

AWE AND WONDER – SCIENCE, MATHEMATICS, AND THE OUTDOORS

EXPERIENCING WOODLAND ENVIRONMENT IN DIFFERENT WEATHER CONDITIONS



Source: personal photograph

PART II:

Young children can explore various scientific and mathematical concepts through interaction with the environment in a woodland setting, which has a rich and diversified ecosystem. Moreover, young children can gain valuable experience in mathematics and scientific ideas through practical interaction and accurate observation of the woodland in various weather conditions. Given this, the February and March months offered children countless opportunities to go outside and experience mathematics and science in different weather conditions and temperatures at different times of the day. As can be seen in the picture, the school woodland is the perfect environment for exploration and discovery, offering children a variety of loose parts and ideal places for the development of imagination and creativity while learning, at the same time, mathematical and scientific concepts that they can then put into practice in everyday life.

To illustrate how the children in a reception group explored and interacted with concepts and ideas about sizes and weights, measurements, forces, and life cycles, the paragraphs below present moments from the children's activities, as follows: mathematics and science on a snowy day, on a rainy day, and on a sunny spring day.

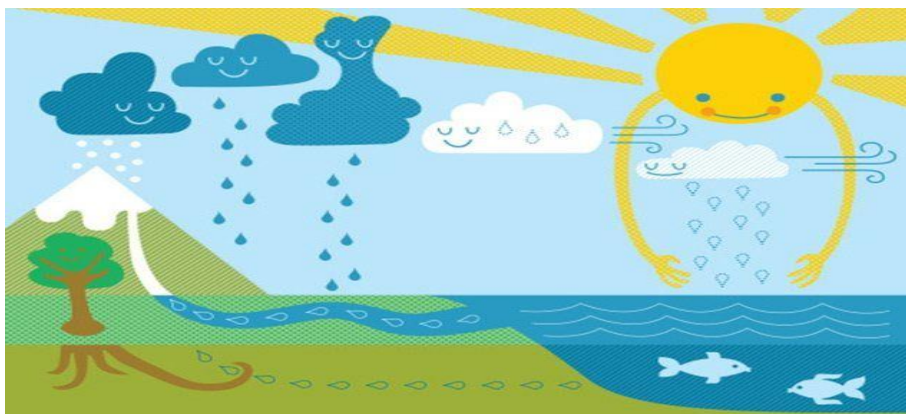
A winter day:

At the end of February, we enjoyed a cold, snowy day. The children were amazed by the snow and excited to explore it because it was their first snow experience. In the snow, children counted the number of trees, rocks, and animal tracks they observed. They also counted the snowballs they threw and the pinecones they collected. After counting their findings, the children sorted the various leaves, rocks, and pinecones into categories according to size, colour, and shape.



Source: personal photographs

Moreover, the children built snow igloos by using snowballs of varying sizes and weights and observing how the size and weight of the snowballs affected the stability and strength of the constructions they created. Children also built snowmen and snow sculptures to experiment with pushing and pulling forces. In addition, they slid down snowy hills and did experiments using the forces of gravity and friction. A student proposed collecting snow in a bucket and constructing a snowman in the class, like Olaf from the movie Frozen. After a while, one of the students noticed less snow in the bucket. The children asked me what happened to the snow they collected, but I suggested they observe and notice what else was in the bucket apart from the remaining snow. A boy immediately answered: "I know what happens to snow. It melts like ice cream but turns into water, not milk." Starting from this phenomenon, we listened to "Pic's Story," the adventure of a drop of rain that tells us about its route through nature. Thus, the children learned about the water cycle in nature.



Source: National Geographic Kids, 2018

With the water from the bucket, which remained after the snow melted, the children watered the plants in the classroom. By doing this experiment, children investigate the properties of snow by observing how it changes when exposed to different temperatures.

A rainy day:

After a few days, the snow melted, and we had a few weeks of rain, during which we played and explored different scientific and mathematical concepts in our woodlands. In the morning, children construct a shelter using natural materials, such as branches and leaves, to protect themselves from the rain. This practice contributes to the growth of children's problem-solving and teamwork abilities. Given this, Reggio-inspired pedagogies emphasise a child

centred approach in which children construct meaning from their everyday experiences through preparation, organisation of ideas, and imagination, according to Edwards, Gandini, and Forman (2012). Moreover, Ghirotto and Mazzoni (2013) claim that the teacher's role is to support children's learning by observing and intervening appropriately. Also, children enjoyed counting the number of raindrops that they observed falling or landing on different surfaces while the rain fell. Moreover, the children made rain art by dropping drops of paint onto paper or other surfaces and letting the rain form patterns and designs on the paint's surface. This activity can help children understand the relationship between cause and effect and boost their creativity and imagination.



Source: Bush,
2016

Furthermore, to collect rainwater, the children used buckets or other containers. The adults encouraged the children to determine how much water they had collected and explore the characteristics of water, such as its weight and volume. Another activity that helps children understand water's characteristics is exploring puddles. Children jumped in puddles and investigated many properties of water, including its surface tension and the way it moved. Children also created "rain music" using kitchen utensils like pans, pots, and spoons. Children may learn about sounds and vibrations by experimenting with the many noises they produce.

A sunny spring day

At the end of March, we had a beautiful day during which we observed how sunlight enters between the branches of the trees and causes nature to heat up and the water to evaporate. We listened to the calming sound of the wind and how it gently moved the flowers and tree branches, contrasting the force of the wind in winter to that of the sunny days of spring. Moreover, the children understood patterns by watching the arrangement of leaves and branches on trees and the ground below them. In addition, they gain knowledge of geometry by examining plant structures such as leaves, petals, and seeds. They also created shadows with their hands, branches, or loose parts.



Source: (MacArthur, 2020)

Also, some children counted the number of petals on a flower; others counted the number of branches on a tree or the number of birds they saw in the woodlands. At the same time, five children were sitting on the benches in the woodland, counting from one to five using rhymes.

"-Hey! I am number one. Who is after me?

- The next is number two; then it is number three.

- Hello! I am number three, and four is after me.

- You are right! I am number four. Could you count more?

- Of course! I am number five, the biggest in the line. "

Additionally, children learned about the properties of water by observing how it flows and interacts with different items in a small puddle that remains from the last rain. I started by encouraging the children to observe the puddle in the woodland environment while I asked them questions like "What do you see in the puddle?" "What do you think is in the water?" "Do you notice anything floating or sinking?" I also asked the children to select objects they think will float or sink in the puddle. They chose leaves, sticks, acorns, rocks, or small toys.

Furthermore, I encourage the children to predict whether the object will float or sink before they place it in the puddle. After making their prediction, I asked them to test their hypothesis by placing the object in the puddle.

PART III:

Location / Activity:	Experiencing woodland environment in different weather conditions-Woodland	Date:	06. 03. 2023
Assessor:	Claudia Bucur	Review date:	02. 04. 2023

The boxes in the table below will expand as you type into them; pre-entered text is simply for illustration. You should delete irrelevant items and replace with text relevant to your circumstances.

Your overall risk rating – Low, medium or high – is based on your judgement about whether the BENEFITS of the activity or opportunity outweigh the RISKS.

Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Balancing on benches	Young people may improve their physical coordination, balance, and core strength by balancing on benches. Their muscles and motor skills are challenged and strengthened as they try to keep their balance on an uneven surface. Moreover, balancing on benches may help children's cognitive and emotional development. Children may enhance their concentration and attention span by keeping their balance. They also gain spatial awareness and perception, which benefit their cognitive development.	Falling: Children can fall from the benches and injure themselves. Accidents might range from minor bruising to more severe injuries, such as fractured bones or head injuries, depending on the height of the benches and the surface below. Slipping: Children may fall on the benches, especially if the benches are wet or slippery, as seen in the main picture. This may also lead to falls and injuries.	Staff and children	Children should be supervised when balancing on benches. Moreover, benches should be placed on a secure and stable surface, and children should wear suitable footwear and clothing. Setting clear rules and limits for the activity is also beneficial in ensuring that children are safe and enjoy themselves.	M
Balancing on benches	Balancing on benches may also be a social		Staff and children		M

	activity for children, as they can play together and take turns balancing or generating various obstacles for each other. That may help them develop their communication and social skills and their capacity to work together and solve problems collectively.	Tripping: When balancing on benches, children can trip over items such as their feet, other children, or objects on the ground nearby. Straining: Balancing on benches can strain muscles and joints, particularly in children who are not yet fully developed. This can cause back, limb, and foot pain.			
Playing in the snow	Physical activity: Playing in the snow requires a lot of physical activity, such as running, jumping, throwing snowballs, and sliding. These exercises help children improve their balance, coordination, strength, and cardiovascular health. Sensory stimulation: Snow is a unique material that provides children various sensory sensations. They can feel the snow's cold, wet texture, hear the crunching sound it produces under their feet, and see the sparkling white landscape surrounding them. Social interaction: Playing in the snow is often a group activity, which can aid in the development of children's social skills. Children may practise sharing, taking turns, and	Hypothermia: Spending too much time in cold conditions may cause a child's body temperature to drop dangerously low, resulting in hypothermia. Slips and falls: Snow and ice may be slippery, resulting in slips and falls. This is particularly harmful if a child hits their head on the ground or an object like a tree or rock.	Staff and children	To avoid hypothermia, children should wear warm, layered clothes, including a hat and gloves, and spend as little time as possible outside in very cold weather. Moreover, children should wear shoes with good traction, such as boots and wellies, to avoid falls and use caution while walking or running on snow or ice.	M
Playing in the snow			Staff and children		

	communicating with their colleagues. Nature appreciation: Playing in the snow may help children develop an appreciation for nature and the changing seasons. Students may watch how snow changes the landscape and learn about the natural processes that produce snow.				
Jumping in puddles	Physical activity: jumping in puddles requires physical movement, which can help children develop gross motor skills, balance, and coordination. Sensory experience: splashing in a puddle may provide a multisensory experience, enabling children to experiment with diverse textures, noises, and temperatures. Exploration and curiosity: jumping in a puddle may help children explore their surroundings and develop a curiosity about the world around them. Creativity: puddles can be an excellent source of creative inspiration for children. Based on their experiences, they may use their imagination to play games, make up tales, or create artwork.	Slippery surfaces: Puddles can make the ground slippery, causing children to lose their balance and fall, resulting in cuts, bruises, and broken bones. Drowning: Children may fall into deep puddles accidentally, resulting in drowning if the water is too deep. Hypothermia: Jumping in puddles may cause children to become wet and cold, which can lead to hypothermia.	Staff and children	Adults should ensure that children wear rubber boots with adequate grip and waterproof clothing to avoid slips and falls. Sandals, flip-flops, and shoes with smooth soles should be avoided. Moreover, before permitting children to jump in puddles, adults should check the area for potential risks such as sharp objects, broken glass, or debris. This may cause serious injury to a child.	M
Experiencing woodlands	Physical activity: Exploring the woodlands requires physical activity such as walking, running,				

	climbing, and jumping. This may support children in developing their motor skills and improving their general physical health. Creativity and imagination: Woodlands can help children cultivate their imagination and creativity. Children can use their environment to build their language and communication abilities by creating games and stories. Learning opportunities: The woodlands have many plants, animals, and habitats. Given this, the natural world, biodiversity, and ecosystems may all be taught to children. By watching and exploring the natural world, they can also improve their awe and wonder for scientific and mathematical abilities.	Poisonous plants: Poisonous plants, such as poison ivy, poison oak, and poison sumac, may be found in woodlands. Children may come into contact with these plants accidentally by playing or exploring. Uneven ground: The woodlands may be rugged and uneven, with steep hills, rocky surfaces, and hidden dangers like tree roots and falling branches. Children may trip or fall without paying attention to their surroundings.	Staff and children	While exploring the woodlands, children should always be supervised by an adult. Moreover, they should wear proper clothing, such as shoes or boots, long trousers, and long-sleeved shirts, to protect against ticks, insects, and thorny plants. Adults should also teach children about identifying and avoiding harmful plants such as poison ivy, oak, and sumac. Additionally, adults can have a first aid kit with them.	M
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PART IV:

According to Bobis *et al.* (2013), play is often a naturally social activity. Also, Vygotsky (1967) states that even solitary play reflects social and cultural circumstances, especially in the rules and roles children accept. Moreover, according to Piaget (1962), everything during the first few months of life, except feeding and emotions such as fear and rage, is play. As a result, it is advised that significant mathematical concepts that are potentially accessible to pre-schoolers be recognised so that caregivers and instructors may be sensitive to potential play scenarios in which these ideas could become evident, although in nascent stages. Once recognised, relevant actions or activities may be devised to assist in the development of children's mathematical and scientific thinking, according to Bobis *et al.* (2013).

According to Bruner (1986), as children connect with adults or other children during play, possibilities for scaffolding arise. Given this, when children experiment, explain, and perform their perspectives and understandings while encountering those of others, the social interactions within play allow collaborative meaning development. Social connection in play supports the problems children often generate in play, reopening chances for inventiveness, risk-taking, and problem-solving. Such interactions are also at the foundation of mathematical and scientific concepts, according to Bobis *et al.* (2013)

Furthermore, according to Summers, Vivian, and Summers (2019), outdoor settings provide children with several opportunities to interact with mathematics and scientific ideas. Moreover, according to Piaget's (1957) theory of cognitive development, young children form their worldviews through interaction with their environment. Given this, McLennan (2017) claims that the outdoors is brimming with excellent chances for math learning with a scientific connection and may captivate and engage children in real-life problem-solving. For this reason, children should spend a considerable amount of time outdoors. Additionally, Holden (2020) claims that the beauty of form, colour, categorisation, order, symmetry, patterns, and numbers are integral to the natural environment. Throughout the context of their outdoor activities, children use mathematical reasoning and acquire abilities. In view of this, children, according to Froebel (1897), are active, curious, and creative learners. He believed children learn best through self-activity, real-life experience, problem-solving, play, and communication. Moreover, when children are emotionally comfortable, they thrive. Also, through imaginative and creative play, they will count, measure, investigate shapes, and learn mathematical

concepts. In the same way, Clare Devlin - Early Education Consultancy (2020), claims that the principles of mathematics are essential to understanding life in general. For this reason, children need many chances to encounter mathematics in various settings during their formative years. Moreover, when exposed to the natural world, children have an excellent opportunity to investigate concepts such as number, form, space, size, quantity, connections, pattern, ordering, and time.

However, The Woodland Trust (2019) claims that children may not often recognise what they are doing as "learning," yet they learn some of their most important lessons outside the classroom. This is one of the many benefits of teaching outside. They experience less physical and mental restriction due to the absence of barriers, which enables them to better establish connections in their thinking by applying it to a situation based on the real world.

Similarly, Moser and Martinsen (2010) claim that children have more and better opportunities to play outside without interruptions or distractions. Moreover, many educational activities like painting, woodworking, and others are performed in open spaces. As a result, the amount of time spent playing outside, the surface area, abundance, and suitability of the physical surroundings, as well as the accessibility and convenience of equipment, materials, and stimulating play zones, all appear to be essential space-related indicators for the quality of the educational experience, according to Moser and Martinsen (2010). Additionally, McLennan (2017) claims that many conventional automobiles and toys, such as tricycles, wagons, tractors, and balls, can be found in many outdoor play spaces.

However, according to Daly and Beloglovsky (2014), natural areas, such as mature woodlands or beaches, provide more play opportunities than constructed play places, such as asphalt school playgrounds or clean urban parks. In view of this, the constant insertion of numerous loose parts might improve these areas. Nicholson (1971) defined *loose parts* as "variables," mentioning materials and forms as examples; smells and other naturally occurring phenomena such as electricity, gravity, and magnetism; music, motion, and sounds; chemical interactions, cooking, and fire. With all these elements, children enjoy playing, experimenting, discovering, and inventing.

In addition, Moser and Martinsen (2010) claim that additional toys, such as buckets and spades, may have a variety of meanings depending on the context in which they are used. Also, toys and materials with a natural or neutral character, such as stones, branches, and acorns, give children a significantly higher chance to identify the possibilities and restrictions. Moreover,

loose materials and a wide range of toys children may carry while playing freely in the kindergarten's outdoor area can guarantee high-quality games and activities over time. Moreover, what resources or toys children have free access will impact how they use them and create their games and activities. Given this, providing children with mathematical tools inspires them to play spontaneously and more complexly. In view of this, adults can facilitate children's activities by integrating loose parts into their play. For example, flowers may be grouped on sorting trays according to colour and size, and sticks can be numbered using a line segment. Moreover, loose natural parts such as acorns and stones can be put on ten frames to facilitate counting (McLennan, 2017).

Notably, according to Head (2021), a Reggio Emilia educational environment—"the third teacher"—is visually spectacular and packed with natural elements that stimulate exploration and the creative play necessary for mathematical and scientific learning in the early years. In view of this, Froebel (1897) maintained that basic, open-ended materials enable children to express their thoughts, emotions, and experiences. These enable children to investigate many aspects of interpretation. Froebel (1897) referred to them as "forms of knowledge," "forms of existence," and "forms of beauty." As a result, any representation may incorporate cognitive elements such as scientific or mathematical comprehension, parts of the child's personal life, and aesthetic qualities such as patterns, form, or symmetry, according to Tovey (2018).

Moreover, according to Bobis *et al.* (2013), when teachers offer tools and conditions that foster discovery in the outdoors, they allow students to engage in purposeful exploration and learning of science and mathematics. Moreover, according to Slatter (2015), adults may use various methods to encourage children's outdoor engagement with mathematics and scientific ideas. By offering tools and resources that inspire investigation and experimentation, it is possible to create a suitable atmosphere for learning. Adults may also teach children to think critically and reflect on their experiences by asking open-ended questions. Furthermore, Wilson (2012) claims that more engaging and realistic first-hand experiences may enhance children's understanding. However, adults should remember that children's behaviour is influenced by those they observe, particularly those near them. Given this, even adults may feel how dry the soil is and how sticky it becomes when combined with water. By doing this, adults can encourage children to engage and try different things, such as tasting snowflakes on their tongues, for example, and model this behaviour while simultaneously engaging in the same activity with the children.

Additionally, according to Palaiologou (2016), although the surroundings must be evaluated to ensure that it is a safe place to play, it is also advantageous for the development of young children to participate in "risky" play since many children like taking risks. If adults support children, this may result in children taking risks that they find acceptable. This may be challenging and controversial for many practitioners whose tolerance for risk in play might restrict the opportunity for such play. Practitioners may also fear legal action if a child is injured while under their care. Ideally, children should be assisted in evaluating their potential and guiding their behaviour in a secure environment. This requires an underlying idea that the child is capable, as opposed to the idea that the child is vulnerable and needs to be protected by an adult.

Furthermore, McLennan (2017) suggests that while playing with and observing children, adults should focus on the children's ideas in the outdoor area and then encourage and support their creative actions. Moreover, the questions that children have may be clarified by teachers, and then the teachers can assist the students in planning an exploration to find the answers. In addition, adults might bring a tablet outdoors so children can record and photograph things they notice, such as leaves changing colour and birds migrating south for the cold season, and then express their opinions during whole-group discussions. Additionally, according to the Department of Early Education and Care (2014), practitioners may saturate the environment with mathematical and scientific talk and concepts. They also have a role in encouraging children to use math talk to assist them in developing mathematical and scientific ideas and the ability to communicate those ideas naturally. In addition, Allen and Kelly (2015) suggest that adults may demonstrate the usage of mathematical and scientific terms in their interactions with children. By utilising concepts like "measuring," "counting," "sorting," "patterns," and "observation," adults may support children in expanding their vocabulary and gaining a deeper understanding of the things they are investigating.

Furthermore, according to the Department for Children, Schools, and Families (2009), observing children's play can assist practitioners in appreciating their expanding mathematical comprehension and revealing strategies to encourage this growth. Children's interests are great catalysts for mathematical exploration and a solid starting point for supporting and expanding their mathematical thinking. Moreover, opportunities for problem-solving, reasoning, critical thinking, and reflection are necessary for children to develop their emergent mathematical learning. Caring adults who respect children's ideas and encourage their play and mathematical exploration through collaborative discussion "scaffold" children's thought processes.

Furthermore, evaluation, meaning making, and interpretation are essential parts of mathematics. When an adult debates topic with children, it shows they are genuinely interested in what the children have to say about their thoughts and opinions. In that case, children are more likely to discuss their thoughts when open-ended questions are asked. Because of this, it will be possible to build and discuss ideas, negotiate, and comprehend concepts collaboratively, according to Department for Children, Schools, and Families (2009).

Moreover, according to Ernst and Tornabene (2012), frequent and meaningful contact with nature is essential for fostering environmental responsibility in children. Children are naturally interested in nature, so spending time outside as a child is very important. In addition, many long-lasting attitudes and values are formed in early childhood, so early experiences with outdoor play may build pro-environment attitudes and views in adulthood. Also, young children who spend time in nature are more likely to develop a sense of science, math, and art. Similarly, Richardson *et al.* (2015) believe that children should spend time in nature regularly to form positive opinions and feelings toward animals and the environment in which we all live. Therefore, Geczi and Div (2020) anticipate that during the next ten years, employment opportunities in the science, technology, engineering, and mathematics (STEM) area will expand at a speed that is noticeably faster than the growth of the total employment market. Moreover, according to their research, most people involved in environmental science, engineering, and activism had formative outdoor exposures during childhood or had role models that oriented their interest in the environment.

In conclusion, finding ways to connect children, regardless of social background, with the outdoors and individuals passionate about the environment constitutes an essential strategy in opening a world of work opportunities for them. Given this, exposing children to natural environments not only aids in their physical, social, and emotional development but also has the potential to inspire in them the interest and motivation to choose a profession in science or another STEM-related subject, according to Geczi and Div (2020).

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