

ECEY5005C Awe and Wonder: science, mathematics and the outdoors

Figure 1: Outdoor play space
(Playtime by Fawns, NO DATE)

The above outdoor learning space will be visited by preschool age pupils between the ages of three and five with three to four adults depending on the number of children visiting. The first activity which will support scientific learning children within holistic play involves learning about gravity by going down a slide. In this learning activity, students will climb to the slide top and race down to the bottom explaining how they reach the ground the fastest. After this, explanation about gravity will be provided to students so that they're able to understand how gravity helps them slide down on an inclined plane. In this activity students will also be timed on how fast they can slide down so that each student is also able to understand the ways in which gravity affects their speed and how does the weight of the student impact the gravitation force.

Adults will start interactive dialogues such as how gravity is the force that pulls everything down toward the centre of the earth and it's what makes things fall. After this small objects such as dyes or balls will be used to demonstrate the impact of gravity on Mars. In this way, students will be able to understand how the gravitational force changes with the change in mass of an object. In this activity students would be encouraged to go down the slide and will be timed. After this, conversation about why do different students take longer time to go down the slide will take place. Metacognitive talk such as how did this happen why did once treatment took longer amount to reached to the end of the slide will be asked.

This activity aligns with the Wales curriculum as it ensures that students generate curiosity and questions how things work. In addition to this involving play based activities in learning such as going down a slide can help students consolidate learning by engaging in the activity again and again so that they are able to fully understand the impact of gravitational force and the role of mass in increasing or decreasing gravitational force on a specific object. After each pupil has taken their turn on slide and understood the phenomenon of gravity, the adults will encourage students to think about the ways in which gravity impacts others play activities such as going on swings or throwing and catching objects. In this way discussion between the students about gravitational force will be introduced ensuring that students learning regarding gravitational sports is not interrupted. This is an alignment with the Wales curriculum as it will support progression towards using knowledge and understanding to predict effect as a part of scientific exploration of students.



Figure 2: Object of different sizes

The next activity will take place at the end of the play space on the thus slope. Students will be provided objects of different sizes, this can be different sizes of playing balls which they will be instructed to roll down from the top of the slope and observe the speed of the ball with which it reaches the ground. This activity is once again focused on explaining gravitational force to students and encouraging their understanding about recognizing their observations about gravitational force and how it impacts students. Once the students completes rolling the ball down the slope of different sizes the adults will encourage students to observe patterns in the way gravitational force impact different objects from their previous activity and this activity. this also aligns with the Wales curriculum as it ensures that students are able to recognize pattern from observation and investigation and can communicate their findings.

In this way, the children will also have the time to repeat and consolidate their learning as they will understand how gravitational force works on different objects and impacts their speed. When students are playing with different objects during the activity, the adults will ask students different questions about how do you think the speed of the object would have changed if it had fallen from a slope of more height or what do you think about the ways in which speed of the object changes at different spots in the slope, the highest point, the lowest point and the middle point. This type of conversation will encourage children to think about what they have observed in the previous activity as well as this activity about gravitational force and its impact on the ways in which objects reach the ground because of gravitational force of attraction. They will be able to understand laws of gravitational force such as the greater the mass the greater the force of attraction. Finally, the children will also be encouraged to differentiate between the ways in which objects are affected by gravitational force on different surfaces, the slide in the previous activity and the grassy slope in this activity. This question will introduce the concept of friction to students which will be discussed in the next activity.



Figure 3: Tarpaulin sheet

This activity will be focused on introducing the concept of friction and frictional force to the students. it will be continued from the last selectivity and will generate scientific curiosity among students as they will be encouraged to discuss why same objects fall at different speeds when thrown down a slide with a

smooth slope and thrown down a grass slope which has uneven and rough surface. During this activity questions about what other forces are working in this phenomenon outside of gravitational force and how can the changes in surface impact speed of the object will be asked to students when they are performing this activity. This is in line with the Wales curriculum as it will progress to the final step where students can investigate scientifically and suggest suitable methods of inquiry after understanding different concepts in this way students will be able to apply their knowledge of gravitational force to investigate about impact of fictional force on different objects.

After this, students will be encouraged to walk down different types of surfaces, grass surface, wood surface, cement surface and surface of tarpaulin plastic sheet. This activity will also be focused on encouraging students to understand the ways in which friction impacts their movement and speed. After the previous activity where they observed the impact of friction on same objects sliding down different surfaces, here the students participate in learning about friction but understanding how friction impacts their movement. As they observe changes in their movements on different types of surfaces, the adults will explain the concept of friction to the students. They will be able to feel the difference in friction on different surfaces and implement their findings from previous activity about recognizing the changes in forces and how it impacts matter under different conditions. This is an engaging play space for children which will support their holistic learning with different activities so that they are able to understand implement and investigate the scientific concepts of gravitational and frictional forces. After all the activities are completed students will be encouraged to discuss about how gravitational and frictional forces work together to impact their movement during play time. This will consolidate their learning and they will be able to understand how different types of forces impact their daily lives.

Risk-benefit assessment for the outdoor space**RISK BENEFIT ASSESSMENT**

Location / Activity:	Outdoor learning about gravitational and fictional forces	Date:	
Assessor:		Review date:	

Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and associated risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk after precautions RATING: L/M/H
Rolling down the slide	This is an engaging activity watching then as it will help them understand the impact of gravitational force on their bodies. In addition to this children will also be able to understand the ways in which math	Slippery surface Hazard Behaviour Hazard Multiple User Hazard Clothing Hazard	Students	This is a high risk activity because it involves A variety of hazards including slippery surface add, behaviour hazard, multiple user hazard and clothing hazard. The slippery surface hazard will be avoided by ensuring that the slides are clean and not too smooth resulting in slippery	H

	impacts gravitational pull on their bodies by observing the speed of different students on the slide. the activity will support play best learning for student as they will be able to enjoy rolling down the slide while also learning about gravitational force. The adults will engage in meaningful dialogue with children supporting their better understanding about the gravitational force so that			condition for children. In addition to this, the teachers will test the slide beforehand to ensure that the risk of any such hazard is minimized. The behaviour hazard will be eliminated by continuously supervising the children so that they are not able to inappropriately climb up the slide instead of using the ladder or push others down creating reckless environment. The activity and play will be conducted in a disciplined manner to avoid any such behavioural hazards	
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	they are able to observe and investigate the real life application of gravity on their bodies and movements.			furthermore multiple user hazard will also be avoided by strict monitoring of teachers so their students are able to use this slide in and enjoyable manner. Finally, the clothing hazard where students clothes might get stuck to any pointed surface of the slide resulting in dangerous conditions for students will be avoided by ensuring that students are not wearing long clothing on the day of the activity and any such case is avoided.	
Rolling balls of different sizes	This is a beneficial and	Chocking Hazard	Students	The choking hazard associated	M

on slide and grassy slope	interactive activity for students as they will be able to and hence the level of understanding about gravitational force by engaging in this activity. Here, the students will be instructed to roll balls of different sizes down the grassy slope so that they are able to observe and analyse how gravitational force impacts the objects of different mass and the role of mass in increasing or decreasing the	Projectile Hazard Tripping Hazard		with this activity is extremely dangerous because it can also lead to death of the student. Therefore appropriate action needs to be undertaken by the teachers to ensure that choking hazard are avoided. The teachers will monitor activities of the students while playing with the balls and rolling them down different surfaces clearly instructing the students not to ingest any of the balls. Since the students engaged in the activity are preschool year there is a chance that they might be inclined to	
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	gravitational force. This is an important activity for children as it will not only deepen their understanding of gravitational force but will also introduce them to the ways in which frictional forces impact movement of different objects. This is because under this activity, the students will roll down bones of different sizes on the grassy slope as well as the smooth slide. After this the student will compare and			ingest the objects because they're small enough. Therefore the teacher will keep strict supervision on each of the students to ensure that they do not ingest the ball avoiding choking hazard. Furthermore, the projectile hazard will be avoided by disciplining the student about throwing the balls on other students or harming the students by using the ball as a projectile. This will ensure that the play based activity is conducted harmoniously without any reckless behaviour from	
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	analyse the difference in speed of the walls when going down a grassy slope and a smooth slide. In this way the activity will introduce them to the application of frictional force and improve their understanding of gravitational force.			students. Furthermore the tripping hazard will be ensured by monitoring that the students return the ball to the adults after completing the activity so that no small object is left on the ground on which the student might trip and fall.	
Walking on different surfaces	This is an important activity for the students as they will learn about frictional force and how it impacts their movement and speed	Tripping Hazard Splinter Hazard	Students	This activity has lower level risk because it simply involves students working on different types of services. However tripping hazard and splinter hazard get negatively	L

	students will be instructed to work on different services including plastic service, grass surface, wood surface and cemented surface. After this they will be engaged in meaningful narrative based understanding about how frictional force impacts movements on different surfaces. This is an important activity for understanding the application of frictional forces and the ways in which			impact the implementation of this activity. Tripping hazard will be avoided by supporting students while working on more slippery surfaces such as plastic and ensuring that students are able to maintain their balance while walking or running on different types of surfaces to understand the impact of frictional force on their movement. Furthermore splinter hazard will be avoided by checking all wood surfaces where students will be working to avoid any rough edges where students might	
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	different services have different level of frictional force.			fall and get splinter. In addition to this a first aid kit will be ready throughout the activities to ensure that any minor accident such as getting a splinter can be treated with the help of bandages and other first aid material.	
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Adults supporting science and mathematics outdoors

Outdoor education involves teaching students different concepts in natural environment and outdoor settings beyond traditional classrooms and text based material (Waite, 2011). White (2011) suggests that outdoor learning has become an important part of curriculum in United Kingdom because it utilizes natural world and outdoor environment providing rich and dynamic place for learning and teaching. This is specifically important for young learners who are able to promote holistic development and create a deeper connection with nature when engaging with outdoor learning. Teachers can easily explain different scientific and mathematical concepts by encouraging outdoor learning of students so that they are able to apply these concepts easily and understand different scientific phenomena. The present report looks at evaluation of how adults working with early years children can support and encourage children engaging with mathematical and scientific concepts in an outdoor environment.

The Gibson affordance theory developed by psychologist James J Gibson provides a framework for understanding perception and interaction of individuals with external environment and can also be used to highlight the role of adults in working with early years children and supporting their engagement with

Mathematical and scientific concepts in outdoor environment (Sedgwick, 2012). According to this theory, affordances are the inherent qualities and properties of objects and environment which influence action of an individual observing the environment by suggesting specific action to the individual. This is specifically important for outdoor learning as it provides an environment to stay where they can observe these affordances that influence their actions. These affordances can include different objects and aspects of the environment such as trees, plants, playing objects and different types of surfaces in the environment.

Grigg and Lewis (2016) goes on to discuss how this theory emphasizes the usage of perception action loop where the perception of individual influences their action and both of these concepts are interconnected. This can be explained in context of outdoor learning as children perceived different objects present in outdoor learning and use it to influence their action. For example a student might look at a balance log and use it for practicing coordination. In this case, the affordance of balance log is perceived and utilized by the student to support their learning this can also be utilized to demonstrate how adults can play an important role in supporting learning of students in outdoor environments as they can introduce different types of affordances and encourage students to perceive and utilize the affordances to support actions which helped them learn different types of concepts and theories.

Furthermore, the affordance theory also states that affordance is direct and does not require complicated cognitive procedures. This means that students directly interact with affordances in context of different kinds of external environment. This is where the role of adults come in context of outdoor learning as adults can play an important role in helping students perceive different types of affordances in context of the specific concept they are learning (Bilton, 2010). For example adults can help students understand gravitational force by introducing or pointing out affordance which are related with gravitational force such as leaves falling to the ground because of gravitational force.

The theory also states that individuals perceive affordances which can be used to interact with the external environment without the need for cognitive complicated procedures (White, 2013). This means that they are able to understand opportunities and challenges of the external environment easily without the need for application of complicated mental procedures. Here, teachers can support learning for students in outdoor environment by helping them describe, discuss and investigate the opportunities and challenges associated with different affordance in the outdoor play area. For example explaining

why leaves are falling to the ground during autumn. The scientific explanation of this phenomenon. In this way it is clear that students can interact with properties of external environment easily but it is important for adults to direct these interactions towards learning instead of becoming mere play.

Moreover, the theory also states that each individuals respond to appearances in external environment differently depending on their skills, abilities, intention and previous experience. Wilson, (2018) believes this theory showcases that every student will interact with the environment differently and standard approach to teaching cannot be adopted in context of outdoor learning with different affordances inciting different responses from each individual student. Therefore demonstrating the role of adults in supporting outdoor learning as they have to engage with each individual student keeping in mind they are able to use their existing skills, knowledge and experience to understand specific scientific and mathematical concept.

Nicholson's loose parts theory can also be used to explain the role of adults in supporting learning for children in outdoor environments so that they are able to understand different mathematical and scientific concepts (Skinner and Dancer, 2012). According to this theory the creative potential and engagement of play environments such as outdoor spaces is enhanced by incorporation of loose parts. Nicholson defines loose parts as open-ended, movable and adaptable materials or objects which can be used in learning. These materials do not have any predetermined purpose and allow learner to manipulate and combine them as they see fit. In context of outdoor learning natural elements such as sticks, rocks, leaves and water along with man made items such as buckets can be considered loose parts (Sangster and Catterall, 2009).

The theory emphasizes the importance of loose parts to encourage creativity and imagination in students (White, 2019). In context of outdoor learning children can utilize loose parts to understand different concepts and creatively engage with scientific and mathematical theories. For example the usage of loose parts such as stones of different colors or leaves of different colors can help student understand different mathematical concepts by categorizing the leaves and stones on the basis of their color and then adding or subtracting some of the loose parts to understand different mathematical operations this type of creative play helps foster problem solving skills, innovation and self-expression in children showcasing the importance of loose parts in helping holistic learning of children in play based activities. White (2019) also suggests the role of adults in this case is to support children in effectively

applying mathematical or scientific of racial while playing with loose parts. Adults can also generate creativity and curiosity in children by asking them questions directing towards the specific scientific or mathematical concept.

Furthermore, the theory also states that the addition of loose parts and external environments provides an opportunity for sensory explanation (White, 2013). This is because natural elements such as soil, water, sand and other play based elements can increase creative exploration of students by supporting multi sensory engagement it can also enhance understanding of the people about the natural world and the ways in which different natural phenomenon occur. Once again this theory can be used to understand the ways in which adult supervision and support is needed for learning scientific and mathematical concept in case of outdoor learning. This is because enhancement of sensory experiences can differ from student to student and supervision and support from adults is required to ensure that the sensory experiences of students when interacting with different loose parts whether natural or man made and completed in a safe environment. Besides this adults can also ensure that students are able to consolidate their learning by repeating their actions and multi sensory engagement with different plus parts to understand the specific scientific or mathematical phenomenon in detail. For example observing that changing color of plants in different seasons, this can help the students develop better knowledge of different scientific phenomenon in multisensory way. Here, adults can support children in understanding the phenomenon and scientific explanation in a way which engages all of their senses such as observing and seeing the changes in plants with different seasons, observing changes scent of specific plants with changes in seasons understand the ways in which the changes impact their smelling sense etcetera. This demonstrates the importance of teachers and adults in outdoor learning spaces (Tunncliffe, 2015).

Jerome burners theory of instruction is linked with constructivist approach to education and can be applied to understand the ways in which student learn in outdoor environment (Johnson and Watts, 2018). This theory prioritizes active learning and interaction with external environment to support learning process of students. The theory offers the idea of spiral curriculum suggesting that students need to revisit key concept and scale multiple times so that their knowledge can be consolidated and they are able to understand the concept with changing levels of complexity. This can be supported with the help of outdoor learning because it provides an environment where students are able to apply

different scientific and mathematical concepts outside of text based learning so that they are able to deepen the understanding of specific concepts (Keith, 2017). For example students can learn about scientific concepts such as frictional force and gravitational force by engaging with materials with outdoor environment and deepen their understanding of these concepts. Adults and teachers can support improvement in knowledge of students in outdoor environments by implementing activities related with scientific and mathematical concepts. Cooke (2007) suggests doing this with varying degrees of difficulty so that students are able to easily understand the application of different scientific and mathematical concept progressing their knowledge with each activity. This demonstrates that adults need to be in charge of outdoor learning of students so that they are able to not only understand the specific concept but engage in different activities which increase their knowledge and application of the specific scientific or mathematical concept (Robertson, 2017).

Burner theory also emphasizes that knowledge becomes more meaningful and memorable for students through narrative based learning activities (Murray, 2019). Outdoor learning can support this type of narrative and storytelling based learning experience for students where learners share their experiences and discuss their observations making discoveries about different scientific and mathematical phenomena. Here, Richardson (2013) believes adults can support storytelling and narrative based learning by asking metacognitive questions and engaging in meaningful dialogue with children.

Conclusion

From the above discussion it is determined that outdoor learning plays an important role in understanding difficult scientific and mathematical concepts. In addition to this outdoor learning you not be successfully implemented without involving adults in the outdoor learning process so that students are able to engage with different outdoor materials and outdoor environment in a meaningful manner improving their knowledge about specific scientific and mathematical concepts educational theories such as affordance theory and Burner theory along with Nicholson loose parts theory shed light on the importance of others in supporting fulfilling and meaningful outdoor learning experience for students. Supervision and support provided by adults can support early years pupils in effectively engaging with different outdoor materials or affordances so that they're able to develop their knowledge. Furthermore adults can also provide children safe environment where they're able to creatively engage with different loose parts in the outdoor environment such as sticks and stones

creating a multisensory learning experience. Finally students are also able to improve their learning when adults are involved in outdoor teaching activities because teachers can support narrative based learning and ensure that students repeatedly engage with different scientific and mathematical concept with increasing levels of complexity so that they are able to understand every aspect of the concept clearly. This demonstrates that adults play a significant role in supporting outdoor learning for early years children.

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