeds grow over time helps develop patience as they learn that takes time and care. - Taking care of their own plant fosters responsibility, as they must regularly water and observe it. - Handling soil, seeds and water stimulates sensory experiences and helps develop fine	might accidentally ingest soil or seeds which could cause choking or illness. - Spilled water may cause slips or falls.		tools and ensure children are handling material safely. - Use child-safe and age appropriate planting tools to minimize injury risks. - Keep the greenhouse or planting area free from clutter and ensure there is adequate space between children to avoid accidental bumps or accidents.	
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	motor skills.				
Activity 5 The Bug Hunt	- Using magnifying glasses helps develop fine motor skills and sensory awareness as they explore different textures, shapes and sizes of bugs. - Children learn about insects and the ecosystem, fostering curiosity. - Group exploration promotes teamwork, communication and collaboration.	- Some bugs may sting or bite, causing allergic reactions or discomfort. - Children may encounter sharp branches, thorns or uneven surfaces that could cause minor injuries such as cuts or scratches. - Uneven terrain or garden tools left around could cause children to trip and	Children	- Teacher should closely supervise the activity, ensuring that children stay safe and away from harmful insects or hazardous areas. - The garden area should be checked beforehand for any dangerous insects, sharp objects, uneven surfaces, or chemical residues. - Children should be educated how to safely observe bugs from a distance and avoid some kinds of insects such as bees and wasps. - Identify children with known allergies and ensure they have appropriate medications. - Ensure that pathways are clear to	Low

	Children can also develop empathy by understanding the importance of bugs in the environment.	fall.		prevent tripping and provide a safe walking space for the children. - Encourage children to wear appropriate clothing to reduce the risk of insect bites.	
Conclusion Wrapping Up the Journey	- Reflecting on their experiences, discussing findings and singing together fosters group collaboration and language development. - The activity promotes mindfulness, appreciation for the	- If the activity takes place under strong sunlight, children could experience dehydration or sunburn.	Children & Teacher	- Ensuring children wear sunscreen, hats and stay hydrated. - Clear instructions are given to children about safe behaviours in nature, such as not running, staying with the group, and not touching unfamiliar plants or insects.	Low

	environment, and fosters positive attitudes toward nature.				
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Part 4

How adults working with early years children support and encourage children engage with mathematical and scientific concepts in an outdoor environment?

Adults play a pivotal role in fostering young children's understanding of mathematical scientific concepts, particularly in the context of outdoor environments. Research suggests that natural settings provide a rich and stimulating space for early years learning, offering children the opportunity to explore, experiment, and discover foundational concepts in a hands-on manner (Bilton, H., 2010). Engaging with nature encourages curiosity, discovery and inquiry, essential components of both mathematics and science, and outdoor learning supports a child-centered approach where adults facilitate rather than direct learning.

The role of adults, including teachers, early years practitioners and caregivers, involves scaffolding children's learning through intentional interactions and structured activities that promote critical thinking, problem-solving, and inquiry. According to Froebel's (1897) theory, play and exploration are integral to children's learning, suggesting that adults should create environments where children feel free to explore natural phenomena and engage with real-world mathematical concepts. Adults can support this engagement by asking open-ended questions, providing materials that stimulate exploration, and encouraging children to make predictions, test hypotheses, and reflect on their findings. Research shows that by guiding children through these experiences, adults can foster a deep understanding of concepts such as measurement, geometry, number sense, and scientific inquiry (Campbell, *et. al.*, 2023).

Studies show that outdoor learning environments provide unique opportunities for exploration, movement, and multi-sensory engagement, which are highly effective for young children (Waller, *et.al.*, 2017). This environment encourages children to experiment with mathematical and scientific ideas in a less structured, more natural setting where trial and error are part of the learning process. Moreover, outdoor environments allow for collaborative learning, which is vital for early childhood development.

How does theory reflect practice?

Adults are crucial in facilitating outdoor learning, drawing on theoretical frameworks such as Gibson's affordance theory, Jean Piaget's constructivist Theory, and Nicholson's loose parts theory to create meaningful, developmentally appropriate experiences. By providing loose parts and open-ended materials, pointing out affordances, and asking thought-provoking questions adults can help children build a strong foundation in mathematical and scientific thinking that will support their future learning.

Gibson's Affordance Theory

One key concept in understanding how children engage with outdoor environment is Gibson's affordance theory (1979), which emphasizes how environments provide cues or affordances that suggest possibilities for action. In outdoor spaces, natural materials like rocks, leaves, water, and sand afford opportunities for mathematical and scientific exploration. Study by Trawick-smith(2014) highlights how natural elements like stones can be counted, sorted by size, or used to create patterns, fostering mathematical thinking. Likewise, natural phenomena like the flow of water can spark inquiry into scientific concepts such as gravity and force. Adults can support these activities by pointing out affordances and encouraging children to experiment and explore.

Piaget's Constructivist Theory

Piaget (1952) argued that children build knowledge through active exploration and interaction with their environment. Outdoor play allows children to engage in hands-on learning, constructing mathematical and scientific understanding through activities like measuring the length of plants, comparing the weight of rocks, or observing patterns in nature. Adults play a key role here, scaffolding children's learning by asking questions that challenge their thinking and extend their understanding.

Nicholson's Loose Parts Theory

Nicholson's loose parts theory (1971) also underscores the potential of outdoor environments for promoting mathematical and scientific engagement. This theory suggests that environments with "loose parts" – movable, open-ended materials like sticks, stones and leaves, which allow children to engage in creative and exploratory play. These materials can be used to teach mathematical concepts such as sorting, measuring and symmetry or scientific ideas like life cycles, natural habitats, and weather patterns. Adults facilitate this by providing access to these materials and encouraging children to explore their properties. Research shows that such open-ended materials stimulate cognitive development and encourage problem-solving and critical thinking skills (Daly, et.al., 2015)

How do adults monitor understanding and progress?

The Reggio Emilia approach is a child-centered, experiential, and inquiry-based method of early childhood education originating. It emphasizes respect for children's ideas, active exploration, collaboration and self-guided learning (Edwards, *et. al.*, 1998). In this approach, adults play the role of facilitators, carefully monitoring children's understanding and progress through observation, interaction, and details documentation. The key to assessment lies in following the children's curiosity and using documentation to capture their learning process and evolving understanding (Rinaldi, 2006). The learning Journey in Part 2 provided involves various outdoor activities where children explore mathematics and science concepts through nature, and these can be tied to the Reggio Emilia principles.

The teacher monitors children's understanding by observing their interaction with the environment and with each other. In the activity "Counting Nature's Treasures" the teacher asks the children to collect exactly 10 natural objects, monitoring their counting process and encouraging dialogue rather than providing immediate corrections. The teacher tracks the children's application of maths concepts through informal and engaging conversations. This process reflects the Reggio philosophy of co-constructing knowledge with children, rather than providing top-down instruction (Edwards, *et. al.*, 1998).

Teacher documentation is shared with the children to help them reflect on their learning process and with parents to communicate their child's development. It also informs future lessons by giving insights into children's interests and areas of strength or challenge. Conversations, such as the discussion in the activities about ladybugs during the bug hunt or the measurement activities in the garden, provide opportunities for teachers to note children's language development, critical thinking, and application of science and maths concepts (Rinaldi, 2006).

Assessment in the Reggio Emilia approach is primarily formative, with an emphasis on reflecting on what children can articulate their understanding and experiences. The final session, the teacher gathers the children for reflection, asking them the favorite part which encourages self-assessment and allows children to articulate their understanding and experiences. Through this method, the teacher can assess each child's progress without using standardized testing, instead fostering a deeper, more personal understanding of their development journey (Vecchi, 2010).

Limitations or challenges of integrating theoretical frameworks in outdoor learning

Gibson's affordance theory emphasises that environment offer cues for potential actions. In outdoor settings, adults can facilitate exploration by highlighting natural features, such as a fallen tree for climbing or a stream for observation which invite children's engagement. Educators can design activities that encourage children to notice these affordances, prompting inquiry and discovery (Heft, 1988). However, a challenge is that not all educators may fully understand how to recognize or utilize affordances effectively, leading to missed opportunities for engagement.

Futhermore, some environment may lack diverse natural features, limiting the affordances available. Professional development and training workshops can equip educators with a better understanding of affordance theory and its practical applications (Trawick-Smith, 2014). Additionally, adults can modify environments to enhance affordances, even in constrained spaces, by incorporating loose parts or creating designated areas for exploration.

Piaget's constructivist theory posits that children learn through active exploration and interaction with their environment (Piaget, 1973). In outdoor settings, adults can facilitate experiences that encourage hands-on exploration, allowing children to construct their understanding of mathematical and scientific concepts. However, a limitation of this approach is the variability in children's developmental stages; not all children may be ready for the same level of inquiry or exploration. Moreover, structured educational settings may prioritize assessments over experiential learning. To address this, adults can differentiate experiences based on children's developmental levels and interests, providing scaffolding to support all learners (Wood, 2014). Flexibility in curriculum design can also promote more inquiry-based learning opportunities.

Nicholson's loose parts theory advocates for the inclusion of movable and adaptable materials in play environments (Nicholson, 1971). Adults can implement this by providing a variety of natural materials, enabling children to engage in open-ended play that promotes creativity and exploration. However, a challenge in applying this theory is ensuring the availability of diverse materials, particularly in urban areas where access to natural elements may be limited. Additionally, there may be concerns about safety and the supervision of children using loose parts. Adults can source materials from local environments or community resources and educate parents about the value of loose parts play. Safety can be managed through proper supervision and by teaching children to use materials responsibly (Prince, 2019).

Conclusion

The integration of mathematical and scientific concepts into early childhood education through outdoor environments offers a powerful opportunity to promote cognitive development. Research and theoretical perspectives consistently highlight the value of outdoor settings, where diverse, hands-on experiences enhance early learning in mathematics and science. These environments naturally afford opportunities for counting, measuring, observing, and experimenting, all of which foster the development of core cognitive skills (Heft, 1988; Trawick-Smith, 2014).

Adults play a crucial role in facilitating these experiences, using the natural affordances of the environment to deepen children's engagement. Educators can enhance this learning by drawing on the principles of Gibson's affordance theory (Gibson, 1979), Piaget's constructivist theory (Piaget, 1952), and Nicholson's loose parts theory (Nicholson, 1971). The teacher's roles as a co-learner and facilitator, combined with careful documentation and reflective dialogue, exemplifies how adults monitor understanding into the Reggio Emilia approach (Edwards, *et. al.*, 1998).

Although outdoor environments provide a rich platform for learning, challenges such as limited access to natural spaces or insufficient training for educators can hinder the effective use of these affordances. However, these barriers can be overcome through professional development, curriculum flexibility, and the intentional design of outdoor environments (Prince, 2019). By leveraging these theoretical frameworks, adults can create rich, engaging learning experiences that promote children's cognitive development and lay the foundation for lifelong skills in mathematics and science.

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