

Awe and Wonder – Science, Mathematics and the Outdoors

Part 1



Source: McLachlan (2024) Yorks Wood

Part 2

The area shown in the above photograph, will be visited by a group of eighteen Reception children, aged four to five years, together with one Early Years Teacher and one Level Three Teaching Assistant, holding a Paediatric First Aid Certificate.

On arrival at the site, children enter via a slope down into the main area, experiencing the effect of gravity, causing them to travel slightly faster when walking downhill. An adult comments 'Gosh, you were moving fast down that slope. Why did that happen?' A child says, 'We are on a hill' and the adult ponders, 'I wonder what would make us move even faster?', leaving the child to consider the question. Hopefully, they will experiment with different ways of using their gross motor skills, improving their strength and co-ordination (EYFS Framework, 2023). When reaching the main area, the ground becomes more level, and the soil and stone surface is covered with both freshly fallen and dry leaves. Children begin collecting leaves and this prompts discussion amongst them, as to why the leaves are different colours. A practitioner asks which season it is, giving a gentle prompt, 'Spring, Summer.....?' A child names Autumn, and the practitioner asks them to recall how the

weather changes in this season, as this is something they have talked about in class previously. The group remember that there is not as much heat and sunlight in Autumn. The adult and children discuss what a plant needs to grow and what might happen if these needs are not met. 'What does a tree need to grow green leaves?' The child says 'Sun'. The practitioner asks, 'What might happen if there is no sun?' Comparisons are made to the human growth cycle - 'What do we need to grow? What happens if we have not got these things?' The children talk about plants needing light and humans needing food, to grow healthily, and they notice that there is no sun today. One child states 'If there is no sun, it will be dark, and the plants won't grow'. Discussions follow about leaves drying out and falling off the plants and trees. The practitioner suggests the children could look out for falling leaves during our visit, and maybe count how many they see in a specified time. The Teaching Assistant's knowledge of the class, informs her that some of the children struggle with counting accurately, so she suggests they drop a small stone into a plant pot, every time they see a leaf fall, and says she will return soon, so they can count them together, as she is excited to discover how many leaves they will have seen. This piques the children's enthusiasm for the activity, as they have something to work towards. Also, the use of pebbles for counting supports the child in developing their understanding of number and counting, as mentioned in the EYFS Framework (2023).

A child approaches, holding out their hand, with a ladybird on their fingertip. 'Look, I found a ladybug' and several other children come over to see. Some of them begin poking at the creature or attempting to knock it out of the child's hand. The practitioner gestures for them to move back, whispering that we need to be calm and quiet, so as not to startle the tiny bug. A couple of children say, 'We need to kill it' and appear scared of the creature. After reassuring children that the ladybird cannot hurt them, the practitioner asks, 'Who is bigger, you or the ladybird?' All children reply, 'Us'. They are reminded how tiny the ladybird is - the practitioner indicates a tiny size using her fingers. Then she lifts an arm to her waist, indicating the average size of the children, showing the difference between them and saying, 'How frightened this little ladybird must be, of us enormous, noisy humans'. This prompts a couple of children to say, 'Let's make a house for it!' They are praised for their kindness and asked, 'What kind of house do you think a ladybird will need?' Discussion follows about how the creature should be kept dry and have some leaves provided, for it to eat. Building materials are considered, with children encouraged to look around them, to see what is available. A couple of children known to share an interest in nature, when playing in the school playground, state that the house should 'keep the ladybird safe from predators'. They are praised for the use of such a clever word and asked if they could explain to the other children, what a predator is. This gives them confidence in their own skills and allows them to expand on their idea, whilst giving practitioners confirmation that they understand the word correctly. The EYFS Framework (2023) mentions the use of newly acquired language when explaining concepts, as an

early learning goal. They decide as a group that the house needs to be built somewhere sheltered, from leaves and sticks, and several children disappear off to look for materials. A couple of minutes later, a child returns with two leaves of different variety. One is a leaf from a nearby tree and the other from a bush, further back in the wooded area. The second leaf appears shiny on the surface, possibly from a laurel bush or something similar. The child tells the practitioner that he wants to use this shiny leaf for the ladybird's house. When asked 'Why do you think that one is best?', he replies, 'Because it's shiny and the rain won't stick to it'. The teacher asks, 'Can you show me what you mean?' and the boy walks over to a small puddle in a dipped area of the woods, where he submerges the entire leaf in water and holds it up, letting the water run off it. He says, 'Look', showing satisfaction that his theory has been proven right. The teacher says, 'That's amazing, how will that help our ladybird friend?' The boy responds, saying, 'It means it will stay dry because the rain will fall off the roof', showing that he has considered the properties of the leaf and given thought to its best uses.

Looking around the site, there are children using provided water and brushes to 'paint' tree trunks. They marvel at how the bark changes colour when wet, observing the change as the water dries out and returns the tree to its original colour. Others are busy creating patterns or pictures, with natural found objects, inspired by the work of artists such as Andy Goldsworthy, whom we have recently learned about in class. Having made their own natural creations indoors, with materials they collected on a nature walk, it is now refreshing to see them recreate their ideas in the outdoors, gaining the health and wellbeing benefits of fresh air and having the spatial freedom to make their designs as large as they want. The children use words such as 'big/small, thick/thin, long/short' to describe the sticks, leaves and stones they use to make their design, learning the meaning of such mathematical language.

At tidy up time, children are encouraged to collect all tools and equipment we have used and return it to the shed. Trays await, labelled with pictures of each item and a number showing how many of each item we began the session with. A couple of children are charged with returning the trays to the shelf, when they have counted the contents and shown an adult that their count matches the number on the tray. Another child is given a tick sheet and clipboard, to record when each item is correctly returned to the shelf, meaning the shed can then be locked up for the day. As well as giving the child a sense of responsibility, this helps them learn about recording the results of their findings, a skill which will stand them in good stead for later scientific or mathematical work.

Part 4 - Risk Benefit Assessment

Location/Activity:	Yorks Wood, Kingshurst	Date:	28/9/24
Assessor:	Kerri McLachlan	Review date:	28/3/25

Experience exploring outdoor space in photograph	Benefits	Hazards & Risks	Who is at risk?	Precautionary Measures Taken	Overall risk rating L/M/H
Walking on uneven or rough ground surfaces.	Children will experience the effects of force and gravity, building muscle strength and agility. Balance and posture will be improved, and children will experience the impact of their vestibular system, becoming aware of what their bodies can do. Children will become familiar with their natural surroundings.	Trips or falls, leading to injury, such as cuts, grazes and bruising, broken bones and potentially more life limiting injuries.	Adults and children.	All parties advised to wear sensible footwear, long trousers, long sleeves. First Aid Kit available and trained First Aider on site at all times. Children advised to walk carefully in wooded area, until they become familiar with the terrain.	M
Exploring natural surrounding s and collecting natural items to support their play and investigation .	Experience the relationships between living things and understand the habitats and environments of different creatures/plants.	Low branches leading to eye or facial injuries.	Adults and children.	Talk to children about roots on the ground and picking up their feet when walking.	L
		Bites or stings from insects/bug s.	Adults and children.	Children advised to look around them and walk slowly in the woods.	L
		Poisonous plants and berries.	Adults and children.	First Aid Kit on site.	L
		Children wandering off whilst exploring.	Children	Golden rule of not putting anything in mouth and hands to be washed on leaving site. Consider boundaries and placement of staff, to ensure all possible	L

Experience exploring outdoor space in photograph	Benefits	Hazards & Risks	Who is at risk?	Precautionary Measures Taken	Overall risk rating L/M/H
	Learn to care for the environment and consider the needs of living things. Understand that natural objects can support their understanding and play.			Emphasise that children should never leave the site without an adult.	
Use tools to dig and build.	Improving strength and gross motor skills. Experience effects of strenuous work on their bodies.	Injuries caused by accident or improper use of tools.	Adults and children .	Children taught how to use tools safely prior to activities.	L
Lifting, rolling or dragging branches and logs.	Development of gross motor skills, increased spatial awareness, improvement in muscle strength and experience of working together to achieve a common goal.	Injury caused by items being swung, lifted too high off the ground, or being dropped.	Adults and children .	Children shown how to drag large branches behind them, at floor level. Small branches and equipment to be carried pointing downwards at their side.	M
Encountering dog walkers and members of the public.	Understanding that animals and people benefit from the outdoors and need exercise too. Learn to respect other people's boundaries and lifestyles.	Danger of attack from animals or humans. Danger of inappropriate interaction with members of the public.	Adults and children . Adults and children .	Speak to children, prior to visiting site, explaining that if a dog approaches them, they should fold their arms across their chest and look upwards, to show the dogs they don't want to interact. Talk about stranger danger.	M

Experience exploring outdoor space in photograph	Benefits	Hazards & Risks	Who is at risk?	Precautionary Measures Taken	Overall risk rating L/M/H
Lining up safely after visit.	Appreciation of safety measures and the need for everyone to stay safe. Attention and listening skills developed.	Child being left behind accidentally.	Children	Children to be told about the need for good listening and attention, when asked to stop and line up by an adult. Children to be counted by both members of staff, to ensure accuracy, before returning to school. Teaching Assistant to remain at the end of the line, whilst Teacher leads, ensuring that no children fall behind.	L
Discovering dangerous or unfamiliar items.	Gaining knowledge of unfamiliar things and understanding or their potential uses or pitfalls.	Danger of child picking up a dangerous item and becoming injured or adversely affected by it.	Children	Children advised to tell an adult if they see something dangerous or unfamiliar, so the adult can investigate. Woodland site to be searched by staff prior to commencement of the session, to check for any obviously dangerous items.	M
Climbing trees	Children will develop muscle strength and gross motor skills. They will also assess their own level of capability and assess their own risks.	Danger of falling from height, resulting in injury.	Children	Children will be asked to climb no higher than an adult's shoulder height, to prevent them being too high to receive assistance if needed. First Aid kit on site.	L
Signed.....		Date....28/9/24.....			

In this section an evaluation of how adults support science and mathematics in the outdoor environment, will be undertaken, with a particular focus on the use of loose parts. Throughout history, children have always played with loose parts, making use of any item they considered suitable to enhance their play. However, officially the Loose Parts Theory was developed in 1972, by Simon Nicholson. Nicholson believed that the level of creativity displayed by children, depended on both the quantity and variety of loose parts available to them. Practitioners need to ensure that as well as small items suitable for arranging and counting, they include larger loose parts, suitable for demarcating children's play area. Nicholson indicates that children are more creative when left uninhibited in their own play space.

With the right level of input from practitioners and other adults, the outdoor environment can provide endless opportunities for children in Early Years to explore mathematical and scientific concepts. According to Waters and Rekers (2019), outdoor play can encourage children's early scientific enquiry skills. Keith (2017) believes that children naturally have mathematical conversations during their outdoor play, however, adults working with Early Years children play an important part in moving their learning forward.

Keith (2017) mentions the importance of play and more concrete experiences, in furthering children's mathematical learning.. He believes that embedded attitudes can occasionally prevent parents and carers from giving their children valuable mathematical experiences at home, and it is therefore sometimes down to practitioners to give children the chance to count, measure and reason in context, in real world situations. This is demonstrated in part two of this portfolio, where the children use pebbles to help them count, as suggested by the Teaching Assistant. Another example would be to encourage children to compare the heights of different trees and plants. Children may do this by picking the flowers and laying them side by side. A trained and experienced practitioner would note this interest and maybe provide tape measures or rulers for the next site visit, giving children a new way to explore height, and also take the opportunity to talk to the children about leaving flowers to grow, rather than picking them and explaining why it is important to do so. This would encompass both mathematical and scientific concepts, in one activity. Number cards and lots of natural objects for counting, such as conkers or acorns, could be provided, giving children the chance to match number to quantity. Bruner (1991) believes providing such resources, acts as a scaffold for children's learning and it is important that they revisit the same activities regularly, at different points in their learning journey. Each time they revisit, their knowledge may have developed a little further and they will use the resources differently, on each occasion, as their knowledge grows. Also, objects of similar shape could be made available, for matching games, as matching and

sorting are a pre-cursor to further mathematical understanding. Likewise, scientific knowledge can be extended through outdoor play and hands on experience of the natural world, according to Waters and Rekers (2019), who believe that this helps children feel attuned and to find their sense of belonging in the world. Froebel (1892) also strongly believes that all experiences are connected with the natural world, and that the outdoor environment should play a part in all that children do. It has been recognised, however, that children's access to outdoor play can be affected by their social-cultural environment, or the affordances offered by available outdoor spaces. As per the EYFS Effective Practice: Outdoor Learning (2007) document, practitioners are required to work with any families who have cultural issues around outdoor learning, to ascertain the best way forward for them and their child. Excelsior Multi Academy Trust (2023) concur with this view, reiterating the importance of collaboration with parents/carers, to tailor outdoor experiences to a child's individual needs. Gibson (2014) talks about the affordance theory and how humans make connections by interacting with resources the world offers them. Practitioners who provide children with a rich selection of tools and resources, may inspire them to test theories and try out their ideas, and children will learn the effect different items have on the outcome they are trying to achieve. For example, they will learn that a knife is good for cutting, and that a funnel is good for getting liquids into small openings. Piaget (1972), supports this reasoning, believing that children learn through a constructivist approach, through their experiences with others, and should be challenged but not presented with any concept that is beyond their current understanding. An example of this type of learning would be the use of manipulatives, especially in mathematics. An example of a manipulative could be a number line or linking cubes, allowing children to begin with a basic concept and build it up further as they begin to understand it more. Practitioners could firstly provide complete number lines, before moving on to lines with some numbers missing, for the child to identify. Finally, a blank number line could be given, to see if the child can record the numbers in the correct order independently. For scientific learning, in practice, jugs, measuring cylinders, weights and scales could be provided, in water areas or mud kitchens, allowing children to see numbers and scale measurements in a real-world situation and to experiment with adding or removing substances to their chosen receptacle. They could also be given different substances to mix in their containers, to enable them to watch the various reactions which may occur when ingredients are combined.

A good practitioner will really know the children in their care and be able to recognise their current stage of learning. Difficulties in mathematics can often be caused by gaps in children's early development (Keith, 2017) and practitioners need to observe children and question them

mindfully, to find out their level of understanding, before moving their learning forward. Bruce (1987), agrees, stating that learning should start from where a child is at, rather than with something they don't yet know. This is similarly reflected in the work of Vygotsky (1978), who discusses the zone of proximal development between what a child can do independently and what they could achieve with help from an adult.

Keith (2017) believes that adults can help children make sensible choices, by involving them in planning their own activities and making decisions about how they will carry out the task. The adult can note the child's interests and provide resources relating to those interests, to promote creativity and spark the child's curiosity. In addition to observing, practitioners could make mind maps with children, asking them what interests them, what they know about it already and what they would like to learn next. The maps could then be displayed in the classroom and revisited, as children progress in their learning. In an environment such as that shown in the photograph at part 1 of this portfolio, magnifying glasses, trowels, bug collecting pots and the like, could be provided, to allow children to explore the natural world more closely and afford them more opportunities to learn. Whether or not the children take up the offer of equipment is entirely up to them, but at least they are being given the opportunity to explore them, if they wish. In some cases, they may ignore the equipment but instead go off to explore a new line of investigation. In this case, practitioners should observe and take note of their new interest, preparing different resources to be provided next time. Keith (2017) agrees that adults need to be adaptable, and let children try things out, If mistakes are made, this gives an opportunity for reflection and evaluation, which can and should involve both the adult and child, encouraging co-operation and allowing the child to develop new strategies, which could be modelled by the adult in readiness for the next attempt. Involving the child in these discussions helps them to recognise that mistakes are not a bad thing and that sometimes, adults do not have the answer to every problem and there may be an opportunity to find answers together, through sustained shared thinking. A child will be more deeply engaged, if the quality of interaction is good and the practitioner has a sound knowledge of the next steps in the curriculum, enabling them to guide the child effectively. White (2011) supports this view, saying that every child should be supported to try an activity again and again, being confident that eventually they will be able to do it.

Children are seen as creators and scientists and White believes that outdoor play, with natural resources, feeds their curiosity and wonder. A barrier to such co-operation, could be that staff are not adequately trained or experienced enough, to understand a child's developmental stages, meaning they are unsure of how best to support them. Also, lack of time and funding could be detrimental to the quality of interaction and resources provided. White (2011) recognises this as a future development need, wanting all practitioners to feel happy, confident and have self-belief that they can support children effectively. It is therefore important for practitioners to constantly reflect and seek to improve their knowledge through continuous professional development, where possible. The EYFS Effective Practice: Outdoor Learning (2007) recognises that access to specific experiences will need constant review, to ensure they still match the interests and developmental stage of the children. As a practitioner, it is therefore our responsibility to observe children and replenish or adapt activities, to ensure they continue to learn new concepts and develop their skills.

Some practitioners may be afraid to let children experiment with new concepts, as they may carry health and safety risks. However, OFSTED (2006) guidance indicates that risk or challenge should not be removed from children's activities altogether, but more that the children should be supported to manage the risk and be educated in how to use resources safely and protect themselves from danger. In practice, this can be as simple as involving the children in creating some class rules, to keep them safe. For example, always tucking in their chairs, never going into areas of danger, such as kitchens, where there may be a 'STOP' sign on the door, telling them not to go near, or always tidying up toys they are finished playing with, to prevent slips and trips occurring. In outdoor learning especially, it is essential to follow pre-set rules such as not lifting heavy objects alone, carrying resources at a low height to prevent injury to others, or staying within a pre-designated boundary to prevent them getting lost or being out of practitioners' view.

One over-riding skill which experienced practitioners tend to have, is the ability to know when or if to intervene in a child's play. This comes with experience and increased knowledge of how children's learning develops. Much intervention in Early Years is carried out on the spot, if it becomes clear that a child has misunderstood a crucial aspect of their learning. However, often, practitioners will feel guilty if they are not actively working with children, or worry that colleagues may think they are slacking in their duties. They may therefore spontaneously try to interact with children, which can sometimes disturb their play and cause them to cease their activity and go somewhere else. On occasion, they can have been doing some valuable learning, which is then lost when the adult interrupts their flow. According to Forest Schooled (2019), interfering in a child's play can cause them to feel disempowered and to lose their autonomy.

Interaction Imagination (2017) consider problems can sometimes arise due to adults feeling uncomfortable entering the child's play space. Adults can think that they are playing but may not have properly connected with the play being undertaken, due to their understanding of it being different to the child's.

In conclusion, an Early Years Practitioner requires extensive knowledge of children's developmental stages and will need to develop their teaching practice over a long period, before being confident in their abilities. Indeed, due to the constantly changing educational policies and increasing needs of children, a practitioner can never really have complete control over every aspect of their practice, needing to reflect daily on how things have gone, and find new ways to improve. The writer feels this is especially so, in relation to science, as methods of investigation are constantly evolving, at a rapid pace. Add to this the increased use of technology in many areas and it is easy to see why it is sometimes difficult to keep up with everything.

However, ultimately, if a practitioner is able to communicate effectively with children and is willing to try out a variety of methods, before finding one that suits a particular child, this is a good start to building positive relationships with the children, as outlined in the EYFS Statutory Framework (2023). Positive relationships consequently help to build confident learners in all areas, including mathematics and science.

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