

The Young Mathematician: Exploration and Problem Solving

“Not only can learning contexts provide excellent, creative mathematical learning opportunities, they also act as ‘meeting places’ where children can discuss ideas, collaborate, solve problems and make important connections between math and other learning.”

(Tucker, 2014)



(Pinterest, no date)

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Activity Plan

Cynllun Gweithgaredd Activity Plan		
Gweithgaredd: Activity: <i>Classroom Shop</i>		
Nifer o blant: Number of children: 3	Oed y plant: Age of children: 4-5	Nifer o oedolion: Number of adults: 1
Lleoliad: Location: <i>Classroom</i>	Amser paratoi: Preparation time: <i>5minutes</i>	Amser gweithgaredd: Activity time: <i>15minutes</i>
Adnoddau: Resources: <i>Shop corner, plastic coins 1p, 2p, 5p, 10p, 20p, money bag, items to purchase (e.g plastic fruit and vegetables, used cereal boxes), price list poster, shopping basket, till, notepad, pencil</i>		
Amcan/ion y weithgaredd: Aim/s of activity: <i>Counting, adding up, subtracting, quantity, value of money and each coin. To support children's mathematical concepts through role-play-based activity of shopping. Choose items from the shop and relate the price of the items to the price list poster, work together to choose what coins they can use to make the correct total amount. Use addition to work out the total, and use subtraction to give correct change if needed.</i>		
Cysylltiadau â deilliannau: Links to outcomes: <i>Ability to read and write number 0-10, understand zero means none, geometry – putting the different shaped and sized items in the shopping basket, use of mathematical words and talk about adding and subtracting, use of 1p, 2p, 5p, and 10p to pay for items and understand the concept that each coin has a different value, understand that each item has a price and the quantity of items to purchase will affect the price for example, two bananas. (Foundation Phase Framework, 2015). To reinforce the use of numeracy skills in different contexts, in accordance to the new curriculum of Donaldson (2015) that indicated the importance of numeracy and how it is necessary for independent living and work.</i>		
Gwahaniaethu: Differentiation:		

Lower-level groups – coins 1p, 2p, 10p coins (use items costing small amounts to is easy to understand concepts, keeping total in pence)
Average level groups – 1p, 2p, 5p, 10p coins (use similar items, and more than one quantity for example two bananas)
Higher level groups – 1p, 2p, 5p, 10p, 20p coins (higher value items, more quantity purchased, total to be worked in pence)
Higher - To show understanding of the concept of 'change' in return;
'Amount given (subtract -) shop total = change'

Iechyd a diogelwch:
 Health and safety:

Completed risk assessment in alignment with setting policy and procedure. Area will be clean, appropriate and safe to use. The coins are quite small; children could put them in their mouth if not supervised responsibly. Fingers could be caught in the till - working of the till needs to be demonstrated. Clean and wipe till, basket and coins with disinfectant after each group has completed the activity.

Rôl yr oedolyn/oedolion:
 Role of adult/adults:

Allow children to shop for themselves (choose own items), to support and prompt the children with in their roles. Ask questions to support their workings out 'how much does that cost? What coin could you use to buy that item?' Give support where needed for mathematical workings out. Encourage children to talk about what they are doing and how much items cost – 'How much is one banana? What is the total cost? Do we have enough money to purchase x2 bananas?'

Y weithgaredd:
 The activity:

One shop keeper and two shoppers
Children go to the shop, one child choose 3-5 items (depending on what group ability working with) off the shelves and put them into their basket, and then go to the shop keeper and place them on the till. The shop keeper will then scan the items through the till, and using the price list they will write down the amount of each item onto a note pad using a pencil. The shop keeper will then add up the items (with support of adult) and give a total amount to the shoppers.
The other shopper will look at the coins in their money bag and work out what coins can be used to make up the total of their shop and give to the shop keeper to put in the till.
Rotate children's roles to ensure each child has completed each activity.
For advance groups – adult can suggest items or use of coins that will create a situation where change needs to be worked out and given.

Evaluation of Classroom Shop Corner Activity

Donaldson (2015) recognise the importance of delivering focused education in a holistic manner. Offering children with play-based learning opportunities that will provide them with the knowledge, life skills and confidence that will utilise later in life. Williams (2015) supports the idea that role play deepens children's understanding of number, Williams states that the mathematical concepts make sense to the children as they are involved in the construction of the activity, in addition to the solution. This supports the idea of children using what they already know and putting it into practice, for example, a hands-on activity will further their knowledge and understanding in a mathematical sense. Similarly, to the Nordic framework, the new curriculum of Donaldson (2015) imply that it is key for the process of challenge, discovery and adventure that enhances a child's learning and development (Early Childhood Club, 2014).

The play-based activity is geared towards children in a reception class that have knowledge of coins and some understanding of the concept that the value for each coin is different, in turn supporting children in mathematical thinking. The activity is supported by Piage's theory of experiential learning and how this demonstrates the power to a better understanding (Sprouts, 2015), the skill of counting and adding the prices to find the total amount, but also, placing the items into the shopping basket, understanding different sizes of the 3D shapes, for example, the cereal box will be quite big, an apple will be small but round and smooth. Children that have difficulty understanding the concept of value of the coins, can be set tasks to support this such as, relation to numicon – visuals. The activity supports geometry within mathematics, as the children use their cognitive development to fit the various shaped and sized items into the basket, this also develops their problem-solving skills.

Similarly, Vygotsky's theory of children's cognitive development state that children progress and learn through assisted performance and social interactions. A well-planned activity prepared by the adult will enhance children's learning and growth (Foundation Phase Framework, 2015).

Tucker (2014) suggests giving equal opportunity between indoor and outdoor environments, however, giving the nature of the activity and the role of the adult within the activity displays difficulty and barriers in creating a free-flow access between areas. Possibility of a 'lemonade stand' style of activity could be set up however, that would change the activity within the planning. Furthermore, Montessori's practice indicated the use of 'real-life' resources in an enabling environment is key to children's development (Montessori Schools Association, 2012), this is reflected within the planning with the use of used cereal boxes, used milk cartons and other real-life items as well as plastic fruit and vegetables. However, Montessori highlights the importance of the outdoors and how it can be utilised to enhance mathematical learning. To support the mathematical learning of children effortlessly, implement the use of outdoors and observe the children's understanding of the mathematical concepts. For example, different sizes of stones have different values; small stones are 1p, medium size stones are 2p and large stones are 10p, the adult can set up the play, observe and support the children. Allow the children to collect stones and add up how much the total amount of 'money' they have, the adult can also encourage the use of mathematical language by asking questions 'what do we thinking the value of this stone might be? What about compared to this stone? Is it bigger or smaller?' This is aligned with the work of Early Years Matters (2021) that states, the outdoors allows opportunities for creativity and that children's use of language is increased while being outdoors.

While the use of cash and physical money is not used as regularly today and payments are taken via credit card or online, it is vital for children to have an understanding of money and the value of it in regards to like skills. In mathematical terms, understanding the value of each coin is important and understanding the addition and subtraction when calculating amounts and change. The chosen activity is supported by Montague-Smith and Price (2012) who view mathematics as a way of making sense of the world, in regards to the activity the children will have to use problem solving skills to work out how the various shapes of each item in the shop are going to fit into the shopping basket. The Foundations Phase Framework (2015) emphasise the importance of facilitating developmentally appropriate play-based activities. Through observations and

social discussions, practitioners are able to identify general interests of the children and use them as tools to make the activity relatable to the children (Welsh Assembly Government, 2008). This can be implemented by having certain items in the shop such as computer or PlayStation games, available for the children to choose. Furthermore, the work of Gull *et al.* (2019), describes the importance of loose parts within early years and giving the children the opportunity to express creativity through use of materials that can be transformed through guided play. In order to develop this within the chosen activity, the shop could have some small baskets on the shelves with some loose parts that can be interpreted as 'sweets', and with the use of small bags and tweezers or scoops, the children can choose what sweets to put in their bags and labelled as 5-10 sweets for a certain price (Gull *et al.* 2019).

Discussion

The Foundation Phase (2015) have enforced the fundamentals of Montessori's work within their framework by creating stimulating and exciting environments, designed to enhance children's engagement and learning. According to Tucker (2016) children are born problem solvers and it is vital for the practitioner to enrich confidence in their mathematical abilities with challenging activities. This theory is reflected within the planning of the activity, creating an area that mirrors that of a shop and has a clear step by step process, that in turn, is inviting for the children to participate and provides space for creativity and focus. Giving the opportunity to use small and large valued coins allows the adult to gauge the children's abilities, and to guide the play for more understanding of the mathematical concepts and gives room for challenge and progression. Tucker (2016) states that creativity in mathematical play can be reinforced by giving children the opportunity to work with a range of resources to explore, allowing them time to revisit activities and by encouraging children to formulate links between mathematics and experiences. Following the activity, the shop corner will remain for a period of time and give the children ample opportunity to revisit the area with peers during play. Also, the activities can be developed using the area as the children progress in their mathematical knowledge using higher valued coins, notes, and items. The activity may also be developed further with the use of the outdoor areas, having a larger range of resources to purchase with their money.

Montessori Schools Association (2012) encourages the impact of using various different types of resources within education and play, and how it is fundamental to a child's development. Within the shop corner activity, the children will mainly use plastic resources such as the fruits and vegetables and the small coins they will use to pay for the items. The children are also encouraged to bring in used items from home, for example, used cereal boxes or a small cuddly toy. This can boost motivations as the children will feel more part of the production of the activity. Welsh Government (2015) highlight this effect of inclusion with young children within their learning, and how this enables children to stimulate mathematical thinking. The coins are interactive resources

that represent real-life money. The children will manipulate them, hold, touch, and use them to give to the 'shop keeper' in exchange for items. Gunderson *et al.* (2011) states that children learn well through seeing and mirroring what they have seen, and teachers' attitudes towards mathematics can have an influence on children motivation towards the subject. Gunderson implies the significance of mathematical concepts and how the style of teaching approach can modify the learning outcome.

Part of the activity is the children working out how to fit the items they have chosen into the shopping basket; this supports their learning of geometry and how they will fit the various different shapes and sizes into the basket – 'will they fit?'

Gull *et al.* (2019) highlights the work of Simon Nicholson (1971) and how loose parts can be used in varied ways to encourage creativity for children.

'Materials that are variable, meaning they can be used in more than one way so that children can then experiment and invent through play'.

(Gull *et al.* 2019)

The 'sweets' baskets within the shop activity encompasses this theory, by allowing the children to create the criteria that order the parts into categories, such as shape or size, and order the baskets however they see fit on the shelves of the shop. During the activity they can have one meaning, however, during children's self-exploration, the adult can encourage creativity in a mathematical aspect. For example, what is the value of the items; small items can be worth a small amount, the biggest loose part can be worth the largest amount.

Explanation

‘Pedagogical approaches that allow connections to be made via common questions, concepts or skills should be explored within and across Areas of Learning and Experience’.

(Donaldson, 2015)

The observation and assessment of the aims of this activity supports the new curriculum framework of Donaldson, stating that assessments should engage the student in their own assessment, promoting the purpose of learning and to be clear of the reasons for assessing. It is the duty of the adult to be clear in their instructions during preparation of the activity and delivery to the students, in order for the children to have understanding of the aims, which is focused on the students understanding of values and addition.

The shopping activity can be applied in a holistic manner and complements all areas of the Foundation Phase Framework (2015). Use of language is applied through role play between the ‘shoppers’ and ‘shop keeper’, and the adult supports mathematical language during the activity by prompting children with questions such as, how much? How many? is that item bigger or smaller? The activity also enhances the children’s social skills with one another and adult to children relationship, this aligns with the Vygotsky’s theory of increasing children’s development through social interactions (Sprouts, 2020).

Reggio Emilia inspired an approach that emphasised a pedagogy of teachers carefully listening to children’s ideas and experiences, and to engage in conversation with them. The Reggio philosophy is recognised around the world and has been exposed to Early Years educators within Australia in the last ten years. The Early Years Learning Framework for Australia have embedded this pedagogy of how teachers interact with children to support their learning (Hall, 2013). Similarly, Welsh Government (2008) considered the way in which children were being assessed, and describes methods in which children’s’ developmental progress can be assessed through observations during play, as appose to formative testing and learning.

Tucker (2014) states that providing a learning environment plays a crucial role in developing children's ability, and encouraging independent learning as young mathematicians in playful context. Donaldson (2015) have rooted these approaches within the new curriculum, allowing teachers' space to observe children in a more holistic way, covering all seven areas of learning within one activity. Howard and McInnes (2012) state, children's learning is more effective when the practical tasks are under playful circumstances, and to uncover the child's optimal learning capabilities, in order for the adult to gain a better perspective of the child's current development and understanding of mathematical concepts. The adult supports this approach by shifting the focus onto certain areas within mathematics by using questions and language. The first part of the activity required the child to use geometry, sorting, matching, patterns, properties and investigation, including addition of the items and money. The Foundation Phase (2015) states that children should be given the opportunity to experience mathematically-rich practical skills in a range of contexts.

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