

Lesson Details	Lesson Study Group
<p>Name of lesson: Simultaneous Shapes</p> <p>Topic: Simultaneous Equations</p> <p>Year group: 2nd year</p> <p>Level: Common</p>	<p>School Name & address: Saint Augustine's College, Dungarvan</p> <p>Advisor: Enda Donnelly</p> <p>Teachers: Rosaleen Curran, Tess Martin, Roisín Feeney, Fergal Walsh, Mags McGrath and Noreen Twohig</p>

Research Theme

Simultaneous equations: Going from the concrete to the pictorial to the abstract.

Background & Rationale

As teachers we feel that simultaneous equations are a recurring problem, which starts in second year but continues into senior cycle. The disappointing standard of student answers for a question on this topic in a recent second year test confirms that this is a worthwhile topic. Students sometimes struggle to make the connection between word sentences, numerical tables, graphs and expressions.

Relationship of the Unit to the Syllabus

Prior Learning	Current Learning	Future Learning
<p>Solving linear equations</p> <p>Graphing linear functions</p>	<p>Coordinate geometry</p> <p>Linear patterns</p> <p>Simultaneous equations</p>	<p>3 variable simultaneous equations</p> <p>Linear and quadratic simultaneous equations (including coordinate geometry of the circle)</p>

Goals of the Unit

Students will develop a variety of strategies to solve simultaneous equations and understand the relationship between the equations and graphs

Unit Plan

Lesson	Brief overview of lessons in the unit
1	Problem(s) using <u>concrete</u> manipulatives e.g. lego, coins... Trial & improvement and elimination could be used by students Tables? Graphs? GeoGebra or Desmos
2 (Research lesson)	Sim equations with <u>pictures/symbols</u> Students must explain their thinking $\triangle + \triangle + \triangle + \square = 25$ $\triangle + \triangle + \square = 18$ Going from pictures to algebra? $3T+S=25$ and $2T+S=18$ Using a variety of techniques to solve Could students make up their own problems?
3	Solving <u>abstract</u> simultaneous equations algebraically
4	Solving <u>abstract</u> simultaneous equations algebraically including writing expressions and possibly linking back in with graphs
5	Putting it all together. Problem solving - JC level questions

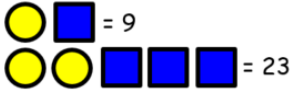
Goals of the Lesson

Students will be able to work with 2 variables and go from the concrete to the pictorial. Students will be able to solve for each variable using a variety of strategies including trial and improvement and elimination.

Flow of the Lesson

Timing, activities, steps, resources, problems	Teacher support, activity	Assessment, questions, comments, strategies

<p>Can you solve it (one or 2) algebraically?</p> <p>Summary</p> <p>If time allows (or homework)</p> <p>Can students make their own problem and ask their partner to solve it?</p>	<p>Allow ~5 mins student work and ~5 mins teacher led discussion.</p> <p>Explain how we've moved from concrete → pictorial → abstract</p>	
<p>2 minutes intro</p>	<p>Explain that yesterday was working with concrete materials, today we're going to develop this further by using pictures.</p>	
<p>5 minutes pair work (first question on sheet):</p> <p>$\blacktriangle + \blacktriangle + \blacktriangle + \square = 25$</p> <p>$\blacktriangle + \blacktriangle + \square = 18$</p> <p>Find the value of a triangle and a square</p> <p>5 minutes teacher-led class discussion.</p>	<p>Teacher observation.</p> <p>Prompt struggling students to trial and improvement</p> <p>Teacher observes and highlights a correct response/responses ~5mins</p> <ol style="list-style-type: none"> 1. Trial and error 2. Subtract one line from the other 3. Use "algebra" - <ul style="list-style-type: none"> $3T + S = 25$ $2T + S = 18$ and solve <p>Highlight this good work if observed</p>	<p>Possibly showcase 2 methods for solving this on the board or on mini whiteboards</p> <p>How can we use "algebra" to replace the pictures?</p>

	Use magnetic resources to work through method 2 and leave on the board.	
<p>“Harder” Question (Q4)</p> 		

Evaluation of Lesson

The student whiteboards worked well in “making learning visible”. They helped the teacher quickly see how the students were progressing and allowed students work together and see how others were tackling the problems.

Some pairs communicated and worked very well together.

Further work is needed with some students to move them on from “trial and improvement” and the next few lessons planned in the unit will be needed to consolidate ideas from this lesson, to practice dealing with algebraic equations with variables and to strengthen the links with graphs.

Students were challenged to solve pictorial simultaneous equations. The equations got progressively more complex and required different techniques to solve them.

The thought given to planning for the wide range of student abilities meant there was sufficient challenge for every student.

We would like to teach the lesson again to a different group with a few tweaks to improve student learning.

Summary of Key Learning

Meeting 1	Simultaneous equations agreed as the topic.
Meeting 2	<p>Briefly looked at a second year question asking students to find the point of intersection of ...</p> <p>The group would like to:</p> <ul style="list-style-type: none"> • use concrete materials to make it less abstract(CPA) • help the students make links between the words, equations and graphs

	<ul style="list-style-type: none"> help the students understand the mathematical language involved <p>Fergal suggested the method of expressing both equations as $y = \dots$ and equating the expressions to solve for x could help</p>
Meeting 3	Recapped previous meeting. Looked at JC syllabus docs and discussed goals of the unit. Worked on a unit plan of approx. 5 lessons. Considering working with lesson 2 as the research lesson
Meeting 4	Recapped previous meeting. Defined goals for research lesson. Looked at activity for lesson 1 in the unit, then planned in detail lesson 2. Proposed Research Lesson Date 7th March
Meeting 5	Planned resources for the lesson. Detailed timing for the lesson. Considered how student ownership will be developed in the lesson. Discussed whether all maths teachers are using the scaffold/balancing method for solving equations.

Final Reflection

The collaborative lesson study meetings gave us an opportunity to discuss the methods we teach our students e.g. solving linear equations and the pros and cons of different methods.

We would be interested in collaborating on algebraic fractions or trigonometry in the future.

Lesson study made us think about how to get students to do more for themselves.

The research lesson was a great chance to look closely at how the students are getting on.

Our discussions in lesson study meetings reminded us that we need to plan for more student-led (rather than teacher-led) lessons”

Lesson study works well for a group of Maths teachers but it could also be an effective way of other subject teachers collaborating on planning and could be part of our school SSE work.

Appendix - Some of the maths activities used.

Throughout, each question is separate, so for example a square can be different values in different questions.

Section A - find the value of each shape

a) $\triangle \triangle \triangle \square = 25$
 $\triangle \triangle \square = 18$

b) $\bigcirc \bigcirc \text{cloud} = 16$
 $\bigcirc \bigcirc \text{cloud} \text{cloud} = 28$

c) $\star \text{cross} = 10$
 $\star \star \star \text{cross} = 22$

d) $\text{cross} \square = 11$
 $\text{cross} \text{cross} \text{cross} \square = 27$

Section B - find the value of each shape

a) $\bigcirc \square = 9$
 $\bigcirc \bigcirc \square \square \square = 23$

b) $\triangle \triangle \star = 16$
 $\triangle \star \star \star = 18$

c) $\text{cross} \text{cross} \text{cross} \text{cloud} = 10$
 $\text{cross} \text{cloud} \text{cloud} \text{cloud} = 22$

d) $\square \text{cross} \text{cross} = 5$
 $\square \square \text{cross} = 13$

Section C - find the value of each shape

a) $\square \square = \triangle$
 $\triangle \square = 15$

b) $\text{cloud} \text{cloud} = \bigcirc \bigcirc \bigcirc$
 $22 = \text{cloud} \text{cloud} \text{cloud} \bigcirc$

c) $\star \star \star = 9 + \text{cross}$
 $\text{cross} \text{cross} = 7 + \star$

d) $\triangle \triangle \bigcirc = 5$
 $\triangle \bigcirc \bigcirc = 2$