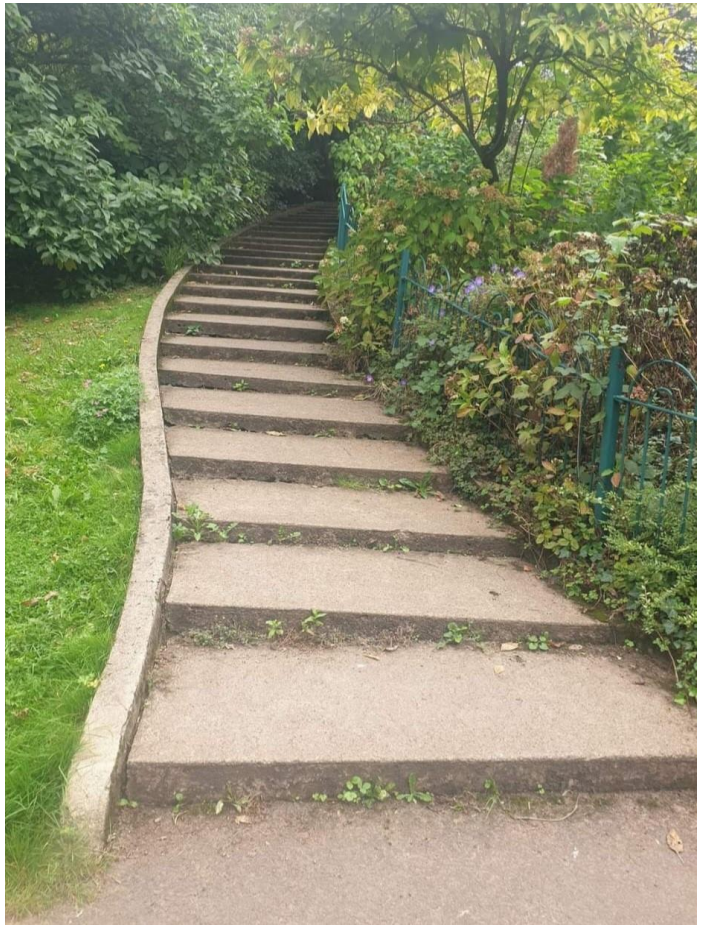
Learning through Mathematics and Science in an Outdoor Local Area

Part 1



(Source: Luckett, 2022).

Part 2

Introduction

These learning activities were created to provide a more holistic approach to the children's learning whilst incorporating the use of the outdoor local environment. The new Welsh curriculum now primarily concentrates on where a child's stage is in terms of ability and not their chronological age (Times Education Supplement, no date). The activities prepared reflect this concept throughout.

Date: 18th September 2024

Commenced: 9:30 am

Completed: 12:00 pm

Setting

- Local community area Bellevue Park
- Concrete step area
- Surrounding grass and foliage
- Weather was dry but windy at times

Cohort

- Class of 24 children
- Aged from 6 to 7 years old
- Adult ratio 1:8
- ALN 1:1

Areas of Learning: Math's/Numeracy

Progression Step 1 (Welsh Government, 2019 a).

- Estimation
- Counting to 20
- Number recognition
- Loose parts of twigs and leaves to reinforce number formation through visual representation
- Handspan used for measuring the width of the selected step

Learning Objective

- Mathematical concepts
- Number recognition
- Simple measurement
- Hand, eye co-ordination
- Holistic learning

Observational Notes

Counting and Number Recognition:

During this outdoor learning activity, the children engaged in number formation and counting using loose parts, demonstrating varying levels of confidence and understanding.

Child A demonstrated enthusiasm while working with numbers. They confidently formed numbers up to 10 using natural materials such as twigs and leaves. As they climbed the steps, they counted accurately up to 12, though their excitement appeared to slightly hinder their focus as they neared higher numbers. Their verbal communication softened when they approached numbers larger than 12, revealing some uncertainty. However, the child's excitement and overall wellbeing were evident throughout, even though this may have limited their learning outcome to a certain degree.

Child B displayed a strong understanding of numbers, accurately counting and forming numbers up to 20 with confidence. They used the loose parts to group numbers into sets of five, including organising up to 10. If a mistake occurred, Child B was quick to self-correct by recounting the objects, demonstrating both independence and accuracy in their work.

Child C required additional support when counting above 10. With guidance and modeling, they managed to count confidently up to 14 using loose parts. However, when verbally communicating, Child C occasionally skipped numbers when speaking quickly. After receiving a gentle reminder, their accuracy improved significantly.

All the children demonstrated different levels of number recognition and counting ability. While some, like Child B, confidently counted to 20, others needed extra support when dealing with numbers beyond 10. Placing the children in mixed-ability groups proved beneficial, allowing for peer support, with strategies such as "Ask a friend" encouraging collaborative learning. The use of loose parts for physical hands-on counting, as well as visual aids like fingers, reinforced their understanding. Further practice is needed to enhance consistency and ensure a more solid recognition of higher numbers.

As stated in the Welsh Government (2019 a) guidelines for progression steps, future activities will focus on extending the abilities of children who are confident in counting, while continuing to support those who need more guidance. This will ensure that each child progresses at their own pace, with activities differentiated to their individual needs and developmental stages.

Areas of Learning: Science and Technology

Progression Steps 1 and 2 (Welsh Government, 2019 b)

- Forces – Push and pull

Push

- Select an object from those provided – Balls small/Medium/Large
- Roll through push down a selected step
- Gross motor skills – Climbing the steps
- Hand, eye co-ordination – Direction of the push

Pull

- Scavenged objects selected
- Utilise the loose parts to demonstrate pull

- Gross motor movement
- Hand, eye co-ordination

Learning Objective

- Push and pull are forms of forces
- Push and pull can cause objects to travel, stop depending on their size
- Independent decision making through object and loose parts selection
- Conceptual understanding of forces
- Holistic learning in the local environment

Observational Notes

Push

During an experimental outdoor activity focused on forces, the children experimented with pushing various balls down a set of steps, showing varying levels of conceptual understanding regarding push.

Child A initially chose a small ball and used their hand to push it down the steps. They quickly noticed a difference when they selected a larger ball, commenting,

"It's harder to push with my hand."

Child A then decided to use their foot, observing that the ball moved much faster when pushed this way, highlighting their developing understanding of force and the influence of size on movement.

Child B took a more investigating approach, carefully holding and examining different balls before making their choice. They made self-predictions about how each ball would travel down the steps and demonstrated a keen awareness of weight, this led to selecting the smaller ball because it felt lighter to hold. Child B's clear interest in the concept of pushing was evident, as they focused on the relationship between size, weight, and movement.

Child C noted that the smaller ball was easier to push compared to the others. Their curiosity extended to comparing how the balls moved when they changed the body part they used to push—whether it was a hand, foot, or another part. This child enjoyed observing how these different actions influenced the speed and movement of the balls. Their facial expressions were demonstrating their sheer pleasure during this activity.

Overall, the children displayed varying levels of understanding about the forces of push. They observed the amount of force needed to move balls of different sizes and engaged through experimenting by using different body parts to push the balls, such as fingers, hands, feet, and elbows. The professional practitioner in the group encouraged deeper thinking by posing questions like, "Why did you choose your hand?" and "What was different when you used a different body part?" These prompts helped the children reflect on their choices and observations, allowing a more conceptual understanding during their activity.

This hands-on activity not only supported the children's understanding of force but also nurtured their problem-solving skills and critical thinking as they experimented with and reflected on the possible opportunities available.

Pull

The outdoor activity for forces was extended further by focusing on the concept of the force pull, the children were encouraged to explore using natural loose parts like twigs, leaves, and acorns. This hands-on approach allowed them to investigate the force of pull in a creative and using the sense of touch. This in turn nurturing their holistic learning through firstly scavenging for the loose parts then discovery

Child A used a thick twig and some string they found to create a small 'sledge' by tying the string around the twig and pulling it across the ground. They began by pulling the twig on its own, which moved easily. However, as they started adding acorns and leaves onto the twig, they noticed that it became harder to pull. Child A remarked, "The more I put on the twigs, the slower it goes!"

This observation demonstrated their conceptual understanding that the weight of their creation affects how much force is needed to pull an object.

Child B was intrigued by the idea of using different materials to see how they responded to being pulled. They collected a handful of leaves and attempted to drag them across the ground using another twig. However, they quickly noticed that the leaves scattered when pulled over the rough surface (step area). Child B verbally communicated,

“The leaves are too light—they do not stay together.”

After a few attempts, they adjusted their method, gathering the leaves tightly before pulling them, which allowed the leaves to stay in place. This child displayed an interest in experimenting with materials and adjusting their approach based on their observations alone.

Child C decided to gather acorns and placed them in a line, then used a small branch to pull them along the grass. They observed that the acorns rolled away when pulled too quickly and slowed down their movements to prevent this from happening. They commented,

“If I pull slowly, the acorns do not roll away.”

This showed their growing understanding of how speed and control affect the outcome when pulling objects of different shapes and sizes.

Throughout the activity, the children demonstrated different levels of understanding about the force of pull, experimenting with how different loose parts moved when pulled and how things like weight, shape, and speed affected this process. The adult practitioner extended their learning by asking reflective questions such as,

“What happens when you add more acorns?”

“Why do the leaves scatter when you pull them?”

“What stops the acorns from floating in the air when they fall from the trees?”

This activity not only provided the children with an opportunity to explore and understand the force of pull in an outdoor local environment in a holistic way, but it also allowed them to engage in problem-solving as they adapted their methods based on the loose parts they were working with.

This outdoor learning experience, combining mathematics and science, provided the children with an opportunity to explore their local environment while deepening their understanding. It offered a holistic learning approach, reinforced by visual representations. The activity could be further enriched by having the time through incorporating estimation and the use of handspan for measurement within the setting. Additionally, introducing the concept of gravity and its essential role in daily life would enhance their conceptual understanding of forces, especially pull.

Part 3

RISK BENEFIT ASSESSMENT

Location / Activity:	Local Park	**Date:**	09/09/2024
Assessor:		**Review date:**	18/09/2024

Experience Exploring outdoor space in photograph	**How will young children BENEFIT from this activity?**	**Hazards and associated risk**	**Who is at risk?**	**Precautions in place to reduce the risk of injury**	**Overall risk after precautions Ratings: Low/Medium/ High**
Walking to and from the local park to participate in outdoor learning. Bellevue Park Newport Cohort: Split year group 1/2	> Road safety > Physical exercise through walking (Gross Motor) > Provide a safe experience for all children ComIT Strategies to include: >Good listening >Good looking > Listening to the chosen speaker	> Moving vehicles/traffic > Members of the public > Unrestrained domestic animals > Zebra crossings > Falls, trips, bumps and scrapes > Bumps and collision with other children > Litter > Animal faeces and urine > Drug usage and equipment	**Pupils and Adults**	> Exceed the guidelines for ratio 1:10 to ratio 1:8 > Adults positioned throughout the walking children > One adult walking the line and ready for road crossing > Adults from setting all have a copy of risk assessment > Volunteers have volunteer information and general risk management > Designated first aider > Charged mobile > Emergency contact list > Children walk in pairs	

				> Adults are competent in expectations > Council Street Scene to support area scrutinisation > ALN the 1:1 is not included in the overall ratio	
Exploring the local park step area. To include: Utilising the step area for reinforcing mathematical concepts for prediction, counting and number recognition Loose parts provided	> Reinforce number recognition > Estimation through hand span and use of loose parts > Allows learning in an outdoor setting > Collaborative participation with peers and other adults. > Fine motor skills > Hand, eye co-ordination > Give pleasure and fun to children	> Animal faeces and urine > Unrestrained domestic animals > Drug equipment > Members of the public accessing the step area > Trips, falls, scrapes or grazes > Eye damage through possible weather changes, loose parts (twigs and leaves) and eye rubbing	**Children and Adults**	> Council Street Scene to scrutinise the area > Further scrutinisation of the area before attendance. A staff member from the setting > Two loud whistle blows alert the children and adults that we stop immediately and assemble quickly (Safety concern) > Provided loose parts of twigs and leaves are free from sharp edges, points and animal excrement > Wet wipes for wiping of hands	
Exploring the local park step area To include: Scientific conceptual understanding of the force in the action for push.	> Children are physically active throughout the activity in small groups with an adult > Select an object provided for rolling and explain their choice > Observe how the object travels down the steps > Give pleasure and fun to children	> Members of the public > Unrestrained domestic animals > Throwing of objects > Trips, falls, scrapes and grazes > Bumps, collisions with other children during the activity	**Children and Adults**	>Two loud whistle blows alert the children and adults that we stop immediately and assemble quickly (safety concern) > Demonstration of the gross motor movement needed to hinder misplaced direction of chosen objects > Adult monitoring throughout > Spare replicant objects in case of damage or loss	

Exploring the local park step area To include: Scientific conceptual understanding of the force in action for pull (gravity)	> An understanding of the concept of gravity. > Why gravity is needed > Outdoor visual representation > Discovery through the outdoor local environment > Give pleasure and fun to children within their local community	> Members of the public > Unrestrained domestic animals > Bumps and collisions with other children, the ground, trees and branches and selected material blowing in the wind > Ingestion of toxins from scavenged materials and plants > Infection from animal faeces and urine possibly present on scavenged materials	**Children and Adults**	> Council Street Scene to scrutinise the area > Further scrutinisation of the area before attendance. A staff member from the setting > Cone off the allowed area for scavenging > Adult supervision throughout > Some loose parts provided to secure further safety plus support ALN pupils > Model the activity to limit possible hazards	
Exploring the local park step area To include: Mathematical and scientific conceptual understanding. Counting, number recognition and forces	> Inclusive > Give the child pleasure and fun	> Special needs of specific pupils – medical, behavioural and educational. > Medical bowel situation due to short gut syndrome > Pupil distress Moving vehicles/traffic > Members of the public > Unrestrained domestic animals > Zebra crossings > Falls, trips, bumps and scrapes > Bumps and collision with other children > Litter > Animal faeces and urine > Drug usage and equipment	**Pupil**	> Take advice from AENCO if appropriate > 1:1 ratio > Make necessary arrangements for individual pupil including individual risk assessment and additional staffing as necessary > Adults in attendance awareness of ALN pupil and their specific needs > Nearby toilet facilities > Spare clothing > Differentiated activities >Two loud whistle blows alert the children and adults that we stop immediately and assemble quickly (safety concern)	

Part 4

Introduction

National Association for the Education of Young Children (NAEYC), (2020) and Penn State Extension (no date) suggests that in early childhood education, the role of adults is integral in fostering a child's understanding of the beginning concepts in mathematics and science. Adults, whether professional practitioners, caregivers, or parents, play an important role in creating environments and experiences that support and encourage children's natural curiosity and exploration of these subjects.

Furthermore, Pacey (2021) and the Welsh Government (2023) acknowledge that through observation, guidance, and purposeful interaction, adults help children build confidence, make connections, and develop problem-solving skills. This process involves aligning learning activities with children's interests, introducing mathematical and scientific concepts in meaningful ways, and promoting inquiry-based learning. This evaluation will explore how adults effectively engage young learners in these curriculum areas, thinking of educational theories and the Welsh curriculum frameworks that emphasise the importance of early experiences with math and science.

The Importance of Loose Parts

Loose Parts Play Theory (no date) cites that this concept was introduced by architect Simon Nicholson in the 1970s. He suggested that if a professional practitioner or familiar adult provided children with a variety of loose part materials whether it is cardboard boxes, wooden pallets, scrap wood, old tires, or pieces of rope or string, children use their individual creativity and resourcefulness to create, build and investigate. It might make the setting or home look a bit messy, but the experience is integral for the children. There is no need to guide their play, just simply allow them to select their chosen loose parts and explore in their own way. Moreover, this conceptual understanding is acknowledged and supported further by Bowyer (2020) and Robertson (2017).

Moreover, PACEY (2019) cites the theory of Simon Nicholson further through: Getting to grips with loose parts play. It states that the loose part of the pedagogical approach encourages children to engage in self-directed learning using everyday objects instead of traditional toys. This concept, introduced by architect Simon Nicholson, highlights the developmental benefits of providing children with a loose parts environment.

Role of the Adult with Mathematics

Williams (2022) emphasises that the adult's role in facilitating mathematical learning with children is to observe from a distance, identify the children's interests, and connect those interests to mathematical concepts. By aligning with the children’s natural curiosity, adults help to foster a deeper conceptual understanding and build confidence in mathematics. This approach not only promotes essential learning but also ensures that the teaching is relevant to the children's interests and experiences. Additionally, the approach encourages adults to link these interests with mathematical concepts while complying with the Welsh curriculum guidelines. This idea is reinforced by other theories such as Birth to 5 Matters (no date), Osana (2020), and Soar (2020), which support the role of adults encouraging early mathematical learning through active engagement with children's interests.

The Welsh Government (2022) acknowledges the five key mathematical experiences - conceptual understanding, symbolic communication, fluency, logical reasoning, and strategic knowledge, can be explored and reinforced through various real-world contexts. A professional practitioner can introduce and secure essential mathematical ideas.

Furthermore, the Welsh Government (2022) states that professional practitioners should create engaging and inclusive experiences that provide early years children with frequent opportunities to verbalise, and justify their understanding of different mathematical concepts, using the correct mathematical vocabulary.

Role of the Adult with Science in the Outdoors

This concept of learning is acknowledged through the theorists, Friedrich Froebel and Maria Montessori. Both emphasised the importance of learning through hands-on approach through exploration and engagement with the natural environment. Their approaches highlight the value and importance of outdoor play as a means for children to interact with and understand the world around them, developing both cognitive and physical development (Bertolino and Filippa, 2021 and Tovey, 2019).

Sargent (2016) cites theorists Jerome Bruner (1915-2016), and Jean Piaget (1896-1980) who advocated physical exploring as a pathway for children to develop basic concepts. Both believed that children absorb knowledge through practical, hands-on experiences, which eventually helps them form more complex abstract thinking.

Science in the early years involves encouraging young children to explore and understand the world around them through curiosity, observation, and hands-on activities. Allowing exploration of their local community enhances this concept through familiarity allowing a sense of pleasure (Franklin, 2021).

Holistic Learning and its Benefits and the Adults Role

Mcilroy (2021) and Queen Margaret University (2023) suggest that holistic development is essential during early childhood because it forms the foundation for a child's lifelong learning and overall well-being. When professional practitioners nurture all areas of a child's growth—cognitive, emotional, social, and physical—they provide opportunities for the child to reach their full potential. This embracing approach helps children build a strong sense of self, confidence and resilience as they approach their early experiences.

Furthermore, UNICEF (2023) suggests by developing essential skills during these integral years, children are better equipped for future challenges and successes. Holistic development also plays a significant role in brain development, promoting the formation of neural connections that enhance a child's ability to learn, adapt, and thrive in their environment.

Additional Leaning Needs Children and the Role of the Adult

Estyn (2022) states that in settings where effective practices are in place, professional practitioners must not purely modify activities designed for the rest of the class. Instead, they take all learners into account from the beginning, developing lessons and teaching methods that cater to their individual needs. Appropriate differentiation in accordance with a child's specific ALN requirements allows inclusion throughout the whole curriculum. Especially in relation to mathematics and science outdoors.

Moreover, Homan (2018) suggests that outdoor learning plays an integral role in early childhood education, particularly for children with additional learning needs (ALN). It offers unique opportunities to engage the children in mathematical and scientific concepts in a natural, hands-on environment, for instance utilising a local outdoor area.

Furthermore, professional practitioners play an active role in facilitating these experiences by making learning accessible, engaging, and inclusive for all. By supporting children in outdoor settings, professional practitioners help close the gap between abstract concepts and factual applications, whilst encouraging curiosity and fostering deeper understanding.

SNAP Cymru, (2024) and Schultz, (no date) acknowledges that ALN children frequently encounter distinct challenges in grasping complex mathematical and scientific concepts. Traditional or historical classroom settings may not always accommodate their specific learning styles or sensory requirements. In contrast, outdoor settings offer a diverse, multisensory experience that promotes their development.

Additionally, Kuo (2019) acknowledges that nature provides an abundance of real-world scenarios, physical activities, and sensory input that can help the children better understand math and science, such as counting items or identifying patterns found in the natural world. The professional practitioner's role should embrace this.

Professional practitioners need to adopt the roles of observers and facilitators when supporting children with ALN in outdoor settings. They must carefully assess each child's unique interests, abilities, and challenges, adjusting activities to match their specific needs (Ball and Cohen, no date a).

Cunningham, (2019) suggests examples and manipulatives to aid a child who finds abstract numbers difficult, and they could benefit from counting natural objects such as leaves or twigs, while a child with sensory processing difficulties might engage more through tactile experiences with materials like sand or water. By personalising the learning experience for each child, professional practitioners can create an inclusive and supportive environment where every child feels valued and encouraged to succeed.

Creating an inclusive environment is essential in outdoor learning, and professional practitioners have a key responsibility in ensuring this. They can modify activities, use assistive tools, or break down complex tasks into manageable steps to ensure every child can participate (Little, 2020).

Cherry, (2023) cites the importance of Lev Vygotsky's theory of the Zone of Proximal Development (ZPD) and highlights the importance of tailoring learning experiences to a child's current abilities and capacity for growth. This approach supports adapting activities and breaking down tasks to ensure every child can engage and participate effectively. This allows for inclusivity for all ALN children.

Encouraging exploration and inquiry is another important aspect of the adult's role. Whether it is observing plant growth, measuring the length of a fallen tree branch, or comparing shapes in nature, professional practitioners and adults can guide children's curiosity in ways that introduce important math and science concepts without overwhelming them.

In summary, Hunter *et al.*, (2018) and Williams (2016) recognises that professional practitioners and adults play an important role in offering outdoor learning experiences for children with ALN, helping them establish a solid foundation in mathematics and science. By designing inclusive, engaging, and accessible learning environments, adults enable children to explore, discover, and make sense of the world around them. Outdoor play promotes cognitive growth while also boosting children's confidence and curiosity, making it an effective approach for supporting their overall development and learning.

Conclusion

In summarising the findings of the role of the professional practitioner or adult in nurturing awe and wonder whilst utilising outdoor learning is essential for fostering children's early development in math and science (Ball and Cohen, no date b and Britto *et al.*, 2017).

Sobel and Letourneau, (2018) propose that when creating opportunities for exploration, guiding discovery, and encouraging curiosity, professional practitioners and adults support children to engage with the natural world in meaningful ways. Adults can scaffold experiences, ask thought-provoking questions, and provide the tools children need to explore patterns, numbers, and scientific concepts. Through their support, adults inspire a sense of wonder, laying the groundwork for critical thinking and a lifelong love of learning in math and science (Valentino, 2024).

Acknowledgements

Word Hippo: To support persistently used vocabulary

My Bib/Cite them Right: To cross check my references

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