Lesson Research Proposal for 2nd Year Statistics

Date of lesson: 04/03/2019
School name: St Brendan’s College / St Brigid’s Presentation Secondary School
Teacher giving lesson: Adrienne Brosnan
Associate: Conleth Dillon
Lesson plan developed by: Adrienne Brosnan, Marina Hickey, Mish O'Donoghue, Niamh Sexton

1. **Title of the Lesson:** Show Me The Money!

2. **Brief Description of the Lesson**
We have chosen real-life data in order to facilitate statistical analysis by students. The use of money and celebrity promotes discussion, allowing students to recognise the different measures of central tendency and to draw conclusions about their uses.

3. **Research Theme**
   **Learner Outcome**
   - For pupils to enjoy their learning, be motivated to learn and expect to achieve as learners.
   - We hope for them to have the necessary knowledge and skills to demonstrate their knowledge and to understand what is required by the curriculum.

   **Learner Experiences**
   - We hope that students get a great sense of enjoyment out of the meaningful learning.
   - We hope that students are challenged and support one another in their learning interactions.
   - We will strive for students to reflect on their learning throughout.

   **Teacher’s Collaborative Practice**
   - We, as teachers, understand the importance of collaboration and engaging in professional development as a means to improving students learning.
   - We hope that working together will help up to devise a learning opportunity for pupils that will go beyond the curriculum and meet the varying needs present in the classroom today.
   - We, as teachers, hope to enhance the range of teaching methodologies that we can use in the day to day classroom.

4. **Background & Rationale**
We chose the topic of choosing the appropriate central tendency to use when looking at a set of data with a 2nd Year Mixed Ability class.
According to the Chief Examiner’s Report, 2015, “In terms of content, the biggest change is an increase in the proportion of the syllabus dealing with statistics and probability. In terms of skills, the new syllabus has an increased emphasis on problem-solving, as well as on the skills of explanation, justification, and communication.”

We have found that there are misunderstandings of averages. There are many colloquial words that are used for the idea of average, such as 'typical' or 'common' or even the word 'average' itself.
Activities where students collect their own data and compare the mean, the median and the mode can be useful in building intuitions for distinguishing the measures of central tendency.

Using the median meaningfully is perhaps the most difficult. Students can believe that it is possible to find the median of categorical data sets.

Activities that challenge students' thinking about mean, median, mode, and the difference between numerical and categorical data are needed.

When focusing on the mean, students at times forget outliers, especially if there is no accompanying graph to attract attention. Activities where outliers are included can be useful.

5. **Relationship of the Unit to the Syllabus**

<table>
<thead>
<tr>
<th>Related prior learning outcomes</th>
<th>Learning outcomes for this unit</th>
<th>Related later learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Collect, organise and represent data using pictogram, single and multiple bar charts, pie charts and trend graphs</td>
<td>Students should be able to carry out a statistical investigation which includes the ability to:</td>
<td>- Students should be able to carry out a statistical investigation which includes the ability to:</td>
</tr>
<tr>
<td>- Read and interpret pictograms, single and multiple bar charts and pie charts</td>
<td>- select, calculate and interpret appropriate summary statistics to describe aspects of univariate data. Central tendency: mean (including of a grouped frequency distribution), median, mode. Variability: range (SP3E)</td>
<td>- select, draw and interpret ordered stem and leaf plots, and ordered back-to-back stem and leaf plots (SP3d)</td>
</tr>
<tr>
<td>- Compile and use simple data sets</td>
<td>- discuss misconceptions and misuses of statistics (SP3G)</td>
<td>- evaluate the effectiveness of different graphical displays in representing data (SP3f)</td>
</tr>
<tr>
<td>- Explore and calculate average of simple data sets</td>
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</tr>
<tr>
<td>- Identify the most frequently occurring item in a data set.</td>
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<tr>
<td>- Compare calculate average with the most frequently occurring item</td>
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<td></td>
</tr>
<tr>
<td>- Students should be able to carry out a statistical investigation which includes the ability to: select, draw and interpret appropriate graphical displays of univariate data, including pie charts, bar charts, line graphs</td>
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</tbody>
</table>

Leaving Cert
- (F)Use a variety of summary statistics to describe the data: central tendency mean, median, mode
- (O)Find the quartiles and the interquartile range
- Use the interquartile range appropriately when analyzing data
plots, and histograms (equal intervals) (SP3d)
- Classify data (categorical, numerical) (SP3c)
- Calculating the mean, median and mode

- (H)Line of best fit
- Recognise the effect of outliers

6. Goals of the Unit
Unit of learning: Measures of Central Tendency
Students should be able to:
- Name the different measures of central tendency
- Calculate the different measure of central tendency
- Recognise when to use the appropriate measures of central tendency given different sets of data

7. Unit Plan

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Brief overview of lessons in unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Types of Data</td>
</tr>
<tr>
<td>2</td>
<td>Calculate the mode, mean and median</td>
</tr>
<tr>
<td>3</td>
<td>Research Lesson - Applying the measures of central tendencies to real life problems and identifying which is the most appropriate to use in different data sets.</td>
</tr>
<tr>
<td>4</td>
<td>Identify an appropriate central tendency for a given graph</td>
</tr>
</tbody>
</table>

8. Goals of the Research Lesson:
Looking at the goals of the research lesson itself from two perspectives:

a. Mathematical goals
   By the end of the lesson students will -
   know how to apply the measures of central tendencies to real life problems understand which is the most appropriate to use in different data sets.

b. Key Skills
   - Using number towards investigating, reasoning and problem solving
   - Preforming and presenting
   - Discussing and Debating - Seeing patterns, trends and relationships
   - Respecting difference - Being curious
   - Learning with others - Evaluating information and data
   - Exploring options and alternatives - Reflecting and evaluating my learning
   - Expressing ideas mathematically - Being social
   - Developing a positive disposition - Being confident

b. (ii) Statements of learning
   The student should be able to:
   - communicate effectively using a variety of means in a range of contexts.
   - recognise the potential uses of mathematical knowledge, skills and understanding in all
areas of learning
- describe, illustrate, interpret, predict and explain patterns and relationships
- devise and evaluate strategies for investigating and solving problems using mathematical knowledge, reasoning and skills

9. Flow of the Research Lesson:

<table>
<thead>
<tr>
<th>Steps, Learning Activities</th>
<th>Teacher’s Questions and Expected Student Reactions</th>
<th>Teacher Support</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>This column shows the major events and flow of the lesson, including timings and what will go up on the board.</td>
<td>This column shows additional moves, questions, or statements that the teacher may need to make to help students.</td>
<td>This column identifies (a) what the teacher will look for (formative assessment) that indicates it makes sense to continue with the lesson, and (b) what observers should look for to determine whether each segment of the lesson is having the intended effect.</td>
<td></td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td></td>
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<tr>
<td>Roll call</td>
<td></td>
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<tr>
<td>Recap on what was covered in previous lessons.</td>
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<tr>
<td><strong>Posing the Task</strong></td>
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<tr>
<td>Working in pairs students must find the average age, average earnings and the “average” profession of The World’s Highest – Paid Celebrities from the Forbes 2018 Ranking.</td>
<td>The question is read aloud.</td>
<td>Do all students understand the task?</td>
<td></td>
</tr>
<tr>
<td><strong>Student Work</strong></td>
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<tr>
<td>Using the worksheet, students calculate the mean, median and mode of each set of data.</td>
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</tbody>
</table>

Maths Development Team: Lesson Study 2018-2019
Ceardaiocht /Comparing and Discussing

Students present their work, explaining
(a) how they calculated each measure of central
tendency, and
(b) why they would use this measure.

Why have they ordered the
data?

What are the different types
of data being used?

Why have they used the
mean, mode or median? Is
this the best? Why?

Did anyone find the mean
profession?

Why is the result for the
mean wage and median wage
so different?

Why did students use neither
mean nor median for the
“profession” column?

Can students discuss and explain why they
would or would not use a particular
measure of central tendency?

Do students recognize when to use the
appropriate measures of central tendency
given different sets of data?

Are students using the
correct terms for each
measure of central tendency and each
data type?

What are the
misunderstandings
students have?

Can students recognize the outlier?

Did some try to use
mean or mode for the
“profession” column?
Students -
- name the different measures of central tendencies
- explain how to calculate the different measure of central tendencies
- explain when to use the appropriate measures of central tendency given different sets of data
- fill in reflection sheet

What is the best job to have? Why? How do we know this?

Which category of celebrities are the wealthiest people on the Forbes Celebrity Rich List?

Can students answer teacher’s questions using mean, mode and median?

10. Board Plan

11. Evaluation

During the lesson the team had hoped to observe students producing a variety of suitable calculations to determine a measure of central tendency for given data sets. We had hoped that the students would actively participate in a discussion on, and thereby gain and understanding of, which would be the most appropriate measure of central tendency to use.

At the end of a lesson students will use “5-4-3-2-1”, to feedback to the teacher.

In using this feedback mechanism, the teacher aims to
- focus the student’s attention on the positive learning outcomes for them in the lesson
- have students identify an aspect on which they need to do some more learning.
12. Reflection

What the team had hoped or expected to observe during the lesson.

The team hoped that the students would work together in their groups to find the average for each category. We expected the students would realize that there is more than one way to find the average, i.e. mean median and mode. We expected the students would divide the workload among the group, for example each member in the group take a category.

What the team actually observed during the lesson by the team members

The team felt the lesson was clear and coherent. The students did not go off task, they stayed on topic. The lesson was student centred. The team felt that the students would remember the topic better than rote learning. The team felt working in pairs cleared up any questions they might have had. Without telling the students the meaning of the outlier, the effective use of questioning led the students to define the word outlier themselves.

The team observed various approaches to the task. In some groups, each member calculated a different average in a category, for example one student calculated the mean, another the median and the mode. The team noticed that these groups did not partake in discussion in their groups when compared to others. When one member had completed their task they did not help other members with theirs. Thus putting pressure on some in the group.

Other groups worked together on each calculation, cross checking their answers. This proved quite effective. It promoted discussion amongst the group as to appropriate approach.

In terms of calculations the team observed a number of various methods. When finding the median, the majority of groups listed the data in order. One group used a stem and leaf to calculate the median. Some groups made use of colours and highlighters to organize the data when finding the mode profession. From the team observations, the majority of groups started by calculating the mean.

Finding the Mean
Finding the Median

Finding the Mode
Issues Addressed
Including the Outlier?

Finding the Mean of Categorical Data?

Major points raised during the post-lesson discussion, and the team’s own opinions.

The team concluded that the students should have been given a set amount of time to complete the work. The groups’ work ethic improved when they were given reminders of time remaining to complete the activity.

Student Reflections

Teachers’ Reflections on their Lesson Study
What did you find useful about participating in a Lesson Study?
What was useful? ... participating in a Lesson Study requires collaboration, working as a team with other maths teachers, developing ideas and strategies and coming up with resources to deliver the topic to students.
It was fascinating to see the different approaches and methodologies practiced in other schools.

Has participating in a Lesson Study caused you to think about your teaching in a different way?
Participating in the lesson study has made me reflect on the teaching methodologies I use in my own classroom, made me to reflect on how much as teachers we talk and do. It has made me think more about how I can facilitate student-centered learning; setting the students a task in order to discover the learning for themselves.

Having participated in one Lesson-Study cycle - can you see the difference between doing a Lesson Study for your professional development versus participating in a workshop? Consider the benefits of doing so, and the associated challenges and possible solutions.
Lesson Study allowed us to delve deeper and explore a specific topic whereas a workshop would be fast paced. In lesson study we had the freedom to choose a topic that we felt the students had misconceptions of, and wanted to learn how to support their learning. Lesson study made us look at how our topic is connected with other sections of their course, as well as what the students know about it from primary school, and what they need to know for Leaving Certificate. I feel this would not be made as clear in a workshop.
Participating in Lesson Study was initially difficult due to dark evenings and trying to arrange meetings during busy school terms, for example with staff meetings and parent-teacher meetings. However, it meant, in comparison to workshops, working in a smaller group, which individual teachers found a lot more beneficial.

Does Lesson Study have a role in supporting other curriculum reforms e.g. junior cycle? If so, how?
Participating in Lesson Study makes you think a lot more about why you are teaching a certain topic, it forces you to make links with the syllabus/ specifications, the Statements of Learning of the new Junior Cycle and at a wider scale, Looking At Our School.
With the new Junior Cycle, we should try to engage students in ‘rich tasks ’ where possible. Lesson Study ticks this box. By participating in Lesson Study, teachers are prepared with a model of how this could be facilitated and it allows the students to develop Key Skills.

Appendix 1:
## Forbes - The World's Highest-Paid Celebrities 2018

<table>
<thead>
<tr>
<th>Rank</th>
<th>Name</th>
<th>Age</th>
<th>Earnings</th>
<th>Profession</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Floyd Mayweather</td>
<td>41</td>
<td>$335 M</td>
<td>Athletes</td>
</tr>
<tr>
<td>2.</td>
<td>George Clooney</td>
<td>57</td>
<td>$189 M</td>
<td>Actors</td>
</tr>
<tr>
<td>3.</td>
<td>Kylie Jenner</td>
<td>21</td>
<td>$166.5 M</td>
<td>Personalities</td>
</tr>
<tr>
<td>4.</td>
<td>Dwayne Johnson</td>
<td>46</td>
<td>$124 M</td>
<td>Actors</td>
</tr>
<tr>
<td>5.</td>
<td>Lionel Messi</td>
<td>31</td>
<td>$111 M</td>
<td>Athletes</td>
</tr>
<tr>
<td>6.</td>
<td>Ed Sheeran</td>
<td>27</td>
<td>$111 M</td>
<td>Musicians</td>
</tr>
<tr>
<td>7.</td>
<td>Cristiano Ronaldo</td>
<td>34</td>
<td>$111 M</td>
<td>Athletes</td>
</tr>
<tr>
<td>8.</td>
<td>Bruno Mars</td>
<td>34</td>
<td>$100 M</td>
<td>Musicians</td>
</tr>
<tr>
<td>9.</td>
<td>Conor McGregor</td>
<td>30</td>
<td>$99 M</td>
<td>Athletes</td>
</tr>
<tr>
<td>10.</td>
<td>Neymar</td>
<td>26</td>
<td>$90 M</td>
<td>Athletes</td>
</tr>
<tr>
<td>Rank</td>
<td>Name</td>
<td>Age</td>
<td>Earnings</td>
<td>Profession</td>
</tr>
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<td>-----</td>
<td>------------</td>
<td>--------------</td>
</tr>
<tr>
<td>11.</td>
<td>Ellen DeGeneres</td>
<td>50</td>
<td>$87.5 M</td>
<td>Personalities</td>
</tr>
<tr>
<td>12.</td>
<td>LeBron James</td>
<td>34</td>
<td>$85.5 M</td>
<td>Athletes</td>
</tr>
<tr>
<td>13.</td>
<td>Katy Perry</td>
<td>34</td>
<td>$83 M</td>
<td>Musicians</td>
</tr>
<tr>
<td>14.</td>
<td>Robert Downey Jr.</td>
<td>43</td>
<td>$81 M</td>
<td>Actors</td>
</tr>
<tr>
<td>15.</td>
<td>Taylor Swift</td>
<td>29</td>
<td>$80 M</td>
<td>Musicians</td>
</tr>
<tr>
<td>16.</td>
<td>Roger Federer</td>
<td>37</td>
<td>$75 M</td>
<td>Athletes</td>
</tr>
<tr>
<td>17.</td>
<td>Stephen Curry</td>
<td>25</td>
<td>$75 M</td>
<td>Athletes</td>
</tr>
<tr>
<td>18.</td>
<td>Jay-Z</td>
<td>44</td>
<td>$75 M</td>
<td>Musicians</td>
</tr>
<tr>
<td>19.</td>
<td>Ryan Seacrest</td>
<td>40</td>
<td>$75 M</td>
<td>Personalities</td>
</tr>
<tr>
<td>20.</td>
<td>Kim Kardashian West</td>
<td>38</td>
<td>$67 M</td>
<td>Personalities</td>
</tr>
</tbody>
</table>