

Lesson Research Proposal for 1st year- Fractions Problem Solving

For the lesson on 25th January 2018

At Ballymakenny College, Nicola McGrane's 1st Year Mixed Ability Class

Instructor: Nicola McGrane

Lesson plan developed by: Niamh O'Connor, Nicola McGrane, Eoghan McEvoy and Kevin O Hanlon.

1. Title of the Lesson: Monkey Puzzle

2. Brief description of the lesson: Problem solving activity involving fractions in a real life situation.

3. Research Theme

- Students are motivated to learn through having a clear sense of attainable and challenging learning outcomes.
- Students demonstrate knowledge appropriate to their stage of development of their own behaviors as individuals, and as members of a group. They apply this knowledge thoughtfully to manage situations and support their wellbeing.
- They are able to work both independently and collaboratively in a very purposeful and productive manner.
- They have a sense of ownership of their work, take pride in it and take responsibility for improving it. This connects with our school's SSE theme of "Learning to Learn".
- Our school is concentrating on fractions as part of the numeracy strategy for their SSE. The focus is specifically on fractions and the understanding of problem solving with fractions.

4. Background & Rationale

Our research objective is for students to become more competent with fractions. We find that students often have difficulty in converting word problems to mathematical expressions. Students should become more confident with their attitude towards fraction questions. This could improve student's literacy skills as well as their self-confidence towards real world situations.

Our school would like to focus on fractions as it is commonly recognized that when dealing with word problems involving fractions students are observed as having great difficulty in comprehending the problems. Numeracy is something that our school would like to improve upon.

This lesson will be aimed at first year students. It is important for first year students to grasp this basic mathematical skill in order to succeed. First Year Maths is taught to mixed ability students at a common level.

5. Relationship of the Unit to the Syllabus

Related prior learning Outcomes	Learning outcomes for this unit	Related later learning outcomes
<p><u>From the primary school curriculum:</u></p> <p>Understand the links between fractions, percentages and decimals and state equivalent forms</p> <p>Use acquired concepts, skills and processes in problem-solving</p> <p>Students should be able to: solve and complete practical tasks and problems involving fractions.</p>	<p><u>From the Junior Cycle CIC:</u></p> <p>Focus on synthesis and problem-solving skills Students should be able to apply their knowledge and skills to solve problems in familiar and unfamiliar contexts</p> <p>In topic 3.1 number systems: Students should learn about Algorithms used to solve problems involving fractional amounts. Students should be able to use the equivalence of fractions, decimals and percentages to compare proportions.</p>	<p><u>For the Junior Cycle students will be required to:</u></p> <p>Use fractions to solve probability problems.</p> <p>Manipulate rational numbers in number system problems</p> <p>Use fractions to calculate and compare the slope in co-ordinate geometry</p> <p>Use fractions to find values for degrees for pie charts in statistics</p> <p>Use fractions with indices laws.</p> <p>Manipulate algebraic fractions in equations, inequalities and functions.</p> <p>Use fractions in applied arithmetic and applied measure calculations</p> <p>Use fractions when using the quadratic formula</p> <p>Convert fractions to percentages to calculate their test scores in other subjects</p> <p>Use fractions in trigonometry for relationships between angles on right angled triangles</p>

6. Goals of the Unit

Students need to have a strong understanding of equivalent fractions in order to access problem solving involving fractions.

Students should have prior knowledge of adding, subtracting, multiplying, dividing and comparing fractions.

Students need to be able to cope with basic real-life applications before dealing with complex fractional problems.

7. Unit Plan

1	Intro to fractions and equivalent fractions <ul style="list-style-type: none"> - What a fraction is - Use the number line to order numbers in Q. - How to check a result by considering whether it is of the right order of magnitude.
2	Adding and subtracting fractions <ul style="list-style-type: none"> - How to generalise and articulate observations of arithmetic operations
3	Multiplying and dividing fractions <ul style="list-style-type: none"> - How to generalise and articulate observations of arithmetic operations
4	Simplifying fractions <ul style="list-style-type: none"> - How to check a result by working a problem backwards
5 The Research Lesson	Our research lesson Recall the rules of adding, subtracting, multiplying and division of fractions To work collaboratively as part of a team to achieve a common goal To analyse a question and break it into smaller parts to solve in a variety of ways To evaluate the most efficient way of solving the problem for future questions
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8. Goals of the Research Lesson:

(a) Students will be more confident with worded fraction problems.

They will need to understand the value of a fraction and apply this to real life situations.

Students should improve their skills in problem solving, specifically interpreting what a problem is asking you to do.

(b) 1. Communicating effectively using various means.

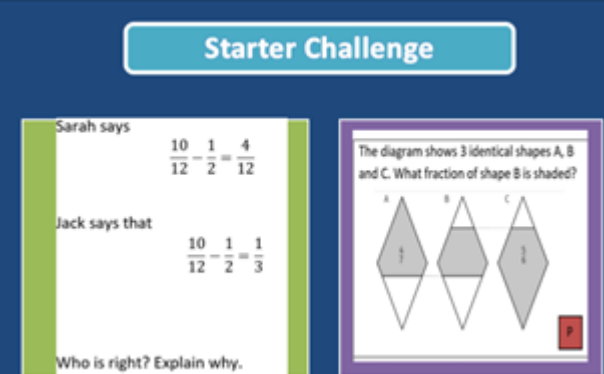
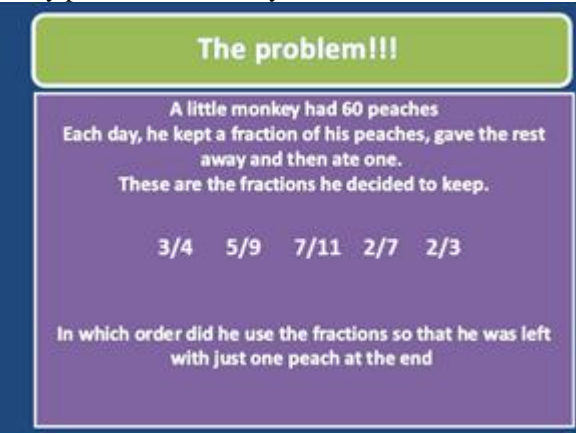
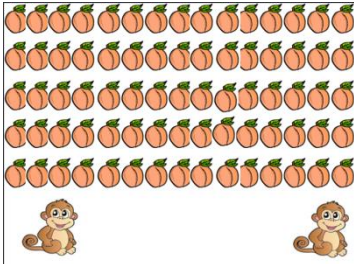
16. Describes, illustrates, interprets and predicts ways to explore patterns and relationships in problem solving.

17. Uses fluidity reasoning and problem solving skills in order to investigate a problem and translate into comprehensible mathematics.

21. Applies practical skills from a variety of mediums to develop models.

23. Students should take an idea from conception to realisation.

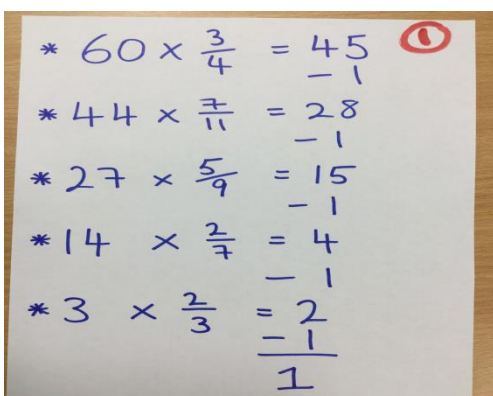
9. Flow of the Research Lesson:

Steps, Learning Activities Teacher's Questions and Expected Student Reactions	Teacher Support	Assessment
<p>Introduction</p> <p>In class today, we are going to use our mathematical skills and knowledge to solve an intriguing problem. We are going to work together in groups and combine our skills to explore the various potential approaches to our problem.</p> <p>Give the students the problem on the left of the diagram to revise common denominators. Use the problem on the right to challenge stronger learners.</p> 	<p>Prompt lowest common denominator and how to do this</p>	<p>Do students recall how to do simple fraction questions involving + - x ÷</p>
<p>Posing the Task</p> <p>Students need to put the fractions in order to see how many peaches the monkey had left in the end.</p>  <p>Clarifying the problem:</p> <ul style="list-style-type: none"> – When calculating what he kept on the other days, remember that he ate one before he gave any more away. – There are some resources available that may be of help to you. (A3 with 75 peaches) – Use your prior knowledge of fractions to solve this problem – Well firstly, you need to work with a divisor – The number has to be divisible by the denominator 	<p>Present an illustration to make the problem easier to interpret.</p> <p>Provide resources (cut out peaches) and present to each group</p> <p>The student will be able to use the peach resource to help them with this problem</p> 	<p>Are the students excited and enthusiastic about solving the problem?</p> <p>Do all the students understand the problem?</p> <p>Do students understand that there will be a new amount of peaches to start each day?</p>

- **Optional statement:** Is not in order of fraction size-
so you can work it out like that

Student Individual Work

Misconceptions we are going to address : the rules of adding and subtracting, multiplying and dividing fractions



* $60 \times \frac{3}{4} = 45$ ①
-1
* $44 \times \frac{7}{11} = 28$
-1
* $27 \times \frac{5}{9} = 15$
-1
* $14 \times \frac{2}{7} = 4$
-1
* $3 \times \frac{2}{3} = 2$
-1
1

②

$$\begin{array}{r}
 * 60 \div 4 = 15 \\
 \underline{\times 3} \\
 45 \\
 -1 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 * 44 \div 11 = 4 \\
 \underline{\times 7} \\
 28 \\
 -1 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 * 27 \div 9 = 3 \\
 \underline{\times 5} \\
 15 \\
 -1 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 * 14 \div 7 = 2 \\
 \underline{\times 2} \\
 4 \\
 -1 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 * 3 \div 3 = 1 \\
 \underline{\times 2} \\
 2 \\
 -1 \\
 \hline
 1
 \end{array}$$

③

60
 $\frac{60}{4} = 15$

28
 $\frac{28}{7} = 4$

15
 $\frac{15}{3} = 5$

3
 $\frac{3}{3} = 1$

* $\frac{60}{4} = 15 \times 1$ $\begin{array}{r} 60 \\ -15 \\ \hline 45 \\ -1 \\ \hline 44 \end{array}$ **14**

* $\frac{44}{11} \times 4 = 16$ $\begin{array}{r} 44 \\ -16 \\ \hline 28 \\ -1 \\ \hline 27 \end{array}$

* $\frac{27}{9} \times 4 = 12$ $\begin{array}{r} 27 \\ -12 \\ \hline 15 \\ -1 \\ \hline 14 \end{array}$

* $\frac{14}{7} \times 5 = 10$ $\begin{array}{r} 14 \\ -10 \\ \hline 4 \\ -1 \\ \hline 3 \end{array}$

* $\frac{3}{3} \times 1 = 1$ $\begin{array}{r} 3 \\ -1 \\ \hline 2 \\ -1 \\ \hline 1 \end{array}$

15

• $60 \times \frac{1}{4} = 15$ $\begin{array}{r} 60 \\ -15 \\ \hline 45 \\ -1 \\ \hline 44 \end{array}$

• $44 \times \frac{4}{11} = 16$ $\begin{array}{r} 44 \\ -16 \\ \hline 28 \\ -1 \\ \hline 27 \end{array}$

• $27 \times \frac{4}{9} = 12$ $\begin{array}{r} 27 \\ -12 \\ \hline 15 \\ -1 \\ \hline 14 \end{array}$

• $14 \times \frac{5}{7} = 10$ $\begin{array}{r} 14 \\ -10 \\ \hline 4 \\ -1 \\ \hline 3 \end{array}$

Ceardaíocht /Comparing and Discussing

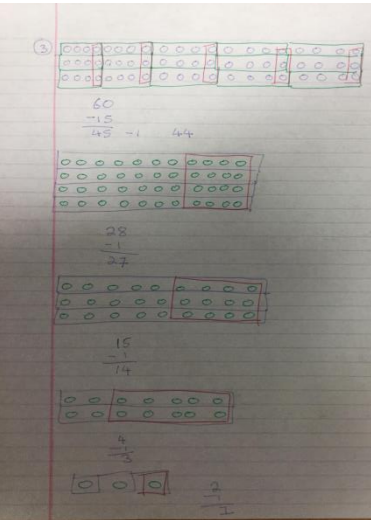
Response 1:

Put your hands up if you used this method or if you would like to use this method. why? how many have picked this?

Are the students defending their idea?
Are they taking on others ideas?
Have they improved their own work or helped others find the solution

$$\begin{array}{l}
 * 60 \times \frac{3}{4} = 45 \\
 * 44 \times \frac{7}{11} = 28 \\
 * 27 \times \frac{5}{9} = 15 \\
 * 14 \times \frac{2}{7} = 4 \\
 * 3 \times \frac{2}{3} = 2
 \end{array}$$

$$\begin{array}{l}
 * 60 \div 4 = 15 \\
 * 44 \div 11 = 4 \\
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 * 14 \div 7 = 2 \\
 * 3 \div 3 = 1
 \end{array}$$

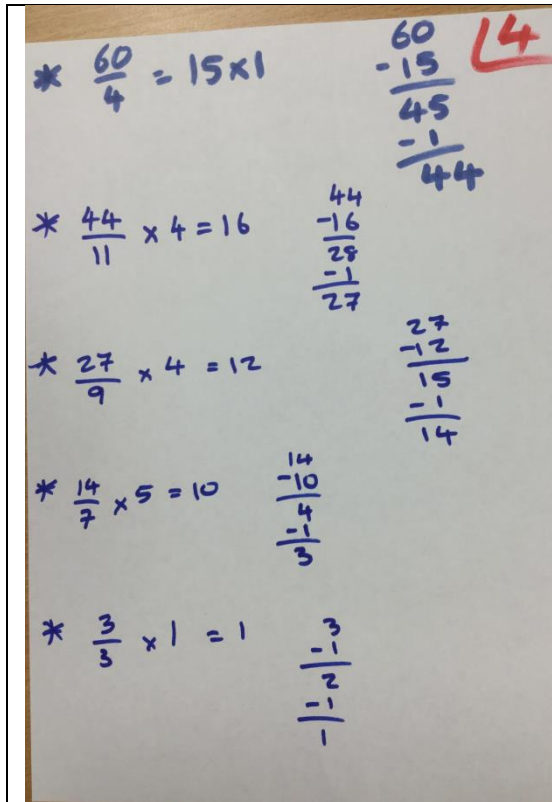


Response 2:

Put your hands up if you used this method or if you would like to use this method. why? how many have picked this?

Response 3:

Put your hands up if you used this method or if you would like to use this method. why? how many have picked this?



Response 4:

Put your hands up if you used this method or if you would like to use this method. why? how many have picked this?

Summing up & Reflection

We used prior knowledge of fractions to answer a worded fraction.

We have learned how to structure and solve a worded problem we have learned how to peer teach our answers and explain it in many different ways.

We have learned how to

The teacher is going to question the pupils about what they have learned this lesson

Do the students' reflections and outcomes match the teachers?

10. Board Plan

Please see above

11. Evaluation

- Following this lesson we wish to discuss the following questions:

Did the students understand the lesson?

Did the students find the lesson enjoyable?

Did the students become more confident with worded fractional problems?

Throughout the lesson, we noticed that the students worked hard on the problem and focused well. Generally, they found the lesson enjoyable and useful.

Some students had a misconception about the problem. They thought that the monkey got 60 new peaches every day. To avoid this we could have been clearer in laying out the problem and explain it in a little more detail. We feel as though this misconception could help students to be more careful in future when solving worded problems in mathematics.

There were three different approaches taken to solve the problem.

- A. The first of these was to multiply the full fraction and subtract 1.

$$\text{For example: } 60 \times \frac{3}{4} = 45, \quad 45 - 1 = 44$$

$$44 \times \frac{7}{11} = 28, \quad 28 - 1 = 27$$

$$27 \times \frac{5}{9} = 15, \quad 15 - 1 = 14$$

$$14 \times \frac{2}{7} = 4, \quad 4 - 1 = 3$$

$$3 \times \frac{2}{3} = 2, \quad 2 - 1 = 1$$

- B. The second was to multiply by the full fraction (what he gave away) and subtract from the total, then subtract 1.

For example: On the first day he keeps $\frac{3}{4}$ meaning, he loses $\frac{1}{4}$. $\frac{1}{4}$ of 60 is 18, $60 - 18 = 45$. Then he eats one so subtract 1 leaving him with 44. Etc.

- C. The third was to work out the fractions by dividing by the bottom and multiplying by the top (to find out what he kept) and then subtract 1.

For example: $60/4 = 15$, $15 \times 3 = 45$, $45 - 1 = 44$ etc.

We got feedback from the students after the lesson and interestingly the majority of the class favored the third solution (C). This was interesting, as we believed that students would prefer the first solution.

After the lesson, students answered some questions for us regarding the lesson and their understanding of it. 8% of the students felt as though the problem was too difficult to understand. 62% were very happy with the outcome of the lesson. Students suggested that in

future it could be better to have more variety in the question instead of just using fractions. It was also suggested that a number of shorter questions could aid learning better than 1 long question.

The students felt as though their group work skills improved during the lesson. They enjoyed working together to solve the problem and felt as though this kind of lesson helped them to achieve a better understanding of the problem and its' various solutions.

By the end of the lesson students learned that there are a number of different, equally valid ways to solve a problem. They also learned the importance of reading questions carefully and listening to each other to aid understanding.

12. Reflection

(a) Before the lesson we were unsure what to expect from the class. As it was a problem solving lesson, our conclusion and learning outcomes relied heavily on students actually being able to solve, what was, a quite difficult problem. We felt there would be no issues with the warm up problem and felt the key area for learning would be in the reflection section at the end. We hoped to see students in their groups of three working collaboratively and sharing ideas about our problem. We also hoped that certain groups who had solved the problem would then be able to explain their method to the rest of the class. Finally, we really hoped that there would be more than one solution/method to solving the problem.

(b) During the lesson we observed much of what we had previously hoped. Our warm up activity worked very well and allowed students to get back into the swing of fractions, a topic which they had not dealt with since well before Christmas. However, something which we had not foreseen was how this warm up activity would go on to shape the remainder of the lesson. The methods for solving the first mini problems were not directly related to solving the main problem of the class. But students were attempting to use these methods to solve our problem, leading them to a dead end. Other groups of students solved the problem without the use of these methods and we were delighted to have three different methods for solving the problem, all of which we had foreseen in our board plan. The final reflection section went extremely well with each group explaining their method to the rest of the class. Our AFL strategies worked extremely well and students delivered excellent feedback on how they felt the class went as well as outlining what level of understanding they had of fractions prior to completing the problem.

(c) During the post lesson discussion we felt the class went well. The students were all engaged in the class and working to the best of their ability. Judging by their own comments they were very much aware of what they were doing and understood when their methods were not working. We discussed that a couple of students had some difficulty in seeing that the order the fractions were presented in was not actually the correct order. We discussed the fact that the problem also lacked a 'full stop' which meant a particular line could then be interpreted in a different way to what we were looking for. We all agreed that the timing and post problem reflection were excellent. We also felt we did not need the peaches which were presented on A4 sheets. Some students wasted valuable time cutting out these peaches instead of focusing on the problem at hand. Looking back they were not a necessity and probably negatively affected the potential learning of some students. When introducing the problem, we also felt it would be better for students to read the problem quietly themselves as opposed to too much teacher voice as well as other noise in the class from students reading aloud.

(d) It was noticed that the students were all very quiet and working well. The misconception regarding the lack of a full stop was highlighted and it was great to notice and fix this problem before it festered. The importance of highlighting that the fractions in the question are not in the correct order was noticed. Students were not keen on completing a more difficult problem for homework. Perhaps providing an easier question with fewer fractions may have worked better. The use of show me was praised and the menti incorporating the emojis was thought of as being a great idea. It was noted that questioning the students as to which method they liked the most was an excellent idea. Lastly, it was highlighted that the timing and flow of the lesson was perfect.

e) For future lessons we would advise using a more progressive approach and working towards the harder problem.

We would not give the hard problem for homework as it was not accessible for some of the students.

Try not to give too many tips and clues on how to solve the problem.

Let the students sit in silence and read the problem on their own.

Don't make the groups too big as it leaves room for some students to not contribute fully.