

For the lesson on [25/2/2016]  
At [Presentation College Currylea, Tuam Co. Galway], [Ms N. Connolly and Ms E. Higgins] class  
Teacher: [Nicola Connolly and Elaine Higgins]  
Lesson plan developed by: [Nicola Connolly and Elaine Higgins]

**1. Title of the Lesson:** Problem Solving: An Introduction to Patterns

**2. Brief description of the lesson:** Students will be introduced to linear patterns through the lens of problem solving.

**3. Aims of the Lesson:**

I'd like my students to:

- Become independent learners. (Key Skill)
- Become more creative when devising approaches and methods to solve problems.
- Experience meaningful mathematics i.e. that they see a need for what they are studying.
- Build enthusiasm for the subject by engaging them with stimulating activities.
- Connect and review the concepts that we have studied already.
- Appreciate that mathematics can be used to solve real-life problems.
- Appreciate that patterns can be used as a tool for making sense of concrete problems.

**4. Learning Outcomes:**

As a result of actively participating in this lesson my students should be able to:

- Present the numbers given, using matchsticks.
- Describe the pattern in students' own words.
- Describe the pattern using a mathematical expression.

**5. Background and Rationale:**

This lesson was designed to:

- Meet the syllabus needs as students and teachers actively engage with the new maths syllabus in a more hands on, interactive and real-life approach.
- Approach problems involving patterns in an active, practical and visual way to engage all learners in the class.

**6. Research:**

The mathematics syllabus for Junior Certificate students sitting their exam in 2016 and onwards

Students learn about	Students should be able to
<b>3.6 Synthesis and problem-solving skills</b>	<ul style="list-style-type: none"> <li>– explore patterns and formulate conjectures</li> <li>– explain findings</li> <li>– justify conclusions</li> <li>– communicate mathematics verbally and in written form</li> <li>– apply their knowledge and skills to solve problems in familiar and unfamiliar contexts</li> <li>– analyse information presented verbally and translate it into mathematical form</li> <li>– devise, select and use appropriate mathematical models, formulae or techniques to process information and to draw relevant conclusions.</li> </ul>

### 7. About the Unit and the Lesson:

This lesson is designed to:

- Help students realise that you can use tables to represent real-life problems in linear patterns.
- Aid students to examine tables and come up with a mathematical expression to represent the pattern.
- Help students to understand that in patterns some things remain constant while other things change.

### 8. Flow of the Unit:

**This unit is an Introduction to Patterns.**

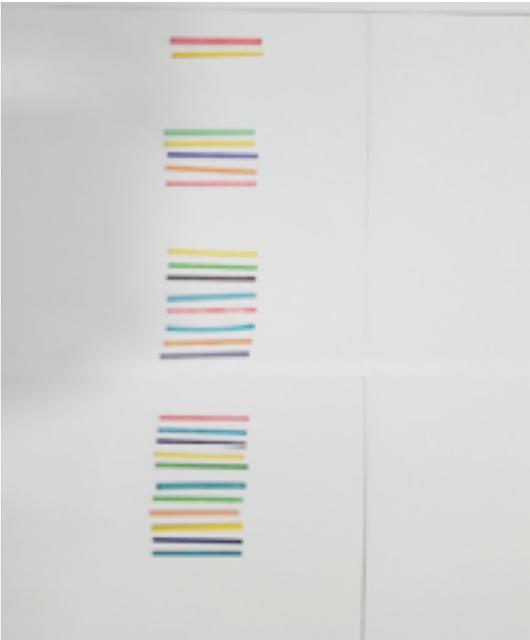
Lesson		# of lesson periods
	These lessons will involve students in investigating and understanding:	8 × 35 min lessons
	<i>The use of diagrams and manipulatives to introduce linear patterns.</i>	<b>Research Lesson</b>
	<i>How to generalise and explain patterns and relationships in words and numbers.</i>	
	<i>How to use patterns to make predictions about what comes next.</i>	
	<i>Use tables and graphs to represent and analyse patterns (e.g. matchsticks) to introduce the concepts of variables and constants.</i>	
	<i>The use of the Junior Certificate Teaching and Learning Plan on Introduction to Patterns in particular the Money Box problem to identify variables and constants.</i>	
	<i>How to develop and use their own generalising strategies and ideas and consider those of others.</i>	
	<i>How to present and interpret solutions, explaining and justifying methods, inferences and reasoning.</i>	
	<i>How to write arithmetic expressions for particular terms in a sequence, linear only.</i>	

## 9. Flow of the Lesson:

<b>Teaching Activity</b>	<b>Points of Consideration</b>
<p>Students are presented with matchsticks and 4 stages of the following arithmetic sequence 2, 5, 8, 11</p> <p style="text-align: center;"><b><u>Part 1 of Lesson Plan</u></b></p> <p><b>1. Problem Posed:</b></p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"><p>Arrange the matchsticks to present the numbers 2, 5, 8, 11 in as many different ways as possible</p></div>	<p>Is the problem posed clear to the students?</p>
<p><b>2. Students work on the Problem individually</b></p> <p style="text-align: center;"><b>Anticipated Student's Responses to Problem 1</b></p> <p><u>Student 1</u></p> 	<p>Teacher circulates the room to assess students' work in preparation for Board Work.</p> <ul style="list-style-type: none"><li>➤ Can students arrange the matchsticks to present the pattern of numbers?</li><li>➤ The word "pattern" is not to be used by the teacher.</li><li>➤ Do students recognise the presence of a pattern?</li><li>➤ Can students explain what a pattern is?</li></ul>

➤ Do students understand that a pattern is predictable?

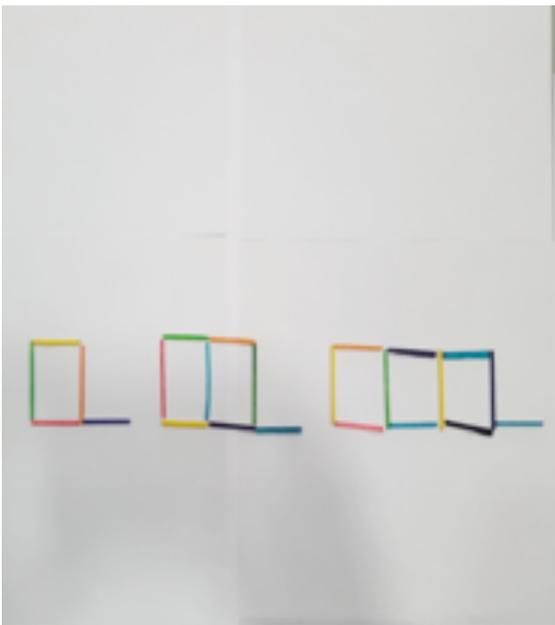
Student 2



Student 3



Student 4



Student 5



Student 6



**3. Comparing and Discussing**

Teacher summarises as each student presents their work.

<p>Students present their work at the board to their peers explaining how they have arrived at their pictures.</p> <p>Students may find it difficult to explain their reasoning / thinking.</p>	<p>Can students explain their reasoning behind the patterns they created?</p> <p>Do students work together effectively in completing the task?</p> <ul style="list-style-type: none"> <li>➤ Have students come up with the term pattern themselves?</li> <li>➤ Do students offer different ways of looking at the pattern?</li> <li>➤ Are students comfortable explaining their thinking?</li> </ul> <p>Ensure that students are given time to explain their approach to the problem.</p>
<p style="text-align: center;"><b><u>Part 2 of Lesson</u></b></p> <p><b>1. Problem Posed</b></p> <p>The teacher reminds the class that patterns are predictable in some way and poses the next problem</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p>Can you come up with a mathematical sentence to explain how you get from one stage to the next using maths symbols.</p> </div>	

Students work on this problem in pairs

### Anticipated Student Responses to Problem 2

Students may find it easier to explain their reasoning using words.

Stage	2 <sup>nd</sup> Stage	3 <sup>rd</sup> Stage	4 <sup>th</sup> Stage
2	$2 + 3$	$2 + 3 + 3$	$2 + 3 + 3 + 3$
2	$2 + 3$	$2 + 6$	$2 + 9$
2	$2 + 2 + 1$	$2 + 2 + 2 + 2$	$2 + 2 + 2 + 2 + 2 + 1$
2	$2 + 3$	$2 + 2(3)$	$2 + 3(3)$
2	$2(2) + 1$	$4(2)$	$5(2) + 1$
<b>2 + 0(3)</b>	<b><math>2 + 1(3)</math></b>	<b><math>2 + 2(3)</math></b>	<b><math>2 + 3(3)</math></b>

The teacher performs in between desk work in preparation for the classroom discussion.

### 3. Classroom Discussion

The teacher brings the class back together as a group and asks a student to come to the board to write their mathematical sentence.

The teacher asks the class if this is the mathematical sentence they got.

Then the teacher asks students with different variations of the mathematical sentence noticed during in between desk work to come to the board to write up their mathematical sentences and explain to the class how they arrived at them.

- Can students explain their reasoning behind their mathematical sentence?
- Do students work together effectively in completing the task?
- It is important that the teacher supports students in developing their reasoning through suitable questioning.
- The teacher ensures that all correct student responses are on the board.
- Do students offer different ways of looking at the pattern?
- Are students comfortable explaining their thinking?
- Can students identify the constant and variable in the

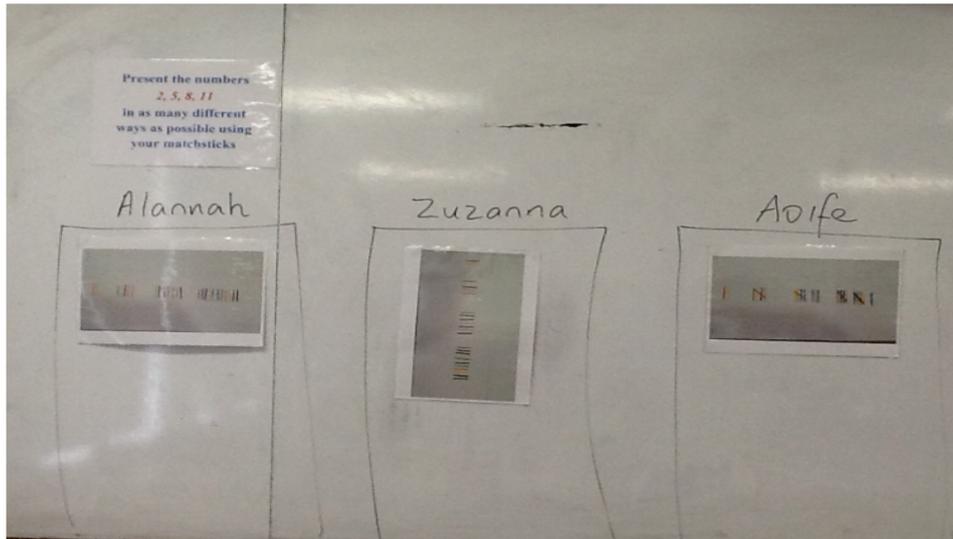
	<p>sequence?</p> <p>It is important that students are given time to explain their approach to the problem.</p>
<p><b>4. Summing Up</b></p> <p>The teacher asks the students to summarise what they have learned in the lesson.</p> <ul style="list-style-type: none"> <li>• Different ways of showing the pattern using matchsticks.</li> <li>• Coming up with the next terms in the sequence.</li> <li>• Coming up with a mathematical sentence to represent any stage in the sequence.</li> <li>• To recognise the constant and variable in the mathematical sentence.</li> </ul>	<ul style="list-style-type: none"> <li>➤ The teacher emphasises the fact that students have solved problems based around patterns.</li> <li>➤ The teacher emphasises that there are many ways to solve such pattern problems and that often one approach is as valid as another.</li> <li>➤ The teacher emphasises the fact that the students solved these problems themselves, with very little help from the teacher.</li> </ul>

**10. Evaluation:**

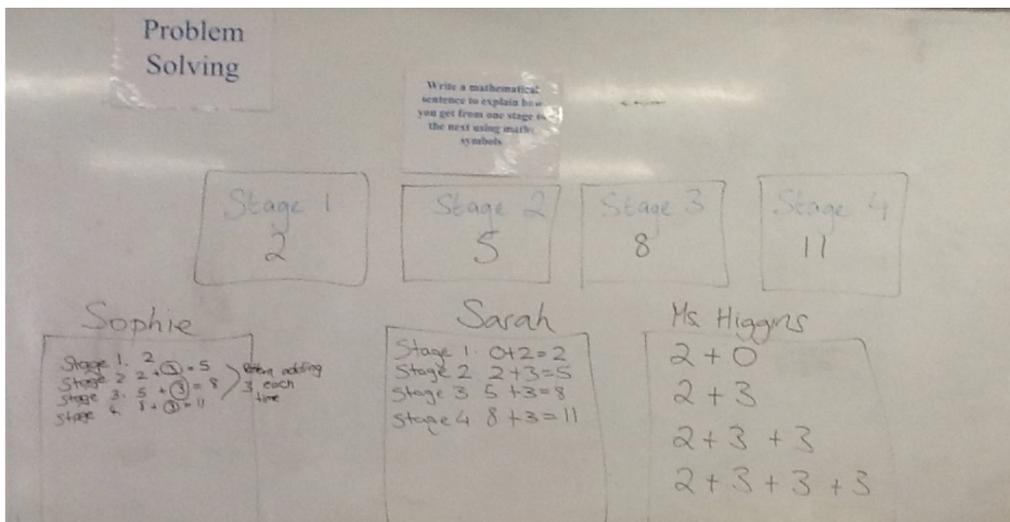
We used the app Lesson Note to observe the lesson being taught this captured all aspects of the classroom from individual work to classroom discussion. This app is free to download on iPads.

## 11. Board Plan from the class taught:

### Problem 1



### Problem 2:



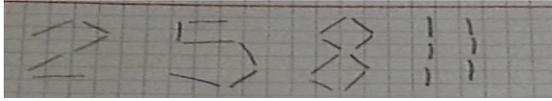
## 12. Post-Lesson Reflection & Evaluation:

Overall this lesson was quite successful as we did achieve our learning outcomes. Our students had absolutely no prior knowledge of Patterns or Algebra.

However when teaching this lesson again we will make some changes to the plan as we identified some misconceptions among the students.

- Students worked individually for Task 1. When posing task one again we would give an

example to the students on how we wanted them to present the given numbers as we saw the student putting the matchsticks together to make the word or the number 2.



- At just 9 minutes from the start of the lesson one student recognised the presence of a pattern and then all students could identify with her discovery.
- The students came up with the basic representations of the number sequence and they used the tally marks to represent the numbers which was no surprise as they had just finished Statistics.
- Students worked in pairs for Task 2. Once each pair came up with one mathematical sentence they stopped. If we were repeating the lesson again we would ask them to try to come up with at least 3 different mathematical sentences. Also we felt paired work did not work for this Task.
- The students realised that the first stage and the common difference were important in their sentence but they failed to come up with the multiples of 3. The teacher had to step in to further the teaching and learning and then one student realised that their multiplication tables were relevant.
- The teacher always referred to each stage of the pattern and never introduced the word term.
- The research lesson concluded with students realising that a pattern revolves around two things, namely the first stage and multiples of the common difference. We had achieved our goal. The next class will be very important.