LEVEL: Junior Primary	CONTENT: Problem Solving	FOCUS: Patterns
In the Classroom		
PURPOSE	• Recognise and explain the importance of struggle and persistence when solving problems • Ask questions to better understand information • Share ideas and strategies and build on others knowledge • Work with others to complete a task • Explain the strategy being used to solve problems • Make patterns using objects • Recognise and continue patterns with objects • Use pictures to record patterns • Use symbols (including numbers) to describe and continue patterns • Create a table to help analyse data	
WARM UP	**Growth Mindset – Learning to struggle** Show students the first matchstick challenge, encourage them to place the sticks in this arrangement, before showing them the instructions. Initially do not allow the students to touch the sticks – just look and think about the problem. Encourage students to discuss their ideas and methods as they go, but if have a solution keep their method to themselves. Now challenge the students to make the new arrangement. Record the language you hear the students using (positive or negative). After 2 -3 minutes stop and as a class discuss how students are feeling. If students are having trouble reveal the sticks that need to be moved through the PowerPoint. • Did anyone make it? How long did it take? How many tries? • Was the first ten seconds of trying much different from the last ten seconds? How? Why? • What was it like when someone else got it? • How many attempts did you take? • How long did you look at the structure before you first started? • How many breaks did you take? • Did you look at what other people were doing? Why? How did it make you feel? Did you learn anything from what they were doing? Repeat the task with the second Matchstick challenge. Refer to the language used during the activity 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	Present the Making Squares problem to students – encourage them to work together on the task	
EXPLICIT TEACHING & LEARNING	**Making Squares** Imagine a matchstick. How many more are needed to make a square? How many more need adding to make yet another square alongside it? Carry on adding more squares ... How many matches have you added? How many matches are there when you have made 10 squares in the row of the same size? 20 squares? Do you notice any patterns? **Challenge** Can you think of another design to make 10 squares of the same size? What is the least number of matchsticks you need to make 10 squares (they do not need to be the same size)?	
DISCUSSION/KEY QUESTIONS	• What are the features/properties of a square? • How many matches do you need to make one square? 2 squares, etc. • Do you notice any patterns? What do you think the solution could be? • How could you record this using pictures or symbols? • Can you use numbers to continue to pattern? • Can you create a table to help us look for patterns? • Is there another way you could make ten squares of the same size? • What is the most sticks you need to make 10 squares? Least? • What if the squares did not need to be the same size?	
DELIBERATIVE PRACTICE	The focus of this activity is to encourage students to explore problems with limited assistance from the teacher. Although the teacher asks questions and can prompt learning, the students will investigate the problem using their own strategies.	

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	Matchsticks Challenge PowerPoint and Coloured matchsticks **Matchsticks –** https://nrich.maths.org/10

Curriculum Connections	
CONTENT	**VICTORIAN CURRICULUM F-10** **YEAR 2 – NUMBER & ALGEBRA** Investigate number sequences, initially those increasing and decreasing by twos, threes, fives and ten from any starting point, then moving to other sequences (VCMNA103) Describe patterns with numbers and identify missing elements (VCMNA112) **YEAR 2 – STATISTICS & PROBABILITY** Create displays of data using lists, table and picture graphs and interpret them (VCMSP128)
WHAT CAME BEFORE	Students experience with problem solving can be varied. Some students embrace a challenge, while some students are reluctant to start without guidance from the teacher. While we do not want students to be upset it is important to gradually the amount of assistance given to students, while at the same time encouraging students who do need assistance to ask questions, rather than just saying they don't know or can't.
WHAT COMES NEXT	This simple problem is a good way to introduce using tables to look at patterns. On the board model drawing a table like this one here. What do students notice? The first column is going up by 1 the second column is going up by 3. Will 10 squares need 32 sticks? Why? What if you wanted 20 squares? 50? 100? How can you work out the number without recording all the numbers? 3 x squares wanted plus 1 – can students come up with this?
VOCABULARY	Growth mindset, positive, struggle, persistence, question, share, work collaboratively, systematic, solution, pattern, what worked well (WWW), even better if (EBI), square, sides, equal, table
MISCONCEPTIONS	Some students may think that if one square needs 4 sticks then 10 squares will need 40 sticks.
WHAT PROFICIENCIES ARE TO BE UTILISED? **Understanding** **Fluency** **Problem Solving** **Reasoning** **Communicating (NSW)** **Justifying (NSW)**	**Year 2 (Australian Curriculum)** **Understanding** includes connecting number calculations with counting sequences, partitioning and combining numbers flexibly and identifying and describing the relationship between addition and subtraction and between multiplication and division **Fluency** includes readily counting numbers in sequences, using informal units iteratively to compare measurements, using the language of chance to describe outcomes of familiar chance events and describing and comparing time durations **Problem-solving** includes formulating problems from authentic situations, making models and using number sentences that represent problem situations, and matching transformations with their original shape **Reasoning** includes using known facts to derive strategies for unfamiliar calculations, comparing and contrasting related models of operations and creating and interpreting simple representations of data.
ASSESSMENT	Rather than assessing students this task is more about a discussion about strategies, what is working, what wasn't working, what did you do when you got stuck, etc.

Squares	Matchsticks
1	4
2	7
3	10
4	13
5	16