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ECEY500/C

*Awe and Wonder: Science,
Mathematics and the Outdoors*



Section 1



Ely and Caerau Children's Centre (2013)

Section 2

The environment shown in this image is one that provides a wealth of rich learning opportunities across the whole curriculum.

Feature 1 – The Stream

Building a dam across this stream would be a very instinctive activity that children would be naturally drawn to. This activity would encourage them to explore the concepts of size and

weight in a meaningful way. They would experience the feeling of heavy and light as they moved different stones into place. They would also need to recognise different sizes and shapes to enable them to try and fit the items like a jig-saw and fill any holes with an appropriately sized stone. The children will invariably try to build the dam using a range of different materials and, as part of this process, will develop their understanding of the concept that some objects float while others sink. Children will gain a deeper understanding of fast and slow in relation to the flow of water. Depending on the weather, the season and the depth of the water, the stream speed will vary. The children will notice this when taken to the environment throughout the year to experience the different seasons which is why it is important for outdoor learning to be a central part of the daily provision.

Children will really enjoy working together with the shared purpose of stopping the water from flowing down the stream. This can be a challenging activity for very young children but it is an opportunity to develop their resilience and problem solving and it is important that they are given the opportunity to re-visit this environment and use their previous knowledge and experience to achieve their goal. These skills are closely linked to the four purposes of the Curriculum for Wales (2021) and can be easily transferred from one situation to another.

Feature 2 – The Fallen Tree

Another experience which this environment might encourage would be tree climbing. The fallen tree in particular makes this a very accessible activity for this age group. Tree climbing involves a range of mathematical and scientific concepts such as higher and lower, taller and shorter, seeing things from different perspectives and recognising that trees are living things that grow. However, this image also represents a tree that is no longer living and this could provide an ideal opportunity to explore the different parts of the tree and understand that the roots are where the tree is anchored into the ground and accesses nourishment to grow. Children would be able to make connections with other plants which have roots and their experiences of growing seeds and plants.

In climbing the fallen tree, children would be able to experience different perspectives of other people and objects, gaining what could be called a ‘bird’s eye view’. They would be able to watch the water run from above instead of being beside it or looking at people or bushes from a completely different angle. They would also be able to explore the concepts of taller and shorter, higher and lower in relation to other people and develop the language to be able to

express these. This experience would promote high levels of well-being and enjoyment as well as enabling children to develop their gross motor skills. The balance and co-ordination required to walk along this tree would be quite considerable and many young children might need the support of an adult initially to build their confidence. The concept of weight could also be explored here, with children learning through experience that using both arms out to balance themselves would distribute the weight evenly, ensuring that they are much less likely to fall. They could be encouraged by the adults to make links with their experiences of weighing and balancing in other settings.

Feature 3 – Natural Treasures

This environment is filled with an extensive range of “natural treasures”. Children would love nothing more than taking a basket into the forest area and collecting a range of different items. This is a simple yet very beneficial activity for developing an extensive range of scientific and mathematical concepts. Children will have opportunities to count, recognise patterns, sort according to a range of attributes, use their senses to explore textures and smells and find out about a range of different plants and insects.

Depending on the age and stage of development of the children, this activity could be guided by the adult to different degrees. Some children might like the challenge of finding something very specific such as different insects, leaf types or seeds, while others might prefer to explore and make their own collection of special things. The opportunity to share and describe what they have found through “show and tell” would be an extremely valuable way of demonstrating what they know and understand and would enable the adult to plan appropriately for the next steps in their learning. This might involve providing sorting hoops so that children could sort their items based on a range of different criteria or magnifying jars so that they could look at the insects in more detail.

As with all the activities associated with this photograph, these experiences are very holistic, covering many aspects of the curriculum in a meaningful way, allowing children to be curious and find things out for themselves. It also provides very powerful learning stimuli for children to continue their learning back in the setting through undertaking further research, creating images and artefacts such as bug hotels or documenting their learning using photographs or video.

Section 3

Location / Activity:	<i>Forest</i>	Date:	<i>13-09-21</i>
Assessor:	<i>Grace Jenkins</i>	Review date:	<i>15-09-21</i>

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Natural Treasures	-Learning about different textures of the items; rough, bumpy, smooth, soft or hard. -Developing as Ethical Informed Citizens; caring for creatures and the environment. -Lots of physical benefits when searching for the treasures; picking things up, fine and gross motor skills, positioning, spatial awareness and self-awareness as they discover their personal capabilities. -Deepening mathematical concepts; counting and sorting. -Scientific concepts; learning new tree types, classification, seasonal changes and life cycles.	-Children putting items in their mouth. -Children catching their head on the trees during their search. -Being stung or bitten by an insect or plant. -Picking up some glass or rubbish by mistake. -Allergies such as hay fever. -Falling or tripping.	Children	-Safety discussion before starting any activities; children must always be able to see the adults when exploring. - Children reminded not to put any objects into their mouths. -Staff to be aware of any allergies and having equipment for all outcomes. -First Aid Box accessible. -Adult always available if needed. -Ensure that there are adequate numbers of adults to children. -Assessing the area before hand for any obvious hazards. - Ensure appropriate clothing is being worn; trainers, long sleeved top and trousers or coat and wellies depending on the weather.	L
The Fallen Tree	-Supporting the development mathematical concepts; different perspectives, height - high/low, taller/shorter, big and small. - Comparing tree types. - Changes in the leaves; understanding the seasons introduces some scientific concepts. -Physical development; fine and gross motor skills. -Building a child's confidence; sense of achievement when they reach the other side. -Respecting nature; learning not to snap branches off the trees. -Team work; helping/guiding each other up and across the tree. -Tree hugging; positive energy from the tree. -Discovering different insects living in the trees.	-Falling from the tree. -Landing on another child or adult. -Catching their face on a branch. - Being stung/bitten by an insect or plant. -Touching a poisonous tree/leaf. - Allergies -Wild birds in the tree.	Children and adults.	-Although the practitioner should try not to intervene too much when a child is taking risks as children know their individual capabilities, it is important that adults remain close at hand and alert to any potential dangers. -Adults should ensure the child knows they are there if needed but to stand back and allow them to concentrate. -Adult should do a safety check of the tree; if the weather was really wet and windy it may not be appropriate to do tree climbing. - Do a safety check for any bee or bird nests. -Ensure that there are adequate numbers of adults to children. -Safety check the floor to remove any big obstructions. -First aid box accessible. -Safety discussion; one child at a time, watch out for flying insects and discuss how to react if one approaches them. -Ensure appropriate clothing is being worn; trainers, long sleeved top and trousers or coat and wellies depending on the weather.	L
The Stream	-Supporting scientific knowledge around weather; damn building may be much harder in the rain due to higher levels of water which may be fast flowing. -Understanding the concept of sticks/pebbles floating and sinking. -Learning about the properties of water as a liquid. -Different water temperatures in different weathers; frozen, cold and warmer. -Team work; helping each other collect sticks and stones and fitting them together. -Exploring what is 'deep/shallow' through their hands-on activity. -Physically developing; carrying heavy items and knowing their personal limitations.	-Falling into the stream. -Drowning. -Dropping a rock on their foot or another child's. -Catching their fingers when picking up or dropping the rocks. -Poking themselves or another child with the sticks. -Getting too cold in the stream.	Children and adults	- The risk of drowning must always be considered as the highest priority whenever children are playing in water. Adults must be constantly in attendance by the water and highly vigilant at all times. -Ensure that there are adequate numbers of adults to children. -Safety discussion to begin; to lift items they feel confident to do so, checking levels of the water and showing them where is too deep. -Ensure the correct clothes and shoes are being worn; waterproofs and wellies. -Staff to do a safety check of the stream and to be familiar where is too deep for the children. -Staff to keep an eye on the water temperature; if it is too cold re-visit on a nicer day.	L

Section 4-

The outdoor environment has the capacity to play such a big role in children's development, both physically and mentally. Children need the outdoors to support their well-being, the development of their fine and gross motor skills, physical health, independence, real life skills, co-operation with others and opportunities to manage risks safely. It is every child's right to experience the outdoors and according to NHS (2019) children of the age 3-4 should spend at least 180 minutes a day outside doing a variety of physical activities spread across the day.

The Foundation Phase curriculum published by the Welsh Assembly Government (2008) promotes the importance of children solving mathematical problems in the real-world through a play-centred approach. However, it is important that this is not done with just a mathematical centred activity but holistically. This might include several areas of learning in each activity. The new curriculum for Wales (2020) takes the holistic approach to learning to a much deeper level and is underpinned by four purposes to create ambitious, capable learners, enterprising, creative contributors, healthy, confident individuals and ethical, informed citizens. According to Welsh Government (2017) this holistic approach prepares children to develop now and for their later life.

In planning and facilitating mathematical and scientific learning outside, it is crucial that the provision is based on the requirements of the national curriculum. For mathematical development and numeracy in particular, practitioners need to have a clear understanding of the different strands of the curriculum and the progression steps within this. Mathematical learning needs to be progressive and the use of The National literacy and Numeracy Framework (2015) is a valuable tool for ensuring that children are able to build up their mathematical skills effectively.

Froebel was a theorist who supported a holistic approach to learning with young children. He believed that hands on experiences of nature, music and arts led to a natural exploration of mathematics. He maintained that play and the outdoors were two very important aspects of a child's development and encouraged children to take part in things they were interested in rather than being given information. The best form of learning takes place when children are invested in following their own lines of exploration and enquiry, guided by supportive and observant adults Pound (2017).

The role of the adult as a facilitator of learning is key to the promotion of independent and creative learners. Nicholson (2009) had a strong passion and belief in the use of loose parts to achieve these aims. He saw them as one of the most beneficial and enjoyable teaching approaches there was for young children. Loose parts offer children affordance; where they allow objects to be used flexibly and imaginatively, transporting items anywhere and applying different purposes to them in different contexts. This supports children's confidence in themselves because all outcomes will look different which will highlight their individual imagination and creativity, there is no right or wrong answer. Nicholson felt that children should be encouraged to create and design new environments, and the use of loose parts is an ideal vehicle for this. However, he felt this was compromised by professionally constructed outdoor areas which tend to be perfectly developed but they can potentially restrict the imagination and creativity which loose parts can provide.

According to Early Education (2020) it is the adult's role to promote and provide for rich, holistic learning experiences and encourage the children to problem solve independently and be as creative as possible. It is crucial that adults build secure and trusting relationships with the children in order for this approach to flourish. Adults need to be willing to follow the children's interests, have equal enthusiasm and excitement, be ready to ask appropriate questions to further learning but only intervening when necessary. This is a skilled and delicate balance to achieve but, where successful, children will become confident, happy and independent learners throughout their lives.

Moorhouse (no date) values outdoor learning and his research demonstrates that children learn far more outside than inside. However, Moorhouse only believes this to be true when all areas of the curriculum are being covered through the continuous and enhanced provision outside. For example, Moorhouse explains that to develop children's mathematical and scientific concepts in the outdoors, adults need to ensure that the resources provided are going to lead to investigation and discovery. Things such as scales, measuring implements, magnifying glasses and different sized containers can all be used practically in their play throughout the outdoor environment and help to build early confidence and competence in their scientific and mathematical understanding. It is vital that children are able to perceive themselves as capable scientists and mathematicians from the start and the adult must do everything they can to promote this confidence. For many adults, their experiences of mathematics and science in school have been negative and, too often, this detrimental view is projected onto children. The

practitioner must feed the children's curiosities and wonders by asking open-ended questions, wondering aloud and engaging in shared discovery and exploration with them. Ultimately, adults need to support children to discover the answers independently. This will provide children with the confidence to explore new ideas and concepts they want to find out for themselves and make connections with what they already know and understand.

Juliet Robertson (2014) promotes the outdoors as a crucial part of the provision. She believes that natural spaces help children to relax, therefore enabling deeper levels of concentration. Ultimately this ensures that the learning which takes place is much more meaningful and deep level. This state of deep level engagement is really important for cognitive development and clearly, exploring mathematical and scientific concepts in the outdoors, will support the children's development of these concepts the most effectively.

In addition to this, it is crucial that practitioners know their children, their interests, needs and strengths. This is done through building positive relationships and observation. This may not always be done through written and formal observations but subconsciously. Louis (2021) discusses the benefits of observing children carefully and the high level of skill that this involves. Louis used to promote a framework for observing children known as OAP; Observe, Assess and Plan. However, she is now more focused on the importance of practitioners 'noticing'. This approach allows practitioners to spend less time on unnecessary paperwork and more time noting down just the important information. This approach supports practitioners to focus on areas such as what is important to each individual child and the best approaches for deepening each child's learning across the curriculum. All children are different and it is important that adults personalise the learning experience for every child. This might be in terms of the questions they pose, the resources they introduce or the support they give. Acting on the outcomes of the observations is very important; schools and settings need to have an appropriate and rich learning environment that is inviting for children but which also introduces challenge, a strong theory promoted by Vygotsky. It is also beneficial to ensure the environment is well thought through, stimulating and enjoyable for all children regardless of their needs. Practitioners need to be conscious of promoting all areas of learning holistically in the outdoors through both the continuous and enhanced provision. This will ensure that observations of play enable practitioners to build up a picture of a child's progress and achievements across the whole curriculum over time and ensure that the provision is constantly adapted to help the children achieve new goals.

Problem-solving is something humans undertake throughout their lives, therefore it is really important that practitioners promote opportunities for children to engage with this as frequently as possible. When playing, it is something most children do without realising. However, when presented with problems and challenges in more formal learning environments, children can find this more daunting. This has significant implications for how practitioners present mathematical and scientific challenges to learners, with a playful approach in the outdoor learning environment being the most conducive to their success. It is really important that adults recognise if children are becoming frustrated and work out the best way to support the learner to overcome their difficulties.

Hughes (2009) built on the work of Piaget and identified four key elements to problem-solving; having a goal, seeing an obstacle, working out the strategy and achieving the goal. This simple structure provides a suitable framework for problem solving at all levels and ages. Piaget was a theorist who felt very passionate about problem-solving and his work still has a huge influence on early years education today. He saw that children did not need to be given information but instead undertook their own discoveries to find their own answers; he referred to them as 'little scientists'. From Piaget's observations he discovered something he referred to as schema, which was what children did during their play to help them make sense of things and deepen their knowledge and understanding of the world. Examples of schema are rotating, transporting, containing and connecting objects together. He believed these schema could lead children to wonder about something completely different to what they originally wanted to discover. Piaget saw children as being much more resilient than adults. He felt that children were comfortable with unexpected outcomes and that this would introduce new concepts into children's thinking. Practitioners need to have a flexible approach towards resources being used fluidly throughout the learning environment in order to facilitate this style of learning. However, in some settings, the control of resources and freedom in specific spaces limits opportunities for children to be able to develop their thinking in this way The Conversation (2015).

Sustained shared thinking is a valuable approach for supporting children's conceptual understanding and thinking. According to Purdon (2013) it is when two people or more work together to solve a problem, explore concepts, evaluate and extend their learning. This can be undertaken between an adult and a child. However, the adult needs to be careful not to dominate the experience and take over the learning. Sustained shared thinking can also take

place between children working together and enables them to think about what the other children are suggesting and allowing them to then see things from a variety of perspectives, instead of just their own. This approach can give adults valuable opportunities to step back and observe the learning that is taking place. This is important as it enables adults to ask questions, make suggestions or provide additional resources if appropriate in order to help children overcome any barriers and move their learning forward. Sustained shared thinking contributes to children's thinking, language and communication skills. The role of the adult during this is to ask open-ended questions, extend on ideas, wonder aloud, support children to make connections while all the time ensuring that the child is leading the learning. Skilled adults can then work with them to build on these concepts and ideas.

Reggio Emilia promotes the importance of children being involved in planning their learning to ensure their interests and passions are fed throughout their school experience. Smith (2018) states that they focus on the importance of children having real life experiences such as the natural environment. An example of developing children's mathematical and science concepts following Reggio would be real life situations such as having real measuring instruments in the builders role play area or nets and inspection jars to go pond dipping. These experiences can also be enhanced through meeting real-life professionals to talk about their jobs and find out about the world of work. Children learn better through first-hand experiences as it is exciting, stimulating and allows them to make connections.

From the research undertaken it is evident that the outdoor learning is beneficial for the development of children's mathematical and scientific concepts. This is not just for the development of their cognitive skills but also their general well-being, self-esteem and health. This evidence has had a powerful influence on the development of the new curriculum for Wales and is going to be extremely important as schools and settings move towards the statutory implementation of the Curriculum for Wales (2021). However, there are still some negative opinions around the outdoor environment, some do not find the outdoors enjoyable or see any educational benefits for its use when compared with more formal learning approaches. There are significant national training implications for this as the Welsh Government needs to ensure that every practitioner understands the importance of enabling each child to thrive throughout their school experience and the opportunity to learn meaningfully outdoors is a central part of this Foundation phase (2009).

Section 5

Reference List

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