

Part 1: Photograph of Outdoor Space



Part 2: Reflective Journal on Mathematical Learning Through Measurement (1,448 words)

Introduction

The chosen outdoor space is a forest school area with a fire pit, logs, a mud kitchen, and natural materials. This environment supports mathematical concepts such as size, length, height, weight, and estimation, while also encouraging scientific exploration of forces and material properties. This reflection focuses on a group of Year 1 children (aged 5–6 years), highlighting their engagement, skill development, and practitioner scaffolding. Possible extensions include using measuring tapes or scales for deeper exploration. Links to cross-curricular learning and the Curriculum for Wales will demonstrate holistic development across mathematical, scientific, and creative learning areas.

Activity 1: Measuring Objects in the Environment

Observations and Engagement

To introduce measurement in a meaningful way, I encouraged children to use natural materials rather than standard tools. The goal was to develop an understanding of size, length, and height through a hands-on, exploratory approach.

We gathered near the logs and fire pit, where I asked; *“How can we measure things without a ruler?”*, *“What could we use instead?”*

Some children instinctively picked up sticks and began comparing them to their arms and legs. Isla excitedly held up a curved stick and announced, *“This stick is as long as my arm!”* This sparked curiosity among the group, leading to comparisons between logs, branches, and leaves using their hands, feet, and arms.

As they explored, I observed children testing different techniques, such as:

- Laying sticks next to each other to compare lengths.
- Using fingers to measure widths of logs and branches.
- Stacking small stones to match the height of a larger rock.

These informal measuring methods enabled children to actively experiment with size relationships in their environment.

Guiding the Exploration

To deepen their thinking, I introduced some open-ended questions; *“What can we use to measure how tall this tree is?”*, *“Can you find a branch that is the same height as you?”*, *“If this log is three hands wide, how many fingers wide do you think it will be?”*

Some children jumped straight into measuring, confidently counting and comparing. Others hesitated, watching their peers before attempting their own measurements.

Zach, initially unsure, observed a friend measuring a log with hand spans before copying their method. As he became more comfortable, he excitedly declared, *“This log is ten hands long!”* showing growing confidence in non-standard measurement.

Recording and Representation

To extend learning, I introduced clipboards and pencils, encouraging children to record their findings. I asked; *“Can you draw what you measured and write down your results?”*

Some children eagerly sketched their logs and sticks, adding tally marks or numbers to represent their findings. Others found recording challenging, so I encouraged them to describe their observations verbally before attempting to document them.

Sienna, who had been quietly observing, traced the outline of a large leaf and noted, *“This is longer than my foot.”* She then drew her shoe next to it for comparison, naturally documenting size relationships in her own way.

Curriculum & Cross-Curricular Links

- Mathematics (Curriculum for Wales Progression Step 2): *“Using non-standard and standard units to measure and compare objects.”*
- Science: Observing growth patterns of trees and plants over time.
- Literacy: Encouraging descriptive vocabulary (e.g., tall, short, longer, wider).

Reflection

This activity provided a rich, hands-on experience, allowing children to take ownership of their learning. The use of natural objects enabled them to engage in measurement authentically, reinforcing mathematical concepts through direct exploration.

Moving forward, I plan to introduce structured comparisons, such as measuring the same object with different non-standard units (e.g., sticks vs. hand spans) to explore the concept of consistency in measurement. Additionally, I will introduce weighing activities using balance scales to expand on the idea of size and weight relationships in natural materials.

Activity 2: Estimating and Counting Steps

Observations and Engagement

For this activity, I introduced the concept of measuring distance through steps, helping children develop an understanding of estimation, spatial awareness, and movement-based measurement. The forest school setting, with its natural landmarks such as the fire pit and mud kitchen, provided an ideal space for this exploration.

We began by selecting two points—the fire pit as the starting location and the mud kitchen as the destination. I asked; “How many steps do you think it will take to get from here to there?”

Children eagerly made initial estimates, with some guessing ten steps, while others estimated twenty or more. Some confidently shouted out predictions, while others hesitated, unsure of how to judge the distance. Those who were uncertain observed their peers first before making a guess, demonstrating early reasoning skills.

To extend their thinking, I asked; “If we take big steps, will we need more or fewer?”

Some children demonstrated exaggerated strides, while others took small, deliberate steps, allowing for visual exploration of how step size influences measurement. As they experimented, they began to adjust their expectations, showing an increasing ability to compare different approaches and refine predictions based on real-world testing

Guiding the Exploration

Once everyone had predicted their step count, I asked them to walk and count aloud as they moved towards the mud kitchen.

- Some children kept track with ease, confidently calling out each step.
- Others lost count mid-way, needing encouragement to pause and restart.
- A few children naturally began checking their progress before reaching the end, revising their initial estimates as they walked.

To deepen their thinking, I asked; *“Are we closer or further than you expected?”*, *“Do you need to change your estimate?”*

At the end, we compared final step counts. The group noticed significant differences, leading to a discussion on why some children took fewer steps than others.

To extend their thinking, I introduced variations:

- Walking with heel-to-toe tiny steps—producing higher step counts.
- Taking giant steps—resulting in lower step counts.
- Measuring the distance using jumps or hops to compare different movement types.

This spontaneous curiosity led some children to try walking backwards or sideways, adding another layer of experimentation to the task.

Curriculum and Cross-Curricular Links

- Mathematics (Curriculum for Wales Progression Step 2): *“Estimating and checking measurements using different tools.”*
- Physical Development: Encouraging gross motor movement and improving coordination and balance.
- Science: Exploring cause and effect through movement-based measurement.

Reflection

This activity reinforced that measurement is not just about numbers—it’s about relationships and comparisons. Children quickly realised that step size and movement

type affect measurement, leading them to adjust their predictions based on real-world testing.

I observed that some children who initially guessed randomly became more thoughtful in later rounds, showing greater confidence in making informed estimations. The introduction of movement-based problem-solving turned a simple activity into an opportunity for higher-order thinking and experimentation.

Moving forward, I plan to introduce non-linear paths, such as estimating steps around obstacles or over uneven terrain, to further challenge problem-solving skills and encourage active engagement in mathematical reasoning.

Additional Exploration: Pattern Recognition and Creative Measurement

To extend children's understanding of measurement and sequencing, we collected leaves and sticks during our outdoor session and explored them further in the classroom the following day. This allowed children to apply their learning in a new setting, reinforcing concepts of size, order, and spatial arrangement.

In the classroom, children sorted materials by size, naturally reinforcing ordering and proportional reasoning. Some placed smaller sticks inside larger ones, exploring equivalence in measurement. I then introduced pattern-making challenges, asking, "Can you create a repeating pattern using leaves and sticks?" and "What happens if you alternate big and small leaves?" Some followed a clear ABAB sequence, while others experimented with more complex arrangements.

Encouraging reflection, I asked, "Why do some leaves make clearer prints than others?" This sparked discussions on material properties, with children noting how wider leaves held more paint, while thinner ones left lighter marks. The activity reinforced pattern recognition, size comparison, and fine motor skills, providing an engaging, visual alternative for children who had found direct measurement tasks challenging. Moving forward, I would introduce seasonal pattern-making, using different natural materials to explore how size, shape, and texture change over time.

Conclusion

This exploration of measurement and sequencing within the forest school environment demonstrated how hands-on, exploratory learning supports early mathematical development. Through non-standard measurement, estimation, and pattern-making, children strengthened their numeracy, problem-solving, and reasoning skills, while also improving fine motor coordination.

The transition from outdoor exploration to classroom-based activities helped children apply their learning across contexts, reinforcing size relationships, spatial awareness, and logical sequencing. Practitioner scaffolding played a key role in extending children's curiosity, prompting questioning, comparison, and prediction refinement.

Moving forward, I would build on these experiences by incorporating seasonal changes, structured comparisons, and new materials, ensuring children continue to develop a deeper, more meaningful understanding of measurement concepts in engaging and accessible ways.

Part 3 - Risk-Benefit Assessment

Location / Activity:	Forest school / Experience exploring outdoor space in photograph	Date:	24/09/2024
Assessor:	Nurul Subhan	Review date:	

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.

Activity/Hazard	Benefit	Risks	Who is at risk?	PRECAUTIONS in place to remove or reduce the risk	Overall risk after precautions RATING: L/M/H
Logs for sitting	Encourages sensory engagement and natural seating Develops connectedness with nature	Risk of tripping or slipping on logs, especially when wet, splinters from rough wood, instability causing falls	Children & Staff	Inspect logs regularly, remove loose bark, ensure proper footwear, supervise play	L
Flat Pit Area with Loose Brick	Provides space for exploration and unstructured play	Risk of trips or falls Risk of loose bricks being thrown	Children & Staff	Secure/Remove loose bricks, conduct hazard checks, teach safe movement	L
Flora (e.g., Stinging Nettles, Holly, Deadly Nightshade (Atropa belladonna), Thorny Plants)	Hands on learning about local ecology, plant identification	Risk of stings, cuts, or from such as stinging nettles, holly (sharp leaves) & thorny brambles	Children & Staff	Identify & remove toxic plants, educate on plant safety, supervise closely, carry first aid	M

		Poisoning by ingestion of deadly nightshade (Atropa belladonna)			
Tyres	Enhance balance, coordination and imaginative play Provides opportunity for development of core and physical strength	Risk of falls or tripping if tyre moves unexpectedly, risk of water accumulation leading to insect breeding or slippery conditions	Children	Ensure stability by positioning tyre securely to prevent rolling Inspect tyre for water buildup and drain after rain Supervise children during play	L
Watering Can	Fosters responsibility and fine motor skills in caring for plants	Risk of slips from water spillage, potential misuse of water leading to safety hazards	Children	Allocate specific water play areas away from slippery surfaces Teach proper use of watering cans Supervise closely to prevent overuse	L
Wildlife (e.g., Hedgehogs, Foxes, Cats, Rodents)	Real-world learning about UK wildlife and ecosystems Animal safety and monitoring signs of animal life	Risk of bites or diseases from animals such as foxes, hedgehogs, rats and feral cats Risk of children disturbing or being harmed by wildlife especially hedgehogs (prickles) or rodents (bite risks)	Children & staff	Educate children on not approaching wild animals Check the area regularly for signs of animal activity (droppings, burrows)	

				Clean and sanitise areas contaminated by droppings, avoiding contact Supervise children closely to avoid disturbing wildlife	
Animal Droppings (Foxes, Cats, Rodents)	Real-world learning about wildlife in natural settings Animal safety	Risk of contact with contaminated animal droppings, leading to infections	Children & staff	Inspect & clean areas, use gloves/disinfectant, educate children, supervise contact	M
Insects (Bugs, Bees, Wasps)	Enhances understanding of ecosystems and local biodiversity	Risk of bites, stings, or allergic reactions, particularly from wasps and bees	Children & staff	Educators to teach children how to observe insects safely and not to disturb them Carry antihistamines for allergic reactions (Epi Pens) Educators to ensure availability of first aid supplies Avoid sweet foods that attract wasps and bees	L
Trees (Falling Branches, Climbing)	Provides shade, promotes climbing for physical development	Risk of injury from falling branches or falling from climbing trees	Children & staff	Inspect trees regularly for dead or loose branches	M

	Opportunities to study Tree biology, moss growth			Set clear safe climbing boundaries (e.g., no climbing above certain heights) Supervise any climbing activities closely	
Soil (Potentially Contaminated)	Provides opportunities for digging and sensory exploration Develops connectedness with earth and nature	Risk of contact with contaminated soil (from animal droppings, pollution, or chemicals), potential ingestion of soil	Children	Test soil quality if concerns arise (due to pollution or nearby waste) Teach children to avoid touching faces or mouths after handling soil Ensure handwashing facilities are readily available	M
Mud (Wet Weather)	Promotes sensory play, builds resilience to messy play	Risk of slipping or falls, soiled clothing causing discomfort	Children	Encourage children to wear appropriate footwear (wellies) and waterproofs Designate mud play areas to reduce slipping risks on pathways Have spare clothing available for children	L

				Educators to manage mud play areas and ensure appropriate clothing	
Lost Child	Encourages exploration and independence	Risk of a child wandering off and becoming lost	Children	Regular headcounts Establish clear, visible boundaries Ensure all staff are equipped with means to communicate with one another Use high visibility vests for children if offsite	L
Rocks and Pebbles	Sensory play, encourages exploration	Risk of tripping, throwing rocks leading to injury	Children & staff	Designate areas for rock and pebble exploration Enforce strict rules about not throwing stones Regular inspections for hazards in rocky areas	L
Weather (Rain, Wet Ground)	Encourages outdoor play in all conditions, builds resilience	Risk of slips on wet surfaces, risk of cold related illness (hypothermia) in wet and cold conditions	Children & staff	Ensure children wear appropriate clothing (raincoats, boots) Lay down mats or designate safe walking areas	M

				Provide shelter or indoor space for extreme weather conditions	
Cold Weather	Encourages outdoor learning in various seasons	Risk of hypothermia or cold related discomfort	Children & staff	Ensure children are dressed warmly with proper layers Limit outdoor exposure in extremely cold conditions Provide warm drinks or shelter if necessary	L
Hot Weather	Provides opportunities for sun exposure, which is essential for health	Risk of sunburn, heat exhaustion, dehydration	Children & staff	Apply sunscreen and ensure children wear hats Provide plenty of water for hydration Schedule activities in shaded areas or indoors during peak sun	L

Part 4: Evaluation of Adult Support in Outdoor Learning (Words: 1958)

Introduction

The role of adults in early years outdoor learning is fundamental in supporting children's engagement with scientific and mathematical concepts. Outdoor environments provide affordances—learning opportunities that children perceive and act upon—allowing them to explore size, measurement, pattern recognition, and problem-solving through hands-on interaction (Boulton & Thomas, 2022; Gibson, 1979). However, while children naturally engage with their surroundings, practitioner intervention is crucial in extending and deepening learning experiences (Welsh Government, 2020a).

Through scaffolding, questioning, and observation, practitioners help children develop mathematical and scientific reasoning, fostering early problem-solving skills (Whalley, 2021; Bruner, 1960). The Welsh Government (2020b) highlights that mathematics and numeracy development in early years should be rooted in exploration, with adults playing a guiding role in facilitating inquiry-based learning. However, the effectiveness of outdoor learning depends on finding the right balance between guidance and autonomy, ensuring that children are challenged but not restricted (Waite-Stupiansky & Cohen, 2020).

This evaluation examines how practitioners facilitate outdoor STEM learning using loose parts play, open-ended exploration, and sustained shared thinking, framed by theoretical perspectives, including Vygotsky's Zone of Proximal Development (ZPD), Piaget's constructivism, Bruner's scaffolding, and the Reggio Emilia approach. While outdoor learning provides valuable opportunities, challenges such as practitioner confidence, risk management concerns, and environmental constraints must also be considered (Welsh Government, 2020a).

The following discussion explores how adults can enhance outdoor learning experiences, overcome key challenges, and ensure that children's engagement with mathematics and science is meaningful and developmentally appropriate.

1. Affordances and Child-Led Play in Outdoor Learning

Affordances refer to the opportunities for action that an environment provides, influencing how children engage with mathematical and scientific concepts (Gibson, 1979). In outdoor settings, natural materials such as logs, branches, and uneven terrain offer open-ended opportunities for exploration, allowing children to engage in measurement, spatial awareness, and problem-solving (Boulton & Thomas, 2022). However, while children naturally interact with these elements, practitioner intervention is often necessary to deepen learning and ensure that mathematical and scientific concepts are meaningfully explored (Welsh Government, 2020a).

The Role of Practitioners in Enhancing Affordance-Based Learning

In Part 2, children's use of logs and sticks as non-standard measurement tools illustrated emerging mathematical reasoning. Some children naturally compared sizes, *"This stick is as long as my arm"*, while others required prompting to explore systematic comparison. This aligns with Vygotsky's (1978) Zone of Proximal Development (ZPD), where adult guidance helps bridge the gap between spontaneous exploration and structured understanding. Research suggests that strategic questioning and scaffolding enable children to make explicit links between play and mathematical concepts (Mathias, 2019).

While outdoor environments naturally invite exploration, not all children recognise or utilise affordances in the same way. The Reggio Emilia approach conceptualises the environment as the "third teacher", suggesting that well-designed spaces provoke inquiry without direct instruction (Waller, 2011). However, in Part 2, some children confidently engaged with measurement and comparison, while others required verbal prompting to explore relationships between objects. By introducing structured questions' *"What happens if we measure using different tools?"*, practitioners encouraged deeper thinking, linking hands-on experiences to progression steps in the Curriculum for Wales (Welsh Government, 2020b).

In Part 2, some children demonstrated immediate problem-solving abilities, showing an ability to compare, estimate, and make predictions independently. Others hesitated, needing verbal encouragement and structured prompts to extend their engagement. Effective facilitation requires an adaptive approach, ensuring that practitioners assess when to step in and when to allow children to explore independently (Robertson, 2017).

This flexibility ensures that children can engage with mathematical concepts at their own developmental level, while still benefiting from adult intervention when needed.

Challenges in Maximising Affordances for Learning

Despite their potential, affordances can be underutilised due to several barriers (Waite-Stupiansky & Cohen, 2020). These include:

- Limited outdoor access in urban schools, which reduces opportunities for large-scale measurement and comparative learning (Welsh Government, 2020a).
- Practitioner uncertainty in linking mathematical concepts to outdoor play, leading to missed opportunities for embedding numeracy in child-led exploration (Robertson, 2017).
- The need for targeted professional development, as some educators lack formal training in facilitating outdoor STEM learning.

To optimise the use of affordances, research suggests that training in affordance-based pedagogy can help practitioners integrate mathematical exploration seamlessly into play (Welsh Government, 2023). Additionally, providing clear frameworks for linking outdoor learning to curriculum objectives may increase practitioner confidence in delivering STEM-rich outdoor activities.

Conclusion

Affordances provide rich learning opportunities, but structured practitioner involvement ensures deeper conceptual understanding. The balance between child-led discovery and guided support is essential in maximising the impact of outdoor STEM learning. Future research should explore how different affordances shape children's engagement with problem-solving, further embedding outdoor learning into early years STEM pedagogy.

2. Loose Parts Play & Open-Ended Exploration

Loose parts play is central to early mathematical and scientific development, providing children with opportunities to experiment, construct, and problem-solve in an open-ended

manner. This aligns with Froebelian theory, which emphasises that children develop an understanding of size, weight, and spatial relationships through direct manipulation of objects (Froebel Trust, n.d.). However, while loose parts naturally encourage self-directed exploration, their educational value depends on the quality of adult facilitation (Robertson, 2017).

The Role of Practitioners in Loose Parts Play

In Part 2, children engaged in pattern-making using leaves and sticks, reinforcing early algebraic thinking. Some children instinctively arranged items into ABAB sequences, while others required scaffolding to recognise and extend patterns. This supports Bruner's (1966) theory of representation, where physical manipulation (enactive mode) precedes visual recognition (iconic mode) and abstract reasoning (symbolic mode). Through strategic questioning, "What happens if we reverse the order?", practitioners guided children toward recognising patterns, a key skill in mathematical reasoning (Welsh Government, 2020b).

While Part 2 highlighted rich opportunities for self-directed learning, some children required additional prompts to make connections between play and structured concepts. However, not all children needed verbal scaffolding, and some independently engaged in classification and ordering of materials. This suggests that effective facilitation requires an adaptive approach, providing structured guidance only when necessary to extend thinking (Bruner, 1978).

Additionally, sustained shared thinking, where adults engage in meaningful dialogue to co-construct knowledge—further enhanced learning. For example, when children experimented with balancing stones, practitioners encouraged hypothesis testing through reflective questions, such as:

- "What happens if we place the larger stone on top?"
- "How can we make the tower more stable?"

These interactions align with Vygotsky's (1978) ZPD, where children develop reasoning skills through social collaboration before internalising them independently (Mathias, 2019).

Critiques & Barriers to Loose Parts Play in Learning

Despite its benefits, loose parts play faces several challenges in structured learning environments. Practitioner uncertainty in linking numeracy to outdoor play can result in missed learning opportunities, as some educators may struggle to integrate mathematical concepts naturally into child-led exploration (Welsh Government, 2020a). However, this was not a major barrier in Part 2—instead, variations in practitioner questioning and engagement styles influenced how deeply children interacted with materials.

To overcome this, structured CPD focusing on outdoor numeracy integration could enhance practitioner confidence, ensuring that pattern recognition and categorisation are actively encouraged within loose parts play (Robertson, 2017).

Conclusion

Loose parts play provides a highly effective way to develop early mathematical and scientific reasoning, but its educational value depends on practitioner intervention. By incorporating scaffolding, open-ended questioning, and sustained shared thinking, educators can bridge the gap between unstructured play and structured learning outcomes. Future research should explore how loose parts play can be systematically integrated into outdoor STEM pedagogy, ensuring consistency in practice across early years settings.

3. Barriers to Implementing Outdoor Learning & Strategies for Overcoming Them

Implementing effective outdoor learning in mathematics and science presents challenges, notably practitioner confidence, access to professional development, and resource constraints. Addressing these barriers is crucial for fostering an environment where outdoor STEM learning can thrive.

Practitioner Confidence & Training

Many early years educators feel uncertain about incorporating STEM concepts into outdoor settings, often due to a lack of targeted training. This can lead to missed opportunities for enriching children's learning experiences. Research highlights that teachers' knowledge and confidence significantly impact the organization and implementation of outdoor learning activities (Kiviranta et al., 2023).

In Part 2, some practitioners varied in their approach to scaffolding outdoor mathematical activities. While some actively engaged children in measurement and classification, others required more structured questioning techniques to encourage deeper exploration. This reflects broader findings that effective CPD can enhance educator confidence in guiding outdoor mathematical learning (Welsh Government, 2020a).

Solution:

- **Professional Development Programs:** Engaging educators in specialized training can enhance their competence in delivering outdoor STEM education. Programs like AEM's "STEM for Early Learners" offer comprehensive modules aimed at advancing instructional skills in this area (AEM, 2025).
- **Mentorship & Peer Collaboration:** Encouraging peer observations and shared planning sessions can increase practitioner confidence by demonstrating how outdoor mathematical concepts can be embedded into play-based learning (Robertson, 2017).

Logistical Challenges in Outdoor Learning

Limited access to suitable outdoor spaces, particularly in urban schools, can hinder the integration of outdoor learning (Waite-Stupiansky & Cohen, 2020). Schools with restricted outdoor areas may struggle to facilitate activities that require movement-based learning, estimation, or distance measurement .

In Part 2, children benefited from a well-resourced outdoor space, but not all settings have access to similar environments. Research suggests that providing adaptable resources can mitigate spatial constraints and allow for effective outdoor learning regardless of setting (Welsh Government, 2020b).

Solution:

- Movable Outdoor Learning Kits—Portable materials such as measuring ropes, balance scales, and loose parts allow for mathematical and scientific exploration in constrained spaces (Robertson, 2017).
- Community Partnerships—Collaborating with local parks, nature reserves, and environmental groups can help provide alternative outdoor learning environments.

3. Recruitment & Retention of STEM Educators

Attracting and retaining qualified STEM educators is essential for the successful integration of outdoor learning. The Welsh Government has recognized this need and is offering incentives to prospective teachers. A press release from March 2024 announced up to £25,000 in incentives to attract individuals into teaching STEM subjects, emphasizing the importance of high-quality teaching for early STEM engagement (Welsh Government, 2024).

While this initiative is beneficial, it is more relevant to long-term recruitment rather than immediate solutions to outdoor STEM integration. In Part 2, the focus was not on teacher recruitment but rather on enhancing practitioner skills within existing staff teams. Therefore, while incentives may help in the long run, immediate solutions should prioritize developing current educators' abilities to deliver outdoor learning effectively.

Solution:

- Short-Term CPD Overhauls—Rather than relying solely on recruitment, investing in existing practitioners' skill development ensures that outdoor STEM learning is immediately improved (Welsh Government, 2020a).

- Collaborative Training Models—Schools can partner with higher education institutions or STEM ambassadors to provide workshops on outdoor numeracy and scientific exploration.

Conclusion

While practitioner uncertainty, logistical barriers, and STEM recruitment issues present challenges, structured CPD, adaptable resources, and collaborative learning strategies can enhance outdoor STEM integration. Supporting educators in embedding numeracy and science in outdoor play ensures that children engage meaningfully with STEM concepts in early years education.

4. Section Conclusion

Outdoor learning plays a crucial role in supporting early mathematical and scientific development, allowing children to engage in hands-on exploration, problem-solving, and inquiry-based learning. Through affordances, loose parts play, and practitioner scaffolding, children develop key skills that extend beyond the classroom, fostering critical thinking and reasoning.

However, effective implementation depends on practitioner confidence, access to appropriate resources, and structured support. Addressing these challenges through targeted professional development, adaptable learning spaces, and curriculum-aligned strategies will ensure that outdoor STEM learning is fully embedded into early years practice.

Moving forward, investing in practitioner training and strengthening outdoor learning policies will enhance its accessibility and impact. By ensuring that all children regardless of setting have meaningful opportunities to engage with outdoor STEM learning, early years educators can lay strong foundations for lifelong curiosity, exploration, and problem-solving.

Reference List

AEM 2025, STEM for Early Learners: Professional Development Series. Available at: <https://www.aemcorp.com/earlychildhood/stem>.

Boulton, P. & Thomas, A. (2022). *How does play in the outdoors afford opportunities for schema development in young children?* International Journal of Play, 11(2), pp. 184–201. <https://doi.org/10.1080/21594937.2022.2069348>

Bruner, J. S. (1960). *The Process of Education*. Harvard University Press.

Bruner, J. S. (1961). *The act of discovery*. Harvard Educational Review, 31, 21-32.

Bruner, J. S. (1966). *Toward a Theory of Instruction*. Belkapp Press.

Bruner, J. S. (1978). *The role of dialogue in language acquisition*. In A. Sinclair, R. Jarvella, & W. J. M. Levelt (Eds.), *The Child's Concept of Language*. Springer-Verlag.

Froebel Trust (n.d.). *Outdoor Play Pamphlet*. Available at: <https://www.froebel.org.uk/uploads/documents/FT-Outdoor-Play-Pamphlet.pdf>

Gibson, J. J. (1979). *The Ecological Approach to Visual Perception*. Erlbaum.

Kiviranta, L. et al. (2023) 'Outdoor learning in early childhood education: exploring benefits and challenges', *Educational Research*, 66(1), pp. 102–119. doi: 10.1080/00131881.2023.2285762.

Mathias, C. (2019). *Early Years Pioneers: Lev Vygotsky*. Available at: <https://www.teachearlyyears.com/nursery-management/view/pioneering-play>

Robertson, J. (2017). *Messy Maths: A Playful, Outdoor Approach for Early Years*. Crown House Publishing LLC, London. Available from: ProQuest Ebook Central. (Accessed: 15 September 2024).

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.

Waite-Stupiansky, S. & Cohen, L. E. (2020). *STEM in Early Childhood Education: How Science, Technology, Engineering, and Mathematics Strengthen Learning*. New York: Routledge.

Waller, T. (2011). *Adults are Essential: The Roles of Adults Outdoors*. In *Outdoor Provision in the Early Years*. London: SAGE Publications Ltd, pp. 35-44. Available at: DOI:10.4135/9781446289099.n4

Welsh Government (2020a) *Introduction to Curriculum for Wales guidance*. Available at: <https://hwb.gov.wales/curriculum-for-wales/introduction-to-curriculum-for-wales-guidance/>

Welsh Government (2020b) *Mathematics and Numeracy: Introduction*. Available at: <https://hwb.gov.wales/curriculum-for-wales/mathematics-and-numeracy/>

Welsh Government (2023). *Teaching and Learning in the Outdoors: The Current State of Outdoor Learning in Schools in Wales*. Available at: <https://hwb.gov.wales/api/storage/177a33a6-7c70-4843-bb63-903e70a04154/teaching-and-learning-in-the-outdoors-the-current-state-of-outdoor-learning-in-schools-in-wales.pdf>

Welsh government (2024) *Welsh Government in push to attract STEM teachers to Wales: "Every day you could be the one positive thing that child needs"*. Available at: <https://www.gov.wales/welsh-government-push-attract-stem-teachers-wales-every-day-you-could-be-one-positive-thing-child>.

Whalley, C. (2021). *National Week of Play: The Role of the Adult in Learning through Play*. Available at: <https://www.eyalliance.org.uk/national-week-play%C2%A0role-adult-learning-through%C2%A0play>