

Awe and Wonder – Science, mathematics and the outdoors.





Activity 1.

Tyre Rolling.

Tyres are a loose part material that has an open-ended use and can be used by the children to incorporate into their play. Tyres provide endless opportunities for exploring science and mathematics outside, as well as supporting schemas for example, transportation (moving objects from place to place), trajectory (pulling, pushing), rotation (twisting, turning, rolling) and positioning (order, first, second and last). The natural outdoor environment within the Nursery garden provides opportunities for children to explore different inclines, ground materials for example bark, gravel and grass and provides space for children to enjoy freedom of movement whilst being challenged. The mathematical and scientific concepts that children can experience holistic learning and metacognitive thinking whilst exploring this activity include:

- Direction and prediction – when they roll the tyre down the hill, will it roll straight or veer off to the left or right. When the tyre is rolled on a flat, smooth surface which way will the tyre roll. When two tyres are rolled at the same time, which tyre will roll the furthest which will lead on to measurement and timing. This activity can open the discussion on why tyres roll faster when rolling down an incline and slower when on a flat surface as well as questioning do tyres roll slower when on an uneven surface?
- Comparison – are all the tyres the same or are they different. How are the tyres different? This will encourage children to observe the tyres and look at differences and similarities. Are some tyres wider, thinner, taller, or shorter? What are the differences between bicycle tyres and car tyres? What are the spokes used for, are some tyres heavier than other tyres and if so, why?
- Forces – pushing and pulling the tyres, which motion is easier and why? Is it easier to move a tyre on a flat surface, an uneven surface, or an incline, why? These experiences provide opportunities for children to problem solve, use logical reasoning, developing metacognitive skills both individually and collaboratively. This activities link to the Curriculum for Wales (2021), understanding forces and how children can use prediction to control their environment and use the knowledge gained for future challenges.
- Patterns- looking at the tread on the tyres, feeling the materials, asking why are tyres made from rubber? Using different materials to look at the patterns in different contexts for example, rolling the tyres in two different coloured paints. Using red and yellow paint, what patterns are seen when rolling the tyres through it, why is there orange paint, which can lead on to the science of colour mixing.



Activity 2.

Leaf nature collage.

Creating a collage from nature provides endless mathematical and scientific learning. Children collecting their own chosen materials from outside allows children to investigate, discover, make decisions and ask questions of their own.

Comparing leaves, which leaves are bigger smaller, smoother, with or without bristles. Discussions can be made by comparing a soft green leaf with a dry brown, brittle leaf, why are they different, what could cause the dry brittleness? Looking at the shape of the leaves, are they pointed or curved. Looking at the colours of the leaves which can lead on to the discussions about biological photosynthesis (the nutrients that are gained from sunlight, carbon dioxide and water), seasons, the weather, temperature changes in the weather and how it can affect our bodies. This holistic learning supports the Curriculum for Wales (2021), understanding the world around us, progression step 3, understanding how living things depend on specific resources in order to survive. Leaf rubbing allows children to look at the veins of the leaf in detail, to understand how the veins transport the nutrients and water between the leaf and the stem which again is photosynthesis. Children can observe and explore the morphology of leaves, from bud to a full leaf, collecting data over a set period to gather evidence to observe and analyse the data in which has been collected either through digital technology or manually.

Running through a pile of leaves provides a holistic experience, listening to the sounds that the leaves make when pushed away or walked on. Picking the leaves up and throwing them up in the air, watching how the leaves fall, which fall faster or slower than others and why. This experience leads on to discussions about gravity and forces. How do individual leaves fall, straight down or do they spiral? Counting the time it takes for the leaf to fall either verbally or digitally using a stop watch and then using order, first second, last. This activity can be done independently, in pairs or as a group of children working collaboratively together to develop logistical reasoning, understand mathematical concepts and have a wide range of knowledge and understanding of the world in which they live. which supports the Curriculum for Wales (2021), understanding the world around us, progression step 3 Leaf rubbing provides children with holistic learning, feeling, smelling, tasting (if edible) bringing their learning to life.



Activity 3. Woodwork.

Numeracy is a fundamental part of woodwork. Children using tape measures, to measure how long, short, thick, or thin a piece of wood is. Being able to feel the wood to see if it is rough or smooth, if it is rough how can it be made to feel smooth? Looking at the biology of different types of wood and what trees do they come from? Children are able to either pre plan and design what they would like to make, making lists of the materials and tools that they made need or children can be in the 'now' and create as they go, understanding and constructing how materials can or cannot work together, understanding spatial awareness, estimation, three dimensional forms as well as scientific investigation, which is the best wood to use, which length nail or screw would be better to use to join the pieces of wood together. Children can familiarise themselves with real tools, feel the weight of the tools, how much pressure is needed to use the tools. This supports design, engineering and thinking, progression step one, Curriculum for Wales (2021). By handling real tools children can understand the tools and how they work, to observe, compare and analyse the different types of screwdrivers, nails and screws and choose which would be more suitable for the job they are doing. This supports the Curriculum for Wales (2021), design, thinking and engineering, for children to be able to safely use tools, materials and equipment, to be able to construct and deconstruct. What materials are the nuts, bolts, screws and nails are made of, what shapes, lengths, weight they are. The children are also able to use metacognitive thinking and shared thinking to risk assess before they start the activity, discuss what the risks could be and how they can minimise the risks, what safety equipment may they need and why?

This activity promotes children to be creative thinkers, problem solve, make their own decisions and learn through trial and error whilst gaining new skills and developing knowledge and self-esteem which supports the Curriculum for Wales (2021) where children are enterprising and creative contributors.

RISK BENEFIT ASSESSMENT

Location / Activity:	Nursery garden -Tyre Rolling	Date:	21.09.21
Assessor:	Lynda Jenkins	Review date:	21.09.21

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Outdoor in different weather conditions and how to protect yourself	Becoming aware of the outdoor temperature and body temperature hot, cold, wet, dry, slippery, icy. Children and adults sharing ideas of how the environment is affected by the weather and season changes and how they can risk assess to reduce the risk to themselves and others.	Cold weather can create ice causing children to slip or fall which may lead to sprains, grazes or broken limbs or head injury. Children or adults may develop hypothermia (low body temperature) or hyperthermia (high body temperature). Children or adults clothing may become damp or wet which may cause discomfort or distress. Children or adults may experience sunstroke or sunburn from exposure to the sun. High winds may cause loose branches or trees to fall resulting in injury to the head or death.	Children and adults	Adults to monitor the local weather and assess whether to dangerous to go outside if stormy or high winds over 30 knots. Appropriate clothing to be worn, hats, tops covering shoulders and sun cream applied. Avoid being outside when it is between 11:00am – 3:00pm when the sun is at its highest point. Use factor 50 SPF sun cream. Staff to be trained in first aid and aware of what signs to look out for. Children to be hydrated at regular times throughout the day. Children to wear appropriate clothing for cold weather, hats coats and gloves when outdoors. Waterproof clothing and wellingtons for wet weather, spare clothing provided when needed.	L

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Children exploring the environment independently.	Children experiencing and exploring different levels, gradients, surfaces. Freedom of space to move around, use their gross motor skills develop spatial awareness of themselves and of others.	Uneven surfaces may cause adults or children to lose their balance.	Adults and children	Site to be inspected beforehand. Appropriate closed shoes clothing which covers arms and legs. Sun cream and hats if weather is warm. Children will be supervised in small groups at a ratio of 1:3. Pre risk awareness discussion with the children. Both staff trained in First Aid and a checked First aid box.	L

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Rolling the tyres	Understanding the scientific concept of cause and effect, prediction, estimation and cementing findings. Exploring the science of forces, gravity and friction. Using mathematical concepts for example, order, first and last. Practising schemas- trajectory – how the wind changes how objects move transportation – rolling, pulling, pushing, carrying rotation – how objects move, spinning, rolling, twisting Using existing knowledge to form strategies to work out the most beneficial way of getting the tyres up a hill. For example, rolling, dragging, pushing or pulling. Children can explore scientific concepts of speed, distance, motion and force. Encourages physical development, gross motor skills when bending, pulling, pushing, lifting and rolling. Encourages independence and teamwork working collaboratively together to get the tyres up the hill.	Children and adults being hit by rolling tyres Children slipping or falling which may lead to cuts and grazes, sprains or broken limbs.	Adults and children	Children to understand and experience rolling objects beforehand and familiarise themselves with the outdoor area. For example, rolling balls, rolling down the hill themselves, shared thinking and risk assessing where the safest place would be without hazards to roll the tyres. Consider boundaries – children may not be aware of any hazards and how being hit by a tyre could cause injury. Becoming aware of self – care and monitoring own risk.	L

RISK BENEFIT ASSESSMENT

Location / Activity:	Nursery Garden - Leaf collage	Date:	21.09.21
Assessor:	Lynda Jenkins	Review date:	22.09.21

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Collecting natural materials for a collage	Holistically exploring the outdoor environment, smelling the grass, leaves, flowers, fruits, touching, tasting (if edible) and listening to the wind, leaves, animals and trees. To experience different surroundings. Children encouraged to be self-aware of their vestibular (balance) and to support their peers. Understanding gravity, angles, gradients which supports forces and energy. Children to gain knowledge in identifying poisonous plants and berries.	Uneven ground, branches and tree roots on the ground, which may cause children to fall, causing bruises and cuts. Branches and shrubs at eye level which may scratch their eye or have a foreign body enter their eye. Ensure children do not eat anything they find, keep their hands out of their mouths and ensure hand hygiene after the session.	Children Adults	Site to be inspected beforehand. Appropriate closed shoes clothing which covers arms and legs. Sun cream and hats if weather is warm. Children will be supervised in small groups at a ratio of 1:2. Pre risk awareness discussion with the children. Both staff trained in First Aid and a checked First aid box. Water and fruit to be provided for hydration. Staff knowledgeable in plants to encourage shared thinking and joint risk assess the dangers and identifying poisonous plants and berries. Children to understand and experience balance beforehand, for example, hopping, obstacle courses, and balance beams.	L
Observing nature	Opportunities to study how different insects live, their habitat and life cycles. Demonstrating a positive approach to insects, understanding and appreciate living things to become ethical citizens.	Bites and stings from wasps/bees/insects and nettles.	Children and adults	Shared thinking and risk assessing what can happen when stung, how it feels and how it can be treated. Long trousers, tops and closed footwear. Nettles to be cleared if possible.	L

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Being self-aware and aware of others	To understand and aware of own and others health and allergies. To support each other, gain independence in identifying and avoiding allergens. To use and explore their gross motor and fine motor skills. Stretching, bending, crawling.	Allergies or pre-existing medical conditions.	Children and adults	All staff to be aware of any known allergies or existing conditions, be aware of treatment and have appropriate medication. For example, (child's own inhaler).	L
Collecting materials	Children can explore and choose which materials to collect and used as loose parts. Supporting schemas for example, positioning and orientation. Discussions on rubbish and recycling and how it can affect the world in which we live.	Sharp objects for example glass, cans or needles.	Children and adults	Area to be checked for dangerous objects beforehand. Shared thinking and prediction of what they may find outdoors and how they can be collected safely by the adult by using litter pickers, carrier bags and protective gloves.	L

RISK BENEFIT ASSESSMENT

Location / Activity:	Nursery Garden - Woodwork	Date:	21.09.21
Assessor:	Lynda Jenkins	Review date:	21.09.22

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.

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Work area And tools	Understanding and assessing own risk as shared thinking with adults and peers, learning from peers and from others. Experiencing first-hand how real tools and equipment work. Understanding how materials and tools work. Children can build self-esteem and confidence, reinforcing capabilities.	Impact with tools tripping	Adults children	Locate in observable area Locate woodwork area in a position that reduces flow/ traffic. Locate away from distractions. Ensure that the floor is clear of obstacles that could cause tripping. Limit number of children working if small area Staff ratio 1:2 and always monitored. Risk assess with the children on using the tools. Walk when transporting tools and hold by side Instruction and demonstration on how to use tools safely (Introductory 1:2 ratio, Saw 1:1) Ensure regularly checked –e.g. hammer head not loose All Equipment to remain in woodwork area Misuse of tools will not be accepted	L

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Hammering nails into wood	Hand and eye coordination Understanding what pressure is needed to hammer the nails into the wood. Understanding which size nails are best to use. Estimating how many nails they may need to use. Children can take risk taking in a controlled environment. Children can make judgements and learn to self-risk assess.	Hitting own fingers with a hammer Splinters from the wood which may lead to infection Injury from nail rebound Debris in eye from wood or metal	Children and adults	Demonstration of the tools and how to use them Ensure that the wood is smooth and sand rough areas Eye protection to be worn. Children who wear glasses to wear google over the top. Instruction on how to use hammer safely. Dangers clearly explained. Fingers moved away when banking hard. Initial adult supervision. 1:2. Eliminate distractions	L
Wood Dust	To gain first-hand experiences using different types of food. Holistic learning, feeling, smelling, looking at the differences in the wood. Scientific and mathematical problem solving, which wood would be easier/harder, more/less pliable.	Splinters, toxicity Dust inhaled and in eyes	Children and adults	No painted, treated wood to be used. Any significant amounts of cutting/ sanding to be done outdoors. Eye protection – goggles if lot of dust Children not to cut MDF	L
Nails/screws	Children to build knowledge and understanding using first-hand experiences on how different materials can be used. Children can use mathematical concepts - compare sizes, shapes, patterns, metals, number, order and also build upon their past experiences of trial and error. Scientific concepts for example forces, how much pressure is needed to hammer the nails. Rotational schemas, turning left right, clockwise, anti-clockwise and twisting the screws, to tighten or loosen,	Skin may be pierced with screws or nails Children may swallow small screws/nails	Children	Any protruding nails to be made safe (hammered over) or removed All nails/ screws to be collected off floor after session. Adult to demonstrate how to hold nails/ screws safely and to take one nail/screw at a time.	L

The adult's role is to provide stimulating, safe environments which give children the opportunities to have the freedom and skills to play independently. Tovey (2016) supports Froebel's theory (Froebel, 1967) that the outdoors provides space and freedom for children to investigate and explore to be able to understand how the world works in which they live. Outdoor space provides opportunities for children to have meaningful play and first-hand experiences in all areas of the curriculum (Early Years Educator, 2016).

White (2011) acknowledged the value of continuous, free access, outdoor provision and the importance of adults to be knowledgeable and enthusiastic to support children's potential.

Wallin (2019) supports (White, 2011) in stating that children, when given the time and space to freely play outdoors, the whole child is exposed to holistic growth, and are able to develop their creativity, collaboration, inventiveness, co-ordination, problem solving skills and physical strength. Children are then able to connect and use their gained knowledge and skills to be able to create their own ideas and implement them (Welsh Government, 2020).

Cremin et al (2015) acknowledged that children who are exposed to first-hand experiences which enable and support children to make connections between science and their surroundings. Cremin et al (2015) also acknowledge (Garaigordobil and Buerrueco, 2011) who state that sustained and supported play enhances children's creative thinking. White (2011) also recognised that the outdoor space should be adaptable and responsive to meet the needs of children where they can move, change and control their play, which links in with the value of loose parts.

Barbre (2017) acknowledged that children's lives are surrounded by science, technology, engineering and mathematical concepts, (STEM) from babies stacking objects on top of each other and watching what happens when they knock them over to dropping their cup or bowl on the floor and looking to see where it has gone are scientific concepts for example, forces - gravity, pulling and pushing and mathematical concepts, order, placement and size.

Adults who have the knowledge, understanding and experience to support children's play without inhibiting it or taking over, allow children to develop independently and at their own pace. Providing quality resources for children to be able to choose from, to make connections through learning and experiences through play across the curriculum including science and mathematics (Welsh Government, 2021).

Having the knowledge to observe and support children in how or what they want to play is essential in enabling children to be confident, experienced and competent learners (Aubrey and Riley, 2019).

Aubrey and Riley (2019) acknowledge Dewey's and Montessori's theory that the adult's role is to create opportunities for active, real experiences and resources for example woodwork using real tools and materials in a controlled environment. Moorehouse (2018) supports this principle stating that real experiences enable children to challenge themselves and to be able to participate is sustained shared thinking to be able to assess risks and take risks in a controlled environment.

Bruce (2012) and (White, 2011) support Dewey and acknowledged the importance of freedom for children to choose, to be in control, to use their imagination, to be able to create something from nothing. (Nicholson, 1971) described loose parts as objects (both man made

and natural), which can be transported, designed, re designed, open ended (not having one specific purpose). Loose parts offer differentiation in size, shape, weight, texture, movement and purpose, which support children's mathematical, scientific and creative experimentation.

Casey and Robertson (2016), supports the value in loose parts and the link to STEM concepts and that everyday objects for example, cardboard boxes, buttons, petals, and stones all provide open ended all provide open ended, child led play and investigation. Brenneman, K (2011) agrees that the earlier children are exposed to STEM concepts and learning opportunities, the more confident and competent children will be to build foundations for inquisitive minds and for future learning. This supports the (Curriculum for Wales, 2022).

Early Years educator (2016), acknowledged how the outdoor environment supports children's holistic learning, living in the present, what they can feel, see – colours and light/shade, what they can feel – the wind, rain, snow, temperature, what they can hear – birds, wind blowing through the trees, water flowing and textures – rough, smooth, hard or soft. The outdoor environment provides affordance to children's learning, where the possibilities that the environment has to offer along with the potential of the individual child, as join together (Early Years Educator, 2016).

Nature Play SA (2017) also supports (Nicholson, 1971) and (Early Years Educator, 2016), that children need freedom and space to explore, to try things out and of the importance and affordance of loose parts. Loose parts provide opportunities for scientific investigation and metacognitive thinking, how different or the same materials and objects work together, if they are rubbed, nailed, screwed or simply placed on top of each other, what will happen? which also supports Piaget's trial-and-error.

Pacey (no date) acknowledged Piaget's theory of Schemas which can be supported through the three activities discussed. These include, transporting – moving objects around, tyres, leaves and twigs to be used in open ended play. Connecting is a schema which can be demonstrated through woodwork, where children can construct, dismantle objects with glue, nails or tape.

Loose parts enable individual learners to play and learn at their own level, using both fine and gross motor skills. From young children developing schema's which is how children develop an understanding of the world around them and themselves (Pacey, no date).

References

Aubrey, K. and Riley, A. (2019) *Understanding and Using Educational Theories*. London: Sage.

Barbre, J. (2017). *Baby steps to STEM: Infant and toddler science, technology, engineering, and math activities*. Minnesota: Redleaf Press.

Brennen, K. (2011) 'Assessment for Preschool Science Learning and Learning Environments', *Rutgers University National Institute for Early Education Research*, 2011. Available at: <http://ecrp.uiuc.edu/v13n1/brenneman.html> (Accessed 18th September 2021).

Bruce, T. (2012) *Early Childhood Practice: Froebel Today*. London: Sage

Casey, T. and Robertson, J. *Loose Parts Play*. Available at: <https://www.inspiringscotland.org.uk/wp-content/uploads/2017/03/Loose-Parts-Play-web.pdf> (Accessed: 19 September 2021).

Cremin, T. *et al.* (2015) 'Creative Little Scientists: exploring pedagogical synergies between inquiry based and creative approaches in Early Years science, Education', *International Journal of Primary, Elementary and Early Years Education*, 20th March. Available at: <https://www.tandfonline.com/doi/10.1080/03004279.2015.1020655> (Accessed 20th September 2021).

Early Years Educator. (2016) 'Possibilities on Offer', *Early Years Educator*, 2nd May. Available at: <https://www.earlyyearseducator.co.uk/features/article/possibilities-on-offer> (Accessed 18th September 2021).

Garaigordobil, M. and Buerrueco, L. (2011) 'Effects of a Play Program on Creative Thinking of Preschool Children' *The Spanish Journal of Psychology*, 6th December. Available at: [Garaigordobil, M., & Berrueco, L. \(2011\). Effects of a Play Program on Creative Thinking of Preschool Children. The Spanish Journal of Psychology, 14, 608-618. - References - Scientific Research Publishing \(scirp.org\)](#) (Accessed: 19th September 2021).

Hwb (2020) *Developing a vision for curriculum design*. Available at: <https://hwb.gov.wales/curriculum-for-wales/designing-your-curriculum/developing-a-vision-for-curriculum-design/#curriculum-design-and-the-four-purposes> (Accessed: 18 September 2021).

Hwb (2021) *Curriculum for Wales*. Available at: <https://hwb.gov.wales/curriculum-for-wales> (Accessed: 18 September 2021).

Moorehouse, P (2018) *Learning through woodwork: Creative woodwork in the early years*. Abingdon: David Fulton/Routledge.

Nature Play SA (2017) *Natural Play Spaces Principles*. Available at: <https://natureplaysa.org.au/wp-content/uploads/2017/08/Nature-Play-Downloads-Loose-Parts-Info-Sheet.pdf> (Accessed: 20th September 2021).

PACEY (no date) *Schemas*. Available at: <https://www.pacey.org.uk/working-in-childcare/spotlight-on/schemas/#typesofschema> (Accessed: 20 September 2021).

Tovey, H (2016) *Bringing the Froebel Approach to your Early Years Practice* 2nd Ed. London: Routledge.

Wallin, M. (2019) 'Let's play outside: The importance of pretend play in natural settings', *Community Playthings*, October. Available at: https://www.communityplaythings.co.uk/learning-library/articles/lets-play-outside?fbclid=IwAR33CxfJL4TgWpCOBwnD_UI3fAPmuvHsLr-C03Ml84EH_KdJjeG1f7X0ga8 (Accessed 18th September 2021).

Welsh Government (2021) *Enabling Pathways*. Available at:
https://gov.wales/sites/default/files/consultations/2021-05/enabling-pathways-consultation-document_0.pdf (Accessed: 17th September 2020).

White, J. (2011) *Core Values for Outdoor Play*. London: Sage