

Syndod a Rhyfeddod – Gwyddoniaeth, Mathemateg a'r awyr agored

Portffolio o dystiolaeth yn amlinellu sut gallwn defnyddio amgylchedd awyr agored i hyrwyddo a chefnogi meddwl gwyddonol / mathemategol plant.

Section1 – Photograph

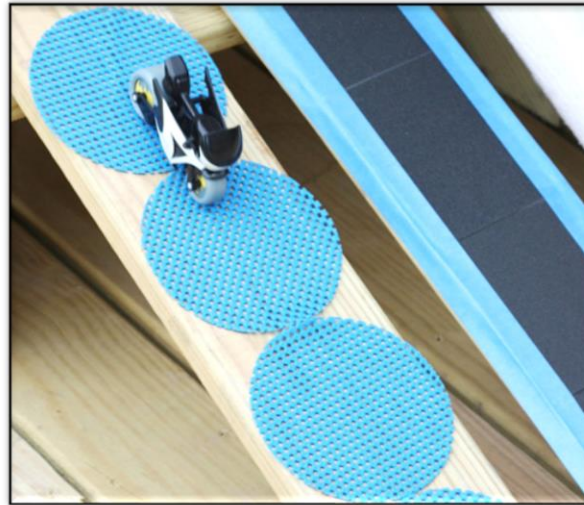


Section 2 – Features of the outdoor environment chosen

Feature 1: Mounds/ Hills

According to Cyfoeth Naturiol Cymru (2021) (41) evidence shows how connecting whilst at a young age with nature gives long lasting healthy behaviours. The Mounds and hills within this picture connect nature, play, and an environment to realise the four purposes within the new

curriculum. In a recent activity within this setting, a mathematical focus task was held within the classroom using man made slopes as seen in the picture below:



Picture: Pre K Pages, 2021 (A)

However, this activity, although a hands-on experience did not engage with all learners. Therefore, the practitioner applied reflective practice, of which the importance is seen by Gray (2013) (44) alongside knowledge and experience to change the activity to become a holistic whole-body experience. The practitioner modelled the rolling down the hill whilst discussing friction and encouraging curious experimentation using the natural features of the environment (See picture below).



Picture: Julesetzoe (2018) (B)

Through the children's choice, varying materials were then added such as rugs, gym mats, hessian lengths of fabric (as seen in picture below)



Picture: Amazon, 2021 (C)



Picture: Surviving Teachers Salary (2013) (D)



Llun: Bing (2021) (E)

This use of tactile materials encouraged a further sustained shared thinking with children critically evaluating the effects of the varying materials and using the natural gradient of the hills encouraged scientific and mathematic concepts. Adult child interactions as seen by Siraj-Blatchford et al (2002) (42) and the role of well-trained practitioners with understanding of pedagogy, affect the interactions with children and their learning through sustained shared thinking. This link to the understanding of pedagogy to enable children runs strongly through the new curriculum for Wales seen in guidance by Hwb (2020) (43). Within activities such as this using the natural features supports the new curriculum in being a curious learner, and

looking for answers, predicting effects, leads to children realising progression steps as seen by Hwb (2020a) (45) within the descriptions of learning in guidance by Welsh Government.

Feature 2: Polytunnel and school garden

The outdoor environment, gardens and polytunnels can support children with their scientific learning according to Education today (2020) (46) Not only does it enable children to experience and learn new life skills, but it also promotes mental wellbeing. This can also be seen by Tebbs (2021) (48) who notes the affect of recent lockdowns and restrictions impacting vulnerable children and their relationship with learning in recent times. Furthermore, Tebbs (2021) (48) notes the effect of outdoor experiences in boosting children's physical but also mental wellbeing, enabling children to realise their potential. Facilitating wellbeing, according to Anna Freud National Centre for Children and Families (2020) (47) encourages children to connect with the outdoor environment, encouraging creativity and imagination, as well as playfulness.



Picture: Own picture (2021) (F)

The polytunnel and school garden encourages investigation of life cycles and insects, growing plants, promoting environmental discussions and much more. RHS (2015) (49) advocate creating habitats that are wildlife friendly and promote learning opportunities for children that support all areas of the curriculum.



Picture: own source (2021) (G)

Adding resources in this area, such as seen in the picture above, bring the natural scientific environment together with mathematical to provide opportunities for play, and therefore deepening understanding of concepts through re-visiting experiences, which has been the theory of Bruner as seen in Right from the start (2016) (50). Alongside this, practitioners with

an understanding of facilitating and creating a rich environment could add areas and items for the children to explore. Within the garden this could be plants, as seen by the RHS (2015) (51) enhancing the hands- on holistic learning. Apple trees have been planted within the setting, as seen below:



Picture: Own picture, 2021 (H)

Alongside an orchard, a more mature group of trees could be planted, allowing for experiential play as seen by Lewis (no date), (52) where the outdoor wooded area has allowed for creative mathematical and scientific exploration within settings.

A setting could also introduce an area such as seen in the picture below:



Picture: Own picture, 2021 (I)

Within a safe environment such as above, practitioners could observe and assess at a safe distance, encouraging independent curious play with water, and plant life allowing the practitioner to see the child holistically.

Assessment within the new curriculum for Wales (Hwb, 2020b) is noted to be “intrinsic to curriculum design” (53) The Foundation phase Framework as seen by Welsh Government (2015) (54) set out to provide a holistic education incorporating baseline assessment scales.

However, in a review by Donaldson (2015) (55) strategies to ensure a holistic education have been highlighted, such as ensuring that children's education is supported by a holistic approach in practice.

Feature 3: Balancing beam & Play Park resources



Picture: Own source, 2021

According to LeMasters & Vandermaas-Peeler (2021) (56) children within an enabling outdoor environment can play imaginatively, take risks, challenge themselves and build physical skills, such as fine motor skills and gross motor skills. However, practitioners need to afford children the resources and opportunities allowing for not just play but risky play, as seen in research by McClain & Vandermaas-Peeler (2016) (57).

The balancing and climbing equipment within the picture is providing an opportunity for children to walk and use their balance, however, it could be improved by introducing other resources allowing for a holistic whole body experience. The vestibular system, that helps organise balance, and a perception of motion and speed would be supported and activated within the child by adding resources as seen below:



Picture: Earth scape Play (2018) (H)



Furthermore, affording children loose parts within this outdoor environment would also give children the opportunities for risky play, sustained shared thinking and collaborating with their peers. Scaffolded by the practitioner using loose parts and opportunities for play and discussion allow for the experience to encourage divergent thinking, rich experiences advocated by Vygotsky and Dewey as seen in Penfold (2019) (58)



Picture: Pintrest. No date

According to Bruce (2011pg 84) (59) play displays children's true knowledge and capabilities, supporting emotional development and new experiences, allowing for holistic observations. The holistic approach to observing and assessing children comes into play with the new curriculum in Wales, as seen in Llywodraeth Cymru (2021) (60), which supports building a holistic picture of the child enabling the practitioner to facilitate rich learning opportunities.

The Mathematics and Numeracy descriptions of learning of the New Curriculum (Hwb, 2020c) (61) could be linked here with the use of relationships between the shapes, and positions, estimating distances together with scientific concepts and progressions steps that show curiosity, exploration and children's personal observational skills.

The golden thread throughout these opportunities is the role of the practitioner in enabling these opportunities of play and learning. Jensen *et al.* (2019) (62) notes research and engagement with scientific, literacy and mathematical skills was improved by the adult co-learning and scaffolding the child through play. However, Jensen *et al.* (2019) highlight the need to equip practitioners to develop skills to enable facilitation of play and to be co-creators in all areas of learning. Within the setting professional development and team building exercises may support this, it is seen throughout the world, from Australia with courses (Foundation Education, 2018) (63) and here is Wales (Social Care Wales, 2016), enabling practitioner professional development in a holistic way. (64)

Section 3 – Risk benefit Assessment

Section 4 – Consider how the adults working with children can support and encourage children to have an opportunity to engage with mathematical and scientific concepts in an outdoor space

Looking through history the importance of the outdoor learning environment can be seen as far back as Plato in ancient Greece according to The outdoor Playbook (2021) (10). Froebel, a pioneer of the nineteenth century, according to Tovey (no date) (3) demonstrated principles that underpin outdoor learning and good practice within settings even to this day.

Piaget, a theorist who has contributed to modern education through understanding of how children learn and think similarly saw children as being part of holistic lifelong learning alongside Froebel, according to Halpenny and Petterson (2013) (9). Froebel resonates in Piaget's theory of play and the environment as a fundamental part of a child's development, through which the children observe, experiment and develop.

Froebel believed that children having the opportunity to engage with nature through play alongside adults that have the skills to nurture and educate gave children the freedom to develop within a strong respectful community (Tovey, no date) (3). Child initiated play, the people and the environment are all part of enabling Froebel's principles, as seen by Early Education (no date) (5). These principles demonstrate the important role of the practitioner within early education environments and the study of nature.

Froebel believed in providing education by practitioners that were highly educated trained and "tuned" into the children's needs through close relationships and observation of children and through play according to Bruce (2011) allowing for informed planning to support the children. (6) Practitioners providing education through the Froebelian approach understand the individual child's needs, providing a holistic approach, according to Cowgate under 5's (2021) (7) that enables and empowers children to discover and be independent learners.

While theorists such as Froebel and Vygotsky focused on the adult relationship and social contexts, Piaget was heavily criticized on developmental milestone theory of learning according to Johnston & Nahmad-Williams (2010, pg. 27) (33). Theorists working in the area of study such as Vygotsky, believed Piaget's developmental milestones did not reflect the findings of further research of cognitive development.

According to Rupendra (2018) (34) Vygotsky believed that children are scaffolded by the practitioner, who are supporting children to develop skills to enable further learning and independence. The concept of ZPD developed by Vygotsky and the scaffolding technique notes the special importance of giving children control of their decisions and becoming responsible, active learners.

An example of the importance of the role of the practitioner in encouraging active learning is seen in a short video clip (Siren Films, no date) (13) with the relationship and role of the practitioner supporting the child new to the setting with language barriers. The outdoor environment alongside the supportive practitioner encourages scientific, language and mathematical discoveries promoting confidence and social skills alongside peers and building on experiences and revisiting as seen with Vygotsky and the ZPD of the child.

According to The Department of Education (2021) (26) practitioners play an important role in creating effective outdoor learning environments, adapting to the children's needs,

exploring resources and putting the ideas of the children into practice. Similarly, through qualitative research Bento & Dias (2017) (29) draw attention to the important role of the adult, and professionals and the relationship between them to promote learning through play outdoors.

Key to supporting children's learning and development both physically and emotionally is a supportive practitioner within an enabling environment according to Pacey (2021) (18). Children's imagination and experimentation can be seen in a short video clip from Learning thorough Landscapes (2013) (17) where the children within a setting have been afforded an enabling environment rich in loose parts and opportunities for mathematical and scientific problem solving and having the freedom to express creatively supported by practitioners standing back to allow rich open-ended play.

Open ended resources and loose parts have been a principal element of education according to Gold and Elicker (2020) (22) Froebel's gifts that were developed allowed for children's free play and exploration of mathematical concepts. Tactile resources also feature within the work of Montessori educational settings, allowing children to develop geometric concepts using a hands-on sensory experience.

To be afforded an enabling environment or the term "affordance" is a theory proposed by Hames.J.Gibson (hrf, 2021). (19)

"Affordance theory is an examination of how each person visually perceives their environment. Gibson suggests that what people see will lead to a decision that they make."

(hrf, 2021)

Understanding these affordances supports practitioners to provide rich play experiences and plan effective environments according to Early Years Educator (2016) (20) Furthermore, these play affordances allow children to bring their unique skills, interests to the play experiences. Engagements with free, wild spaces and enabling environments supported by practitioner allow children to take risks and engage with nature through exploring open ended resources. Hodgman (2015) (21) supports this and draws attention to the impact of being afforded even small outdoor environments positively affecting children's ability to regulate emotions and grow into confident co-operative learners.

As seen in a study by Carr *et al.* (2017) (23) the ideal time for children to engage in natural free play is during the preschool years, where they can be afforded opportunities to problem solve within "playscapes". Within the playscapes practitioners can link to STEM activities with the school's curriculum and integrate cross-curricular experiences.

However, in a study of affordances of outdoor environments by Bjørgen (2016) (24) children within a Norwegian Kindergarten demonstrated differences between a natural outdoor environment to the school outdoor areas and children's physical activity levels. A clear difference was seen in the amount of high intensity exercise whilst children visited the natural environments. The positive affect of outdoor areas, and play is noted by Bjørgen (2016), (24) with features of the natural environment supporting development, earning and promoting wellness, health motor development and confidence for risky play.

Similarly, Kiwera & Vaselack (2016) (25) conducted a qualitative research study on outdoor classrooms and environments, however Kiwera & Vaselack (2016) focuses on the role of the

practitioner supporting experiential learning. The study calls attention to the importance of observation by teachers, supporting children to follow the children's interests, encouraging dialogue in a rich environment allowing for cross curricular learning.

Giving the opportunity to play freely allows the practitioner to observe. National Improvement Hub (2021) (26) note schemas within play and the importance of the role of the practitioner in observation. Observation allows the whole child to be seen, with the child immersed in play the child's individual schema can be observed by a knowledgeable practitioner. Understanding schemas can support learning allowing children to follow their individual interests.

“Schemas are patterns of repeated behaviour in children”

Grimmer, 2017

Schemas and the way in which children's thinking is seen within play must be understood by adults who have an awareness of what is happening before them according to Atherton and Nutbrown (2016) (27). Effective schematic pedagogy is attained through understanding the associations and patterns of behaviour, furthermore practitioners who seek to encourage and take the time to understand the unique child.

Kathy (2011) (35) notes schematic play and the division of practitioners perhaps due to not being educated about schemas, hindering practitioners in enabling understanding of what engages and encourages the child to develop through each individual's schema.

Kathy (2015) (36) also notes the benefits of exploring children's thinking process, allowing practitioners to support learners individually. Similarly, Nutbrown (2015) (37) discusses schemas and the role of the practitioner in learning through deep understanding of how to support children, however, Nutbrown notes the importance of movement within all schemas, which can be linked to underpinning skills used within writing and drawing. Martin (2018) (28) discusses Piaget identifying schemas and knowledge for practitioners and how children can be supported to learn outdoors through individual schematic play. Teach early years (no date) (38) consider outdoor quality play encourages children to express natural behaviours and therefore learning with space, open ended resources key to effective, supportive practice within the early years.

Alongside schematic play, there are Kinaesthetic learners that need to be supported by knowledgeable practitioners as seen by Kinaesthetic Learning Strategies (no date) (30). Kinaesthetic Learners require movement. According to Motor Story (no date) (32) Kinaesthesia nerves are within the muscles of the body; stretching and activities that will move the body will wake up the system therefore the brain and cognitive development. Utilising the outdoor environment naturally adds elements to learning to support learners to become active learners as seen noted by Beck (2017) (31)

Barlow (no date) (39) notes the relationship of the outdoor environment and its instrumental position in supporting children within early years to develop skills through and curiosity of the world. Sensory activities using the whole body within a rich spacious environment enables the child to become an active learner if given time to explore and engage.

The new curriculum within Wales due to come into play by 2022

Within America an early childhood franchise developed a pre-school curriculum, giving a child centred approach, a curriculum rich in science, maths, engineering, technology and art, giving children the opportunity to engage in hands on experiences allowing for an encouraging environment developing natural confident scientists PR Newswire (2015) (40)

Cross curricular learning

Norwegian Kindergarden

Things to bring in somewhere:

Woodlands TV (2018) (16) offers an example of a forest school within the UK highlighting the natural sensory hands on experience, exploring and challenging

Oxfordshire County Council (2017) (14) demonstrates the importance of the practitioner to achieve these outcomes in a language context and according to Davies *et al.* (2014, pg 39) (15) respectful trusting relationships are essential for scientific discussion .

It is seen through research by teacher scaffolding, collaboration and professional support affords children scientific experiences within the early years (Cremin, 2015) (12)

However, Vygotsky's theory proposed a different learning process to Piaget according to Redford (2013) (11)

However as seen in Waite (2011, tud 151) (8) although outdoor learning has many benefits, children in modern ages are spending less time in the outdoor environment.

Within outdoor environments children naturally experience “Wonder and Delight” according to Wilson (2013) (2) and this wonder is what gives children the ability to engage in their environment and in the moment. Practitioners observing children playing within the outdoors will see moments of spontaneous excitement and joy while discovering and exploring.

According to Keeler (2013) (1) children explore nature and the world by using senses.

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