

# Lesson Research Proposal for 2nd Year, Relative and Expected Frequency

For the lesson on 25<sup>th</sup> January 2018

At St Farnan's Post Primary School, Prosperous, 2<sup>nd</sup> Year mixed ability class

Instructor: Niall Kenna

Lesson plan developed by: Sam Cribbin, Máire Donlon, Niall Kenna, Oliver Delaney & Ciana Ennis

## 1. Title of the Lesson: Katie V Conor Who will win the fight?

## 2. Brief description of the lesson

Students explore probability and the probability of who would win in a fight Katie Taylor or Conor McGregor. Through their work students will develop an understanding of how to find the expected frequency. They will also recognise the benefit when there is a large number of trials.

## 3. Research Theme

We want students to:

1. Engage purposefully in meaningful learning activities through lesson study and associated activities.
2. Enjoy their learning, are motivated to learn and expect to achieve as learners.

We as teachers will respond to the needs of our students by:

1. responding to individual learning needs and differentiate teaching and learning activities as necessary. The teaching will allow for success for all learners.
2. Value and engage in professional development and professional collaboration.
3. Teachers work together to devise learning opportunities for students across and beyond the curriculum.
4. Teachers share their expertise with teachers from other schools, for example through education centres, online forums, and school visits, particularly through the participation of Lesson Study.

## 4. Background & Rationale

(a) This section of probability aimed at second year students. The teaching of probability is important as it will build on the students previous learning from both first year and also in primary school. It will also be extended on in senior cycle at a deeper level.

There is often difficulty for students in recognising the relationship between expected frequency and relative frequency, and this leads to misconceptions related to the two.

We also found that this section of probability is under-resourced in comparison to other sections. This can lead to too little time being spent on the topic as there are no games/activities for students to help relate it to real life.

(b) In our experience, while students have little difficulty in understanding and calculating simple probabilities, once the problems become more difficult they often struggle. This can lead to rote learning of formulae and a lack of understanding in why they are using the formula.

While expected frequency is included on the CIC, in our experience students do not remember it or how it is calculated when they get to second year.

## 5. Relationship of the Unit to the Syllabus

Related prior learning Outcomes	Learning outcomes for this unit	Related later learning outcomes
<p>From <b>3<sup>rd</sup> class</b> students begin to use vocab of uncertainty and chance. They also record outcomes of simple random processes.</p> <p>By <b>5<sup>th</sup> and 6<sup>th</sup> class</b> students are able to estimate the likelihood of events from 0-100, or 0-1. They can construct and use frequency charts and tables.</p> <p>In <b>1<sup>st</sup> Year</b> students encounter the fundamental principle of counting, language of uncertainty and probability, predict the relative frequency.</p>	<p>In <b>2<sup>nd</sup> year</b> students will:</p> <p>Strand 1 Topic 1.1, 1.2, 1.3</p> <p>-Compare expected frequencies and actual frequencies</p> <p>- Determine the theoretical probability of an outcome in a probability experiment</p> <p>- Use a two-way and tree diagram to determine probabilities</p>	<p>In <b>3<sup>rd</sup> Year students will:</b> apply the principle that, in the case of equally likely outcomes, the probability is given by the number of outcomes of interest divided by the total number of outcomes (examples using coins, dice, spinners, urns with different coloured objects, playing cards, etc.) – use binary / counting methods to solve problems involving successive random events where only two possible outcomes apply to each event</p>

## 6. Goals of the Unit

- Students will understand that there are different ways to represent data.
- Students will have a greater understanding of how to convert between mathematical expression and English languages.
- Students will understand that there are different ways to solve the same problem.
- Students will understand how to apply mathematical expressions to real life situations.
- Students will have a greater understanding of the language associated with probability and what the terms mean.

## 7. Unit Plan

Lesson	Learning goal(s) and tasks
1	Revise Relative Frequency
2	Introduce two-way tables with simple problems. Then use Project Maths Lesson on Fair combined events, focusing on presenting the outcomes. Students will understand that two-way tables are a method of determining all possible outcomes of a combined event.
3 The Research	Introduce <i>Expected Frequency</i> Use a suitable problem to:

Lesson	a) Understand that Expected Frequency problems have a definite answer. b) Understand that the Expected Frequency answer is then used to predict how often an event will occur.
4	Practice how to solve questions associated with Expected Frequency, allowing for extensive differentiation.
5 & 6	Introduce tree diagrams with simple problems. Then use the same Project Maths Lesson as the previous day. This time students must determine the results using tree diagrams.
7	To consolidate all learning students will construct a probability scale and position on this scale the words associated with chance, as well as the numbers associated with probability. They will also position outcomes to particular problems on this scale.

## 8. Goals of the Research Lesson:

### a) Mathematical Goals:

Students will:

- Understand that Expected Frequency problems have a definite answer.
- Understand that the Expected Frequency answer is then used to predict how often an event will occur.




### b) Key Skills and Statements of Learning

1. Being Literate: Through Ceardaiocht, students will have the opportunity to express their ideas clearly and accurately.
2. Managing myself: Students will be able to reflect on their own learning
3. Staying well: By allowing all students to achieve to some degree, students will feel positive about their learning and grow in confidence.
4. Managing information and thinking: Students creative and critical thinking skills will be encouraged and extended.
5. Being Numerate: Students will develop a positive attitude towards investigating, reasoning and problem solving.
6. Being creative: During Ceardaiocht, students will solve the problem in a number of different ways.
7. Working with others: Students will learn with and from each other by discussing different approaches to solving the problem.
8. Communicating: Students will present, discuss and debate their mathematical thinking.

This lesson also meets the following JC Statements of Learning:


15. The student recognises the potential uses of mathematical knowledge, skills and understanding in all areas of learning.
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><b>Introduction [3 mins]</b>            Displaying images of Katie and Conor, simply pose the question "Who do you think would win in a fight?". This is to engage the class and get them to make a prediction.</p>	<p>Teacher will place the image of Katie and Conor on the Board and pose the question.</p>	<p>To engage students in the problem and get them thinking about who would probably win the fight.</p>						
<p><b>Posing the Task [3 mins]</b></p> <p>Conor is fighting Katie in a boxing match and rolling two di will determine who wins. Two di are thrown and the two numbers are added together.            The rules are that:            Conor wins if the total is 2, 3, 4, 5, 10, 11 or 12.            Katie wins if the total is 6, 7, 8 or 9.            Who do you think will win?            Try to solve it as many ways as possible and record all results.            Use the resources on the table to help.</p> <div data-bbox="140 1003 746 1653" style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;"><b>Probability Game</b> Who would win the battle?</p> <div style="display: flex; justify-content: space-around; align-items: center;">  <span>vs</span>  </div> <p style="text-align: center; margin-top: 10px;">How to play...</p> <div style="display: flex; justify-content: center; margin-bottom: 10px;">  </div> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 50%;">Add the numbers on the two dice</th> </tr> </thead> <tbody> <tr> <td>Conor wins if you roll one of the following numbers</td> <td>2, 3, 11, 12, 10,</td> </tr> <tr> <td>Katie wins if you roll one of the following numbers</td> <td>6, 7, 8, 9</td> </tr> </tbody> </table> <p style="font-size: small; margin-top: 5px;">Note: Record ALL your results</p> </div>		Add the numbers on the two dice	Conor wins if you roll one of the following numbers	2, 3, 11, 12, 10,	Katie wins if you roll one of the following numbers	6, 7, 8, 9	<p>Insert Problem Sheet here            A3 Poster of problem will be stuck on the board. Students will be given a copy of the worksheet</p>	<p>Do students understand the task?</p> <p>Do you understand the game?</p> <p>Can you explain it back to me.</p> <p>Are students keen to start solving the problem.</p> <p>Do students understand they need to use the di to solve the problem.</p>
	Add the numbers on the two dice							
Conor wins if you roll one of the following numbers	2, 3, 11, 12, 10,							
Katie wins if you roll one of the following numbers	6, 7, 8, 9							
<p><b>Student Individual Work [10 mins]</b></p> <p>Response 1:            Describe in words "Conor will win because he more chances to get the numbers" * <b>Students may overcome this misconception as they complete the problem in various other methods.</b></p> <p>Response 2:            Play the game a number of times using the di</p> <p>Response 3:</p>	<p>As one makes class rounds look for good examples of the various methods, note the order in which you will need to call students to the board.</p> <p>During the problem solving-stage, you might ask students who cannot figure out any solution methods "Did you use</p>	<p>Are students able to tackle the problem?</p> <p>Do the resources on the table help the students to solve the problem?</p>						

<p>Two way table, and count number of ways to get each outcome.</p> <p>Response 4: Calculate probability from two-way table.</p>	<p>any of the equipment on the table”</p> <p>Students who complete the di throws can be asked “how many times did you run the experiment”</p> <p>You could ask students who are doing multiple di throws “Are there any faster ways to solve this problem?”</p>	<p>How many students found different ways to solve the problem?</p>
<p><b>Ceardaíocht /Comparing and Discussing [20 mins]</b></p> <p>Response 1: “Katie will win because on the two way table there are more chances for Katie to win”</p> <p>Response 2: “Katie will win because he more chances to get the numbers” *</p> <p>Response 3: “Katie will win because there 20/36 chances that her numbers will come up”</p> <p>Response 4: “Katie will win because I played the game a number of times and she won the game the most.</p> <p><u>Extending Students Learning</u> Now we want to extend the learning to expected frequency. To do this we will ask students “How many times do you expect Katie to win if the game was played 18, 45 or 72 times” “Can you come up with a rule for the <b>expected frequency</b> based on this” .</p>	<p>Response 1: Please raise your hand if you used this method or if you would like to use this method? Why?</p> <p>Response 2: Who else thinks Katie will win? Why do you think that?</p> <p>Response 3: How did you get that? Does anyone else get that? Did anyone else do it the same way? What did you do?</p> <p>Response 4: How many other people played this game? How many times did you the game? Who won the most times in your experiment?</p>	<p>Are students able to defend their answers?</p> <p>Do they respond to each others answers?</p>
<p><b>Summing up &amp; Reflection [4 mins]</b> Ask the students: “After this lesson what do you think is the most efficient way to solve problems with this”</p>	<p>The teacher will run back through the board work from start to finish.</p>	

# 10. Board Plan

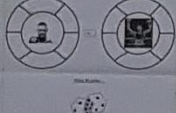


## Sam

## OLLIE


### Probability Game

Who would win the barrow?



### Playing the game

### TWO-WAY TABLE



I played the game 3 times and Kate won.

- 1) Kate won (7)
- 2) Conor won (10)
- 3) Kate won (8)

I predict Katie is more likely to win.

$K = 20$

$C = 16$

Katie is more likely to win

KEY WORDS

HOMEWORK

## Susan

## Samantha

Words	Probability
Katie has more chances than Conor to win	Katie $\frac{20}{36}$ Conor $\frac{16}{36}$

Ex freq = Prob X Number of times

$$\frac{5}{9} + \frac{5}{9} + \frac{5}{9} + \frac{5}{9} + \frac{5}{9} + \frac{5}{9} + \frac{5}{9} + \frac{5}{9} = \frac{45}{9} = 5 \text{ times}$$

$$18 \text{ times}$$

$$\frac{5}{9} \times 18 = 10 \text{ times}$$

$$72 \text{ times}$$

$$\frac{5}{9} \times 72 = \frac{350}{9} = 36 \text{ times}$$

## 11. Evaluation

When observing the class the observers will focus on seeking answers/evidence to the following questions

- Where the goals of the lesson reached?
- What was the most common way students answered the question
- Did students use the appropriate mathematical language, focus will be on their mathematical language.
- Did students overcome their misconception that Conor would have a greater chance than Katie of winning, if so how did they recognise that Katie had a greater chance
- When developing the expected frequency will students recognise to multiply the probability rather than add the probability a number of times?

## 12. Reflection

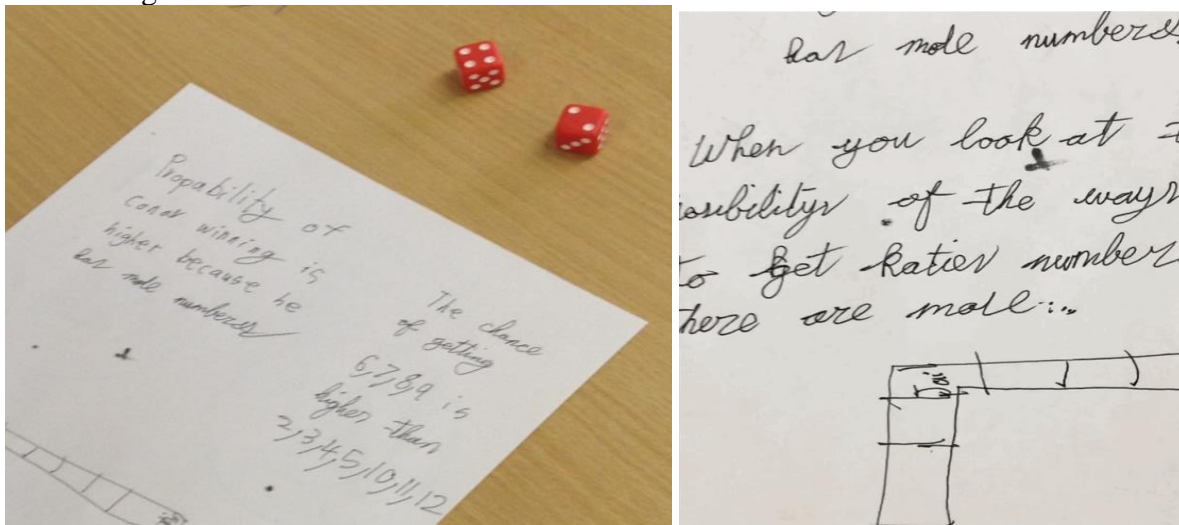
The team of teachers were overall happy with how the lesson went. There was a positive atmosphere in the classroom which was evident between the interaction of the teacher and students. Students were comfortable questioning the teacher and also giving their opinion to the teacher.

The use of the celebrities to gain the students interest in the lesson worked well. The teacher getting a show of hands for the prediction was a great introduction to the class.

Students were eager to investigate the problem. As discussed prior to the lesson students did all go straight to using the di provided to play the game. As two way tables had been introduced the class prior students did recognise the benefit to using these and their efficiency. However students didn't enter numbers but rather enter C (for Conor) or K (Katie) to work out who had a greater chance of winning the fight. We had not preempted students would use letters than numbers. To code their two way table. At this stage students did overcome their previous misconception and worked out that Katie had a greater chance.

					Katie
					Conor

One student used words and originally stated Conor would win but after further investigation of the chances of getting certain numbers when rolling two di. He overcame his misconception and adjusted his wording.



During the ceardaiocht section, the teacher did feel under pressure for time to ensure he had enough time to fit in all the ceardaiocht. The two-way table was slightly rushed with the student filling it in and if we were to teach it again we would spend more time questioning the weaker students who ha difficulty filling it it. We all recognized the pressure of a live lesson and the teacher did state he would have spent more time on the 2 way table in a normal class setting.

Teacher did interact well with the students and used good questioning when intereacting with the students during ceardaiocht.

During the ceardaiocht section of the lesson, students did recognise to multiply straight away. They looked at the relationship between the probability [ $P(C) = \frac{5}{9}$  and the number of trials]. This had not be preepeted either we had expected for students at the beginning to add up the probability a number of times.

Changes we would recommend being made to the lesson;

- More time spent during ceardaiocht on filling in the two way table
- A worksheet on expected frequency to ensure all students understood the concept.

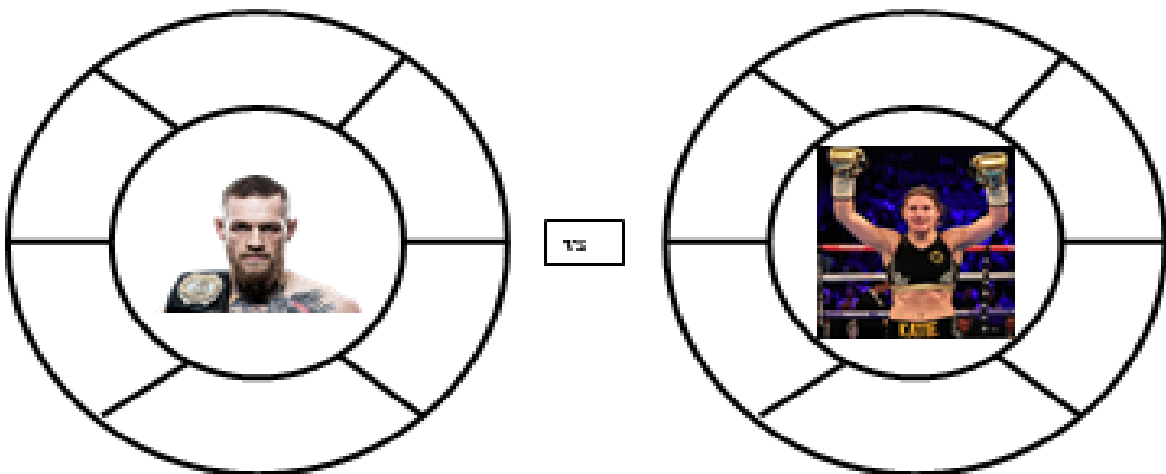
However we feel we could not make a definite decision on the 2<sup>nd</sup> worksheet as it would depend on the timing of various teachers classes. If more time had been spent on the 2 way table then there might not have been time for the 2<sup>nd</sup> activity.

As a team we were happy with how the lesson went and feel all students were actively learning and engaged well with the lesson.



# Probability Game

Who would win the battle?



How to play...



	Add the numbers on the two dice
Conor wins if you roll one of the following numbers	2, 3, 4, 5, 10, 11, 12,
Katie wins if you roll one of the following numbers	6, 7, 8, 9

Note: Record ALL your results

