

Lesson Details	Lesson Study Group
Name of lesson: Missing in Action Topic: Algebra Year group: First Years Level: Mixed Ability	School Name & address: Tyndall College Carlow Associate: Bernadette Flanagan Link Advisor: Enda Donnelly Teachers: Angela Keating, Deirdre Fitzgerald, Nicola Phelan, Paula Kennedy, Ann DeVries.

Research Theme

We want our students to (i) engage purposefully in meaningful learning opportunities and (ii) reflect on their progress as learners and develop a sense of ownership of and responsibility for their learning (*Looking at Our School 2022 – A Quality Framework For Post-Primary Schools p.25*). Our engagement in the Lesson Study process demonstrates our ability to (i) select and use teaching approaches appropriate to the learning intentions and to student's learning needs on a daily basis and (ii) value and engage in professional learning and professional collaboration (*Looking at Our School 2022 – A Quality Framework For Post-Primary Schools p.25*) in pursuit of such standards.

Background & Rationale

This lesson is aimed at First Year students. The lesson seeks to address the common misunderstandings, misinterpretations and misconceptions often encountered by students when writing mathematical equations from given word problems. Building on their work in the Number strand students will generalize their observations, expressing, interpreting and justifying general mathematical statements in words and in symbolic notation. They will use the idea of equality to form and interpret equations and the syntactic rules of algebra to transform expressions and solve equations. Emphasis will be placed on helping students to get used to describing, explaining and justifying their method for doing this.

Relationship of the Unit to the Syllabus

Prior Learning	Current Learning	Future Learning
Number Strand: In particular, students will have an understanding of the different aspects of Number including different representations of numbers and the connections between them, as well as the properties and relationships of binary operations.	Building on their work in the Number Strand, students will generalise their observations, expressing, interpreting, and justifying general mathematical statements in words and in symbolic notation. They will use the idea of equality to form and interpret equations, and the syntactic rules of algebra to transform expressions and solve equations.	Students will explore and analyse the relationships between tables, diagrams, graphs, words, and algebraic expressions as representations of functions.

Goals of the Unit

This unit is intended to help students to:

AF.2: investigate situations in which letters stand for quantities that are variable so that they can:

- Generate and interpret expressions in which letters stand for numbers
- Find the value of expressions given the value of the variables.

Knowledge	Students should know: <ol style="list-style-type: none"> How to represent unknown numbers using symbols or letters That when an expression contains more than one operation, we follow BIRDMAS
Skills	Students should be able to: <ol style="list-style-type: none"> Find the value of an expression by substituting in given numbers for letters

	2. Translate an expression into an English statement and vice versa.
Understanding	Students should understand: 1. The meaning of the words: variable, term, expression, like/unlike terms, constant and coefficient.
Value	Students should appreciate: 1. The use of letters in formulae they would have come across, such as area, volume etc.

c. Use the concept of equality to generate and interpret equations.

AF.4: Students should be able to select and use suitable strategies (Graphic, numeric, algebraic, trial and improvement, working backwards) for finding solutions to:

a. Linear equations in one variable with coefficients in Q and solutions in Z.

Knowledge	Students should know: 1. The mathematical meaning of English words that appear in problems.
Skills	Students should be able to: 1. Use the balancing method to solve an equation 2. Translate an equation into a word problem and vice versa.
Understanding	Students should understand: 1. That they need to use the skills they learnt in other areas of algebra in order to simplify and solve linear equations.
Value	Students should appreciate: 1. That being able to solve an equation is a fundamental mathematical skill that will be used in all other strands.

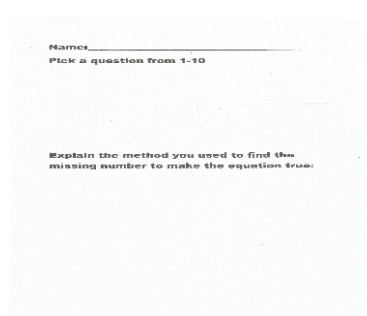
Unit Plan	
Lesson	Brief overview of lessons in the unit
1	Students will investigate situations in which letters stand for quantities that are variable so that they can: <ul style="list-style-type: none"> a. Generate and interpret expressions in which letters stand for numbers
2	<ul style="list-style-type: none"> a. Find the value of expressions given the value of the variables. b. Introduction/use of the syntactic rules of algebra
Live Lesson	<ul style="list-style-type: none"> a. Use the concept of equality to generate and interpret equations. b. apply the properties of arithmetic operations to generate equivalent expressions so that they can select and use suitable strategies (numeric, algebraic) for finding solutions to: <ul style="list-style-type: none"> i. Linear equations in one variable with coefficients in \mathbb{Q} and solutions in \mathbb{Z}.
4	<ul style="list-style-type: none"> a. apply the properties of arithmetic operations to generate equivalent expressions so that they can develop and use appropriate strategies to: <ul style="list-style-type: none"> 1. add, subtract and simplify <ul style="list-style-type: none"> i. linear expressions in one or more variable with coefficients in \mathbb{Q}
5	<ul style="list-style-type: none"> ii. quadratic expressions in one variable with coefficients in \mathbb{Z}
6	Multiply expressions of the form <ul style="list-style-type: none"> a. $a(bx+cy+d)$ where $a, b, c, d \in \mathbb{Z}$
7	<ul style="list-style-type: none"> b. $(ax+b)(cx+d)$ where $a, b, c, d \in \mathbb{Z}$
8	Divide quadratic expressions by linear expressions, where all coefficients are integers and there is no remainder

Goals of the Lesson

This lesson is intended to help students to:

1. Build on their work in the Number strand.
 2. Generalize their observations, expressing, interpreting and justifying general mathematical statements in words and in symbolic notation.
 3. Use the idea of equality to form and interpret equations.
 4. Use the syntactic rules of algebra to transform expressions and solve equations.
 5. Describe, explain and justify their method for doing this.
 6. Investigate situations in which letters stand for quantities that are variable so that they can:
 - a. generate and interpret expressions in which letters stand for numbers
 - b. find the value of expressions given the value of the variables
 - c. use the concept of equality to generate and interpret equation (AF. 2)
 Select and use suitable strategies (graphic, numeric, algebraic, trial and improvement, working backwards) for finding solutions to:
 - a. linear equations in one variable with coefficients in \mathbb{Q} and solutions in \mathbb{Z} or in \mathbb{Q} (AF. 4)
- (Junior Cycle Mathematics, 2017 pp.18-19)

Flow of the Lesson

Timing, activities, steps, resources, problems	Teacher support, activity	Assessment, questions, comments, strategies
<p>Lesson 58 mins.</p> <p>At the beginning of the lesson students are given a handout containing all the tasks to be completed.</p> <p>Task 1 (a)</p> <p>Find the missing number to make the following equations true</p> <p>Task 1 (b)</p> <p>Pick a question from 1-10</p>	<p>At the beginning of the lesson students are given a handout containing all the tasks to be completed.</p> <p>Teacher talks the students through all the tasks to be completed. As each task is completed and following observation students are invited to display their work on the</p>	<p>At the beginning of the lesson students are given a handout containing all the tasks to be completed.</p> 

Explain the method you used to find the missing number to make the equation true.

Task 2 (a)

Using the variable n to represent the unknown number translate an English statement into an expression in maths

Task 2 (b)

Pick a question from a-h

Explain the method you used to find the missing number to make the equation true.

Task 3 (a)

Write an equation for each of the following English statements (Use the variable z to represent the unknown number

Task 3 (b)

Pick a question from 1-5
 Explain the method you used to find the missing number to make the equation true.

Task 4

Matching Exercise

Match the English statement with the

board and to explain their method used in arriving at their solution.

Name: _____

Using the variable n to represent the unknown number

1. I think of a number and call it n . What number is

- 2 bigger than n _____
- 3 less than n _____
- 14 more than n _____
- Twice n _____
- Five times n _____
- Half of n _____
- A quarter of n _____
- 2 greater than twice n ? _____

Name: _____

Pick one question from a-h above. _____

Explain the method you used. _____

Name: _____

Write an equation for each of the following. Use the variable z to represent the unknown number.

- I think of a number. I add 6. The result is 12. _____
- I think of a number. I subtract 7. The result is 10. _____
- I think of a number. I double it. The result is 14. _____
- I think of a number. I double it and then add 8. The result is 19. _____
- I think of a number. I triple it and subtract 6. The result is 15. _____

Name: _____

Pick a question from 1-5 above. _____

Explain the method you used to find the equation. _____

mathematical expression
and/or vv.

Task 5 (a)

You are given the

equation $z+6=12$.

Complete the table below
by changing only the
variable each time. (Hint:
there are 25 more ways to
write this equation)

Task 6 (a)

Write an equation to
match the situation:

Ms. Kennedy's class is
selling sweets for a
fundraiser. The class has
a goal of raising €450 for
selling c boxes of sweets.
Each box of sweets costs
€3.75.

Equation: _____

Task 6 (b)

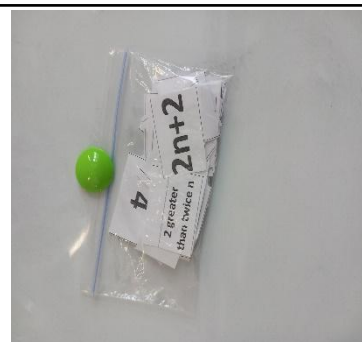
Explain your method for
doing this.

Task 7 (a)

Using the equation you
formed in the previous
task find the value of the
variable.

Task 7 (b)

Explain what your answer
means.



$z + 6 = 12$

Name: _____

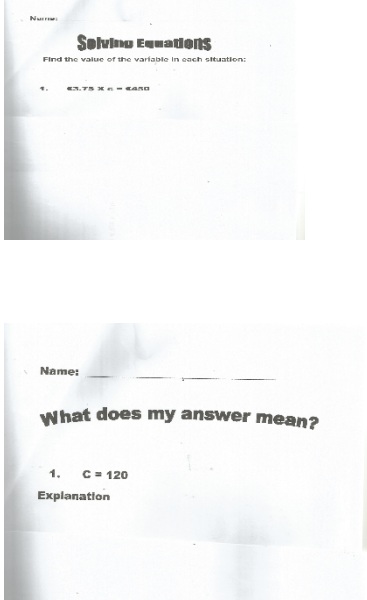
Writing One Step Equations

Write an equation to match each situation:

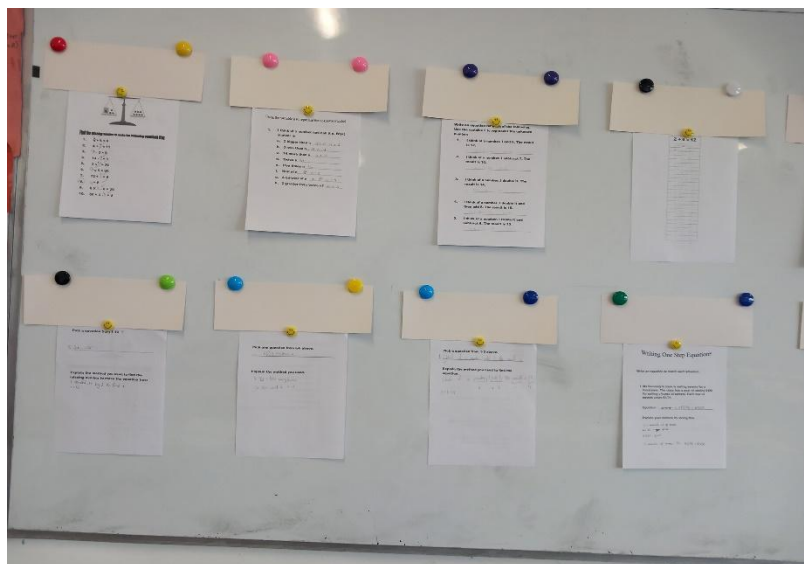
1. Ms Kennedy's class is selling sweets for a fundraiser. The class has a goal of raising €450 for selling c boxes of sweets. Each box of sweets costs €3.75.

Equation: _____

Explain your method for doing this.

<p>Follow up Exercises assigned for H/W.</p>		
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Board Plan



Evaluation of Lesson

On balance, we concluded that the Lesson Study process appeared to be beneficial to student outcomes. Consideration of the students' reflection on the

lesson further strengthened our conclusion. Students noted that they felt more confident in their ability to write and solve equations. In addition, students pointed to feeling included in the class and having their opinion heard and taken into account. Students also commented on the pace of the lesson, with some pointing out that it was fast but manageable. Notably, all students expressed satisfaction following engagement in the matching exercise where they sought to match word problems with the relevant mathematical expressions and equations.

Overall, we felt it was a very busy lesson. Students were occupied for the entire lesson and the momentum to keep moving forward was maintained throughout the lesson. Although students did complete the matching exercise within the time allocated they did nonetheless express their desire to spend more time doing this type of exercise in the future.

Final Reflection

During the reflection stage we sought to reflect how each activity elicited the sought after change as detailed in the goals of the lesson above. On balance, we concluded that the Lesson Study process appeared to be beneficial to student outcomes. Consideration of the students' reflection on the lesson further strengthened our conclusion. Students noted that they felt more confident in their ability to write and solve equations. In addition, students pointed to feeling included in the class and having their opinion heard and taken into account. Students also commented on the pace of the lesson, with some pointing out that it was fast but manageable. Notably, all students expressed satisfaction following engagement in the matching exercise where they sought to match word problems with the relevant mathematical expressions and equations.

Write an equation to match each situation:

1. Ms Kennedy's class is selling sweets for a fundraiser. The class has a goal of raising €450 for selling c boxes of sweets. Each box of sweets costs €3.75.

Equation: _____

Explain your method for doing this.

2. Jack is building a playpen for his dog. The area of the playpen is 24 square meters. The length is 6m and the width is w meters.

Equation: _____

Explain your method for doing this.

3. Molly has saved €27.50 of her pocket money. She bought her brother an ice-cream for €2.50 and has € d left.

Equation: _____

Explain your method for doing this.

4. CJ and Ben ran a total of 10 km. CJ ran 4 km and Ben ran m km.

Equation: _____

Explain your method for doing this.

5. Patrick received €278.25 in his pay check for working h hours this week. The rate per hour is €13.25.

Equation: _____

Explain your method for doing this.

Find the value of the variable in each situation:

1. $€3.75 \times c = €450$

2. $6m = 24$

3. $€27.50 - €2.50 = d$

4. $m \text{ km} + 4 \text{ km} = 10 \text{ km}$

5. $€13.25 \times h = €278.25$

I think of a number and call it n . What number is

- a. 2 bigger than n _____
- b. 3 less than n _____
- c. 14 more than n _____
- d. Twice n _____
- e. Five times n _____
- f. Half of n _____
- g. A quarter of n _____
- h. 2 greater than twice n ? _____

Pick one question from a-h above.

Explain the method you used.

Write an equation for each of the following. Use the variable z to represent the unknown number:

1. I think of a number. I add 6. The result is 12.

2. I think of a number. I subtract 7. The result is 10.

3. I think of a number. I double it. The result is 14.

4. I think of a number. I double it and then add 5. The result is 19.

5. I think of a number. I treble it and subtract 6. The result is 15.

Pick a question from 1-5 above.

Explain the method you used to find the equation.

Matching Activity

2	6	8	72	8	9
4	7	11	24	4	6
12	3	9	6	6	30
14	13	1	30	3	4
3	9	36	6	÷	÷
12	5	60	÷	6	6

$n+2$	$n-3$	$n+14$	$14-\square=1$	$3\times\square=36$	$\square\times5=60$
$2n$	$5n$	$2\times n$	$72\div\square=9$	$\underline{\square}=6$	$6\times\square-6=30$
$5\times n$	$\frac{n}{4}$	$\frac{n}{2}$	$30\div3-\square=6$	2 bigger than n	3 less than n
$n\div4$	$n\div2$	$2n+2$	14 more than n	Twice n	Five times n
$\square+6=8$	$4+\square=11$	$\square-3=9$	Half of n	A quarter of n	2 greater than twice n