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Rolling, balancing and measuring: using our woodland tyre zone for Year 1/2 science and maths.

At the field's shady edge sit two big tractor tyres, a smaller car tyre, scattered stumps, exposed roots and a gentle slope. With a small Year 1/2 group and a curious adult, this becomes a brilliant enquiry spot. I keep the focus tight: two science ideas—forces and balance/stability—and one mathematical idea—measuring distance. Language stays plain and practical, with the Curriculum for Wales (CfW) threaded throughout so learners observe, explore, compare, estimate and measure in a real context and then explain what they have found.

Why this space fits the focus.

Uneven ground, leaf litter and roots create contrasting surfaces; the slope and the weight of the tyres make motion obvious; the stumps invite balancing. Children can feel how gravity pulls objects downhill, how friction slows a rolling tyre, and how bodies and objects stay stable or topple. Every roll prompts the question “How far did it go?,” giving a real reason to measure. This is authentic, connected learning across Areas of Learning and Experience, reflecting CfW purposes and principles.

Minimal resources, maximum enquiry

To keep the space natural, I add only what helps test and record: three short planks as ramps (plain wood; one with a rough bark strip; one with a smooth plastic strip); measuring tapes or a metre stick; a bright rope start line pegged or weighted with stones; clipboards with wipe-clean results sheets; magnifiers for close looking while children wait; and cones, wooden discs or pegs with ribbon to mark where rolls stop. Small baskets hold leaves and sticks for quiet observational moments. These low-cost, durable choices support CfW emphases on real materials, learner agency and clear, simple representations of thinking.

What a session looks like

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We gather at the rope and begin with noticing. A child pats a tyre: “It is heavy.” I build from this: “Gravity is a pull that brings things down to the ground. Let’s see what it does to our tyre.” The small tyre rolls a short way across lumpy soil and leaf litter. On the smooth plank it travels further. I ask, “What is the different?”—“It is slippery.” I name it: “There is less friction here, so it doesn’t slow down as quickly.” Vocabulary grows from felt experience—exactly how CfW expects scientific language to develop.

To support reasoning, we agree a light fair-test rule: same tyre, same start, change one thing (the surface). Our routine is steady—place the tyre at the rope, hands off, count “three, two, one, let go.” After each roll, one child drops a disc at the stopping point, other plants a small flag, and a third stretches the tape from rope to marker, reading large numbers with support. We record a simple measure and place a dot under smooth / wood / rough on the wipe-clean sheet. The aim is not millimetre accuracy; it is comparing sensible measures and justifying ideas with evidence. This serves CfW Mathematics & Numeracy (estimating, measuring, representing) and CfW Science & Technology (using observations to explain everyday occurrences).

While waiting, children explore balance on the stumps. I ask, “What helps you not wobble?” Replies—“Arms out!” “Two feet!”—lead to stability talk: “When your heavy middle stays over your feet, you balance. If it leans past your feet, you tip.” We stand a tyre upright between two stumps and notice how easily it topples when nudged. Children try supports—wedging with a stick, leaning it on a stump—so words like base, support and steady gain meaning through action. This blends movement, noticing and explanation, matching CfW’s picture of physical, cognitive and language development working together.

We revisit ramps with predictions: “Which surface will send the tyre furthest? Why?” To extend thinking, we lift the rough ramp with a small block. I prompt, “A steeper ramp gives gravity a stronger start—what do you think?” Many predict further travel, then notice it still does not beat the smooth surface at the same (or even smaller) slope. The contrast shows that surface and slope both matters. We mark the furthest stop with a cone and add a star sticker in the matching column. Talk centres on more/less, further/shorter and because, modelling CfW’s expectation that learner’s reason aloud, not just produce numbers.

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Science learning (forces + balance/stability)

Children meet forces through direct effect. Gravity appears as a dependable pull that starts motion on a slope and keeps the tyre moving until friction between tyre and surface slows and stops it. Swapping surface makes friction visible and touchable: the tyre rumbles and halts sooner on rough; it glides and travels further on smooth. Adjusting slope shows that starting higher increases the tyre's initial "go," yet surface grip can still limit distance—an accessible cause-and-effect contrast that invites explanation ("It did not go far because the bark is grippy").

Alongside forces, the stump trail grows balance and stability. Children widen their base (two feet, arms out), keep weight over their feet, and try supports to prevent toppling. Movement comes first, then simple explanation. This is CfW Science & Technology in action: observe, explore, make connections, and use evidence and language to explain everyday phenomena.

Mathematics learning (measuring distance)

Rolling gives a real reason to measure. We may begin with non-standard spans (placing discs as quick step-markers or pacing) to compare, then shift to a measuring tape for metres so distance has a stable reference. Children help hold the tape taut, read the large numbers with support, and record a single rounded figure ("2 m", "3 m") plus a dot or star in a three-column sheet. They use that record to decide which surface produced the longest roll, explain why, and test again to see if the pattern repeats. This maps directly to CfW Mathematics & Numeracy: learners select sensible units, record simply, compare and order, and reason from results in an authentic context where numbers answer a question that matters—Which ramp makes it go furthest?

Safety, inclusion and practicalities (trimmed)

Keep it simple and visible. Mark a rolling lane with cones and a bright start rope; only the releaser stands by the ramp while others wait behind the rope. Check stumps are steady and start with low ramps; model bent knee lifting for tyres and planks. Adjust for

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need—lower a ramp, add a helping hand or an adult spotter on the trickiest stump—and offer a calm parallel task (magnifiers, surface-sorting) for children who prefer quieter work. This aligns with CfW Health and Well-being (safe, confident movement; teamwork) and Language, Literacy and Communication (explaining choices and results) without slowing the enquiry.

Capturing evidence and assessing in the moment

Recording stays light. I take two or three photos: the rope start line, a close-up of the tape at the marker, and the simple results sheet. On the wipe-clean board I note phrases such as “further,” “shorter,” “slippery,” “bumpy” and “because the bark is grippy.” These are progress markers in CfW terms: children are observing, comparing, measuring and explaining using everyday language plus accurate terms. If talk is tricky, I invite children to show their idea—move the cone to the furthest mark, choose a picture card for predict/test/measure, or demonstrate the stance that helped them balance. Quick checks include: Did the child help keep the test fair? Did they choose a sensible unit? Could they offer a simple reason for a result? Assessment stays responsive without interrupting play.

Reflection and next steps

The strength here is clarity of focus. We do not chase every possible idea in the woodland. We go deep on forces and balance, and we keep maths to measuring distance. The site does much of the teaching: children feel gravity, hear the rumble over bark, and find the furthest marker. The adult notices, names and nudges, turning hunches (“This one is slippery”) into explanations (“It went further because the smooth ramp has less friction”). That habit of using evidence and talk aligns closely with CfW purposes: ambitious, capable learners who reason and explain, and healthy, confident individuals who move safely and work together.

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In summary

This modest woodland corner is a strong context for Year 1/2 science of movement and maths of measure. With a few ramps, measuring tapes and simple markers—and with concise, timely adult prompts—children build genuine understanding of gravity, friction and balance, while strengthening measurement as a tool for reasoning. The learning is playful, practical and clearly connected to the Curriculum for Wales, woven from first release to final explanation.

RISK BENEFIT ASSESSMENT

Location / Activity:	Woodland	Date:	19/09/25
Assessor:	Anna Griffiths	Review date:	22/09/25

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 associated risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk after precautions RATING: L/M/H
Rolling tyres down ramps and uneven ground.	Children explore forces such as gravity and friction in an authentic, exciting way. They practise teamwork, turn-taking, and apply mathematics through measuring and comparing distances. This activity directly links to CfW Science & Technology and Mathematics & Numeracy AoLEs.	Tyres may roll unpredictably into children; trips on uneven ground; fingers trapped between tyre and ramp edges.	Pupils, supervising adults.	A rolling lane is marked using bright cones/rope. Only the “releaser” stands at the ramp; others stay behind the line. Adults demonstrate a safe countdown release routine. Large tractor tyres are handled only by staff; children use smaller car tyres. Adult supervision ensures rules are followed throughout.	low

Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and associated risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk after precautions RATING: L/M/H
Balancing and climbing on stumps	Builds confidence, coordination and physical literacy. Children understand balance and stability, supporting CfW Health & Well-being AoLE. They also learn resilience and safe risk-taking	Children may slip on wet stumps, fall when balancing, or bump into each other.	Pupils (staff if assisting closely).	Only low, stable stumps are used. Adults check for rot or wobble before the session. One-at-a-time rule in place. An adult spotter stands nearby to give reassurance or support. Children are taught safe balancing techniques (arms out, feet apart). Alternatives (marking, measuring roles) provided for less confident pupils.	Low
Handling ramps and planks	Children experiment with surfaces, slopes and cause/effect. They practise teamwork when setting up ramps and learn problem-solving through trial and error.	Splinters from wood, unstable ramps shifting, risk of lifting injuries.	Pupils and staff	Larger ramps are positioned only by staff. Children handle only light resources. Planks checked for splits or sharp edges before each session. Ramps are wedged or weighted securely. Staff model safe lifting (bent knees, straight backs). Any plank showing damage is removed immediately.	Low
Measuring with tapes, markers, pegs	Develops numeracy and communication. Children practise using standard and non-standard units, comparing results, and recording in simple charts. Encourages collaboration and reasoning aloud.	Measuring tapes may snap back; tripping on loose markers/pegs	Pupils, occasionally staff.	Adults model safe tape use and supervise closely. Pupils work in pairs to hold tape taut, avoiding overstretching. Markers and pegs collected straight after use. Measuring zone kept clear of clutter to avoid tripping hazards.	Low
Natural environment – roots, leaf litter, insects	Encourages respect for nature and awareness of changing outdoor conditions. Builds resilience and sensory exploration. Links to CfW Science & Technology and Health & Well-being AoLEs.	Slips and trips on roots or leaves; insect bites/stings; contact with allergens in soil/leaf litter.	Pupils, staff.	Site is checked before sessions for loose debris or insect activity. Children reminded to “walk feet, eyes down.” Suitable footwear required. Staff carry first aid kit and know medical plans for allergies/asthma. Open cuts are covered before play.	Low

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Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and associated risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk after precautions RATING: L/M/H
Weather conditions (rain, wind, heat)	Children build adaptability and resilience by experiencing different weather safely. They learn to recognise limits, make decisions, and understand how weather affects play and safety	Slippery ramps/stumps in rain; risk of falling branches in high winds; sunburn/heat stress in hot weather.	Pupils, staff.	Sessions postponed in storms or high winds. Shade breaks and water provided in hot conditions; sun hats/cream encouraged. In wet weather, ramps kept low and checked for grip. Indoor alternatives used if conditions deteriorate.	Low
Manual handling of tyres and planks	Pupils observe safe lifting techniques modelled by adults and may practise moving light items responsibly. This develops teamwork, responsibility and awareness of limits.	Risk of strains, bumps or dropped equipment if handled incorrectly	Staff mainly, pupils with smaller tyres	Adults move and position heavy tractor tyres. Children only roll smaller tyres. Staff model safe lifting or use two-adult lifts. Clear instructions keep pupils away from moving equipment. Tyres stored flat to prevent rolling.	Low

Adults, outdoor pedagogy and early conceptual development: a Reggio–Vygotskian evaluation

Introduction

Outdoor spaces in early childhood education can offer powerful opportunities for learning, but being outside alone does not guarantee deep engagement with scientific or mathematical ideas. Outcomes hinge on adult decisions: how the environment is set up, how interactions are guided in the moment, and how children are helped to make sense of what they notice. This essay evaluates those adult roles in outdoor settings, examining environment design, moment-to-moment pedagogy, and ways of making thinking visible, while also weighing common constraints such as risk culture, time pressures, subject knowledge, and equity of access. It concludes with clear, practical principles for strengthening practice.

The discussion is framed by Reggio Emilia principles—particularly the view of the environment as a “third teacher,” the centrality of documentation, and the stance of adults as co-researchers with children—alongside a Vygotskian explanation of why dialogic scaffolding works. The argument draws on UK-relevant guidance and research on outdoor provision, early years inquiry, and early mathematics, and aligns with the expectations of the Curriculum for Wales.

Why outdoors for science and mathematics

The Reggio tradition treats the environment as pedagogical. Spaces and materials communicate possibilities and values and can be shaped to invite complex thinking when adults design them deliberately (Edwards, Gandini and Forman, 2012). Outdoors, these possibilities multiply. Gradients, textures, wind, water, shadow and seasonal change provide real phenomena that are felt and seen

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rather than simply told. From an ecological perspective, such features offer affordances—action possibilities that are perceived and acted upon—so a slope affords rolling, a puddle affords floating and sinking, and a log affords balancing (Gibson, 1979). Each affordance connects naturally to concepts in science, including forces, material properties and change, and to mathematical activity, including comparing, ordering, measuring and mapping.

The use of loose parts strengthens these affordances. Nicholson (1971) proposed that open-ended materials which can be moved, combined and transformed lead to higher levels of creativity and problem solving. In early years practice, loose parts include planks, tubes, crates, fabrics, stones, sticks and containers that children reconfigure at body scale. White, (2011) argue that such collections allow children to manipulate variables—size, weight, shape, angle and texture—and to encounter ideas like friction, stability, distance and duration in ways that are both physical and thinkable. For mathematics, an outdoor approach that legitimises estimating, measuring and representing—using rope start lines, pegs to mark stopping points, metre sticks and simple tallying—supports reasoning without reducing play to worksheets (Robertson, 2017). For science, short cycles of looking, predicting, testing and evaluating, beginning in sensory experience and moving towards simple explanations, are recommended as developmentally appropriate (Brunton and Thornton, 2010).

These practices sit comfortably with the Curriculum for Wales, which expects learners to observe and explore, to use evidence to explain how things work, and to apply number and measure in meaningful contexts. The framework also places emphasis on language-rich dialogue and purposeful play as routes to progression (Welsh Government, 2022). The implication is clear: outdoor spaces hold promise, but it is the adult's planning and interaction, before, during and after the encounter, which turn potential into progress.

A theoretical alignment: Reggio Emilia and Vygotsky

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Vygotsky's sociocultural theory explains why adult interaction is vital. New forms of thinking appear first in social interaction and are later incorporated, development proceeds through mediation by tools, signs and language (Vygotsky, 1978). The zone of attainable development captures the distance between what a child can do unaided and what becomes possible with support, while scaffolding describes the temporary, responsive help that enables success. Reggio practice, although distinct, is highly compatible with this picture. It treats children as competent co-researchers, gives status to documentation—photographs, transcripts, drawings and artefacts that make thinking visible—and uses revisiting to refine ideas over time (Edwards et al., 2012). Documentation functions as a cultural tool in Vygotsky's sense: it stabilises fleeting events so that children and adults can compare and analyse. Bruner's account of representation—enactive action, iconic image and symbolic language or number—adds an explanatory layer, since moving between actions such as rolling or pouring, images such as photos or sketches, and symbols such as measures or labels scaffolds conceptual growth (Bruner, 1966).

UK evidence strengthens the case for an interactive, co-constructive stance. The REPEY/EPPE studies associated episodes of sustained shared thinking—where adults and children co-construct meaning by posing genuine questions, hypothesising, testing and explaining—with stronger cognitive outcomes (Siraj-Blatchford et al., 2002; Sylva et al., 2004). Outdoors, where events are immediate and variable, such episodes can transform casual noticing—"it went far"—into causal reasoning, for example, "which surface made it go further, and how can that be checked fairly?", and into quantitative reasoning, for example, "how could distance be shown so that results can be compared?". A Reggio-Vygotskian stance therefore supports a cautious but robust evaluative claim: high-quality adult interaction predicts depth of learning more reliably than the outdoor setting alone.

What effective adults do outside and why it works?

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One strand focuses on creating spaces with lots of opportunities for play through loose parts. Effective adults plan variables rather than narrow tasks. Ramps with different surfaces and adjustable heights, water channels with varied gradients and junctions, sets of containers for capacity, and natural collections for classification are not worksheets in disguise; they are invitations to investigate that preserve children's choice. Guidance on outdoor provision emphasises simple, durable materials that invite full-body action—pushing, carrying, balancing—so that ideas such as friction, stability, distance and duration are both felt and named (White, 2011; Warden, 2012). For mathematics, small additions such as metre sticks, timers, rope lines and pegs or flags give children legitimate tools for estimating and measuring without turning play into a recording exercise (Robertson, 2017). For science, adults choose materials so that children can change only one variable at a time—surface, slope or mass—laying foundations for fair-test thinking (Brunton and Thornton, 2010). Through a Vygotskian lens, the environment then becomes a set of mediational means that serve to widen the kinds of problems children can bring into their zone of development. Through a Reggio lens, the curated space respects agency, because adults make possible what children decide to try.

A second strand relates to interaction. Observation precedes intervention, and adults choose when and how to join children's thinking. When a child offers a theory such as "smooth is faster," the adult responds with light, open prompts that invite explanation, propose comparisons and encourage careful description. The style is consistent with sustained shared thinking and with early years inquiry cycles in science and mathematics, and it includes modelling of precise but sparing vocabulary, so that everyday terms such as slippery, bumpy or grippy sharpen into surface, friction, steep or measure in context (Brunton and Thornton, 2010; Robertson, 2017; Siraj-Blatchford et al., 2002). In Vygotsky's terms, the adult supplies temporary scaffolds—conceptual, procedural and representational—and then fades. In Reggio terms, the adult acts as a co-learner who honours children's theories and strengthens them with evidence while resisting over-direction.

A third strand concerns representation and revisiting. Because outdoor events are transient, making thinking visible is central to continuity. Adults use rope start lines, pegs or flags at stopping points, photos of set-ups, sketches of gradients and simple labels

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such as “2 m”. These artefacts allow revisiting: children compare sequences, argue from evidence and refine explanations.

Recording is deliberately light so that it serves thinking rather than interrupts it (Edwards et al., 2012; Robertson, 2017).

Representation moves experience along Bruner’s pathway from enactive to iconic and symbolic forms and also meets Curriculum for Wales expectations for reasoning and communicating findings in authentic contexts (Bruner, 1966; Welsh Government, 2022).

A fourth strand is inclusion and fair participation. Effective adults widen access by providing multiple ways in. Physical adjustments such as lower ramps or lighter items, communicative supports such as first–then visuals, bilingual word banks and gesture, and rotating roles such as releaser, marker, measurer and explainer ensure that all children participate in core thinking, not just confident movers or fluent speakers. Outdoor guidance stresses a risk–benefit approach that keeps meaningful challenge while managing hazards and recognises that doing difficult things safely is itself a route to conceptual understanding (White, 2011; Warden, 2012). Inclusion is pedagogically generative: when roles and modalities vary, more evidence is created, more explanations are offered, and more children practise the language and tools of science and mathematics. This resonates with the Curriculum for Wales purposes for ambitious, capable and healthy, confident learners.

Challenges, tensions and limits

The promise of outdoor learning is often diluted by structural and cultural constraints. One persistent tension is the relationship between risk culture and authentic challenge. Over-cautious policies can remove weight, height, speed and texture—the very conditions that make forces and measurement meaningful. A risk–benefit stance is more productive than simple risk-avoidance because it mitigates hazards, teaches routines and retains productive risk. Without leadership support for this stance, outdoor sessions tend to shrink into safe but concept-thin activities (Warden, 2012).

Time and evidence pressures create a second difficulty. Accountability can push adults towards over-documentation or towards tidy, quick outcomes that curtail dialogue. The REPEY/EPPE work warns that sustained shared thinking is easily squeezed when

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paperwork dominates the day (Siraj-Blatchford et al., 2002; Sylva et al., 2004). Reggio practice suggests selective documentation that captures hinge moments of reasoning rather than everything, while Robertson argues that mathematical recording should remain in the service of thinking. Settings therefore benefit from a shared view of what good evidence outdoors looks like so that adults can prioritise interaction over administration (Edwards et al., 2012; Robertson, 2017).

A third issue relates to subject knowledge. Many practitioners report lower confidence with physics concepts such as forces and material properties and with measurement progressions outdoors. This can lead either to over-control, in which telling replaces probing, or to under-scaffolding, in which misconceptions go unchallenged. Focused professional development on a small number of high-leverage ideas—fair testing with one changing variable, moving from non-standard to standard units, and sharpening everyday talk into precise terms—can make a strong difference to practice (Brunton and Thornton, 2010; Robertson, 2017).

A fourth concern is equity and access. Access to quality outdoor spaces and storage for loose parts is uneven across settings. Practical guidance shows how small or urban spaces can still be designed for affordances, but structural inequities remain and can limit who experiences concept-rich play. Leaders are more likely to protect this entitlement if outdoor affordances are treated as core infrastructure rather than as extras (White, 2011).

Finally, cultural expectations about “real learning” can be a barrier. Families and some staff may equate learning with tables and neat pages. The Curriculum for Wales, by contrast, values purposeful, contextualised science and mathematics and accepts diverse forms of evidence. Adults therefore need to make learning visible through photographs, child quotes and simple measures, and to communicate clearly why such evidence is credible and sufficient for judgment (Welsh Government, 2022).

Synthesis and implications

A consistent mechanism runs through the theoretical and practice literature. Adults design environments so that affordances and loose parts make key ideas tangible. Children act on the environment and propose provisional theories, for example that smooth

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surfaces make objects travel further. Adults then mediate using language and tools: they press for reasons, propose ways to hold one variable steady, and introduce representational means that stabilise evidence in manageable forms. Through sustained shared thinking, adults and children co-construct explanations and revisit them using documentation. Over time, children move from every day to more precise concepts and from non-standard to standard measures in the manner expected by the Curriculum for Wales (Bruner, 1966; Brunton and Thornton, 2010; Edwards et al., 2012; Robertson, 2017; Siraj-Blatchford et al., 2002; Welsh Government, 2022).

This synthesis helps explain why a Reggio–Vygotskian alignment is useful in practice. It protects agency because children lead and shape the inquiry, yet it also protects rigour because adults help to test, name and represent ideas. The same outdoor area can therefore produce either shallow activity or deep learning, depending on whether adults orchestrate affordances, dialogue and representation with intention.

The implications are straightforward. Planning should focus on variables and affordances rather than on tightly scripted activities, so that children can manipulate surface, slope, mass, volume or flow in response to their own questions. Adults should prepare questions rather than answers, keeping a handful of open prompts ready to sustain shared thinking and to build explanation without telling too much or too soon. Representation should be light but strong, using rope lines, pegs, one photo and one number or sketch per test so that evidence can be revisited without interrupting play. Progress should be sequenced clearly, moving from non-standard to standard units, from every day to precise vocabulary, and from single comparisons to small sets of data. Inclusion should be designed in, with graduated challenge and rotating roles so that every child measures, reasons and explains at some point. A risk–benefit stance should be normalised so that meaningful challenge is kept, hazards are mitigated, and rationales are recorded.

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Conclusion

Outdoor learning is not a guarantee of powerful learning; it is a multiplier of good pedagogy. When adults adopt a Reggio–Vygotskian stance—curating affordance-rich loose-parts environments, engaging in sustained shared thinking, and helping children represent and revisit ideas—outdoor experiences become fertile ground for early scientific and mathematical thinking. Guidance on outdoor provision illustrates how to design such environments; inquiry texts in science and mathematics show how to shape the dialogue and the measures; and UK research links sustained, thoughtful interaction with stronger outcomes. The Curriculum for Wales aligns with this picture, prioritising inquiry, reasoning and meaningful application.

There are genuine constraints. Risk aversion can thin out challenge, evidence demands can displace dialogue, gaps in subject knowledge can limit scaffolding, and access to space and materials can be uneven. Even so, the literature suggests that modest, well-judged shifts—planning for affordances, scripting questions, representing lightly and sequencing progress—can yield substantial gains. In short, it is the adult's thoughtful orchestration, not the presence of trees or tyres, which determines whether outdoor time becomes a site of deep conceptual learning in science and mathematics.

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