AMSI | AUSTRALIAN MATHEMATICAL SCIENCES INSTITUTE

LEVEL: Middle Primary	CONTENT: Problem Solving	FOCUS: Recording Solutions & Explaining thinking
In the Classroom		
PURPOSE	- Identify the qualities of a good mathematician - Demonstrate the qualities of a good mathematician - Use trial and error to investigate the problem - Share ideas and approaches with other students - Explain and record thinking using a systematic approach - Recognise and explain reflections and rotations	
WARM-UP	**Good Mathematician** Brief discussion about the qualities of good mathematicians -. Make a list of the key terms and during the lesson list any other words or phrases (positive or negative) you hear students use. Reflect on this language at the end of the lesson and remind students how the language we tell ourselves quickly becomes our own best friend or worst enemy. Include a discussion about having a growth mindset, persistence, learning from each other and working together.	
INTRODUCTION	**Egg Cartons** Farmer John wants to investigate the number of different ways to place eggs in rectangular egg cartons. There is only one way to place 6 eggs in a 2 x 3 carton. How many ways can you place 5 eggs in a 2 x 3 carton? Reflections and Rotations of arrangements are not considered different.	
EXPLICIT TEACHING & LEARNING	**Systematic Approach** Students are encouraged to not only find possible solutions to the Egg Carton problems, but to record possible solutions using a systematic approach. Can students prove they have found all the solutions? **Challenge** How many ways can you place 4 eggs in a 2 x 3 carton? Or 3 eggs in a 2 x 3 carton	
DISCUSSION/KEY QUESTIONS	- What do you notice about this problem? - How many solutions do you think there are? - How can you record your solutions? - What is a reflection? What is a rotation? - How can you prove you have found all the solutions? - Can you use this information to solve to predict the number of solutions to a similar problem? - If 6 eggs have one solution how many solutions does 1 egg have?	
DELIBERATIVE PRACTICE	The focus of this activity is to encourage students to use trial and error and persistence to solve the problem. All students will be able to find possible solutions, but can they find a way to record their solutions and prove that their solutions are different from one another and that no other solutions are possible.	
REFLECTION	Discussion with students about WWW and EBI regarding the task. This should lead into a discussion about the power of having a positive mindset, learning from each other and working together to achieve a task.	
RESOURCES	Counters or other material to represent the eggs Students may prefer to use white paper with a dark texta – this will help students see the flips	
Curriculum Connections		
CONTENT	**VICTORIAN CURRICULUM F-10** **LEVEL 3 – LOCATION & TRANSFORMATION** Identify and describe slides and turns found in the natural and built environment (VCMMG145) **Elaborations:** Recognise and represent slides and turn used in brickwork around the school; Recognise and represent slides and turn used in sporting activities **LEVEL 3 – STATISTICS & PROBABILITY** Collect data, organise into categories and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies (VCMSP149)	

CHOOSEMATHS

	Elaborations: Explore meaningful and increasingly efficient ways to record data, and representing and reporting the results of investigations Interpret and compare data displays (VCMSP150) **Elaborations:** Compare various student-generated data representations and describe their similarities and differences
WHAT CAME BEFORE	When learning to solve problems students will often begin to record possible solutions using a haphazard approach. This method is fine, but over time a more systematic approach is required so solutions can be checked and compared. Initially, the teacher can model a way to record the students thinking on the board, as the student is speaking.
WHAT COMES NEXT	Finding and recording possible solutions is one thing – analysing and interpreting possible solutions is another. Once students are satisfied with the number of solutions for a given number of eggs can they use this knowledge to predict the number of solutions for a different number. Is the pattern increasing, decreasing or does it form more of a bell curve?
VOCABULARY	Combinations, reflections, rotations, translation, flip, slide, turn, horizontal, vertical, lef, right, top, middle, bottom, systematic, prediction, analysis, interpreting, explaining
MISCONCEPTIONS	Students' knowledge of shape transformations may be limited. Rotations or turns are easier for students to visualise. Reflections or flips can be more challenging as there two ways to flip an object, vertically and horizontally. Sometimes students will describe flipping an object left to right or up and down. A reflection is a flip over a line.
WHAT PROFICIENCIES ARE TO BE UTILISED? **Understanding** **Fluency** **Problem Solving** **Reasoning** **Communicating (NSW)** **Justifying (NSW)**	**Level 3 (Australian Curriculum)** **Understanding** includes connecting number representations with number sequences, partitioning and combining numbers flexibly, representing unit fractions, using appropriate language to communicate times, and identifying environmental symmetry **Fluency** includes recalling multiplication facts, using familiar metric units to order and compare objects, identifying and describing outcomes of chance experiments, interpreting maps and communicating positions **Problem-solving** includes formulating and modelling authentic situations involving planning methods of data collection and representation, making models of three-dimensional objects and using number properties to continue number patterns **Reasoning** includes using generalising from number properties and results of calculations, comparing angles and creating and interpreting variations in the results of data collections and data displays.
ASSESSMENT	**Exit Pass** – Farmer John wants to find all the different ways of arranging 6 eggs in a 2 x 4 carton. Reflections and rotations are not considered different. **Think about** What does a 2 x 4 carton look like? How can you record your discoveries? Have you checked to see if you have any reflections or rotations?

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