3rd Year (Ordinary Level) Comparing and Understanding The Use of Percentages, Fractions and Decimals

For the lesson on 12/12/16
At Colaiste Ris, Dundalk
Teacher: Thomas Campbell

Lesson plan developed by:
Thomas Campbell, Selena McEvoy and Liam Doheny

1. **Title of the Lesson: Comparing and Understanding The Use of Percentages, Fractions and Decimals**

2. **Brief description of the lesson:** Students will have to calculate a percentage / fraction of a given number. Students are expected to attempt to solve the problem using as many different methods as possible.

3. **Aims of the Lesson:**

Long Range goals:

I'd like my students to be able to see fractions, decimals and percentages have a use in their everyday lives. E.g. calculating profit & loss, sale prices etc.

I'd like to build my students' enthusiasm for the subject by engaging them with stimulating activities

I'd like my students to connect and review the concepts that we have studied already

I'd like my students to become more creative when devising approaches and methods to solve problems

I'd like my students to discover that there are often a number of different methods to solve a problem and for them to understand that all methods are equally acceptable

Short Term Goals:

For students ***to be able*** to get a percentage / fraction of a given quantity

For students ***to understand*** the relationship between fractions, decimals and percentages and be comfortable moving from one to another.

4. **Learning Outcomes:**

By the end of this lesson I'd like my students to be:

Able to find a percentage of given number using an array of different methods.

Comfortable with the use of percentages, fractions and decimals.

Understand the link between percentages, fractions and decimals.

5. Background and Rationale

In the Junior Certificate Syllabus under Strand 3, Numbers, there is a section 3.1 Numbers that deal with fractions, decimals and percentages. Also in 3.3 Applied Arithmetic which deals with financial maths and working with percentages.

Some students struggle to see the relationship between fractions, decimals and percentages. Looking at fractions in particular some students mix up their procedure for adding, subtracting, multiplying and dividing fractions. Furthermore, many students do not understand the basis for a particular procedure and are entirely relying on memorising procedures.

Students often pick a single method for solving a problem and learn it off by heart without actually understanding why they are doing it. As a result when a question is posed in a different manner they don't know how to start the problem as it isn't in their 'bank' of learned off methods.

In this lesson we will try to address this lack of understanding. We want to see students to be able to see a relationship between fractions, decimals and percentages. We also want them to see the link between the methods used for getting a percentage /decimal / fraction of a number. (E.g. if asked to get 75% of a number we often get 1% first, similarly when using fractions we often get ¼ of the value first. We want the students to both see the similarity between these methods and ***understand why*** they are doing so.) We believe that by focusing on this understanding we are developing our students to become independent learners.

6. Research

Section 3.1 of the Junior Cycle Maths Curriculum: number systems, states students should be able to; calculate percentages, use the equivalence of fractions,decimals and percentages to compare proportions.

Section 3.6 of the Curriculum: synthesis and problem solving skills, requires that students be able to; explain findings, justify conclusions, communicate mathematics verbally and in written form, apply their knowledge and skills to solve problems in familiar and unfamiliar contexts, analyse information presented verbally and translate it into mathematical form and finally devise, select and use appropriate mathematical models, formulae or techniques to process information and to draw relevant conclusions.

Common Introductory Course for Junior Cycle Mathematics – *NCCA (2010)*

First year Teachers Handbook from Project Maths website

Chief Examiners' Reports – State Examinations Commision

7. About the Unit and the Lesson

This is a revision topic incorporating decimals, fractions and percentages. In previous lessons students compared fractions, decimals and percentages and they were comfortable converting from one to another. Students will understand the meaning of "per cent" – "per hundred" and thus will be comfortable translating statistics and written information into percentages, fractions and decimals. Students should know (or will have seen previously) that 'of' means multiply and that in order to get a certain percentage or fraction (eg 60% or 3/5) of a value, it is often beneficial to first find 1 unit (eg 1% or one fifth) of the value. Students have also previously worked with fractions, decimals and percentages in a number of different topics in their mathematics syllabus (Probability, Applied Arithmetic) as well as other subjects (Business, Science etc.)

The students task is to find the solution to the problem "what is 80% of 600" using as many different methods as possible.

Through the activity students will realise that there are a number of different ways of solving the problem. We want students to then compare these methodologies and note the similarities between them. In doing so, students will build on their understanding of the relationship between fractions, decimals and percentages. By comparing and contrasting the different methodologies students will understand the logic behind them rather than simply learning these methods off by heart.

Questioning:
The use of both ***higher and lower order*** questions will be used during the introduction, conclusion and summary to evaluate and deepen student understanding.

Ask questions such as 'why do we get 1% first?' to deepen students understanding of what they're actually doing when they work through a solution.
Follow up with questions such as 'is this similar to any of the other methods that we've used?' By drawing comparisons between similar solutions students will start to understand the logic behind a particular method.

Leading questions will also be used in the introduction to prepare the students for the task, and similarly during the conclusion to encourage the students to explore this concept in greater depth for homework.

Class / Peer Discussion:
Students are expected to summarise what they've learned by explaining it in their own words.

8. Flow of the Unit:

Lesson		# of lesson periods
1	Recap lesson on decimals, fractions and percentages. The conversion from one form to another.	1 x 40 min.
2	Research Lesson	1 x 40 min. **(research lesson)**
3	Getting more than 100% of a value. Re visit questions from topics that heavily use percentages – Applied Arithmetic. Can we now answer the questions using a number of different methods	1-2 x 40 min.
4	Given 80% of a number, what is the number? Given 120% of the number what is the number? Do we now have a number of methods of solving such questions?	2 x 40 min.

9. Flow of the Lesson

Teaching Activity	Points of Consideration
Students are welcomed, the Roll is taken and the teacher explains the presence of the observers in the class.	Students will be seated in their allocated seats to ensure that their names match up with the seating charts the observers will be recording their information in.
1. Introduction Prior knowledge on the meaning of percentages and fractions and the conversion from one form to another. Class answers questions on the conversion from one form to another and on the simplification of fractions. "What happens when I multiply by a fraction that is less than one (e.g 3/4)?" "What happens when I multiply by a fraction that is greater than one (e.g. 5/4)"	 "Part of a whole" "Percent means out of 100" " '*of*' means multiply"
2. Posing the Task **80% of 600 people voted for Fine Gael, how many people voted for Fine Gael? Find your answer using as many different methods as possible.** It is explained to the students that they will have 10 minutes to complete this task and that they need to try and find as many different methods as possible. Students may work individually or in pairs	Divide the board into sections in order to help them understand the task is number of different ways they can get that answer.
3. Anticipated Student Responses R1. 0.80 X 600 = 480 R2. I only know one way R3. "get 1% first": 600 / 100 = 6 "get 80%" : 6 X 80 = 480 R4. "get 1 hundredth first": 600 / 100 = 6 "get eighty hundredths " : 6 X 80 = 480 R5. "get 1 tenth first": 600 / 10 = 60 "get 8 tenths" : 60 X 8 = 480 R6. "get 1fifth first": 600 / 5 = 120 "get 4 fifths" : 4 X 120 = 480 R7. (80/100) x 600 R8. (8/10) x 600 R9. (4/5) x 600 R10. We could get 20% and take it away R11. We could get 1 fifth and take it away	If a student calculates using a decimal encourage them to try a fraction or vice versa use a decimal. Is that the only fraction you could have used? For students really struggling to begin: The teacher should assist the students in interpreting exactly what is being asked – get 80% of 600. And remind them of what was discussed in the introduction. The teacher will use best judgement to decide what (if any) level to prompt is necessary to keep the student on task, motivated to keep trying and to ensure that each individual student is learning and benefiting from the lesson. Early finishers will be encouraged to work with and discuss their methods with their neighbors to ensure accuracy and to see can they come up with any further methods. It is likely that most students will not come up with the method of subtraction. Depending on the pace of the lesson the teacher can decide to prompt an early finisher to

R12. We could get 0.2 of 600 and take it away R13. Similar methods using subtraction R14. I don't understand the question – wording	consider such an idea. The student would then be expected to find similar methods as outlined. Alternatively (and ideally) if this method hasn't been used, the teacher can describe this method during board work. The teacher can then invite the students to consider this idea of subtraction and see would it fit in anywhere else. (see responses 10-13)
4. Comparing and Discussing As the teacher circulates the room they can gather the ideas which students are writing down and sort them from easiest (most common method) to more difficult. The teacher could then call on a particular student with a correct method, ask them to explain their reasoning, have a show of hands as to who got this method and progress until all methods are discussed and displayed on the board.	It is important that students recognise the various methods used to achieve the same result. Encouraging students to problem solve. Students should be able to use prior knowledge and connect their learning. Understanding of the methods used through questioning from the teacher
5. Summing up Recap on each of the methods displayed on the board Highlight whether the methods used fractions (equivalent fractions) or decimals	All students should have each method recorded in their copy
6. Homework A worksheet is handed out for the students to complete for homework. Students are encouraged to try some of the more interesting methods discussed.	

10. Evaluation

Thomas has provided a seating chart which both observers will use to record all noteworthy observations and remarks. This seating chart gives the observers a simple but efficient method of *accurately* recording observations they have made of students they will be unfamiliar with. This guarantees a greater degree of accuracy for our discussions in our post-lesson reflection.

Student performance will also be evaluated by collecting their worksheets at the end of the lesson. This will allow us to accurately assess each student's progress through the task and see if they were they able to find links between different methodologies. If given a prompt to assist them with a particular method, were they then able to assess this method and reapply it using a different fraction / using percentages etc. A camera will be used to photograph the board work to ensure we collect as much info as possible to assist us with our post-lesson reflection.

9. Post Lesson Reflection

The biggest issue that we expected with this group was getting the students to actively participate for the entire

ten minutes of the task. This was discussed in our meetings prior to the research lesson and it was agreed that it would be essential that we ensure the students were familiar with this type of activity before the research lesson. During the lesson we observed that even though all students found one method and most kept working to find a second method, we were relying on the same three or four students to come up with the more inventive/creative methods.

This highlights the obstacles one faces when adopting this teaching & learning methodology to a group of students with less motivation and confidence in their ability. Although some effort had been made to ensure the students were familiar with structured problem solving more effort and time was needed to allow it to become part of the classroom *culture*.

The discussion element of the lesson was incredibly positive, we observed very genuine learning with the majority of students making insightful links and showing a good understanding of the topic. Upon reflection we all agreed that the students' learning would have been enhanced further if they were given a supplementary activity after the discussion. Due to the fact that the students were engaged and focused after the discussion, we felt it would benefit the students to undertake a secondary activity rather than it being left for homework before they saw the material again.

In order to do this we suggested reducing the time allocated for the original task from 10 minutes down to 5-6 minutes. If this was achieved, the teacher would then have time to allocate a second task (which could be finished for homework). This would also give the teacher an extra opportunity to assess student learning.

In conclusion we feel that with some minor adjustments (as outlined above) the lesson will successfully meet its aims and objectives and will be a considerably beneficial lesson for the revision of fractions, percentages and decimals.