CENTRES FOR EXCELLENCE IN MATHS

FE centre resource

Pearson

Lesson plan

Averages and Range

1. Lesson objectives

- To understand the difference between mean, mode and median
- To be able to use the appropriate average for different purposes
- To understand that range is the data spread and not an average

2. GCSE curriculum

Statistics
S4 Interpret, analyse, and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean, mode, and modal class) and spread (range, including consideration of outliers).

3. Lesson plan

This is an overview of the lesson. More notes can be found in the notes in the lesson slides.

Activity	Purpose of this activity	Time (min)	Guidance	Materials
Introduction Whole Group Discussion	Exploring the concept of average.	5	What is average? Whole group discussion about the nature of average. Slide 2: Parvis is feeling average. What does this mean? Ask for ideas from the group about what this could mean. Prompt with questions: Does Parvis feel wonderful? Does he feel dreadful? You might explore where Parvis would be on the scale, if feelings can be quantified (dreadful = 1, wonderful = 10). Slide 3: How did Parvis do in his maths test? – Average! Discuss what this means, as now scores and marks can be quantified, and averages can therefore be calculated. Is there a way of seeing whether Parvis has done averagely well on his maths test? Can learners think how this might be done? Explore this with the class. Would it be possible to see the average for the class? The college? The country? How?	Slides 2−3

Activity	Purpose of this activity	Time (min)	Guidance	Materials
Introduction of the context	Introduce the garden centre and how averages might be used in the workplace.	2	James has started work in a garden centre. Provide a very brief explanation of this using slide 4. Slide 4: James has been given the task of finding a flower that is not too short or too tall. Discuss with the group what this means. See if they have any ideas about how James could complete this task.	Slides 4−5
Collaborative/ dialogic learning approach	Using prior knowledge to calculate averages (mean, mode, and median) and dealing with the misconception that range is not an average.	10	Slide 6: This displays flowers of various heights. Say what you see – have a group discussion to look at the information that James has and how he could use it. Slide 7: James' friends have worked out some figures. Learners work in pairs to decipher what his friends have calculated, working on whiteboards. Discuss the findings: Parvis – 42cm = mean Jane – 20cm = mode Maya – 35cm = median Kenji – 70cm = range Ask learners what they did, how they did it, and how their findings might help James to find the flower of average length. Be sure to discuss Kenji's range and ask, "Is this an average?" Discuss the concept of range and how it might be used.	Slides 6−7 Whiteboards

Activity	Purpose of this activity	Time (min)	Guidance	Materials
Discuss	Introducing the context of customer expenditure	2	The tutor will explain the context of customer expenditure. Explain that this can only be estimated – a brief discussion should follow as to why it is an estimation and not an exact figure.	Slide 8
Collaborative/ dialogic learning approach	Learner activity to explore the concept of how outliers affect data using customer expenditure data	5	Whole group discussion – customer expenditure for a single week. Say what you see. Ask if the learners notice anything that stands out particularly in the table – they may spot that Wednesday's figures are unusual compared with the rest of the week. Question: How much did each of the three customers spend on Wednesday? The answer to this is unknown and could be anything that adds up to £15000 (you might prompt them to find the mean average for the day, which will help – however, do not directly suggest this method as it is important for learners to draw their own conclusions). Briefly discuss what the task entails and how the learners are going to complete it.	Slide 9 Mini whiteboards
Review	Using weekly expenditure figures, learners work in pairs to find the estimated	10	Learners will work in pairs to find an estimate of what a customer spends at the garden centre. Be prepared for a productive struggle. Scaffold through questioning if the learners run out of ideas.	Slide 10 Handout 1 – customer spending

Activity	Purpose of this activity	Time (min)	Guidance	Materials
	expenditure per customer. Discovering that outlier figures can skew results.		Learners could divide the total weekly expenditure by the total number of customers (£25.50); this will give the mean expenditure of all the customers, but is this useful? Refer to Wednesday's results. Circulate, noting ideas, the way the learners are working, and the calculations being made. It is vital to understand the way that learners are thinking and working for the post-activity discussion. Once the time is finished for the activity, discuss what the learners have found by bringing all of their ideas together. Make sure to discuss Wednesday's outlier figures and how this affects the overall results.	Mini whiteboards
Review	Introduction to the context of buying wellies	1	Tutor gives a very brief introduction to the new context of buying wellies.	Slide 11
Explore 1	Using past sales data to inform the purchase choice of wellies to expose the misconception that a mean average of size and sales can be used.	10	James has some brief raw data showing the sales for an unspecified week to inform his choice of the quantities and sizes that he will purchase next. Discuss the limitations of this information. Is it enough? What would be better? Highlight that James also has a very limited budget. He will not be able to simply replace the stock that has been sold. He must	Slide 12 Handout 2 Mini whiteboards

Activity	Purpose of this activity	Time (min)	Guidance	Materials
	To use the modal average.		prioritise which sizes to buy. How will he determine this? (The modal average is the best here). Display the order form and explain how this will be completed. Learners are to work through the task with a partner. Be sure to note the learners' methods, thinking, and calculations. This will be vital to consolidate the task in the post-activity discussion.	
Explore 2	Substantial task of matching the mean averages using pictorial representations, tables, number lists, and calculations to explore the underlying mathematical structure of the mean average.	15	Introduce the context of the task: The garden centre sells stackable boxes, which are one of their best sellers. James has been given some information about the sales of these boxes. All of the information relates to mean average. The cards must be matched to make sense of the data. Ask: How is mean average calculated? Allow learners time to complete the exercise, making note of the learners' thinking and any written work. This will guide the post-activity discussion. Once the learners have had enough time or they have completed the task, facilitate a discussion as to what the learners did and why. Ensure that you do not simply show the answers. Ask: Is the mean average a suitable average for analysing the average height of the stackable boxes sold? What about the decimal?	Slide 13 Handout 3 (cut into cards) Mini whiteboards

Activity	Purpose of this activity	Time (min)	Guidance	Materials
Review	A further activity exploring the mathematical structure of mean	10	Introduce the context: The garden centre has some missing information about the mean average time of how long visitors stay there. Show the learners the table and highlight the information given. Explain that there is missing information and that it is the learners' task to calculate what is missing. Display slide 15 and hand out the exercise in handout 4, explaining how the learners will work: • Work by themselves first. • Explain to their partner what they have done and why. Display slide 16, which has room for working and displaying some of the learners' ideas. Then, reveal the answers in the animations. If a pair has been successful in finding the missing information, ask them to explain how they did this and invite them to the board. If this is not possible, bring together the ideas of the class.	Slides 14−16 Handout 4 Mini whiteboards
Discuss	Paired activity and whole group discussion analysing delivery times to determine the most consistent delivery service.	5	Which delivery service? Introduce the task and explain that the garden centre wants a delivery service with the most consistent times. It will be useful to discuss what is meant by the word 'consistent'. The range is a vital calculation to use here because the mean average of both delivery services is exactly the same (4 hours).	Slide 17 Whiteboards

Activity	Purpose of this activity	Time (min)	Guidance	Materials
	Summarise learning, to capture ways of thinking and to clarify the concept of range.		Once you have explained the task, learners will discuss it in pairs and decide which delivery service is better. Be sure to take note of the learners' thinking and any calculations made to inform the post-activity discussion. Discuss their ideas with the learners, bringing everyone together to explore their methods and thoughts.	
Practice questions	GCSE Practice Questions – mean, median, and mode.	10	There are two exam questions. Learners will work independently. Depending on time and the ability of the learners in the group, you may choose only one or both questions for the class. Question 1: Learners must work independently to answer the Edexcel practice question. This question will help those learners who need more practice calculating averages and ranges. Question 2: Learners must work independently to answer the Edexcel practice question.	Slides 18−19

Review	Reviewing learning	5	When the exam questions have been completed, ask learners whether they have used a different approach to that used prior to the lesson when solving average problems. Has their thinking changed? What have they learned about averages? What have they learned about range? Discuss where they might use these skills in future. Display slide 20 and recap the lesson objectives asking questions about each point.	Slide 20