

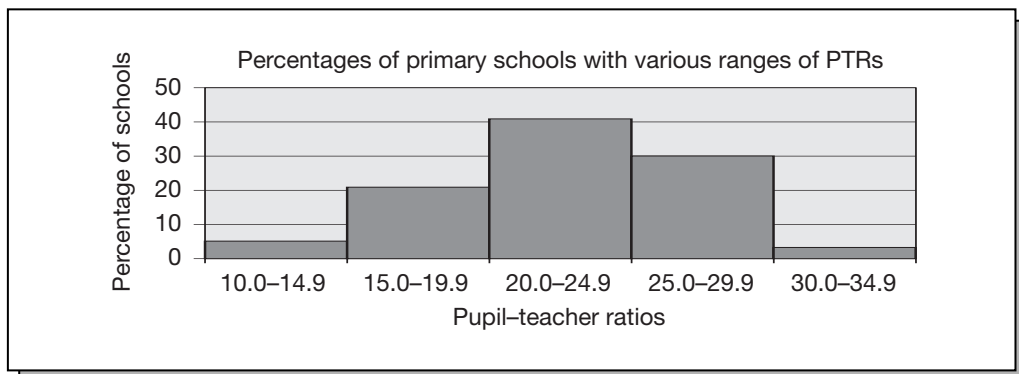
Check-Up

6

Bar charts for continuous data

The pupil–teacher ratio (PTR) for a school is calculated by dividing the number of pupils by the number of teachers. The bar chart shows the distribution of PTRs across all the primary schools in one LEA. To process the data the PTRs have been rounded to one decimal place.

- What is the PTR for a school with 345 pupils and 17 teachers?
- Approximately, for what percentage of schools is the PTR in the range 20.0–24.9?
- Approximately, for what percentage of schools is the PTR 25 or greater?



Answers to check-up 6

- a) 20.294117647... (using a calculator), which rounds to 20.3.
- b) About 41%.
- c) About 33%.

Discussion and explanation of check-up 6

For (a), on my calculator, I enter $345 \div 17 =$, to find the PTR for 345 pupils and 17 teachers. This gives the result 20.294117647. Because this is nearer to 20.3 than 20.2, when we round it to one decimal place we give it as 20.3. The answer for (b) is obtained by reading off on the vertical axis the approximate height of the column labelled '20.0–24.9'. For (c) we have to add the percentages for '25.0–29.9' (about 30%) and for '30.0–34.9' (about 3%), giving 33% in total.

We looked previously at displaying data from a frequency table where the variable could only take a certain number of separate (discrete) values. For example, Key Stage 2 mathematics test levels could only be whole numbers, namely, 1, 2, 3, 4, 5 and 6. Reading ages for a Year 2 class could only take values such as 5.1, 5.2, 5.3, 5.4, and so on. Contrast these with a variable like the height of pupils in a school. This could lie anywhere on a continuum of values from the minimum height to the maximum height. A growing pupil's height does not suddenly jump from 145.6 cm to 145.7 cm, for example. It increases continuously through all the values in between. For example, at one moment the pupil's height is presumably 145.654321 cm, even though we would not be able to measure it to that degree of precision. Such a variable is said to be *continuous*. In the example in Check-up 6, the variable could theoretically take thousands of different values, with any number of figures after the decimal point, including recurring decimals that go on for ever. The variable is not just restricted to a series of discrete values. For example, in (a) we found the PTR to be 20.294117647, with more figures to follow if the calculator had room to display them. So the PTR has to be treated as a continuous variable.

Now, in practice, to handle a continuous variable we always have to round the answers to the nearest something. If we measured heights, for example, we might decide to give them to the nearest half-a-centimetre. If we measured the weights of pupils (another continuous variable) we might record them to the

nearest 100 grams. In this check-up, each PTR has been rounded to one decimal place. Once you have done this, you have effectively turned it into a discrete variable – grouping it into appropriately sized intervals. But just to indicate that the original data was continuous in nature, the convention is usually to draw the bar chart with no gaps between the columns, as has been done here.

Summary of key ideas

- ◆ A continuous variable (like the height of pupils in a school) is one that can take any value on a continuum and is not restricted to a series of discrete values.
- ◆ In practice, because continuous data always has to be rounded to the nearest something (e.g. to one decimal place), it could be grouped and handled in the same way as grouped discrete data.
- ◆ To indicate that the data came from a continuous variable, when it is represented in a bar chart the columns should be drawn without any gaps between them.

Further practice

- 6.1 Decide which of these variables are continuous:
- a) the number of children in the families of pupils in a school
 - b) the times taken by pupils in a Year 7 group to run 100 metres
 - c) the number of A-level passes obtained by pupils in an A-level cohort
 - d) the ratio of girth (waist-size) to height for the 45 members of a school staff (this is called the index of rotundity!).
- 6.2 For the examples in 6.1 that are continuous variables, decide how you would round the data to the nearest something and then how you would group the data in intervals for display in a bar chart.