Lesson Details	Lesson Study Group
Name of lesson: What is the meaning of z - scores? **Topic**: Statistics **Year group:** Transition Year **Level**: Higher Level	**School Name & address**: Colaiste Pobail Naomh Mhuire, Buttevant **Associate**: Megan Heffernan **Link Advisor:** Enda Donnelly **Teachers involved:** Yvonne Lane, Maggie Corbett, Faye O'Donoghue & Michelle O'Hanlon

Research Theme

Numeracy Targets:

Focus on percentages and the meaning of the percentages in the empirical rule (Normal distribution). Be able to use the calculator when calculating mean and standard deviation.

Literacy Targets:

Underlining key words and understanding the maths terminology in this topic. Identifying what they are being asked and what they already know.

Problem Solving:

Use the problem solving plan in the students journal when answering questions and to link questions to real life contexts.

Future Learning:

A focus on creating a common teaching approach for the maths department when teaching z-scores. Implement the schools vision to support high achieving students in class.

Background & Rationale

Students can often find it difficult to read z scores, understand what the question is asking and understand the percentages in the normal distribution. Teachers sometimes find themselves rushing through this topic due to an unlike for the topic

or not feeling confident in teaching this topic. Sometimes teaching to the test rather than for understanding. Over the past few years lesson study has been focused on junior cycle students so we would like to develop lesson study with more senior cycle groups. We would like students to understand inferential statistics in real life contexts and to have an understanding of the normal distribution (bell curve). It is applicable as students often hear of the 'bell curve' but may not know what it actually is. Focusing on Statistics will help students to create a poster for the John Hooper poster competition this year.

Relationship of the Unit to the Syllabus

Prior Learning	Current Learning	Future Learning
Primary and JC Probability and Statistics • Probability terms • Fractions, Percentages, Decimals • Mean, Median and Mode • Types of Data • Range • Histograms and their shape	• Calculating the mean, median, mode and standard deviation • Drawing histograms and stem and leaf • Commenting on the shape of the distribution • Calculating the range and interquartile range	• Empirical Rule • Probability from z-scores • Scatter Graphs • Correlation

Goals of the Unit

- Common teaching approaches as a department for teaching averages, range, interquartile range, standard deviation, z-scores, and probability.
- See the real life applications of z-scores.
- Picking the most appropriate graphs for the data they are working with.
- Student enjoyment in this topic.
- Be able to collect data, analyse data, and draw and interpret diagrams.

- Identify where the mean and median lye in the histogram.
- Cross curricular connections between maths and coding by interpretaing and analysing the mean, median and mode.
- Encourage the use of different problem solving strategies.

Unit Plan	
Lesson	**Brief overview of lessons in the unit**
1 class	Types of data and collecting data
1 class	Populations and sampling
2 classes	Measures of location
3 classes	Measures of variability
2 classes	Stem and Leaf
2 classes	Histograms and the shape of distribution

Research Lesson	Standardising raw data using z-scores

5 classes	Normal Distribution
2 classes	Probability Distribution from z-scores
2 classes	Scatter Graphs
2 classes	Correlation

Goals of the Lesson

- Students should be able to present, interpret and analyse the raw data, and understand how to standardise their findings using z-scores.
- Make the z-score questions relatable to the students.
- Be able to identify the mean and standard deviation.
- Teachers want students to engage in mathematical discussions.

Key Skills:

Literacy: Identify key words (mean, median, mode, range, standard deviation, z-scores, standardise, histogram, distributions)

Problem Solving: Strategies on page 2 of the students journal.

Communication: working and communicating together (think-pair-share)

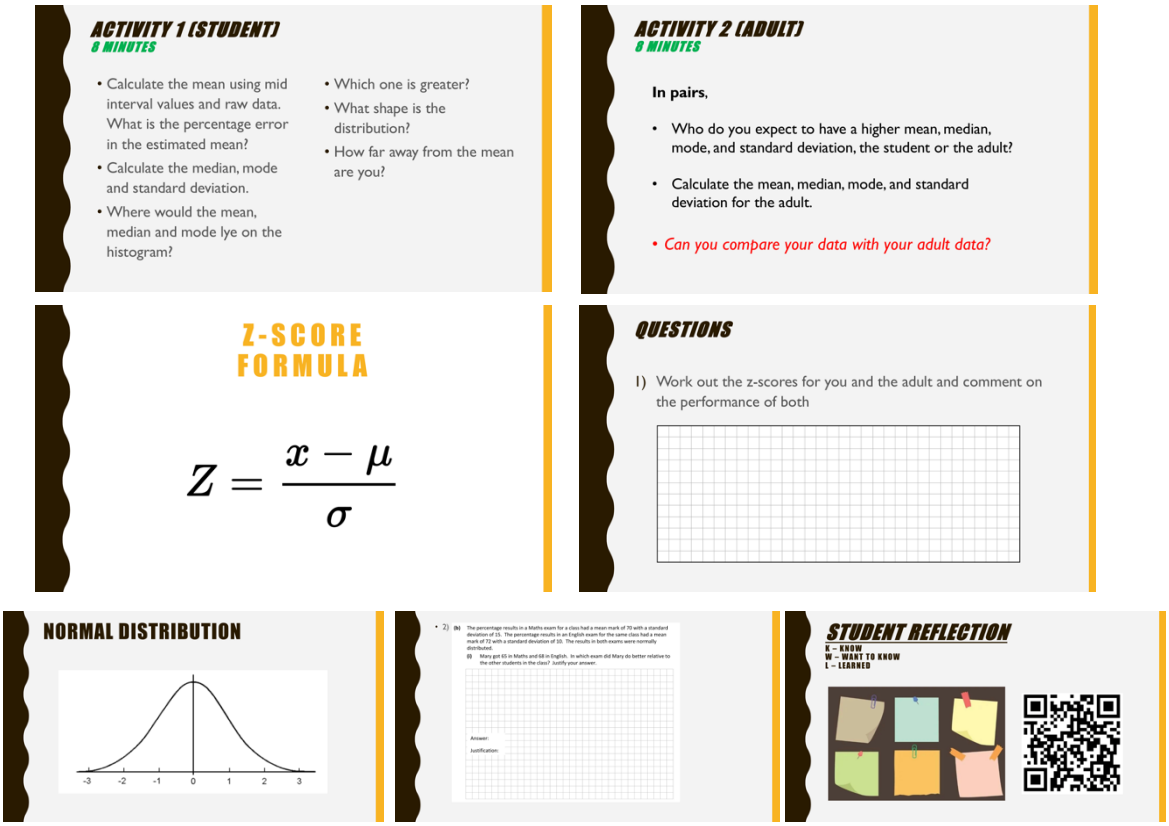
Flow of the Lesson		
Timing, activities, steps, resources, problems	**Teacher support, activity**	**Assessment, questions, comments, strategies**
Introduction: Welcome, explain why new people are in the room 2 mins Explain the learning objectives and show the TikTok video. 2 mins **Activity 1:** Students will have drawn a histogram in the previous lesson of the class data from excel. Students will answer the following questions from the PowerPoint on the class histogram. 8 mins	Teacher circulating the class to ensure students are answering the questions.	Is everyone ready to get started? ***PowerPoint Questions*** - Calculate the mean using mid interval values and raw data. What is the percentage error in the estimated mean? - Calculate the median, mode and standard deviation. - Where would the mean, median and

		mode fall on the histogram? - Which one is greater? - What shape is the distribution? - How far away from the mean are you?
Activity 2: ***Think-Pair-Share:*** Students will have the adult histogram drawn in the previous lesson from the data in the excel sheet. **In pairs**, they will calculate the mean, median, mode, and standard deviation. 8 mins	Answer: No, this is why we need z-scores to standardise it.	***PowerPoint Questions*** - Who do you expect to have a higher mean, median, mode and standard deviation, the student or the adult? - Calculate their mean, median, mode and standard deviation. - Can you compare your data with your adult data?
Activity 3:		***Slide 6***

Introduce the z-score formula through the PowerPoint Slide, followed by a TikTok video of the teacher demonstrating an example of using the z-score formula. 5 mins		explaining the variables in the z-score formula ***Slide 7*** **TikTok** showing the teachers z-score example
Activity 4: **PowerPoint Slides** with z-score questions. 8 mins	Question 1: Teacher takes a few answers from students of their z-score value and their adults z-score value. (Slide 9) - Where do you lye on the normal distribution? - Where does the adult lye on the normal distribution? Question 2: Answer displayed on slide 10/ Student demonstrates answer on the board.	**PowerPoint Questions** - Question 1: Work out the z-scores for you and the adult and comment on the performance of both. - Question 2: 2018 P.2. Qs.2. (b) - Extension Qs Page 299 Qs. 16
Lesson Reflection:		Padlet:

Ask students to complete a reflection on Padlet 4 mins		KWL (Know, Want-To-Know and Learned)

Board Plan



Evaluation of Lesson

Once the lesson was over, the teacher teaching the lesson and the observing teachers gave their initial feedback as follows:

They felt that there was a good flow to the lesson and that every student was engaged. Timing was an issue, it took students longer than expected to calculate the mean, median, mode and standard deviation but teachers were happy with what was covered in the lesson. Some students needed reassurance and some prompting on what to do rather than how to do it when calculating the mean,

median, mode and standard deviation. Some students found it difficult to interpret the questions due to the English barrier. The teachers found that using the calculator saved time throughout the lesson for students. One teacher observed that students were very good at calculating the standard deviation, while another teacher said that the lesson included a lot of discovery learning. Students were engaged throughout the lesson and enjoyed the teachers TikTok video. The teachers found that the recap at the end of the TikTok video was a good summary of why we use z-scores. Students were asked to calculate the percentage error but it wasn't explained why they calculated it so it could have been left out of the lesson. To save time, students could have done some calculations at home.

Summary of Key Learning	
Meeting 1	• The teachers discussed possible topics for the lesson study and possible year groups and levels. • There was a focus on linking more than one topic together and how this might shorten the time needed to teach topics separately. • Statistics was the chosen topic, focusing on the normal distribution and z-scores. • The teachers discussed the scheme of work for TY higher level from September to Christmas in relation to what topics needed to be taught before the lesson study. • The research theme was identified and the background and rationale for picking this topic were discussed.
Meeting 2	• Recap on meeting 2. • Enda attended this meeting. • Discussed the main teaching points of the unit, revising averages, focusing on standard deviation, terminology, z-scores, and probability. • Identifying types of z-score questions that would be suitable to the interests of the students.

	• Discussed the possibility of using GeoGebra to get students to check their graphs, and identify how the mean and median changes. • Discussed the sequence of the lessons for the unit. It was decided that scatter graphs and correlation would be done at the end of the unit.
Meeting 3	• Decided on the research lesson date, Wednesday 1st March. • Decided on dates for meeting 4 and 5. • Recapped on what was discussed in meeting 2. • The flow of the lesson was discussed and broken down into 5 or 10 minute intervals. Some possible questions for the worksheets and class discussions were identified. • The teachers identified possible options of comparing students phone data with an adults phone data. • Discussed the possibility of using the visualiser to display questions in class and displaying class data as a histogram on Geogebra. • Identified ways in which this research lesson shows a cross curricular connection with coding, by commenting on the findings on the mean, median and mode.
Meeting 4	• Recapped on meeting 3 • Discussed the questions that needed to be asked in activity 1 & activity 2 • Looked for a video to explain z-scores. • Created a list of questions for the observation sheet. • Identified the current and future learning.
Meeting 5	• Recapped on meeting 4 • Went through the PowerPoint presentation and adding some new slides to it. • Decided to create a new teacher TikTok video with an example of using the z-score formula. • Came up with the question for the last activity of the lesson.

	• Went through the observation sheet and added in new points to be observed. • Went through the timing of the lesson. • Discussed the day of the research lesson, our meeting time, classroom and evaluation of the lesson.
Meeting 6	Research lesson date Wednesday 15th March at 10:10 • Discussed the answers to the PowerPoint questions and the observation sheet before the lesson started. • Live lesson took place. • Enda attend this lesson. • Reflected as a group at the end on how the lesson went and discussed our next steps and future lesson planning.

Final Reflection
The teachers really enjoyed the lesson study process. They wanted to make the lesson interactive for the students and base it around the students interests which was a success during the live lesson as students really enjoyed learning from the TikTok video. During the lesson study meetings, teachers found it comforting to discuss ways of teaching topics and were glad to hear that other members in the department struggled with teaching the same topics as them. Lesson study was very good for teacher collaboration. With careful department planning, this unit of learning will now save time in teaching this topic in fifth and sixth year. It is a unit that all teachers have decided to continue teaching in TY. Teachers found that students struggled with mathematical phases such as central variance throughout the unit so it is something that will be worked on going forward. This unit of learning could be repeated next year and the results could be compared with this years group.