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How does play in the outdoors afford opportunities for schema development in young children?

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This paper explores children's use of schemas to construct their knowledge and understanding within the outdoor learning environment. It considers how a knowledge of schemas can facilitate practitioners in supporting children along their learning continuum and inform early years pedagogy. Further, it examines how the affordance of resources found in the outdoors can nurture and nourish children's schemas. It charts different children's learning journeys over two terms and how a '*coming to know*' about their schemas facilitated practitioners' different perceptions of their actions, which helped shape classroom pedagogy both indoors and outdoors. The research considers how loose parts and the affordances of these resources in the outdoors can nurture development of schemas. Being outdoors affords greater engagement of the senses and the freedom afforded by the space, enables children to use the outdoor environment and the 'loose parts' in ways that are unique to them, providing learning opportunities that have meaning and value. Movements are greater, creativity is deeper, and schemas are overtly witnessed during outdoor play, where the self-governance of the play itself enables the development of the schemas.

Keywords: schema; outdoors; loose parts; play; affordance theory.

Introduction:

Since 2008 children aged 3-7 years in Wales have been taught through a play-based pedagogy known as the Foundation Phase (FP). A key feature of the Foundation Phase is the use of the outdoors as a teaching and learning environment. The benefits of being outdoors and learning actively in nature, impacts on early childhood experiences and the two have been connected for decades. The Montessori approach along with Froebel's work is an example of this and their influences have shaped the pedagogies used which are an integral element of Early years practice. Their work along with Steiner has been prominent in shaping the curriculum in Wales, where it is emphasised that outdoor space to play and learn, is essential in supporting children's holistic development. All children are expected to have regular access to the outdoor environment as part of their curriculum (WAG, 2009) and the Education and Training Inspectorate for Wales, Estyn (2011) reported that the Foundation Phase places significant importance on children

using the outdoors to experiment, explore and take risks. Real life learning opportunities affords children the ‘everyday adventures’ through which they develop skills for life (Palmer, 2006).

Within this curriculum children are viewed as active meaning makers, constructing their knowledge, and understanding along a learning continuum with playful supportive adults (WG, 2015). The ethos of the FP curriculum is that it starts with the child and builds upon what a child can do, requiring practitioners to have an in-depth understanding of child development (Thomas and Lewis, 2016).

One such way that a child actively constructs their knowledge is through schemas. Piaget was the first pioneer to identify and discuss schemas as a means of constructing knowledge and suggested that children organise their knowledge and understanding of the world into cognitive structures which he called schemas (1953; 1959 and 1970). Piaget believed that children learned through repeated actions and behaviours on objects and materials within their environment and through these repeated actions, working theories are built up and developed. Any new experience is fitted into the existing schema (assimilation) so that equilibrium is maintained or if the experience is new or different then the child alters (adapts) their schema to accommodate this new experience. In this way, new thinking and knowledge is constructed and cognitive gains made.

Other researchers have also shown that schemas facilitate the construction of knowledge and understanding (Athey, 2007; Atherton & Nutbrown, 2013; Arnold, 2015; Brierley and Nutbrown, 2017; Deguara and Nutbrown, 2018). This paper explores children’s knowledge construction through schemas and how resources such as loose parts in the outdoor learning environment supports this. The research has taken place in one FP setting in South Wales and presents evidence through photographs and

narratives, of several children's use of their schemas in the outdoor learning environment.

The research took place over two school terms with children aged between four to five years. The children were observed and photographed whilst engaging with resources in the outdoors. Any evidence of schemas was noted and analysed with the practitioners in the setting to look at ways to support and develop the children's threads of thinking (Nutbrown, 2011).

In addition, this research also explored the theory of loose parts and how materials and spaces found in the outdoors, afforded opportunities to facilitate the development of children's schemas. This can reconceptualise early years pedagogy to incorporate the outdoors as part of that pedagogy, and not as a 'bolt-on' to learning and play.

The Foundation Phase:

The FP is the current early years curriculum for Wales. It is a play-based curriculum that espouses to be experiential, child-centred, child-led and takes a holistic approach to child development (Thomas and Lewis, 2016). FP practitioners are play partners accompanying children along a learning continuum, and delivery is through a mixture of indoor and outdoor provision (Welsh Government (WG), 2015).

The curriculum is delivered through continuous, enhanced, and focused provision across seven areas of learning (WG, 2015). The continuous provision is a constant of the learning environment on offer, allowing consolidation of skills such as problem solving, decision-making, teamwork, and independence through playful activities. In the enhanced provision, the practitioner adds resources to the continuous provision based on the observed interests of the children (Thomas and Lewis, 2016). The last part of the FP

model of delivery are the focused tasks, which is the adult-led provision where new skills are taught (Maynard et al., 2012; Thomas and Lewis, 2016).

All types of provision are evident in both the indoor and outdoor learning environments. However, any detailed guidance on including schemas within this model of delivery is absent from Welsh Government (WG) policy documentation.

Furthermore, there has been little comprehensive training or guidance offered to FP practitioners to develop their knowledge and understanding of schemas. This can be deemed a missed opportunity for both practitioners and children as by nurturing and nourishing schemas, practitioners can gain an insight into the ways children start to construct their knowledge and understanding (Athey, 2007; Arnold, 2015; Brierley and Nutbrown, 2017; and Deguara and Nutbrown, 2018). This enables the practitioner to have a window into a child's thinking and to shape the curriculum on offer. It facilitates the adult in supporting the child's interests, a key principle that underpins the ethos of the FP (WG, 2015).

Schemas and the outdoors:

Piaget has significantly influenced the study of child development. He believed that knowledge must be invented or constructed by each learner through their actions (1972), and he was the first to identify and define schemas. However, since Piaget's first identification of schemas there have been many other researchers who have built upon Piaget's work starting with Chris Athey. Athey's seminal work on schemas within the Froebel Early Education Project (1973-1978) with children aged three to five years, refined Piaget's original definition of schemas (Thomas, 2018). She defined schemas as, 'a pattern of repeatable behaviour into which experiences are assimilated and that are gradually co-ordinated' (Athey, 1990, p.37). Through a process of detailed

observation and analysis, Athey (2007) drew on the work of Piaget to label and describe the following specific dynamic schemas:

- Dynamic vertical
- Dynamic back and forth
- Dynamic circular
- Going over and under
- Going round and through a boundary
- Containing and enveloping space

Since Athey's work other action schemas have been identified such as positioning and transformation (Arnold and the Pen Green Team, 2010).

Children benefit in so many ways when practitioners place greater emphasis on the use of the outdoor environment as a resource for learning (WAG, 2009). Outdoor learning and play facilitate the development of dynamic schemas as well learning related to 'real life experiences. Maynard et al. (2013) identified changes in behaviour of children and staff during outdoor play. Staff were more relaxed in their approach and children were much calmer than they were normally. Therefore, the benefits are tangible for both children and the adults that facilitate learning in outdoor spaces. It is maintained that outdoors, children can move more freely, play on a larger scale and experience at first hand the world around them (Beyer et al, 2015; Bilton, 2002; Ouvry, 2003).

Gardner's multiple intelligence theory further explains 'naturalistic intelligence' or 'nature smart' as interpreted by Louv (2009, p. 203), which supports this connection to the outdoor environment in children's learning and which provides a rich environment for healthy growth and development (Pickering, 2017). The physical benefits of children learning outside are plentiful, including developing balance, flexibility, and coordination. Gross motor movement improves and subsequently

continues to develop bone density, all of which lead to children developing their fine motor skills enabling them to hold a paintbrush or pencil.

These aspects of physical development cannot be isolated from the benefits to cognitive development in the early years. This aspect of development may not always be as overt as that of physical development but there are significant elements of cognition required to physically, as well as emotionally engage with all that the outdoors affords children. Open and unstructured play allows a child's brain to recharge; free play enables children to think creatively where their actions and ideas are steered by their imaginations (ISM, 2018). In addition, the outdoor world allows children to learn at their level and their pace, in a way that is less judgemental (Maynard and Waters, 2008). Moore (2015) suggests that when children acquire 'secret outdoor spaces', this can enable children to feel free, independent and 'not being watched' allows them to be more creative, engaging in activities and sometimes risks that require higher level thinking.

Opportunities that are afforded by being in an outdoor or natural environment, can allow children to observe the effects of action on objects or materials (Athey, 1990), in a way that is different to that of being in indoors. Outside children have the space to engage in a deeper level of fantasy play and to develop positive dispositions for learning such as resilience, playfulness, and reciprocity (Ouvry, 2003). The outdoor environment can stimulate the senses far more than an indoor learning environment (Carson, 1956) and when senses are heightened learning is magnified and learning experiences are retained for longer (Clarke, 2006).

Learning through the senses is fundamental in the early years and using all the senses in the outdoors, helps to build the neural pathways and organise information in the brain for later reference. The outdoors can offer activities and resources on a larger

scale because of the space available and having the space allows children to develop spatial awareness, as they are able to move themselves and larger objects around the space. Access to materials like sand and water, blocks, soil and wood not only provide a vast array of tactile materials but also encourage visual, olfactory, and auditory combinations to support learning.

Affordance Theory:

When children play in a space or with an object, they experience it in a unique way.

Rather than its intended purpose, they may view it in terms of its 'affordances.'

American psychologist James J. Gibson (1979) suggested that environments and objects within them have values and meanings that are unique to the person perceiving them.

The 'affordances' of an object or space are all the things it has the 'potential to do or be.'

Forman (1994) states that different media have different affordances or capacities for representing a concept. Forman (1994) identifies some media provide a greater affordance to be transformed and contends that, 'children learn more deeply when they represent the same concept in different media', (Forman 1994, P.41). This can be considered in terms of children's schemas where they choose varied materials to represent their schema or threads of thought (Nutbrown ,2011).

Through different media children can test out ideas but also design ideas (Forman 1994). Materials found in the outdoors such as sand, water and large play equipment can afford children lots of diverse ways to use their schemas to construct their knowledge and understanding. Atherton (2013, p.42) argues that when Athey talked of 'content and match', where content was chosen to match a child's schema, this can be considered 'Forman's media and affordance.'

The affordances provided by being in the outdoors are often ‘hidden affordances.’ Gaver (1991) expanded Gibson’s theory and identified that ‘hidden affordances’ offer the potential for actions to be taken but are not necessarily perceived by individuals within their environment. One might look at a drainpipe and think, ‘that can be used for collecting water;’ or it could also be used to transport a ball into another object such as a bucket. Thus, having the freedom of being outdoors to manipulate objects and use varied materials that engage the senses in a multi-faceted way, affords opportunities for children to develop their schemas. They can construct meaning and knowledge and understanding of the world, in ways that are personal and unique to them. Thus, affordances will vary according to the characteristics of the individuals who interact with the environment. The concept of affordances can therefore account for the different forms of physical activity and the experiences provided by engaging with the materials and ‘loose parts’ that are available (Nedovic & Morrissey, 2013).

However, research suggests a tension exists between what EY practitioners would like to provide for children and their ‘accountability under regulations’ (Little et al. ,2012, p.307; Sandseter, 2007; Sandseter 2009). Some regulations such as those suggested propose the removal of objects such as ‘dangerous’ sticks, large wooden structures, and tyres, which would otherwise afford opportunities for construction (Johnson, 2013), and development of schemas linked to transporting and enveloping, by creating ‘undisturbed hiding places for play’. These opportunities are identified as essential chances for children to develop creativity, independence, and self-governance (Cobb-Moore & Miller, 2007; Moser & Martinsen, 2010).

Loose Parts:

Resources and materials deemed as ‘loose parts’ are those that facilitate open ended play, so like materials that allow affordance, sand, water, large play equipment, diverse

types of containers and blocks can be regarded as loose part materials. These are becoming more common in an early years outdoor learning environment.,

The introduction of loose parts into children's play affords significant opportunities for holistic development but particularly cognitive development. The theory of 'loose parts' was proposed by architect, Simon Nicholson, (1971). He described them as 'variables' and included things like materials, smells, gases, fluids and music, animals and plants all of which he declared children loved to play with and experiment, becoming 'inventors.' Nicholson proposed that loose parts were 'all the things that satisfy one's curiosity and give us the pleasure that results from discovery and invention' (1971, p.30). Nicholson further argued, that in any environment the amount of discovery or creativity a child gets, is causally linked to the varied materials made available within it.

Loose parts are about real-world learning for all children and young people, they are objects used outdoors generally because they are either larger, messier, require more space to manoeuvre or are simply found naturally in the outdoor environment. The process both of introducing them and of playing with them involves collaboration, sharing, thinking, problem-solving and decision-making where the outcome is evident, ...better play experiences (Play Wales, 2017).

Loose parts like this allow children to develop body awareness and perception of shape, depth, and size as well as orientation. Children need environments they can manipulate and where they can invent, construct, evaluate and modify their own constructions and ideas through play. Thus, the use of loose parts is a crucial element of children's play in the outdoors and objects such as drainpipes, tyres, wheels, buckets, sticks, and pallets, are all stimuli for creative ideas. These can be used for making patterns, transporting objects, covering objects as well as people, and can indicate how a

child's brain interprets the world. But the theory of loose parts is about more than the materials and the objects, it is a theory about democracy and self-governance, individuals, and groups collaborating to shape their world according to their own vision (Hobson, 2020).

Thus, when left to their own devices, children will play with whatever is around, it does not need to be costly and usually comes from the recycling bin or someone's garage. Loose parts need to reflect the context of the local community and its culture; in an urban community pipes and bricks may be seen, in coastal communities fishing nets might be recycled. Planning is often needed to gather resources and recycled materials so that worn items can be replaced, and objects remain interesting (Play Wales, 2017). This does require time; however, practitioners need not have anxiety about objects being damaged or lost; this learning is not about the loose parts, it is about how it affords richer, deeper play experiences (Hobson, 2020).

Consequently, the properties of different loose parts in the outdoors affords children unique opportunities to develop and use their schemas. Sand and water can be used to envelop hands, and both can be used with trajectory schemas to fall downwards. Large play equipment facilitates positioning schemas and trajectories, containers are carried and dragged to support transporting schemas, whereas large bricks can be transformed into horizontal and vertical trajectories.

Materials and Methods:

This research followed children aged three to five years as they played outdoors. The research was gathered through photographs and narrative observations with the children. It explored how the outdoor learning environment and the resources within it, afforded children opportunities to construct their knowledge and understanding through their differing schemas.

This research design is that of a case study. Bell (2005) argues a case study approach is particularly useful and helpful to investigate an issue in more detail. This can be deemed as the study of the social world or as Bryman (2012: 28) states, 'The study of the social world requires a different logic of research procedure, one that reflects the distinctiveness of humans as against the natural order'. Further, Thomas (2011, p23) contends that case studies are 'analyses of persons [and] events...which are studied holistically.' Therefore, this was deemed the most appropriate methodological approach to take.

Data gathering and analysis:

The research was carried out in one Foundation Phase setting in South East Wales and data were collected with the children across two school terms. The research evidenced how children chose spaces and resources in the outdoors that afforded them the opportunities to use their schemas. However, a limitation of this research is that it was carried out in one setting and a limitation of a case study methodology is that it can be difficult to generalise findings (Newby, 2014).

The data were gathered through observations and photographs of children using their schemas outdoors. Palaiologou (2012), states that narrative observations have the advantage of giving detailed information and allows the observer to capture persistent activities and focussed behaviours. The annotated photographs supported and supplemented the narrative observations. Cottle (2016) contends that photographs allow for a rich insight into the child's world in the setting; they can provide a representation of a person's lived experiences within a given time and environment.

The observations and photographs chosen for this research depict how children selected resources found in the outdoors that are considered loose parts and had a greater affordance to facilitate their schemas. The observations and photographs were analysed

and interpreted by the researchers and practitioners through a schematic lens, underpinned with loose parts and affordance theory to facilitate new understandings. They were supplemented with evidence of the children's speech indicating their developing threads of thinking (Nutbrown, 2011). This supports the interpretivist epistemological stance taken in this research.

Ethical Considerations:

The study was granted ethical approval by the university where the authors are based and adheres to the BERA Ethical guidelines (BERA 2018). Ethics is according to Greig et al. (2007) about treating participants well *prior* to data collection, *during* data collection and *after* data collection. Prior to commencing the research, informed consent was obtained from all the practitioners and parents of the children involved in the research process. All parents were made aware of their right to withdraw their child's participation at any time. Time was spent in the setting getting to know the children before any observations took place to establish what Atherton and Nutbrown (2013, p.66) term a 'comfortableness' between the children and the researcher.

During the research, the children were always asked permission to take their photograph and all photographs were shown to the children. Further, they were asked if it was okay for the photographs to be used in the researcher's work. Although the photographs were taken by the researcher the consent for use was always given by the children. The researcher explained that the photographs were to be used to get to know more about the ways the children liked to learn. If at any time the children indicated, they did not want to be observed or photographed this was respected by the researcher. This can be considered as 'moment by moment' consent and was an 'ongoing negotiation' (Mukherji and Albon, 2015; EECERA, 2015). Ethical protocol, as Greig et al. (2007) state, should also be considered after data collection. Therefore, all

participants were given pseudonyms (Bell, 2010) and any photographs were anonymised to respect the children's privacy.

Results and Findings:

The FP setting where the research took place had its own enclosed outdoor space for the children. Part of the continuous provision on offer was an outdoor sand tray, large play equipment for the children to explore, a water area with tyres and tubes and a large wooden climbing frame. The enhanced provision consisted of different resources brought out for the children to play with, sometimes on request from the children themselves. These consisted of equipment added to the sand and water provision such as sieves, watering cans, paint brushes or large building blocks to build structures on the outdoor yard.

The following photographs and observations depict the children's observed schemas during their outdoor play explorations. The findings have been grouped under the different schemas observed and are taken from a much larger study carried out as part of a PhD study (Thomas, 2018).

Dynamic Circular Schema:

Figure 1. Here

Figure 2. Here

Sand can be considered a staple of any early years learning environment. In this study there was a large sand tray outside as part of the continuous provision. The children were given free choice as to what equipment they wanted to add to the sand tray as part of the enhanced provision and the resources added can be termed loose parts.

Lewis used the sand to explore his dynamic circular or rotational schema (Figures 1 and 2). Arnold et al. (2010 p.22) describes a rotational schema as. ‘twisting, turning or rolling oneself or objects.’ Lewis spent time scooping the sand into the sieve and watching it fall through the round holes. He repeated this over and over explaining to anyone that was nearby that, “*The sand falls into the round holes and then falls out again.*” On another occasion he went straight over to the sand tray and this time he twisted the sieve deep into the sand. He seemed surprised that the sand appeared inside the sieve exclaiming, “*Look it’s coming up and out of the holes, look!*”

Lewis seemed fascinated with how the sand could push upwards through the round holes, compared to his earlier explorations when it fell downwards through the sieve. Again, the affordance of sand to be able to trickle downwards and be pushed upwards, combined with Lewis’ rotational schema has allowed him to make new connections. He has discovered that you can force sand both down and up through holes.

Figure 3. Here

Water can also be considered a staple of the outdoors. During this observation, Lewis chose to paint water circles over the shed, thus supporting his rotational schema. He spent a long time repeatedly painting all over the shed (Figure 3). Lewis painted both large and small water circles and he gave a running commentary to the girl with him, “*Look I have done an O, I can do big ones and small ones.*” Lewis further added that, “*It’s ok to do it wrong as it goes away, and I can do it again better.*”

Deguara and Nutbrown contended in their research, ‘children’s semiotic drawings could reflect their schematic understanding and meaning-making’ (2018, p.6). Here Lewis has used water to make a letter ‘O’ as a symbol. He has chosen an ‘O’ as it is supportive of his rotational schema. Indoors the practitioners had found it hard to engage Lewis to sit and do any sort of mark making. They noted his enjoyment in mark

making with water outside and how it afforded him the opportunity and confidence to make mistakes that disappeared. Forman (1994) argued that an affordance is the relationship between the transformable properties of a given medium and the child's use of that property to make symbols. They decided to use other transformable material with Lewis to encourage letter formation such as coloured sand and clay as any errors could easily be rectified.

Lewis enjoyed the space of being outside and the side of the shed gave him a bigger than normal canvas to draw upon and he enjoyed the freedom of being able to draw big circles. This is the benefit of using the outdoors as it provides more space to move, a greater sense of freedom (Nedovic & Morrissey, 2013) and children feel less supervised which results in them being less constrained and more creative in their actions. This observation also supports the notion that outdoor spaces afford children more opportunities to move more freely, play on a larger scale and experience at first hand the world around them (Rivkin 1995; Bilton 2002; Ouvry 2003), thus helping to develop schemas through heightened senses and first-hand experiences.

Enveloping Schema:

Figure 4. Here

Oscar chose to use the sand in a different way to Lewis. He explored his enveloping schema by repeatedly pushing his hands in and out of the sand. Arnold et al. (2010 p.22) defines an enveloping schema as, 'covering oneself, an object or space.' As Oscar delved into the sand over and over, he shouted out, "*Look it is making my hands go away, look they are all gone.*" He proceeded to pull his hands out of the sand, allowing the sand to fall off before pushing them back in again.

As stated previously, Forman (1994) identified the different properties of different media, suggesting some materials provide a greater affordance to be transformed. Owing to its malleable properties sand could be viewed as such a material and is used here to envelop Oscar's hands. Oscar is not using sand in the conventional way, but he is using it combined with his enveloping schema to make his hands disappear. Oscar is learning about area and space; he is discovering how deeply he needs to embed his hands within the sand to make them disappear and how much sand he needs to envelop his hands.

The practitioners observing these new discoveries, were able to become play partners with Oscar. They used supportive language and introduced unfamiliar terms such as, 'Depth and Area.' They ensured that the learning continued indoors too with opportunities made for Oscar to draw around his hands onto graph paper to determine their area linking to mathematical development (WG, 2015).

Dynamic Trajectory Schema:

Figure 5. Here

Water can be termed a malleable material as it can be transformed into different shapes and be used in different contexts. It can also be considered a loose part as Nicholson (1972) stated, loose parts are materials which can be moved around, designed, and redesigned, and tinkered with. In the above photos Harri is tinkering with the water and using it in ways that nourishes his schema.

Harri had been observed using a trajectory schema in his play. A trajectory schema can be defined as 'all forms of movement taking place in all directions' (Athey, 2013, p.8). Harri spent hours outdoors at the water station and he was fascinated with pouring the water into the uppermost tubing and waiting for it to appear at the bottom.

He worked with other children and used different sized and shaped containers to pour the water into the tubing. On one occasion he poured water from a large white cylinder (Figure 5) and some of it splashed onto his feet and shoes. Harri turned to the boy behind him and exclaimed, “*Silly water, you have wetted my feet.*” The boy behind him laughed and they watched the water flow down the pipes and come out at the end. Harri explained to the boy what was happening, “*The water goes in the top of the yellow bit and then it runs down here and comes out here.*” The affordance of water has supported Harri’s trajectory schema. Forman (1994) proposed that thoughts could be influenced by the different properties of a material. Here the ability of water to flow in a downwards trajectory has nurtured Harri’s thinking, and he is eager to explain this to his friend.

Again, the practitioners were eager to build upon this observation as they had noted that Harri did not regularly engage with other children. The setting benefited from a large garden and the practitioners gave Harri the role of watering the plants. He was able to choose different children to work with him and in this way, they encouraged his communication skills and teamwork. Harri was able to use watering cans and a hose pipe to water the garden and he enjoyed watching the water flow down from the nozzle of the watering can and out of the end of the hose pipe.

Other outdoor play equipment also afforded another child Amy in using her trajectory schema. She used the large outdoor bricks combined with her trajectory schema to build towers, beds, and paths.

Figure 6. Here

Figure 7. Here

Figure 8.

Amy had shown evidence of a trajectory and positioning schema in previous observations and outdoors her favourite play resource was the large bricks. She enjoyed moving them around the yard and constructing different things with them. Arnold (2010, p.22) defines a positioning schema as, ‘children position themselves and objects in different ways....’

In Figure 6 she spent all afternoon with another child, building a tall tower telling everyone, *“I want the tower to be as tall as me, how many bricks will that be?”* The other little girl seemed to think and replied, *“This many”* and held up five fingers. Amy started to count aloud, *“1, 2 3....”* She kept counting till she got to twenty and said, *“We will need that many to be as tall as me.”* Amy carried on building the tower until it was taller than herself. She called the practitioner over and they counted the bricks together to see how many *bricks tall* Amy was. Nutbrown (2011) believed that vertical trajectories assist in developing knowledge of height and Amy’s play with the bricks seemed to support this.

Another time Amy was playing with the bricks again. This time she was positioning the bricks horizontally and when she finished, she laid on top of them and closed her eyes (Figure 8). When the practitioner asked her what she was doing she said, *“I am sleeping, I am tired, and this is my long bed.”* In both these observations Amy has used her trajectory and positioning schema to assimilate knowledge around height and length. Selbie and Wickett (2010) state that when play is encouraged children can learn through exploration and self-discovery. Amy is exploring her schemas and mathematical development in discovering how tall she is and how long she is (WG, 2015).

On a different occasion Amy was playing outdoors with the bricks again, alongside another child (Figure 9). They spent time constructing a long path that stretched to the fence. They were chattering to each other and Amy was saying, “*It’s a path to a secret place.*” I wandered over and asked them what they were doing. Both children considered this for a moment and then Amy replied, “*It is a path to Space.*” The other child with her jumped up and down and agreed laughed saying, “*Yeah it goes to Space, up and up.*”

Prior to this observation the children had been reading a book about aliens and space. Amy had used her imagination alongside her trajectory and positioning schema to “*build a path to space.*” This resonated back to her earlier play with the bricks where she was interested in height and length and now, she had built a path that goes “*up and up.*” Athey (2007, p.113) argued that children choose activities based on, ‘commonalities and continuities (‘cognitive constants’).’ Here Amy has continued with her theme of distance and height and has used the bricks to pursue her forms of thinking (Atherton & Nutbrown, 2013). Bricks are the loose parts that allowed Amy to continue her thinking about height and length and the outdoors afforded her the space to do this.

Bricks whilst not malleable materials, can be transformed via a child’s imagination and the space outdoors supports this as Amy refers to her ‘secret place.’ This could indicate the need to be away from prying eyes; a space which enables imaginative thinking. It could also illustrate children’s capacity to construct places to provide time alone to make meaning of their world (Moore 2015). It also connects with Tuan’s empirical work (1977) which maintains that we give a ‘place’ meaning and become connected and attached to it through lived experience and in this, children become emotionally attached to their place; their space.

Positioning Schema:

Figure 9. Here

Figure 10. Here

The outdoors also benefited from a large fixed wooden play frame with rope tunnels and wooden bridges. During several observations, David had shown evidence of a positioning schema which can be defined as positioning oneself and objects in different ways, leading to different views of the world (Arnold et al., 2010). David always gravitated towards the play frame when outdoors and today he immediately ran to the rope tunnel and hung upside down laughing. He encouraged his friend to join him by shouting, “*Look at me I am a cheeky monkey, I can see sky and the ground.*”

On a different occasion David once again went straight over to the rope tunnel but this time he chose to climb on top. The children had been studying pirates as part of their topic for the term and once on top David exclaimed, “*I am Pirate Pete on top of the crow’s nest.*” (The children had read a Pirate book earlier that week as part of focused provision). Athey (2007), Nutbrown (2011) and Atherton and Nutbrown (2013), argue that motor actions such as the above form the foundations for cognitive development, linking actions to thoughts.

David’s positioning schema could result in him developing an understanding of how things look differently depending on the angle of interpretation. Here it could be argued that David is combining the physical actions of positioning his body on top of objects to facilitate a different viewpoint. David was also able to recall the story he had read and used his schemas to pretend to be a pirate. Athey (1990, p.68) discusses thought as ‘where a child gives a verbal account of an experience in the absence of any...reminder of the original experience.’ Here David has transformed the rope bridge into the crow’s nest. As Forman and Fosnot (1982) stated children need rich learning

environments that support active exploration, discovery but also challenge thinking.

The rope tunnel has afforded David the opportunity to imagine he was on a crow's nest.

The practitioners observed David's actions with some concern but allowed him the time to pretend to be the '*cheeky monkey*' and '*Pirate Pete*.' They spent time with David after these observations in PE sessions setting up obstacle courses where David could climb over and under equipment. They reinforced his schematic interests in using positional vocabulary such as, above, below, beneath, and over. Here the practitioners are engaging in what Athey (2007, p.152) terms 'precise language' to nurture and nourish his schema. David enjoyed being able to use the large outdoor equipment in a way that allowed him to assimilate content into his form of thinking or schema. He was building up a working knowledge of how to support his weight, how to balance and a developing perspective of how things look from different angles.

Although the outdoor play frame was not a loose part as defined by Nicholson (1972) or a malleable material in terms of affordance (Forman1994), it did lend itself to be transformed through David's imagination and creativity. David used it to view his world from different or unusual perspectives.

Here, the outdoors provided the space needed for David to move around more freely, and the size of the resources as well as the unstructured approach meant that he could steer his imagination and engage with higher thinking skills as described by Moore (2015). The physicality of the play is magnified by its situation outdoors. The scope for physical development is heightened due to the types of materials and the space afforded by being outdoors, so that gross motor development is supported by climbing and hanging 'over and under.' This cannot be isolated from the cognitive development that occurs, although it may be less overt (ISM, 2018), but can also be seen and heard in the use of language and communication used.

Conclusion

Schemas are an essential element of children's development, they are a key cognitive process through which they construct knowledge and actively make meaning of the world around them (Piaget, 1953). The results indicate, through the many observations conducted, that children will choose to engage with loose parts as a significant part of their play if the opportunity is provided, especially when accessed in an outdoor environment. The space available enables holistic development to occur, where cognitive (including language), creative and physical development appear to be enhanced by the diverse ways that the children engage with the loose parts. They each perceived the objects from different perspectives and used them in different ways to support their schemas. This facilitates opportunities for new skills and knowledge to be assimilated as children learn through discovery.

When children are engaged in play outdoors, they experience a greater sense of freedom (Maynard et al., 2013) and a sense of more available space facilitates this, therefore the children are more active, moving more vigorously than they would indoors. Access to loose parts that are portable seems to encourage this further, and they are used and placed in different ways. Children 'tinker' with the objects available to them, taking them into places, spaces, and orientations outdoors that would be difficult to replicate indoors. This encourages language to be enhanced as children appear to express themselves more willingly, explaining and sharing their ideas, telling stories about their loose parts and what they represent. In addition, they use their bodies more physically to make sense of their experiences, facilitating their schemas.

This may also be connected to the child-led pedagogy that materialises when children engage in outdoor play with loose parts. Practitioners seem more willing to step back and interfere less (Maynard and Waters 2007) and consequently, this affects

the ways that children play. It becomes more self – directed play and children are aware of being ‘less-watched.’ The need to create their own play spaces comes to the fore and thus creativity is embraced along with self-governance of the play itself (Moore, 2015).

Being outdoors also affords a much more heightened use of the senses (Carson 1956) and as such enables children to use the outdoor environment and materials [loose parts] in ways that have meaning and value that are unique to the child perceiving them (Gibson, 1979). Thus, for each child the loose parts represent different things like the bricks represented ‘a bed’ or a ‘secret path.’

Recommendations

Although this research has taken place in one FP setting, the use of the outdoors and the resources provided are not unique but are a staple of any FP learning environment. FP practitioners need to be aware of schemas and schemas need to part of educational policy in Wales. This is especially timely with the new curriculum for Wales being rolled out next year (September 2022). Practitioners have more autonomy to design his new curriculum based upon learners needs and there is an opportunity to include schemas as another way to support young children's learning.

A recommendation would be to consider adding more loose parts to the outdoor area such as real house bricks for the children to play with. Here Amy could get to feel the weight of bricks and learn about how best to position them to make a stable tower or path. Practitioners could consider adding more natural resources such as plastic guttering and string so the children can create their own water stations in different areas of the outdoors. Further research could include the children taking their own photographs of their play actions and spaces (mosaic approach). Then with a growing awareness of schemas, practitioners could work alongside children to include resources and play spaces that facilitate thier preferred schemas.

This research also recognises the importance of the role of loose parts in the outdoor environment to facilitate the development of schemas. In addition, practitioners need to recognise how access to loose parts can enhance holistic development, due to the affordances that they offer each individual child. Practitioners do not need to teach children how to play with loose parts, but just need to step out of the way, enabling children's imaginations to nurture their schemas. This in turn will further engage children in their learning, support their interests and their ongoing development- thus providing an authentic holistic pedagogy for our youngest learners.

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Figures:



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Figure 2. Lewis ‘twisting’ the sieve into the sand



Figure 3. Lewis-painting water circles on shed



Figure 4. Oscar- sand enveloping his hands



Figure 5. Harri-pouring water through tubes



Figure 6. Amy-trajectory and positioning schema- building a vertical tower taller than herself



Figure 7. Amy-making a long 'bed'



Figure 8. Amy helping to make a path to space



Figure 9. David hanging upside down from the rope tunnel



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