

ECEY 5005

AWE AND WONDER- SCIENCE, MATHEMATICS AND THE OUTDOORS

Part 1.



Source: (Zyhomy,nd)

Part 2

In the photograph one can see stepping logs and a woven structure. This is quite a natural environment and I believe many children in an early year learning environment will find it very intriguing to learn more about. The logs and the tunnel encourage them to touch things, even step on the area, and navigate the space. If the children could be allowed to interact with this space, they would be realizing some philosophies like balance, weight, and the cycle of wood and other materials that are in works. Environment would also give the children opportunities to create mathematical knowledge about size and shape and numbers.

In this section, will explore how this area assists learners with these ideas and how adults can support their learning. They will be connected to frameworks such as the Curriculum for Wales.

Forces and Movement

An activity that children would first engage in is hopping or stepping from one log to another. This is a good way to teach balance and forces. When a child steps on a log, their weight is transferred, and through mutual pressure, the child remains balanced. Some logs may roll over,

causing instability and giving the child knowledge about movement.



Source: (Wp.com, 2024)

Adults can ask the children:

- “How do you feel when standing on this log?”
- “What will happen to this log: will it remain still or sway?”

Children will learn about friction as one of the driving forces. If logs are smooth, there can be slippage. If logs are rough, they provide a better grip, helping children understand how shoes or surfaces affect running.

Size and Measurement

The stepping logs can also teach children about size and measurement. Logs are probably not equal in size; some may be taller or wider. Children will learn that, depending on each log's distance and height, they need to step higher or take bigger steps.

This provides opportunities for adults to introduce measurement language like:



- “Which log or the stick is the tallest?”
- “How many steps to the big log?”

Adults should provide rulers or measuring tapes so children can measure logs. This exposes them to dimensions and attributes of height, helping them differentiate between ‘big’ and ‘small.’

Weight and Balance

In this environment, children can also learn about weight. If the logs are different sizes, they will begin to realize that some logs are more cumbersome than others. If the logs are transportable, children can attempt to pick them up or roll them to understand weight and balance.

An adult can ask:

- “Which log do you think is heavier?”
- “What makes this log difficult to slide?”

These questions lead to conversations about making objects heavy or light. They might also ponder what happens when running with a small log or pushing or rolling it, and how much force is needed.

Exploring Nature and Life Cycles

This setting uses trees and vines for the logs and the woven tunnel, providing a chance to learn about the life cycle. Wood comes from trees, which plant themselves, live long lives, and die through biological processes or being felled. This can lead to understanding tree growth, leaves, branches, death, and decay.

Adults can explain the life cycle of a tree by saying:

- “This log was once a part of a tree. Can you see the rings? They show the tree’s age.”
- “Where do you think a tree goes when it grows old?”

If trees and plants are part of the scene, children can explore what happens with time in nature. This might include bugs or small insects, animals living near the logs, educating children about

animals’

homes

and

environments.



Source: (Jenkins, 2019)

Properties of Materials

The logs are made of wood, and so is the tunnel. This type of construction is suitable for children, especially at their early age. Wood has its own characteristics, such as texture, hardness, and even a rough feel to the touch. This allows children the opportunity to discover that the wood is rough in some places and smooth in others.



Source: (Alvis, 2016)

Adults can encourage this exploration by asking questions about the characteristics of objects:

- “What does the soil/ mud or wood feel like?”
- “Can you find a rough part and a smooth part?”

The children will also learn that wood is a versatile material used in constructing the tunnel or steps. This helps them understand the transformations applied to the materials they work with and the different forms these can take. We can also offer other resources, like rocks or sticks, so the child can compare other materials and understand how wood is different.

Extra Resources to Encourage Exploration

To support learning in this environment further, you can introduce some basic instruments and toys. Here are some ideas:

- **Magnifying glasses:** These will allow children to focus on the features in the wood and leaves, such as the grain on the wood or small insects.
- **Simple weights or scales:** Children could use the balance to play a game where they attempt to balance and see which of two objects is heavier, like the small logs or sticks.

- **Water:** Children can pour water over the logs and observe how water moves over rough and smooth parts of the logs. This could lead to explanations about absorption and how wood reacts to water.
- **Measuring tapes:** To enhance their learning about size and length, the children could use a measuring tape to measure the log's length or width.

These additional facilities can enhance the environment and encourage children to ask more questions and gain a deeper understanding.

This exploration has several connections to the EYFS framework for the UK (Department of Education, 2023). The framework should offer children opportunities for instance, when children are jumping on logs or touching natural materials, they practice their movement and coordination, which falls under the area of learning called "Physical development."

Maths is one of the key subjects in EYFS, through this activity, children will begin to identify and retain the ways in which items have different shapes, sizes, weights, and volumes.

Subsequently, children can begin to consider the number of logs, moving them in different directions, or following a pattern, as well as how to manipulate and play with them. Even when children are pointing out why some logs are big or why some of them move when wobbled, they are learning "Mathematics and Numeracy" (DfE, 2022).

The EYFS Curriculum's "Understanding the World" section covers science in the Foundation Stage. In order for young children to meet the Early Learning Goal of "Understanding the World," science instruction is crucial. It is obliquely presented through exercises that inspire all children to investigate, solve problems, watch, anticipate, analyse, decide, and converse about their environment (EYFS,2022).

Children will investigate insects, animals, plants, and items in their natural habitats with this activity. To find contrasts and commonalities, they will examine and work with various materials and items. The questions adults ask will help children consider forces, balance, and the cycles of living things.

All in all, the environment in the photograph is ideal for facilitating children's scientific and mathematical thinking. When children play with the logs and other natural materials, they are

likely to discover forces, balance, size, and the life cycles of living beings. Building on that, here is what I believe can make this space foster curious learners out of children, making them inquisitive and explorative, with a little help from adults.

Part 3.

Location / Activity:	Willow playhouse space with stepping logs, as seen in the photograph.	Date:	28.09.24
Assessor:	Janna Saif	Review date:	5.10.24

Experience exploring outdoor space in photograph	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
Stepping Logs The stepping logs are perfect discoveries that can help kids improve balance and coordination. Crossing rough surfaces enhances gross motor coordination because a child has to walk awkwardly but self-consciously. These logs help develop their spatial understanding of where to put their feet while having fun and going outside to play.	- The stepping logs help children bend their legs to improve balance and coordination. Walking and running on the uneven logs enhance gross motor skills and spatial awareness. - Supports creative thinking and gross/ fine motor skills. - Natural surfaces, like tree stumps, offer varying resistance and promote muscle growth and body coordination. - understanding of	Risk of tripping on the logs and falling if the used wood is wet or has growth of moss on it. It is also important to add that sometimes one can slip and twist an ankle, for example.	Children using the logs, supervising adults.	- Understand that logs must always be upright and well-anchored to avoid rolling or toppling over. They should be cleaned or inspected regularly, especially for moss or slipperiness. - Younger children must be supervised when crossing the logs to prevent accidental injury during the activity.	L to M

	mathematical concepts due to the pattern formation encourage counting, going back word, forwards.				
Woven Willow Structure The willow playhouse can help children reduce anxious feelings and encourage them to create scenarios and dramatize. It can be used for role-playing games, allowing them to act as if the structure is a storybook or play area where they can interact socially by telling stories or playing hide and seek. It helps children express feelings, solve problems in a natural environment, and relate to their surroundings.	• The willow structure stimulates creativity and encourages happy thoughts. It may represent a fort, hideout, or tunnel, allowing children to act out and narrate their experiences. • It fosters social interaction through cooperative games, enhancing teamwork, communication, and conflict resolution. • Exploring different material, shapes and size	The willow structure could be full of branches, some still dangling or sharp, which could lead to scratching. Although rarely, poor maintenance may result in structural failure of the house.	Children entering or playing around the structure.	• Conduct semi-annual inspections to ensure the stability of the structure and the absence of sharp branches or other loose objects. If any area has been left undefended, fortify it with more natural elements. • Ensure that doors are wide open and free from any obstructions to avoid the possibility of children getting stuck or trapped.	M
Natural Hazards (Uneven Ground, Weather Conditions) Exploring natural settings helps children become aware of their environment and understand how to manage risks. The rough terrain enhances physical flexibility and fosters positive attitudes towards outdoor activities. Children learn to solve problems like playing in the rain or when it is sunny, which improves their problem-solving skills.	• A new environment fosters curiosity and problem-solving. Children learn how to step on the log or join the structure, challenging their planning and risk-taking abilities. • Studies show that natural environments improve stress management and concentration. • Give them a natural place and material to climb and jump • Exploring and examining soil, adding water to make mud	There could be differences in the elevation of the ground where the logs are placed, which would lead to falls. These surfaces may become slippery when wet, posing risks such as slips and falls to individuals.	Children and adults navigating the area.	• In case of rain, if the surface of the area becomes slippery, close the area. Ensure that there are warnings and, if necessary, barriers are applied. • Also, make sure that the surface of the ground around the structure and logs is flat or has a soft underlay of materials such as mulch in the event that someone falls.	L to M

Insect Bites / Allergies Children learn about their environment, including features and dangers like insects. If children learn how to behave around bees or wasps, they will develop respect for animals and be more cautious in natural environments. This awareness helps them understand the dangers of such places and be careful in similar situations in the future.	Connection with Nature: - Natural settings enhance awareness and gratitude towards nature. The textures of wood and branches bring children closer to nature. - The play space encourages understanding of sustainability and the role of natural elements in daily life. - Develop immune system	Stings from insects like bees or wasps may sting kids playing near the structure. Pollen or plant materials might cause allergic reactions in sensitive individuals present in these areas.	Children and adults who are allergic to insects or pollen.	- Check often for bee or wasp nests within the structure and in the vicinity. Teach children about insect danger and what they should do if they encounter a bee or a wasp. - Ensure that staff and patients have access to a first aid kit with relevant remedies, such as antihistamines for allergic individuals if needed.	L
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Part 4

The theories of cognitive development by Piaget, Vygotsky, Bruner, and Froebel are fundamental in understanding children's learning and their interactions with their surroundings. Each theory offers insight into outdoor learning, and their applicability depends on the learning objectives and environments.

In line with Piaget's theory of cognitive development, knowledge is constructed through the assimilation of information that children actively seek (McLeod, 2024). In outdoor settings, this means that students can explore their environment as they engage with mathematical learning content, such as counting or sorting using natural elements (White, 2020). However, some arguments can be raised against Piaget's approach, particularly because of the emphasis on self-education (McLeod, 2024). Some children are unable to develop higher-order thinking skills on their own and require adult intervention. For instance, while they can sort objects like leaves or stones into baskets, they may not be able to calculate or guess how many candies are in a jar without assistance.

In contrast, Vygotsky's social constructivist theory emphasizes the role of adults in guiding learning through the Zone of Proximal Development (ZPD) (Shabani, & Mohammad, & Ebadi, 2010). In outdoor environments, this means adults should actively participate in

children's explorations, offering prompts and questions that lead to deeper thinking. For instance, a child observing how plants grow might be encouraged to think about the conditions necessary for growth (Tunnicliffe, 2015). This guided exploration is especially relevant when considering the limitations of Piaget's approach, as Vygotsky underscores the importance of interaction (Shabani, & Mohammad, & Ebadi, 2010). However, one might question whether too much adult intervention limits a child's autonomy in the learning process, potentially stifling creativity and curiosity.

Bruner's constructivist theory introduces the notion of discovery learning, where children learn best when they actively discover new information (Chand, 2024). Outdoor settings naturally lend themselves to this form of learning, but Bruner's emphasis on scaffolding means that adults need to create an environment rich with materials and resources to provoke this discovery. For example, introducing magnifying glasses or measuring tapes allows children to explore scientific and mathematical concepts like observation and measurement (Sargent, 2015). The strength of Bruner's theory lies in the balance between self-directed exploration and structured guidance. However, this approach requires a highly skilled adult presence - one capable of knowing when to intervene and when to step back. The practical implication here is that training for educators in outdoor learning strategies becomes essential, adding to the cost and complexity of implementing such pedagogical approaches.

Froebel's emphasis on play and nature has informed numerous OL frameworks, including Forest School. Froebel was interested in the child's access to nature, and as such, he supported learning that involved children being exposed to or having the opportunity to explore nature freely (Early Years TV, n.d.). Froebel's ideas are found particularly suitable in outdoor environments where the societal surroundings provide children with numerous opportunities for free choice to learn about shapes, volume, and space. On the other hand, Froebel's style of education can be seen as somewhat weak in providing children with specific academic skills, a critique that could be leveled at many free-play-based approaches to learning (Knight, 2013). Thus, to promote both creativity and academic learning, it may be more advisable to combine Froebel's focus on play with more Vygotskian or Brunerian instances of adult-enacted learning.

Loose Parts Play

Loose parts play, such as using sticks, stones, and water as toys, can promote mathematical and scientific understanding of the world among children in more flexible and creative ways. Loose parts also provide opportunities for constructing, deconstructing, and reconstructing, thus creating the chance to explore core mathematical concepts such as measurement, geometry, and balance. For instance, while playing, children can use stones to build balanced structures, which in turn teach them about equilibrium and the center of mass (Keith, 2018).

While the play aspect that utilizes loose parts is widely advocated, it is also relevant to question the extent of this methodology. Studies indicate that children from different cultural and socioeconomic backgrounds may play with loose parts in varied ways based on their past experiences with similar objects (Robertson, 2017). Thus, while many educators and parents appreciate loose parts for their usefulness, these toys and materials might not be as functionally available or stimulating for all children. There must be an awareness of these differences and effective facilitation to ensure equal learning opportunities among students. This might include explaining the differences, introducing more familiar materials, or offering additional support to children less accustomed to outdoor play.

Furthermore, loose parts play raises questions about resource distribution and property. Even if natural materials are freely available, organizing an effective and diverse outdoor learning environment can be costly and time-consuming for institutions (Sargent, 2015). Schools may need to invest in training educators to fully benefit from the loose parts approach. However, if not well-monitored, loose parts play can become disorganized, reducing learning opportunities. Even though loose parts are a valuable tool for supporting cognitive and intellectual skills, their use should be carefully managed.

Affordance and Open-ended Play

Affordance, as defined by psychologist James Gibson, is the possibility of an action that an environment offers (Chong & Proctor, 2019). Outdoor environments are full of mathematical and scientific resources that foster such thinking patterns. For example, rocks provide affordances for

stacking, while puddles offer opportunities for experimenting with volume and water flow (White, 2020). With knowledge of affordances, adults can engage children outdoors to enhance brain development.

However, it is worthwhile to examine whether all affordances are beneficial for meaningful learning. Not all affordances are appropriate for learning – for instance, while trees encourage climbing and stones invite stacking, both are good for mathematical and scientific discovery. For example, a tree provides an opportunity for climbing, but when a child climbs, they may not consider the space or danger they might encounter. Therefore, adults must balance allowing children to play freely with intervening to help them learn something productive from their environment (Knight, 2013).

Another useful method for outdoor activity is open-ended play, where children use objects and spaces as they desire. This play is similar to scientific investigation, where children test theories through experimentation. For example, when children play with water and mud, they develop an understanding of natural processes like absorption and evaporation (Bilton, Bento & Dias, 2017).

However, similar to affordances, the success of open-ended play depends on how it is conducted. Some learners may not engage in certain actions unless prompted by an adult, especially when grappling with ideas beyond their grasp. For instance, while splashing water, a child may notice it flows downhill but may not associate it with gravity. This learning can be supported by adults who ask questions or provide tools like containers to measure water flow. Therefore, the challenge in open-ended play lies in balancing the child's initiative with adult guidance.

Sustained Shared Thinking and Inquiry-based Science

Shared or collaborative thinking is when adults and children engage in group discussions of problems and ideas for extended periods. This approach fits perfectly into Vygotsky's social learning theory, where the adult acts as a facilitator and guide for the child, leading them in a search for the knowledge they lack. This might involve a child carrying out an activity in an

outdoor learning environment, noticing a shadow, and seeking an explanation for changes in its size. Through consistent use of shared thinking, the adult can assist the child in explaining the position of the sun and the length of the shadow.

As a result, sustained shared thinking is effective in developing critical thinking, as it involves not only posing questions but also reasoning, hypothesizing, and considering answers. However, this approach requires time and attention that may not be available in large early years settings, where adult-child ratios are higher (Johnson & Watts, 2019). Additionally, sustained shared thinking requires a great deal of skill from the adult.

Science inquiry also fosters cognitive skills learning in an outdoor setting. This approach involves activities that encourage children to make observations, ask questions, and conduct experiments like a life scientist. For example, children might try to identify the properties of a particular type of soil, predict which type will hold more water, and then test their predictions by pouring water on the samples. Engaging in investigation enhances problem-solving skills in children and helps them better understand scientific concepts (Sargent, 2015).

Barriers and Challenges

Several issues can prevent or reduce the efficiency of outdoor learning. One is the availability of green spaces in buildings. Unfortunately, not all early years settings can offer diverse and stimulating outdoor experiences due to funding or space constraints, especially in large cities (Watts, 2020). Additionally, safety concerns related to space and play arise if children play in areas not designed for them. Ensuring safe outdoor play environments can be challenging and, at times, costly for early years provisions.

Curriculum challenges also prioritize confinement in limited classrooms over free learning outdoors. As most systems focus on measurable academic achievement, children might spend less time outdoors. However, Johnson & Watts argue that outdoor learning enhances outcomes through problem-solving, critical thinking, and creativity. Therefore, educationalists and policymakers must recognize these benefits and incorporate them into the educational framework.

To conclude children should be provided with many opportunities to explore, enjoy, learn, practise, and discuss their increasing understanding of problem solving, reasoning, and numeracy. Opportunities for practice, confidence building, and competency in the application of these abilities must be given to them. Young children's acquisition of mathematics and science is greatly aided by the environment that practitioners give. Through play, problem-solving, reasoning, and observation, young toddlers are starting to understand early science principles. Children can gain an understanding of similarities and differences, as well as the "why" and "how" behind their enquiries, by indirectly learning about science through enjoyable outdoor activities.

outdoor learning is a strong learning environment that positively impacts children's cognitive and intellectual development in early years learning, focusing on mathematics and science. By employing loose parts, affordance, open-ended play, sustained shared thinking, and inquiry-based learning, the adults involved can foster interest-promoting learning environments that enable children to naturally learn. Moreover, with the right training and support, along with the necessary resources, the effective use of outdoor learning can be an asset in shaping holistic development in the early years and helping a child learn to love education for a lifetime.

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