# Chapter 10 Use and interpret data

## Specification

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| **FS coverage and range** | Use and interpret statistical measures, tables and diagrams, for discrete and continuous data, using ICT where appropriate |
| | Use statistical methods to investigate situations |
| **FS exemplification** | Mean, median, mode and range for discrete data |
| | Modal class for grouped data |
| | Comparison of two groups using measure of average and range |

## GCSE

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| **GCSE specification** | SP h | Calculate median, mean, range, **quartiles and interquartile range**, mode and modal class |
| | SP j | Look at data to find patterns and exceptions |
| | SP l | Compare distributions and make inferences |
| | SP u | Use calculators efficiently and effectively, including statistical functions |
| **Edexcel GCSE course** | **Specification A:** | |
| | **Foundation** Chapter 12, 16.1–16.3, 16.5–16.7, Chapter 25 | |
| | **Higher** 11.1–11.7, 18.2, 18.4–18.6, 18.9–18.10, 24.4 | |
| | **Specification B:** | |
| | **Foundation Unit 1:** Chapter 2, 3.2, 3.4–3.5, 3.7–3.10, Chapter 4 | |
| | **Higher Unit 1:** 2.2, 2.4–2.6, 2.8–2.10, 3.2, 3.4–3.6, 3.9–3.10, 4.6 | |

## Resources

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| **General resources** | Timer or clock (showing seconds) |
| **Resource sheets** | 10.1 |
| **Links** | http://www.bbc.co.uk/weather/world/city_guides/ |
| **ActiveTeach resources** | Video |
| | ResultsPlus Knowledge Check |
| | ResultsPlus Problem Solving |
| | Question Audio |
| | Animations |

# Lesson 1

## Objectives

- Choose the correct values to find the range
- Find the mean and range from a set of data
- Interpret and communicate results from calculations using the mean or range

## Starter

- Conduct an experiment to see how accurately students can estimate the length of 1 minute. Students cover their eyes until they think 1 minute has elapsed, then record the actual time that has passed using a timer or clock. Discuss the methods used to estimate and then repeat the experiment. Ask students what differences they would expect to see in the second attempt. How could these be measured and analysed?

## Main teaching and learning

- Divide students into groups of 4–6 and ask them to analyse the data they collected during the Starter. They should use mean and range to compare the accuracy of their initial estimates with the second attempts. Ask: *Were estimated times more consistent? Were they generally more accurate? Were there any outliers/exceptional data? Would omitting the outlier from a mean calculation make a big difference?* Compare this activity to *Take a look:* Average running times (p99).
- Collect some simple data from the group (for example, hours spent watching TV yesterday) and record it in a tally chart and frequency table. Discuss how mean and range can be calculated directly from a frequency table and how this relates to raw data.
- Ask students to complete *Have a Go* Q1–3.

## Issues and misconceptions

- Ensure that students appreciate that mean is a measure of location and range is a measure of spread, when making decisions on which statistical technique to use. They may be tempted to think of higher mean and range as positive features without reference to the actual data. Many students find communicating the results of analysis in the form of comparative statements difficult.
- Ensure that students divide by the total frequency, not the number of categories, when finding the mean from a frequency table. In Q2, note that frequencies are given as percentages.

## Support

- Check students' understanding of mean and range and ensure that they do not confuse either with the median.
- Encourage students to check that their calculated mean is reasonable in the context of the raw data.

## Extension

- Ask students to find the median from the raw data for the 1-minute estimation activity.

## Plenary

- Pose the following questions: *When is it not appropriate to use the mean to summarise a data set? How did any outliers for the estimation of 1 minute affect the mean calculated?*

## Formative assessment

- Ask students to discuss in pairs the calculations carried out for Q1–3. They should compare their numerical answers and the reasoning for their conclusions.

## Homework

- Ask students to find three references to 'average' in the news. Was the mean, mode or median used? How was the average calculated?

# Lesson 2

## Objectives

- Choose appropriate measures to compare two sets of data
- Compare and interpret means and ranges
- Make conclusions and communicate results

## Starter

- Use topical examples of averages from the news (collected as Homework for Lesson 1) to discuss whether mean, mode or median were used. For example:
  - *What does an average speed camera record?*
  - *What is an 'average smoker'?*
  - *How would average house prices for a region be found?*
  - *When is mode given as a modal class (for example, 11–16 year olds)?*

## Main teaching and learning

- Divide students into small groups and give each a set of data/average matching cards from Resource sheet 10.1. Ask them to match the means, modes and ranges given with the correct data sets, to consolidate understanding of the definitions and calculations.
- Ask: *In a small company, the average age of the 10 female staff is 30 and the average age of the 15 male staff is 40. What is the average age of all 25 staff?* Ask students to discuss whether the correct answer is 35 or 36 and explain why.
- Ask students to discuss in pairs the relative merits of using the mean, mode or median to compare two or more sets of data. They should complete a two-way table showing the pros and cons for using each type of average (similar to the table in the Know Zone on p98). Ask each pair to discuss their ideas with another pair, then come together as a class and construct a final version of the table.
- Use the three examples from the Know Zone (p98) to decide on the best average to use in each situation. Compare the averages chosen with those given in the Know Zone.
- Display the data from *Have a go* Q7 (p102) about salaries earned by employees in two firms. Discuss how Robyn should decide and how appropriate each average is to use.
- Ask students to complete Q4–7, working in pairs.

## Issues and misconceptions

- Students may mix up the different definitions and methods for the various averages.
- Q7, on the wages of company workers, will help emphasise that the relative size of each group will affect the calculation of the overall mean from the group means.

## Support

- Use a number line to demonstrate range as a measure of spread and compare two sets of data. Display definitions of averages for easy reference.

## Extension

- Ask students to make up puzzle questions of their own, as in the card matching activity.

## Plenary

- As a class, mark the numerical answers for Q4–7. Discuss students' recommendations.

## Formative assessment

- Pairs of students peer-assess another pair's card matching activity, to check accuracy.

## Homework

- Ask students to make a poster or set of PowerPoint slides about the different averages. For each average they should include the method of calculation, when it is most suitable to use and an example in a real context.

# Lesson 3

## Objectives

- Decide how to use the information given in the question
- Examine relationships between sets of data
- Think about the implications of results to give advice

## Starter

- Use information from http://www.bbc.co.uk/weather/world/city_guides/ or similar to display rainfall and temperature data for two different cities. Ask students to suggest how they could decide which has the 'better' climate.

## Main teaching and learning

- Divide students into small groups and ask them to develop a detailed plan to compare the two sets of climate data from the Starter activity. They should consider the possible reasons for doing so and think about the averages that could be used and their relevance. Ask: *Is any information redundant? For example, if a location for a summer holiday is sought, winter data could be disregarded.*
- Discuss *Take a Look:* Average fuel economy (p103), emphasising that calculations may be required before data can be compared.
- Ask students to look at *Have a go* Q8 in pairs. They should initially write a plan including the calculations that they would do, the comparisons that they would make and what they would look for as evidence for a recommendation. Compare the two runners chosen by each pair and discuss the reasons that they were picked. Each pair should then work on either Q9 or Q10 and prepare a presentation for their final conclusion.

## Issues and misconceptions

- When comparing sets of data, students should decide whether high or low values are preferable. For example, a low race time or a high long jump distance.
- Emphasise the open nature of comparison questions and the need to justify recommendations with evidence, including the results of calculations.

## Support

- For Q9, ensure that students understand that a negative weight loss is actually a weight gain.
- In Q10, students need to take account of the different prices per kilogram that Ellen receives for the different breeds of lambs.

## Extension

- Ask students to design a spreadsheet to help with the calculations for Q8–10.

## Plenary

- Choose three pairs of students to present their work for each of Q9 and Q10.

## Formative assessment

- Ask students to compare their own findings with those presented during the Plenary.

## Homework

- Ask students to complete a full comparison of the climate in the two cities from the Starter activity. They should make a fully justified recommendation. (Students could be given a particular target audience for their recommendation.)