

Lesson Details	Lesson Study Group
<p>Name of lesson: Top Dog Area</p> <p>Topic: Problem Solving (Algebra & Applied Measure</p> <p>Year group: 5th Year</p> <p>Level: Ordinary Level</p>	<p>School Name & address: Coláiste Pobail Setanata, Phibblestown, Clonee, Dublin 15</p> <p>Associate: Mairéad O'Rourke</p> <p>Link Advisor: Marilyn O'Riordan</p> <p>Teachers: Liam Nielsen, Alan Gaul, Hannah Cassidy, Frances Shannon, Mairéad O'Rourke</p>

Research Theme
<p>This year our school is in a review year of SSE.</p> <ul style="list-style-type: none"> • Our requirements this year are to: • Look at the impact of COVID-19 on the motivation and engagement of our students- relevant supports for all students including SEN and at-risk students. • Consider what will be needed to initiate a wellbeing promotion review and development cycle by 2025. • Take stock of the effectiveness of the SSE process in CP Setanta to date- is it collaborative, inclusive and impactful. <p>Lesson Study provides us with an opportunity to focus on these requirements as a department.</p>

Background & Rationale
<p>From discussing the 2015 chief examiners report and meetings of our own department, the maths teachers feel that students have difficulty with questions which required them to use their prior knowledge and multiple strands of the syllabus at once. We have redesigned our schemes to units of learning while planning for the new Junior Cycle. We believed this would provide opportunities for students to apply the skills and knowledge from one strand to another strand and</p>

remove the aspect of our schemes which compartmentalised the strands into chapters rather than the continual flow that lies in the Maths curriculum. While compartmentalising knowledge may help keep it organised we have seen how it restricts the ability to cope with unfamiliar questions, particularly those requiring the synthesis of knowledge and skills from several strands.

Students should be encouraged to persevere in these types of question, if the initial attempt does not work, they should be prepared to try the question a different way. Based on our discussions and research findings we have chosen to base our unit and research lesson on creating a more productive approach in our teaching to help develop students problem solving skills and have students make links between abstract concepts like algebraic expressions to familiar everyday problems such as area and volume of shapes.

During our discussions we identified many problems our students face: 1. While students can often handle questions well when given at least some dimensions, we recognise that they regularly have difficulties thinking/working with variables particularly in the area of problem solving in geometry. 2. Problem solving tasks that require students to activate mathematical thinking processes. 3. Students often display difficulties in applying their knowledge and skills to solve problems in unfamiliar contexts.

Relationship of the Unit to the Syllabus

Prior Learning	Current Learning	Future Learning
<ul style="list-style-type: none"> Familiar with algebra, area and volume of regular and irregular shapes from Primary school. Limited knowledge due to COVID and remote teaching. 	<ul style="list-style-type: none"> The general problem solving skills acquired in this unit can be applied across all strands of the syllabus at Senior Cycle, and on to further study of Mathematics. 	<ul style="list-style-type: none"> Co ordinate geometry the line: area of a triangle and area of shapes constructed by points and lines. Draw and interpret scaled diagrams. Functions and graphing functions.

<ul style="list-style-type: none"> JC Strand: <p>Number systems Use the binary operations of N, Z, Q and R/Q. Appreciate the Order of Operations.</p> <ul style="list-style-type: none"> JC Strand: Applied Measure <p>Model real world situations and solve a variety of problems involving surface areas, and volumes of cylinders, spheres, cones and prisms.</p> <p>Strand: Algebra: Factorising and solving expressions/ equations.</p> <ul style="list-style-type: none"> Students will be able to develop and re-enforce their problem-solving skills. Students should be able to: Apply their knowledge and skills to solve problems in 	<ul style="list-style-type: none"> Recognize the difference between 2D and 3D. • Investigate the nets of cubes, cuboids and prisms. • Draw the nets given their dimensions. • Construct 3D models from nets. • Calculate the surface area and volume of cubes and cuboids. Modelling real-world situations and solving a variety of problems (including multi-step problems) involving surface areas, and volumes of cylinders and rectangular solids. Select and use suitable strategies to estimate the area of a combination of 	<ul style="list-style-type: none"> Reading and interpreting graphs in functions.
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<p>familiar and unfamiliar contexts.</p> <ul style="list-style-type: none"> Students should be able to explain why the procedures they apply are mathematically appropriate. Students should be able to devise, select and use appropriate mathematical models, formulae or techniques to process information in a questions and draw relevant conclusion from it. <p>Analyse a problem and break it down into manageable steps, reflect on their used.</p> <p>The general problem solving skills acquired in this unit can be applied across all strands of the syllabi at Junior Cycle.</p>	<p>regular and irregular shapes.</p>	
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Goals of the Unit

- Solving real life problems
- Develop their problem solving skills
- Making links between abstract concepts, algebraic expressions to familiar area and volume shapes.
- Tackling problems using prior knowledge and using strategies already taught.

Unit Plan

Generalising and Solving Real World Problems

Algebraic expressions, equations, area and volume.

Algebra 1 (simplifying expressions), Algebra 2 (solving linear equations), Applied Measure

Students have been taught a lot from the algebra and trigonometry strand prior to beginning applied measure (area & volume). We hope students will draw on this knowledge and identify the connection when using shapes.

Lesson	Brief overview of lessons in the unit
1	Revise perimeter and area of regular shapes from the Junior Cycle curriculum. (square, rectangle, circle, parallelogram)
2	Revise area of a triangle, make links with trigonometry knowledge and Pythagoras theorem.
3	Calculate the area and perimeter of irregular shapes and trapeziums
4	Recap on circles. Learn how to calculate the area of a sector and length of an arc. Make links to everyday life and be able to explain their differences
5	Research Lesson: deduce different shapes from a word problem using different area and perimeter formulas. Make reference to trigonometry and generalisation using algebraic notation.
6	Calculate cross sectional areas of shapes and calculating volume using a third dimension.

Goals of the Lesson

Students will be able to write more than 3 possible solutions to the task.

Students will be able to draw on prior knowledge of area and perimeter of shapes when answering the questions.

Students will learn that when calculating area of enclosures that it's not just rectangular that other shapes can give larger areas.

Students will be able to use images to explain their workings.

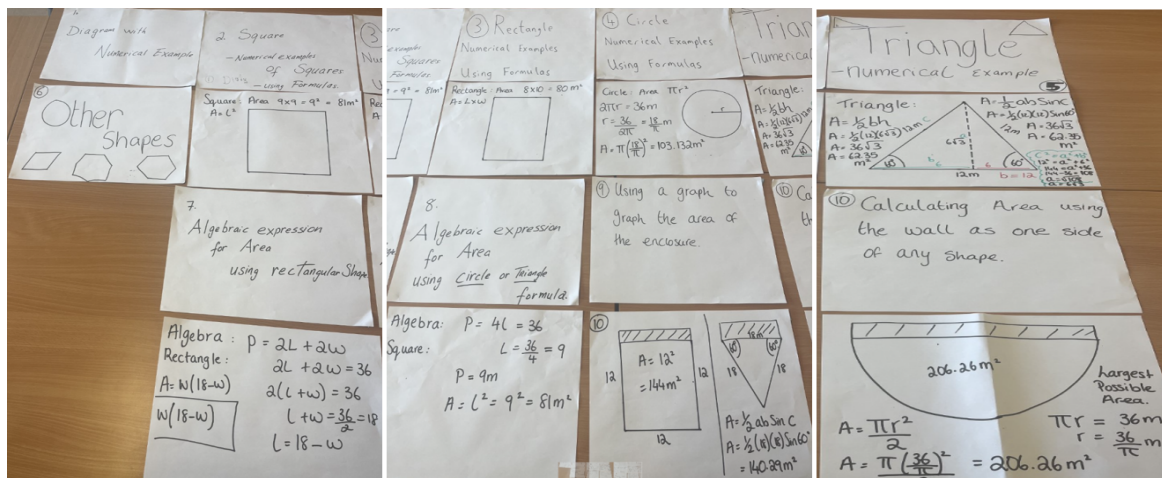
Flow of the Lesson

Timing, activities, steps, resources, problems	Teacher support, activity	Assessment, questions, comments, strategies
<p>Introduction (5 mins)</p> <p>Quick recap over learning to date.</p> <p>Pose the problem task.</p> <p>Students work individually for 15 minutes.</p>	<p>Mind map over learning to date on shapes.</p> <p>Teacher writes all notes on one note for students.</p>	<p>Assess knowledge on topic so far.</p>
<p>Students can then work in groups at their table to discuss and see if anyone beside them came up with a different solution 5-10 minutes. Discussion solutions and how they are valid.</p>	<p>Introduce and hand out problem task. Walk around groups observing their answers and approach to the question.</p>	<p>Students using their problem solving skills to answer the questions in as many ways as possible. Observe student work.</p>
<p>Ceardaíocht of student responses 20-25 mins: Rectangle, square, circle triangle, using the wall as</p>	<p>Ask students to present their solutions to the class in an ordered fashion and explaining reasons for choosing that way.</p>	<p>Assessment of student work and they will be asked to justify their work to the class.</p>

<p>a fourth side so only 3 needed for fencing.</p> <p>Other solutions hexagon, triangle against the wall</p> <p>So only 2 sides of fence needed etc.</p>		
<p>Plenary (8 mins)</p> <p>Recap over learning today. 2 stars 1 wish</p> <p>Were the objectives achieved and give homework questions.</p>	<p>Recap over learning and objectives for students in today's class by asking questions.</p> <p>Have students write 2 stars and a wish on their exit slips and scale learning for today.</p>	<p>AFL: 2 stars and a wish/exit slips to see where student learning is.</p> <p>Students scale their learning of today using traffic lights in their journals.</p>

Board Plan

Problem Task Question: Student Council want you to design a play area for our new therapy dog in the school garden. 36 meters of fencing was bought , and they want you to make the biggest play area possible. What are your options and which side lengths should they choose for the play area?



Evaluation of Lesson

Students achieved the goal of the lesson in attempting at least three possible solutions.

It was interesting to see that many students thought that the area needed to be 36, and not the perimeter.

We were very surprised that a lot of students tried to use compound shapes.

Students successfully made links from their trigonometry knowledge to calculate the area of a triangle using the area formula.

As we had expected very few students made links with their algebraic knowledge in writing.

As expected all students used diagrams to explain their workings.

All students used the formulas they were familiar with using when answering the task. Students used their formula page to help them.

Summary of Key Learning

Meeting 1	Teacher student time in class to teach the skills we would like is a problem. Would like to have more time to explore concepts through problem solving. Hopefully with the skills we will teach and help students develop will encourage them to use their skills and answer more problem solving questions.
Meeting 2	Review schemes of work to facilitate how we will teach the unit plan. Regarding time in class as it won't change we hope with recalling prior knowledge and creating as many opportunities for problem solving it will encourage students to attempt more problems. Over the past number of years we have noticed less students are trying more challenging problems. We would like to identify why this is happening? COVID?, interest?, knowledge?, confidence? Past experiences in Maths?
Meeting 3	During our meeting we changed group from a junior cycle class to a senior cycle class. We concluded that the skills we wished for our junior students to develop also apply to our senior cycle students. This group of students struggle with abstract concepts and algebra so we hope this approach will help them realise that what they view

	as abstract can be applied to familiar shapes and give them more confidence in their mathematical ability.
Meeting 4	When writing up possible solutions to our problem task it was interesting to see how drawing on knowledge from algebra and trigonometry will help students come up with more potential solutions. First time we have taught trigonometry with this unit so will keep it as part of our plans moving forward as students can make links to calculating area of triangles in more than one way.
Meeting 5	We have been enjoying having professional and meaningful mathematical conversations which we wouldn't usually get time for. Developing a bank of problem solving styled questions suited to our unit of learning have also helped us develop suitable resources for students in class.

Final Reflection

One of the many benefits of lesson study is getting to work with colleagues during school based CPD. In a busy school, time is always an issue. However, lesson study gave us the opportunity to use our CPD to have conversations about our students' misconceptions in Maths and their problems with particular topics. Lesson study also provided us with the platform to work together to design and create questions and tasks specifically to challenge our students in the areas we feel they need most support.