

Lesson Research Proposal for 1st Years – Integers

For the lesson on Integers

At Coláiste Mhuire, Johnstown

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1. Title of the Lesson: **The Integers Cup – McIlory v Lowry**

2. Brief description of the lesson

In this lesson students will try to solve a problem based on the game of golf. They will use this problem to determine who wins ‘The Integers Cup’. Students are encouraged to use as many different ways as possible to solve the problem.

3. Research Theme

At Coláiste Mhuire Johnstown, we want students to:

- a) Enjoy their learning, are motivated to learn, and expect to achieve as learners.
- b) Reflect on their progress as learners and develop a sense of ownership and responsibility for their learning.

As Mathematics teachers, we will actively support the achievement of these goals by paying attention to the following entry points in my every day classes:

- a) Student enjoyment in learning is evident and arises from a sense of making progress and of achievement. Their engagement with learning contributes to their sense of wellbeing.
- b) Student see themselves as learners and demonstrate this in their positive and reflective approach to classwork and homework.

4. Background & Rationale

1. Why we chose this topic?

The teaching of integers is important subject material from the point of view that it brings together the reality of positive and negative numbers in real world contexts. It is commonly noted that students experience difficulty when dealing with positive and negative numbers and often leads to students not fully understanding how to deal with integers.

Having discussed this topic within our group, there was consensus on the difficulties encountered teaching integers and the negative attitude expressed by students, coupled with high levels of frustration. There was also a ripple effect experienced when students would require the use of integers in other subjects, namely business and science. Therefore, our rationale for choosing this topic and developing strategies to improve the teaching and learning of integers offers opportunities to not only make gains in their maths classes but to carry the skills into other subjects as well as real life situations.

2. Our research findings

Through discussions of members of the Maths department we realise that our teaching of integers may not be delivered in such a way that makes sense to every learner. We do not always give the necessary time to allow students explore and come up with their own way of answering and demonstrating their understanding. We need to convey through our teaching an increased awareness of the importance of integers in real life situations in which they arise. As a result of these shortcomings we have decided to introduce integers using problem solving situations, which will engage the students and motivate them to want to learn, while demonstrating this in a positive and reflective manner. In designing the research lesson we want students to see themselves as learners, enjoy their learning and develop a sense of ownership of and responsibility for their learning.

The lesson proposal will enable students to comprehend integers and give plenty of time to think about the problem and figure it out on your own and move away from procedural teaching.

5. Relationship of the Unit to the Syllabus

Related prior learning Outcomes	Learning outcomes for this unit	Related later learning outcomes
<p>In first through to fourth class students learn to: add and subtract, without and with renaming, within 999 estimate sums and differences (rounding where necessary) check estimates record using horizontal and vertical presentation • know and recall addition and subtraction facts • solve word problems involving addition and subtraction</p> <p>By fifth class, identify positive and negative numbers in context examine and discuss money affairs, video counters and calculator displays, sports reports, golf scores, temperature, sea level and lifts, leading to the need to distinguish between amounts above and below zero refer to positive and negative numbers as ‘positive seven’ and ‘negative three’ record positive and negative numbers with + or – signs raised e.g. +7 –3</p> <p>In sixth class, Identify positive and negative numbers on the number line walk the number line</p>	<p>In 1st year, students deal with operations of addition, subtraction, multiplication and division and the relationships between these operations, beginning with whole numbers and integers. Students will also : -investigate models such as the number line to illustrate the operations of addition, subtraction, multiplication and division in Z -use the number line to order numbers in N, Z, Q (and R for HL) -generalise and articulate observations of arithmetic operations</p>	<p>In 2nd year we review and extend second-year work. Students will: -investigate models to help think about the operations of addition, subtraction, multiplication and division of rational numbers – consolidate the idea that equality is a relationship in which two mathematical expressions hold the same value – analyse solution strategies to problems – engage with the idea of mathematical proof</p>

to experience positive and negative numbers that arise in discussion and/or in context identify and mark positive and negative numbers on personal and class number lines.		
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6. Goals of the Unit

- Students will investigate the number line to illustrate the operations of addition, subtraction, multiplication and division in \mathbb{Z} .
- Students will apply their knowledge of integers in different contexts.
- Students will demonstrate an enquiring and open-minded attitude towards themselves and those around them.

7. Unit Plan

Lesson	Learning goal(s) and tasks
1 The Research Lesson	Research Lesson – problem solving approach to consolidate dealing with Integers in different combinations of operations (e.g. Addition, Subtraction, Multiplication
2	Consolidating the information from research lesson through other real life situations. Definition & Notation. Number line and ordering numbers. Real life context e.g. Temperature, Sea Level, Financial Problems.
3	Developing Multiplication of Positive / Negative integers
4	Applying prior knowledge and patterns to the Division of Positive/Negative numbers
5	Using the order of operations when dealing with Integers (BIMDAS)

8. Goals of the Research Lesson:

a) Mathematical Goals

- Students will learn that there are several ways of solving problems
- Students will gain a conceptual understanding of adding and subtracting integers.

- Students will apply their knowledge gained from real life contexts to mathematical scenarios.

Individual Goals

- Student will improve their pair work & peer tutoring capacity as a result of this lesson.
- Students will increase their participation and enjoyment levels when learning in a Math setting.

b) Key Skills and Statements of Learning

1. Being Literate: Students will have the opportunity to express their ideas clearly and accurately.
2. Being numerate: It will develop a positive disposition towards problem solving.
3. Managing information and thinking: Students will be encouraged to think creatively and critically.
4. Working with others: Students will learn with and from each other.

This lesson is also designed to meet the following JC Statements of Learning in particular:

- 1 The student communicates effectively using a variety of means in a range of contexts.
15. The student recognizes the potential uses of mathematical knowledge, skills and understanding in all areas of learning.
16. The student describes, illustrates, interprets, predicts and explains patterns and relationships.
17. The students devises and evaluates strategies for investigating and solving problems using mathematical knowledge, reasoning and skills.

9. Flow of the Research Lesson:

Steps, Learning Activities Teacher's Questions and Expected Student Reactions	Teacher Support	Assessment
<p>Introduction</p> <p>Brief introduction to the scoring system in Golf.</p> <p>We're going to try to solve the problem by ourselves and then we're going to come together as a class and use all your knowledge to learn something new</p> <p>Now look at today's problem</p>	<p>Demonstrate on the board how to fill out the score card.</p>	<p>Can students fill out each score card correctly?</p>
<p>Posing the Task</p> <p>There are two golfers playing a match on a 9 hole course.</p> <p>Each golfer marks their own card.</p> <p>Neither knows how the other got on.</p> <p>It's up to you to announce the winner. Find out in as many ways as possible who won the 'Integers Cup'</p> <p>Let's go through the problem to make sure everybody understands it.</p> <p>I want you now to work on the problem individually and then share with your partner your work</p>	<p>Present an image of the golf course on the board with the score of each hole outlined</p> <div data-bbox="850 1310 1029 1509" data-label="Image"> </div> <p>Provide the students with a copy of a scorecard for each player. (below)</p> <p>Explain to students that they must work in pairs & write their outcomes on the white board.</p>	<p>Do students understand the task?</p> <p>Do students understand the scoring rules?</p> <p>Are students eager to solve the problem?</p> <p>Is each student able to</p>



HOLE	1	2	3	4	5	6	7	8	9
SHOTS	5								
PAR	4	4	3	5	4	4	5	3	4
SCORE	+1								

Student Individual Work

Student Responses 1-5

1. Matching all the opposite terms together to create zero. Whatever is left over at the end will be the overall score

$$-2 + 2 = 0$$

$$-1 + 1 = 0$$



2. Use of a number line moving forwards or backwards for each score finally ending up with the end score



3. Grouping negative numbers together and positive numbers together. Finding their totals

As one makes class rounds look for good examples of the various methods

Offer positive reinforcement of their pair work.

Helps keep students on task, especially if they've reached an outcome.

Provide such pairs with additional Show Me Boards

Use higher order questioning to probe
 "Are there any faster methods to solving the problem?"

Are students able to begin the problem solving?

Have students used the resources to aid the problem solving?

separately and then doing one operation to find the answer.

Negative	Positive
-1	1
-1	1
-1	2
-2	1
-2	3



4. Taking each hole separately and using the score as a start for the next hole.



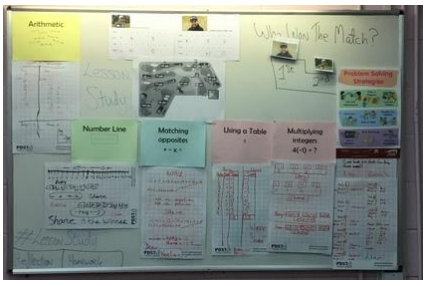
5. Multiplying the similar terms and then adding or subtracting to find total score

$$5(-1) = -5$$

$$3(-2) = -6$$

$$5(0) = 0$$

Do students continue to look for alternative approaches, even when an outcome reached on one approach?



Ask students who use multiplication to solve the problem “Can you now summarize in your own words a general rule for multiplying integers?”

Ceardaíocht /Comparing and Discussing

So who won the game?
 Teacher selects appropriate answers in the order outlined above to bring the board to explain. Anyone not comfortable with this can use Think, Pair, Share and come to the board in a group. Students come to the board and present and explain

Method 1: Matching opposites. So why did you use this way? Explain to the class the how you solved the problem. Could you identify and problem areas other students need to watch out for?
Method 2: Number line. Why did ye use this way? Is there anything to be gained by using a number line compared to the 1st method?

Do students realise the lower the score the better?
 Are students defending their ideas?
 Are they responding to each other’s ideas?

<p>their work to the class.</p>	<p>Method 3. Grouping positive and negative numbers. What is the benefit of using this method? Do we learn anything about adding and subtracting integers?</p> <p>Method 4: Arithmetic. Was this method harder than previous method? Why? Explain</p> <p>Method 5: Multiplying. Please explain your approach. What is the benefit of this approach? So what do we learn from this approach?</p>	<p>Are the goals of the lesson being discussed?</p> <p>Do students realise that there are numerous ways to find the winning golf score?</p>
<p>Summing up & Reflection Ask students to fill out the individual reflection sheets.</p> <p>For homework students are asked to try come up with a different combination of operations to integers that has not been used as an approach to solving the problem in today's class.</p>	<p>Each reflection is individual. Be as honest as you want</p> <p>Recap with the students what combinations of operations they have used in today's lesson.</p> <p>Can you figure out a different combination of operation on 2 integers and work out the answer?</p>	<p>Do students understand the task?</p> <p>Students must write a sentence for each answer in the individual reflection.</p>

10. Board Plan

The board will be divided evenly into approximately nine sections.

Section one at the top of the board will contain the Score Cards & a Map of the course, which will be used to introduce the problem & the scoring system.

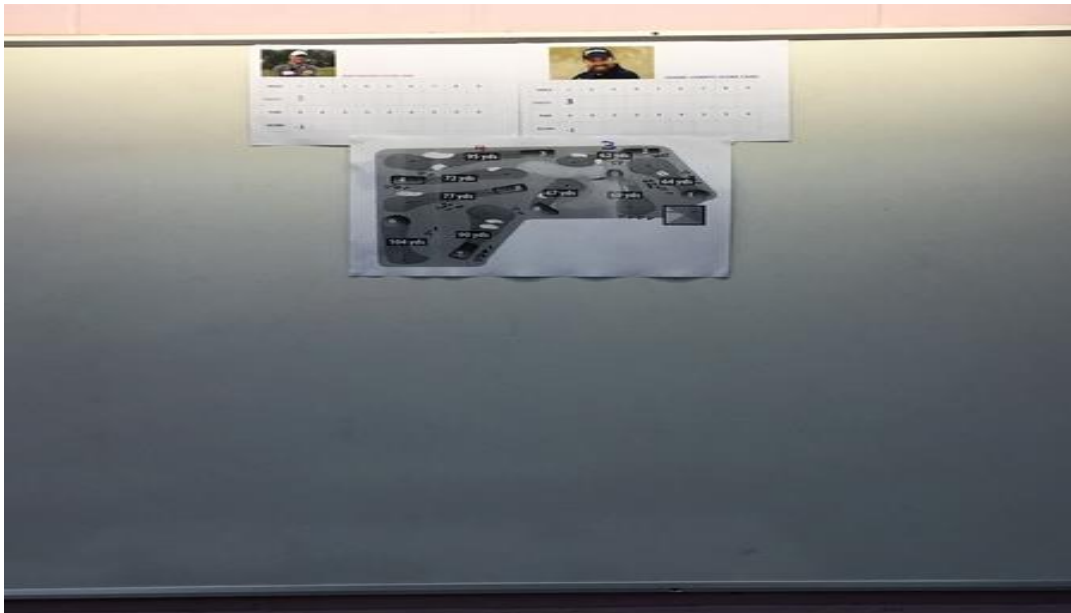
Section two will contain a podium for 1st & 2nd place to illustrate the Winner from the outcomes.

There will be six sections underneath this reserved for the Students work. Here they will place their *Show Me* board in a section for each of the predetermined methods, as outlined above (e.g. Arithmetic, Number Line, *etc.*).

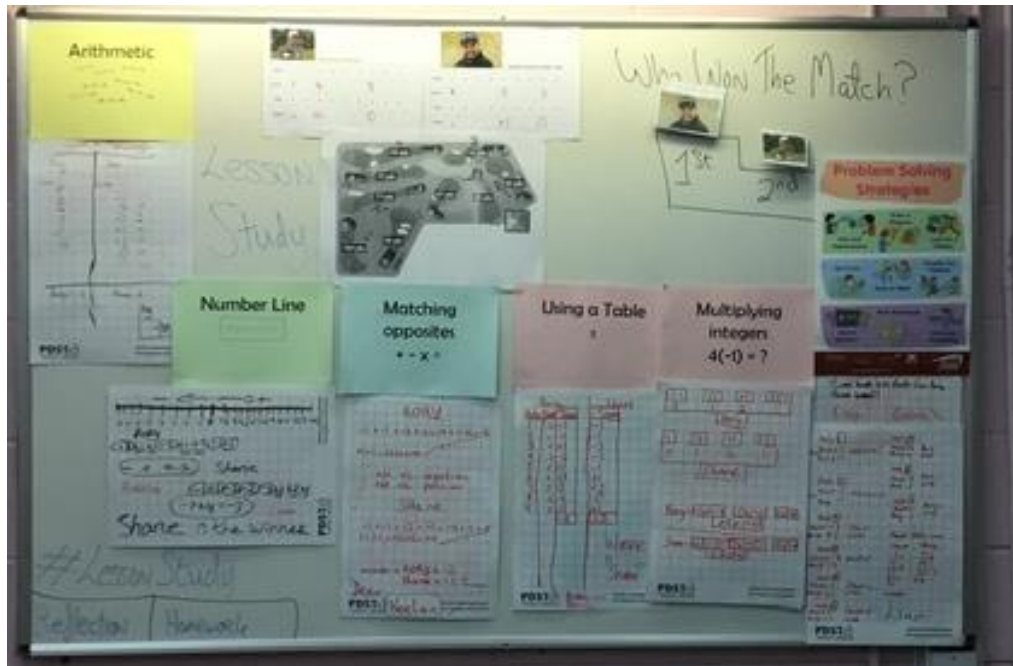
This will display the variety of methods & leave a final section free (section nine) to lead a Reflection & assign Homework.

Board:

Before the lesson



Board: After the lesson



11. Evaluation

The lesson was evaluated using the following question that we felt kept in line with the Research Theme and Goals of the Lesson:

Did each student enjoy their learning, achieve success and appreciate other student's approaches to solving a problem?

There were three observers in the class, two of which had a group of 8-9 students and the third observer focused on the class as a whole using the lesson note app on the iPad. We as a team decided to focus on the following areas when observing the students:

- The various methods used to solve the problem and checking were all the approaches mathematically correct. Any common mistakes were noted;
- Comments/questions and answers the students had;
- Common misconceptions; how and when in the lesson where these were dealt with;
- Were the students able to defend their approach compared to others?

- Were students actively engaged and enjoying the lesson?
- Did the activities in the lesson support the goals of the lesson?

12. Reflection

Upon reflection in the post-lesson discussion everyone agreed the lesson was a success for many reasons. Firstly, all the goals of the lesson were met and students were engaged and interested in the problem. The individual reflection sheets provided the evidence of this. The feedback from the students was all positive and many of the students commented how ‘fun’ the lesson was but also that they learned for themselves the ‘rules’ when using integers. One student in particular commented how he loved that the class was a change from the ‘normal’ class of textbook and teacher providing all the answers. He really liked that the class were allowed to ‘figure it out’ for themselves.

From our discussion the group felt the most significant part of the lesson is the Ceardaíocht. It is vital that the teacher pushes the student with the right questions to extract the required answers. The students’ must defend their own approach as the best because this allows them to understand the benefits of others. This will lead to the students’ successfully achieving the mathematical goals of the lesson.

The change in the students’ mind sets really occurred when they started to see other solutions to the problem. They saw the benefits of others students’ work and the whole class agreed on their favourite approach.

The groups’ original reason for designing this lesson was to move away from a procedural approach to teaching the rules when dealing with integers. ‘The Integer Cup’ shows that this is possible. The problem allows for the students to discover the answers to adding and subtracting integers but more importantly the answer when a positive number is multiplied by a negative number. The one drawback of this lesson is that the problem does not allow for students to investigate a negative number multiplied by a negative number. To overcome this problem we included an open ended question that students have to attempt for homework.

'Is there any combinations when dealing with integers that we haven't looked at today and from what you have discovered today what might the answer be?'

The evidence showed in the follow on class that over 75% of the class discovered the answer and even some went and divided a negative number by a negative number.

As the discussion came to a close, the chairperson asked the group their thoughts on the lesson study process. Everyone agreed unanimously that the benefits and potential of a lesson study approach to maths education are huge. Although it can be time consuming the teachers felt that the benefits far outweigh this. Each member felt excited and all agreed to commit to future lesson study groups. We all felt that this structured problem solving approach through collective departmental meetings would be time well spent, considering we have to document 11 hours of our 22 through the JCT coupled with the pending introduction of Cosáin.



RORY MCILROYS SCORE CARD

HOLE	1	2	3	4	5	6	7	8	9
SHOTS	3								
PAR	4	4	3	5	4	4	5	3	4
SCORE	-1								

THE INTEGERS CUP

