

Awe and Wonder: Science, Mathematics and the Outdoors

Part 1 – Photograph



_(Source: Paddington Station, Unknown)

Part 2 – Learning Story

The photograph shown above gives an idea of how open – ended play can look for children within environments. Here you can see a variety of gradients for children to explore within such as sandy areas, grass, and a variety of logs and bridges they can climb. The setting of the learning story will be based on a rainy day, and the delegated to me will be exploring this area shown above.

9am

All children arrived at the setting promptly, and eagerly ready to learn. All the children, both boys and girls, delegated to me for the day are 3 – 4 years of age. From observation, I could see one little boy counting all the raindrops trickling down the window as quickly as he could “1,2,3,4,5,6...”, and then he proceeded to giggle with excitement. “Children, look!



(Source: Mueller, 2019)

It is raining outside, would you all like to come outside and explore with me” I said, to which all the children excitedly squealed “Yes, yes”. Before proceeding to go outside, I helped all the children get their wellies and waterproofs, however, whilst doing this the children began asking questions. One child asked, “where does rain come from and why is it wet?”, to which I replied, “that’s a very good question, how about once we have finished exploring, we come in and look for some books to answer your very interesting questions?”. All the children looked and nodded with me in agreement. The children were all now currently stood in the cloakroom room, jumping with excitement ready to go outside and explore. “Right then children, who wants to see if the rain is making some big puddles for us to splash in?”, I say with excitement. All the boys and girls proceed to run outside.

**9:30am**

There was lots of excitement amongst the children as they were running around and jumping in the puddles along the winding path. As I was observing the children engaging with the outdoors, I noticed lots of them were discussing amongst themselves where rain comes from and how it comes from the sky. Eventually all the children began getting involved by telling others what they thought

Source: Little People
Think Big, (2017)

happened. It was interesting watching the children’s curiosity with their discussions of the scientific and mathematical aspect. After watching them for a while longer, I called over to them “boys and girls, gather around!”. “I heard you all talking about

where the rain comes from, does anybody want to tell me what they think. One curious little boy looked back at me in awe and wonder and said, “the clouds”. I nodded in agreement and then proceeded to get a sponge, and a food bag with a little diagram on. I firstly began explaining to the children that when the clouds get full, it rains. I picked up the sponge and dipped in a puddle at my feet. “Can you see the sponge is full of water and there is not any water coming out, watch this now”. I then squeezed the sponge, and all the water began running



Source: lukeosaurus and me (2020)

out. All the children gasped with shock and excitement and one little girl said, “so that sponge is like what the clouds are like in the sky?”, to which I replied “yes, that’s right!”. This very curious little girl then asked “but how does the water get in the clouds. Next to me, I picked up the food bag with the diagram on and filled the base with water. I went on to describe the water cycle and how the water evaporates from the sea, back up to the clouds. All the children were starrng and completely mesmerised. “Miss!”, one called. “Yes?” I replied. “Does the rain feed the plants?”. I smiled and nodded with pure joy, the curiosity from these children was incredible. “Follow me, let me show you something. I walked over to the corner of the enclosed area in which we were surrounded by trees and plants. In the corner there was a few weeds, I pulled one out and passed it around amongst the children. “You see the hairy bits at the bottom of the plant, these are called roots. These are like the plants straws that sucks up the



water from the ground. The plant will such up all the water they can through these and then they are able to grow”. All the children looked at me, open eyed with amazement. Next, I proceeded to explain that the big trees surrounding us also had roots, very big roots and they also do the same. Once we finished our discussion, the children went on to play.

10:15am

Observing the children, I noticed that some were playing over in the sandy area and collecting twigs and leaves from

Source: Imagination Tree (2013)

around. As I approached, I could see that the children were creating a bug hotel. Arranging the twigs and placing the leaves to create the perfect shelter, it was amazing watching them discover for themselves their capabilities. Scattered around were other children, some walking across the big logs and trying to keep balance, others were playing with the mud and drawing all different shapes with twigs they had found. It was interesting watching all the children do their own activities, things that really peaked their interests. I began observing the children creating the bug hotel. You could see a few of the children foraging for twigs and leaves. "get some big twigs to make it taller", one boy shouted, and as the other few children came skipping back with their findings, I was observing them measuring and comparing all the twigs in size and arranging them. I then walked over and approached the children that were playing in the mud. "Look Miss!", the little girl said excitedly, "I have written my name and drawn a heart". I replied, "Well done!", I then drew with my fingers another few shapes and letters and began engaging with the girls to see if they could correctly guess the right names and letters. After a few giggles, I left them to play whilst I set up the last planned activity for the morning.

10:45am

"Come over here boys and girls, I have one final activity for us all". All the children came running over and gathering around. "What is that for miss?" one little boy asked. Placed on the ground in front of us was a tray. Looking around at all the curious faces, I could see them all discussing amongst themselves what they thought it was for. "I would like you all to find some objects from this area that you find interesting. We will use these later then to create some images to remember our adventure outside today. Are you ready, 3...2....1.... GO!". There they went, running, skipping off around the area, scavenging for their objects. As time went on, the tray was filling up with all sorts of things. We had some shells from the sand, twigs, leaves, acorns, conkers, mud and even handfuls of sand put in the tray. Eventually, I called all the children back to the sitting area and asked them what they enjoyed the most about their morning. It was interesting to listen to them all discussing their thoughts and interests and seeing their scientific and mathematical approach developing. Before we went back inside, everyone gathered around and sat on the log sitting area and we passed around the

tray of objects and gave the children the opportunity to use their senses, by smelling and feeling the textures of all the interesting things they found.

It was very interesting working and playing with these children outside today, whilst observing their scientific and mathematical approach towards things. By allowing the children to seize the opportunity to play outdoors like this, you can just see their development and confidence come on leaps and bounds. I also found that giving the children objects such as spades and trays, it allowed them to use their imagination and to explore with the objects in a lot of ways. Outdoor play is proving to be extremely beneficial and after this activity, it is clear how well children begin engaging in activities such as this.

Part 3 – Risk Assessment**RISK BENEFIT ASSESSMENT**

Location / Activity:	Outdoor Environment Play – On a rainy day	Date:	18 th March 2023
Assessor:	Bethany Thomas	Review date:	18 th March 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
Wet Outdoors/ Raining	They learn scientific concepts such as the water cycle and how plants need water to grow etc. It aids their 5 senses. Touch, Taste, Smell, what they can see and what they can hear. There will be lots of textures outside especially if it has been raining. Promotes creativity and their fine motoring skills.	There could possibly be a risk of slipping or falling over.	Both adults and the children	Areas that are more sheltered for children so there are dry areas that are not as slippery. An accessible first aid kit so if it is needed it can be used with quick effect. Always ensure a spare pair of clothes and shoes are available.	L

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
Cold Conditions	Help strengthen their immune system. They learn about different weather conditions and seasons.	A possibility of catching a cold if not wrapped up warm enough outside. Wind could possibly be too strong and could cause objects to fall in the area children are playing.	Both adults and children	If weather conditions are too extreme, do not go outside. Always carrying out a check prior to organising activities outside with the children. Shoes with good grip to be worn. Sensible footwear at all times. Warm clothes should always be worn otherwise it could make you ill. Layers of clothes to be worn, coat, gloves, hat, scarf and thick socks.	L

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
Walking on uneven ground in the woodland area/paths.	Will help promote and support their co-ordination skills. Improve balance and strength. They will explore different textures. For example, the soft squelch of the sand, the crunch of leaves and twigs.	Possibility that children could slip/fall whilst doing this. Possibility of cutting themselves, spraining and worst scenario, breaking a bone.	Both adults and children	All areas children are to be playing in should be thoroughly checked prior to children going out to play. Anything slippery areas should be noted and cordoned off. First aid kit to be near by and accessible at all times.	L

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
Collecting objects and playing with objects such as twigs.	It will aid their senses with different objects. Allowing children to feel the textures of objects and smells will help with the development later in life. Might benefit them with the mathematical skills as they will be able to count and compare	An object that one of the children could pick up could possibly be heavy, which could result in them dropping it on themselves, causing injury. Objects picked up could be sharp. For example, materials such as twigs, which could result in an injury.	Both adults and children	The area children are to be exploring within should be checked and assessed prior to the area being used. Any unsafe objects should be removed so that the children can play safely. First aid kit should always be nearby and accessible at all times.	L

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
Playing within muddy/sandy areas	It will aid their senses and act as a sensory activity, which will benefit them emotionally. Could aid to strengthen their immune system. It could develop their creativity, fine motor skills and their independence.	They could become ill due to germs. If a child was to have a cut if it is not covered, it could possibly lead to an infection.	Both adults and children	All members of staff should be very vigilant whilst outside in areas such as this. All children are to be told not to eat the mud, sand or any other objects. It is important to explain the dangers of doing so. First aid kit to be nearby and always made accessible.	L

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
Logged/ Sitting Areas	Areas such as these can allow the children to sit down and communication. This will develop their social skills.	Children could end up getting splinters if there are rough edges. Children could also fall off the logged areas if not sat appropriately resulting in injury.	Both adults and children	Any rough areas should be assessed beforehand. If the areas are too dangerous, it should be cordoned off for the time being until resolved. All adults should be vigilant whilst the children are out playing. A first aid kit should be always accessible, just in case an injury occurs.	
Climbing metal fencing on the outside or playing right next to it	It could enhance a child's co-ordination, strength. It could promote their ability to self assess a situation prior to doing so.	Children could end up escaping. Children could fall off the fence, causing injury. Children might endure strangers talking to them.	Children	Children are to be told the dangers of talking to strangers and that they are not to do so. First aid kit should be easy and accessible, just in case it is needed.	L

Part 4 – Academic Evaluation

Although, not commonly associated together, both mathematics and science have a close relationship which benefit one another in variety of different aspects (Dr. Wright & Prof. Chorin, 1999). The Welsh Government (2019) discusses how for children in the early years, it is a crucial evidential part of their learning and development to apply mathematical and scientific issues within their play. Olson, et al (2021), further talks about how outdoor play can further stimulate a child's development in mathematics and science. Deemed extremely important, self-directed play is seen as the best way for a child to truly explore and express their selves (Bruce, 1997). Children can self-direct outdoor play and use their initiative to explore their mathematical and scientific sides. Raymund (1995) also supports this idea and states how children have a preference and prefer to play outdoors in comparison to indoors. Russel (2022) supports outdoor play and further states how outdoor play is continuously allowing children to explore maths and science as they can play within the nature and begin pondering, using their curiosity to investigate things.

Science studies have shown that the brain is designed to be exploring outdoors as the mind works better when actively moving and investigating (Kiewra and Veselack, 2017). Kiewra and Veselack (2016) completed a study and discovered that children were the most creative and curious about learning when based in an outdoor environment full of nature, where they could let their curious little minds wander and really engage and investigate. Outdoor learning also allows the child to have that direct experience with the science outdoors has to offer, with natural objects surrounding (Greenwood and Hougham, 2015). Vygotsky (1986), discusses how learning is the basis of child's scientific development, and outdoor play can often allow children to truly be inquisitive with the science of nature outdoors and allow them to truly make sense of the outside world (Hedges, 2012). By encouraging and allowing children to play outdoors, you are giving the children the opportunity to observe science for itself and exquisite in awe and wonder, by asking questions (VCAA, 2015). Outdoor education is seen as a direct opportunity for children to truly learn about scientific aspects such as the outdoors (Greenwood & Hougham, 2015) and children are constantly within that environment, exploring, learning and creating (Russel,2022).

Bruner discusses how children learn best from exploring and discovering for themselves in self – led play as they can get involved without judgement from others or being led into a specific avenue of play. In agreement of this Piaget (1952) states how children are curious

scientists that are constantly exploring. This suggests that as practitioners, it is beneficial to allow children to participate in open – ended free play as it teaches them independence. Not only is open – ended play considered important but Water – Davies (2022) discusses how it also encourages sensory play. This is experienced when jumping in puddles, climbing objects and even playing in a mud kitchen with mud. In agreement to this statement, Early Years Education (2016) discusses how it is an opportunity to sense the outdoors and feel the world changing scientifically. The Montessori Partnership (2021) talks about how Montessori was very passionate about a child's learning and development flourishing when playing outdoors. It is talked about how she believed children playing outdoors allows them to form a connection with nature and science, and encourages their curiosity. Alongside the scientific aspect developing, they are also learning about maths too, feeling the weight and density of objects they may feel or play with (White, 2015). In the article, Montessori Partnership (2021) states how encouraging the children within the setting to play with outdoor objects such as mud and sticks will aid their development. The Welsh Government (2015) discusses how a child's learning should be continuously encouraged in order to be able to aid the children in expanding their knowledge and abilities, and as studies have shown over the years, outdoor play is a way in which it can and is best achieved. Although proven beneficial in a scientific and mathematical way, outdoor play is a very important foundation in which it allows children to problem solve, improve their independent learning and thinking skills, bring on their imagination and creativity within activities and allow them to ponder and question things they are curious about. Another important aspect outdoor play can encourage is risk taking as children are free to play open endedly and consider all aspects of the result of actions they may do, or participate within (Cremin et al, 2015). The Welsh Government (2015) focusses on how outdoor environments allow children to ponder their curiosity by asking questions such as 'how do tree's grow?' and 'where does rain come from?'. Without the opportunity to be within an outdoor environment as enriching as this, children may not have the chance to truly explore, exquisite and express themselves as we wish them to do.

Although studies have shown the strong benefits towards outdoor environments, and the positive results it has on a child's learning, some settings have reported not having the facilities or accommodate the children to be able to do this. A survey was conducted in 2015, which showed shocking results that over 400 settings based within the UK believed they did not have an outdoor area suitable, appropriate or big enough for children to be able to explore in the kind of way in which they need to be able too. Another factor that was being noted by settings within the UK was that staff had a lack of training resources available and

that staff members also felt as though they were not capable enough of being able to promote science and maths outdoors due to their knowledge (Davey, 2016; Nursery World, 2016). Manning-Morton and Thorp (2003) discuss how vital an practitioner's involvement is within assisting children in self - directed outdoor play as practitioners have a connection and a strong understanding of a child's needs and wants so can understand their actions and behaviours within situations they may observe. Within the article Muddy Faces (2022), it is suggested that although practitioners may not always be the most confident within certain subject matters, that they always consider the best needs for the children within their care at their setting, whether that being capable of pushing their boundary of allowing children to participate in riskier play or encouraging activities, the children's best interests and development should always come first. However, opportunities and resources are becoming available to ensure that practitioners within settings are always comfortable and confident when providing outside environment opportunities for children, such as Learning through Landscapes (no date). If practitioners seek out opportunities to develop their skills further, they may learn new techniques to enhance the children's learning outdoors by providing them with a concept such as 'loose parts'. Nicholson (1971; cited in Gull et al, 2019) discusses how the theory of loose parts is to place objects within a self – directed play area and allow the children to find them and use their creativity to use them. This could mean placing objects such as magnifying glasses, allowing them to look for minibeasts, or leaving spades and buckets out and watch them use them within the muddy area, for example. Before placing objects down, it is crucial that practitioners watch and study the children whilst they are playing and engaging and watch the imagination grow, then begin adding little incentives to aid the children's curious and inquisitive minds.

In conclusion, it is important to remember that children truly begin learning mathematical and scientific concepts at a young age, and the encouragement from an outdoor learning environment and practitioners throughout this part of their learning journey and development is crucial. Next, it is vital that the connection between maths and science is seen as they have a similarity to each other which is not often obvious. Studies are clearly showing the benefits to a child's development and knowledge when encouraged to get involved within self – directed outdoor play, so it is crucial that this is continued so that as practitioners, we are doing the upmost best to provide the best care and learning opportunities for the children. When children are playing with objects that evolve from science and nature, they are using their mathematical skills to be able to feel the weight and density of objects and the shape and size of objects too which is very beneficial to their learning. It is extremely important that as practitioners, we continue to learn ourselves, about ways in which we can promote and provide the best learning outcomes for children by using concepts such as 'loose parts. Practitioners should always have the children's best interests at heart and allow the children to continue to learn in awe and wonder.

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