Topic: Percentages, Fractions, Decimals Year group: First year mixed ability

Lesson Plan taught: January, 2017 At Coláiste Mhuire, Askeaton, First year class Teacher: Liz Purcell Lesson plan developed by: Liz Purcell (Coláiste Mhuire, Askeaton), John Dromey (Gaelcholáiste Luimnigh), Pearse Ryan (Kilrush Community School), Niamh Hogan (Coláiste Mhuire, Askeaton), Séamus Ó Conghaile (Seamount College, Kinvara)

Title of the Lesson

"Perfecting Percentages"

Brief description of the lesson

This lesson aims to illustrate the power of percentages in understanding the concept of proportion. Students are encouraged to link fractions, equivalent fractions and percentages enabling them to compare results in a meaningful way.

Aims of the lesson

- a) Short term aim: We would like our students to recognize, understand and apply the relationship between fractions, decimals and percentages. They should also recognise the benefits of using percentages to compare and contrast the relative size of different quantities in numerous situations outside of the classroom.
- b) Long term aims: We would like our students:
 - i. to appreciate that mathematics can be used to solve real world problems,
 - ii. to foster students to become independent learners
 - iii. to become more creative when devising approaches and methods to solve problems and solutions,
 - iv. to encourage students to investigate a problem and use equally valid methods,
 - v. to experience meaningful mathematics i.e. that they see a need for what they are studying
 - vi. to connect and review the concepts that have studied already i.e. number systems,
 - vii. to build students' enthusiasm for Mathematics by engaging them with stimulating activities,
- c) We would like to support our students in developing their literacy and numeracy skills through discussing ideas.¹

¹ This Lesson Proposal illustrates a number of strategies to support the implementation of

Literacy and Numeracy for Learning and Life: the National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020 (Department of Education & Skills 2011).

Learning Outcomes

As a result of studying this topic students will be able to:

- a) recognize and use percentages in both a classroom and everyday scenario,
- b) compare quantities with different denominators,
- c) convert decimals, percentages and fractions to one another,
- d) make inferences based on being able to calculate percentages.

Background and Rationale

Percentages, fractions and decimals are fundamental mathematical skills that students should possess. Students should also be able to convert percentages, fractions and decimals to one another. These concepts are a foundation for both the Junior and Senior Cycles. According to the Junior Certificate syllabus section 3.1 students need to be able to calculate percentages and to be able to use the equivalence of fractions, decimals and percentages to compare proportions. It is a challenging topic to teach effectively and one that takes many students a very long time to grasp. In the past students have had difficulties calculating percentages and they have failed to recognize the links between percentages, fractions and decimals. The aim of the lesson is to address the above mentioned issues as well as fostering independent learning, problem solving skills and mathematical discussion. Furthermore, students will discuss real life examples of percentages in use outside of the classroom underlying the importance of mathematics.

Research

In preparation of this lesson plan the following materials have been used:

- a) Junior Certificate Mathematics Guidelines for Teachers (DES 2002)
- b) First and second year Teachers Handbooks (from the Maths Development Team's website <u>www.projectmaths.ie</u>)
- c) The Junior Certificate Mathematics syllabus. http://www.ncca.ie/en/Curriculum and Assessment
- d) The following series of books: Concise Maths, Active Maths and Text and Tests.
- e) Mini whiteboards and markers
- f) BBC bitesize website <u>http://www.bbc.co.uk/education/topics/z7kw2hv</u>

About the Unit and the Lesson

According to the Junior Certificate Mathematics Syllabus for examination from 2016 (Strand 3, Section 3.1 The Number, page 22) students at Ordinary Level should be able to:

- a) calculate percentages
- b) use the equivalence of fractions, decimals and percentages to compare proportions

According to the first year handbook and within the Common Introductory Course, these lessons occur while studying the number system Q. This follows sequentially from the Number system N and the Number system Z. Lessons will involve the students investigating and understanding decimals, percentages and then the equivalence of fractions, decimals and percentages to compare proportions.

After the above mentioned lessons, the research lesson students will consolidate their learning of fractions, decimals and percentages. Students will use decimals to calculate equivalent fractions and percentages, fractions to calculate percentages and decimals, percentages to find equivalent fractions and decimals. Furthermore it is intended that students discover the power of percentages when comparing and ordering items within the classroom and outside the classroom. Students' mathematical skills will be practiced along with their ability to discuss and analyse mathematical results.

Flow of the Unit

The Number System Q, Fist Year Teacher Handbook (Section 1.4) based on 2016 syllabus

Торіс	# of lesson periods
Decimals	2
Fractions and equivalent fractions	2
Percentages	2
The equivalence of fractions, decimals and percentages to compare proportions	2 (1 research lesson included)
Consolidation of the above	2

Flow of the Lesson

Teaching Activities and Students' Anticipated Responses	Points of	
	Consideration	
1. Introduction (3 minutes)		
Prior Knowledge:		
a) Students have studied decimals, fractions and percentages and are	Teacher has distributed	
aware and knowledgeable about all three. The prior knowledge is	mini-whiteboards and	
also within the problem solving task below.	markers. There is one	
	for every pair.	
2. Posing the Task (2 minutes)		
Last week Sarah's Report Card arrived home with the following results.		
	Teacher distributes the	
REPORT CARD	problem to all students.	
English 15/20	Teacher emphasizes to write the results in as many different forms as possible.	
Maths 479		
Matris 47/2		
Science 0.73		
French 39/50		
History 68%		
Business Studies 111/200		
Initial Task		
1. Write the results in as many different ways as you can		

3. Students individual work (8 minutes)	Teacher circulates the
	room assessing
	students' work to plan
	how to orchestrate the
	presentation of
	students' work on the
	board and class
	discussion.
4. Anticipated Student Responses: (20 minutes)	Teacher asks students to
English	convert a fraction to a
	percentage and a
Students convert English result of 15/20 to 75% and 0.75. Some students may	decimal etc on the
convert to equivalent fraction such as ³ / ₄ or 30/40 or 6/8 etc.	board. When the
Will students multiply 15/20 X (100/1) or by 100/100?	student has presented
Students may multiply 15/20 X 5 to get the percentage and the decimal.	his/her work the
	teacher asks a student
Maths	to comment on the
	results and for their
Students convert 47% to 0.47 and to 47/100. Will students recognize that 47	reasoning. Teacher
is a prime number and hence cannot be reduced from 47/100. Will students	may probe further and
convert to equivalent fraction 94/200?	ask for comparisons.
Science	Student may be asked
	to give oral feedback on
Students convert 0.73 to 73% and then to 73/100. Will students recognize	answers depending on
that the 73 is a prime number and that 73/100 cannot be reduced to an	time constraints.
equivalent fraction with a smaller denominator.	
Other Subjects and potential misconcentions	If time does not allow
	leave it for the next
Students may have difficulty converting 111/200 to percentages and	class
decimals.	
Students may multiply a fraction by a different numerator and denominator	
when seeking an equivalent fraction.	
There may be difficulty in dividing numbers such as 111 by 2.	
Numeracy errors in division and multiplication.	
Students may rank the results without prompting.	
5. Comparing and Discussing: Céardaíocht	
1. Ask one of the students who came up with a solution to show it to the	
class.	
2. Let other students infer how the student explained their calculations.	
3. Let the student who came up with a solution justify it if the other students'	
inferences are incorrect.	
Repeat the above on a number of occasions placing emphasis on English	
Science and Business Studies for written neer feedback from students. On	
occasion time may dictate that oral feedback will be required for Maths	
French and History.	
If there any unexpected solutions/comments, discuss them with the class.	
Ask one of the students, which result was the best and ask another student	
which mark was the worst result.	
Ask other students to complete the ranking table orally.	

6. Summing up (5 minutes)	
Ask students for examples of where they see percentages in out of classroom	
situations and discuss them briefly.	
Extend the Learning (Homework task): Sarah wants to improve her test	
result to 70%. Her teacher says that there will be 40 questions, all equal	
marks in the next exam. How many questions must she answer correctly to	
achieve 70%?	

Evaluation: Plan for observing students

- A seating plan provided by the teacher
- Students were arranged in pods of four and each of the four observers was assigned to approximately 6 students.
- All observers used pen and paper to observe.

Introduction, posing the task	Was the wording of the task clear?	
	Questions asked by students	
Individual work	Does it take students long to start working?	
	Are prompts required?	
	What strategies do they employ when calculating percentages,	
	decimals and fractions?	
	Are they more proficient in calculating one than the other?	
	How long do students spend on the task?	
	What kind of questions do students ask?	
	How efficient was the teamwork?	
	Are the mini white boards effective?	
	Do they persist with the task?	
	Do they enjoy the task?	
	Any unusual / unexpected work?	
	Are any errors observed and what are they?	
	Are they engaged with the task?	
Discussion	Are students attentive to what is happening on the board?	
	Are clarifications needed to presenters' board work?	
	Did the discussion promote student learning?	

• Additional kinds of evidence collected (exemplars of students' work, photographs, end of lesson reflection)

Board Plan

Sarah's report card. Decimial Fraction Percentinges	Sarah's best subject?
English 15 20	Sarah's weakest subject?
Malks 47%	Order (rank) her subject results from
Science .73	best to Weakest
French 39.	What way did you use to rank her results?
History 68%	Sarah wants to improve her Maths result to 70% Her teacher says there will be 40 q's
Bus. studies III 200	How many questions will Sarah need to set right to achieve 70%?

Above is the initial board plan

	Sarah's tep	ort ca	ard.	Sarah's best subject?
I	Decimal Fraction Percentage	s Grade	New grade	
English	0.75 20 4 75%	B	H3/03	Sarah's weakest subject? Maltis
				Order (rank) her subject results from
Maltis	·47 the 47%.	D	H6/06	best to Weakest
Science	•13 <u>73</u> 73%	B		What way did you use to rank her tesults?
French	0.78 39 18 78%.	B		Sarah wants to improve her Malths result to to?. Her teacher says there will be to a:s
History	0.68 68 1 68%	С		all equal marks in the next exam.
Bus. stu	ties0.555 111 555 555 200 56	51. C		How many questions will Sarah need to get right to achieve 70%?

Board work at the end of the lesson.

Percentages are Powerful Fractions Everyolay examples: Exam results Sales - 50% off Weather 10% rain Sugar / Fat content in food Statistics e.g. Census Askeaton: C.S.D. S Primary education 20%. data Second level - 64%. Third level - 16%. Bank Interest rates 3.75%

The above was used to link percentages to out of school situations.

Post-lesson reflection

What are the major patterns and tendencies in the evidence?

Students engaged quickly with the task. There weren't any misunderstandings with the task. Students approached the task in a number of different ways. Some students did all the percentage calculations followed by fractions and decimals etc. Others did the calculations by subject and others calculated results randomly. In general the calculations were very accurate and calculators were not used. Students comfortably moved from decimals to fractions and to percentages. Students were very engaged and thoroughly enjoyed the task.

What are the key observations or representative examples of student learning and thinking?

The vast majority students interchanged percentages, fractions and decimals very comfortably. Students felt they were succeeding with the task at the outset and then proceeded with both speed and confidence.

One student multiplied a fraction with a different numerator and denominator and another student had two decimal places when converting to decimals. Overall, students tackled the problem admirably.

Students were very attentive to the board work and a number of students were observed

self-correcting during the lesson. The homework task generated significant excitement. There were a number of students who were discussing the problem and how to solve it after the class had ended. Others were observed discussing the problem in the school corridors before their next class.

What does the evidence suggest about student thinking such as their misconceptions, difficulties, confusion, insights, surprising ideas, etc?

In general students were confident in their understanding of decimals, fractions and percentages and were exceptional at converting one to the other two. Some students were observed correctly rounding 55.5% to 56%.

One student converted 111/200 to 0.55.5, incorporating two decimal places. Another group were observed calculating a percentage incorrectly but they were later observed self-correcting. Within the discussion there was a misunderstanding in relation to CSO statistics which was resolved.

Observers were surprised that some students converted the percentages into a bar chart format while others linked the grades to the new leaving certificate points classification system. Cross curricular links to Business Studies were made. One student was able to link percentage rates to bank interest rates. He further added when asked to comment on interest rates for loans v savings and knew that banks would charge more for loans to make money. Links were made to Home Economics and the percentages of additives found in food.



75/100 47/100 73/100 1.21 55.5 usiness studies

The mini-whiteboards were used very successfully indeed. Furthermore the students enjoyed using them.

In what ways did students achieve or not achieve the learning goals?

Students achieved their learning goals as all students were able to move comfortably from decimals to fractions and percentages. Students also made numerous links with topics not specifically related to the Mathematics class which demonstrated their understanding, literacy and analytical skills.

The students were able to articulate their methods clearly at the board and orally to their peers. The main concepts were reinforced and summarized by the teacher after each student presented their work. The pre-prepared posters worked very well in getting all students to follow the flow of the lesson. The final board plan worked very well as a final revision of the class. Overall, it was clear from the student engagement in this class that the students understood these concepts.

Based on your analysis, how would you change or revise the lesson?

The lesson had been trialed a week previously and it was noticed that 10 minutes was too long a period for the initial task involved. The time for students work was therefore reduced to 8 minutes. Adding an additional more challenging result to calculate (e.g. Geography 47/ 57) to further challenge students. Further links with Statistics could have been explored and the new leaving certificate points classification system compared with the old system where students could achieve a maximum of 600/625. The conclusion needed some more time and students grappled with the C.S.O. figures so that needed further explanation in the following class.

What are the implications for teaching in your field?

Through the process of planning the lesson we experienced how important it is (and not straightforward at all!) to formulate a clear meaningful problem that allows students the opportunity to extend their knowledge and give an account of their work within a single lesson. All participants agreed that the amount of discussion and thinking about the shape of the lesson will certainly influence our future teaching. We learned that problem solving is not the same as just solving a task.

We observed the enjoyment, excitement and discussion this problem solving lesson created and hope to create this excitement again.

It remains to be seen if the experience of this lesson will help retain information regarding the equivalence of decimals, fractions and percentages when other concepts are studied. However, we believe that this lesson deepened students understanding and provided them with an opportunity to link and analyze these numbers in everyday contexts. All participants agreed it would be most worthwhile to prepare lessons using teamwork. To conclude, the synergy created from this lesson study was most stimulating, satisfying and successful for both teachers and students involved.

Appendix 1. Worksheet

Last week Sarah's Report Card arrived home with the following results.

REPORT CARD
English 15/20
Maths 47%
Science 0.73
French 39/50
History 68%
Business Studies 111/200

Initial Task

1. Write the results in as many different ways as you can