**Data and Chance**: Data

**13. Data 1**

This unit builds on existing knowledge of data sets and representation, and introduces new ways to compare, contrast and analyse.

**Unit Information**

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| **Learning**  **Outcome(s)** | Pose questions, collect, compare, summarise and represent data selectively to answer those questions.  Critically analyse and evaluate findings; and communicate inferences, conclusions and implications from the findings. |
| **Mathematical Concept(s)** | * The mean, median and/or mode are measures of centre which communicate different middles of the data and provide a range of insights. * Samples can be drawn from a population of data as representative evidence, to make generalisations and determine the degree of confidence or certainty about the generalisation. * Reported data can be evaluated in terms of its representativeness, intentionality and reliability. * Data displays (e.g., graphs) can be used to represent the variability in the data, the measures of centre and to compare between two groups. |
| **Mathematical Language** | data, data set, representation, bar chart, pie chart, line graph, histogram, dot plot, Excel, statistical software, bell-shaped, skew, symmetrical, mean, median, mode, range |
| **Prior**  **Knowledge** | * Be able to collect and represent data in different ways. * Understand the difference between qualitative and quantitative data. * Understand and be able to find different averages: mean, median, mode. * Be able to read and analyse data in a variety of presentations. |
| **Potential**  **Misconceptions** | * “Skew right” means that the tallest data point is on the right. [The opposite is true – it means that more data points are on the right.] * All averages can be used in all data sets. [One average is usually more useful than others – for instance, mean is good for sharing equally, mode will tell you most common.] |

**Unit Overview**

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|  | **Lesson 1** | **Lesson 2** | **Lesson 3** | **Lesson 4** | **Lesson 5** |
| **Focus of New Learning** | Represent data on appropriate graphical displays. | Represent data using an increasing variety of tools. | Analyse the shape of graphs and makes inferences about the data. | Discuss, describe and compare data by referring to distribution, shape, centre and variability. | Consolidate learning. |
| **Slides** | 13.1 | 13.2 | 13.3 | 13.4 |  |
| **Book** | p. 78 | p. 79 | p. 80 | p. 81 | pp. 82–83 |
| **Concrete**  **Resources** | ruler compass protractor | electronic devices ruler compass protractor | graph paper ruler | graph paper ruler |  |
| **Digital Resources** |  | | | | |

**Lesson 1: Represent data on appropriate graphical displays.**

Teaching Slides 13.1 | Student Book p. 78 | ruler, compass, protractor

**Learning Experiences and Anticipated Student Responses**

**Introduction:**

* Begin with a discussion of different data presentations. Ask the class to name as many as they can: bar chart, line graph, pie chart, histogram, pictogram, etc.
* What are they used for? Ask for examples.
* The slides give a little information on each one, as a recap. Take your time with these if necessary, to ensure that all children are caught up.

**Parts A and B:**

* Here, children get to choose how to represent the data given.
* There are two opportunities to create graphs/charts, so encourage children to use two different representations.
* Bar charts will be much quicker to do than pie charts, which require calculations of angle sizes before drawing.

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| **Anticipated Student Responses** |
| Answers will vary – children may choose to draw any type of data representation. |

**Part C:**

* Children write how the data from the displays can be used to inform planning for future business and to inform decisions made about the business.
* Some children may struggle to get going with this, as it’s an open-ended question on a topic they may not have really thought about before. Help them along by guiding them towards one or two of the examples listed below.
* Some possible answers are given here, but other answers are possible.

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| **Anticipated Student Responses** |
| * Looking at what drinks are popular to ensure enough stock is ordered. * Looking at what drinks are not popular and making changes to improve the sales of these drinks. * Examining the ingredients used to make drinks and ensuring that stock is bought from suppliers with the best prices to ensure maximum possible profits are made. * Looking at months that are not as busy and planning on how to increase the number of customers in these months. * Looking at busy months and ways of increasing profitability in these months such as special offers to encourage customers to upgrade the size of drinks, add on a snack with their drink etc. |

**Extension activity:**

* Another chance to display data in a way that they choose. When considering profit, encourage children to think about what sort of relationship there might be between the number of customers each month (i.e. the data from Part B) and the profit made.
* There is likely to be a direct relationship between the two – i.e. when number of customers goes up/down, then profit will probably also go up/down. This should be kept in mind when making a graph/chart of profits – it should broadly be the same shape as their answer to Part B.

**Lesson 2: Represent data using an increasing variety of tools.**

Teaching Slides 13.2 | Student Book p. 79 | electronic devices (computers/tablets), ruler, compass, protractor

**Learning Experiences and Anticipated Student Responses**

**Introduction:**

* Another quick recap of types of charts and graphs. This was covered in detail in the previous lesson so it should be fairly fresh in the memory still.
* Now consider *how* to make these – in Lesson 1, the class drew them out. Of course, it’s possible and potentially much more efficient to create them on a computer using tools such as Microsoft Excel, Google Sheets or similar software.

**Parts A, B and C:**

* These tasks are very similar to those in the previous lesson.
* If children have access, these tasks should be done on a computer – however if this is not possible, then it does provide further beneficial practice of data representation.
* If this is done by hand, then once the activity has been completed, you could demonstrate on an interactive whiteboard how they would look when done using software such as Excel. Children can then see these and compare them to their hand-drawn charts.
* For Part C, children can now look critically at their own work to analyse how well it represents the data. Is it easy to read? Did it take a long time to make?

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| **Anticipated Student Responses** |
| Answers will vary – children may choose to draw any type of data representation. |

**Extension activity:**

* Look again at the car sales data. What does it say about car sales? This is an open-ended discussion that children can have as a class, or in pairs or small groups.
* Listen into their pair/group discussions, and ensure their observations are on-topic and not just about appearance of the charts. They should be saying something about the actual car sales, not just how the graphs look.

**Lesson 3: Analyse the shape of graphs and makes inferences about the data.**

Teaching Slides 13.3 | Student Book p. 80 | graph paper, ruler

**Learning Experiences and Anticipated Student Responses**

**Introduction:**

* This lesson starts with a look at dot plots. The slides give three different dot plots and invite children to compare and contrast them.
* **Maths Talk:** “They are all numbered 1 to 10”, “The first and third dot plots are symmetric”
* This is an opportunity to introduce some new terms: **skew** means that a lot of data points lean, or skew, in one direction. The second dot plot is an example of skewed data.
* A **bell-shaped** curve is when data is symmetrical, and that most of the data is clustered in the middle with fewer points as you move away from the centre. The third dot plot is bell-shaped.
* These observations can tell you a lot about the averages – i.e. the mean, median and mode.

**Part A:**

* In addition to saying whether the data is skewed, you can also say *in which direction* it’s skewed.
* Data is **skewed right** if there are more data points on the right, and a higher grouping on the left. The “tail” of the curve will be on the right.
* Similarly, data is **skewed left** if the tail is on the left. So there are more data points on the left, but a higher grouping on the right.
* In the intro examples, the second dot plot is skewed left.

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| **Anticipated Student Responses** |
| 1. Skewed right 2. Bell shape 3. Symmetrical 4. Skewed left |

**Part B, C and D:**

* Children now draw a data set and describe it using this new vocabulary.
* Help will be needed when thinking about whether data skews left or right – it seems intuitive to say that it “skews right” because the tallest section is on the right, but this is incorrect!

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| **Anticipated Student Responses** |
| * Answers will vary – children may choose to draw different types of data representation. Likely choices will be bar charts or dot plots. * From their representation, they will notice that the data is **skewed left**. * This means that the data was not distributed in a symmetrical manner. More of the data was above 5 than below 5. |

**Extension activity:**

* More opportunity to practise displaying data visually.

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| **Anticipated Student Responses** |
| Any bell-shaped representation. |

**Lesson 4: Discuss, describe and compare data by referring to distribution, shape, centre and variability.**

Teaching Slides 13.4 | Student Book p. 81 | graph paper, ruler

**Learning Experiences and Anticipated Student Responses**

**Introduction:**

* This lesson discusses mean, median, mode and range. Ask the class what each of these are. What do they tell you about the data, and how do you work them out?
* **Maths Talk:** “For mean, you add up all the values, and divide by the number of values. It tells you what they would all be worth if everything was shared equally.” “For median, you line up all the values in order and find the middle one. It tells you which value is right in the centre of all the data, so half of the data is above it and half is below it.” “For mode, you count up the most common value.” “For range, subtract the smallest value from the biggest. It tells you how spread out the data is.”

**Parts A and B:**

* The first two parts in this lesson are based on the same data set.
* Children are first asked to represent the data – a histogram would be most suitable.

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| **Anticipated Student Responses** |
| * Mean: 3056 ÷ 16 = 191 cm * Mode: 190 cm (there are 5 sunflowers of this height) * Median: 190 cm * Range: 201 – 182 = 19 cm * Shape: looking at the representation from Part A, it shows that the graph is symmetrical |

**Part C:**

* Even though these are still sunflower heights, this is now one week later (so heights will have changed) and only 6 sunflowers are being looked at. Ensure that children don’t get confused with the first data set, and concentrate only on this new data.

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| **Anticipated Student Responses** |
| The total height of the 6 sunflowers is 203 × 6 = 1218.  The total of the 5 given sunflower heights is 203 + 205 + 198 + 208 + 197 = 1011.  So the missing height is 1218 – 1011 = **207 cm**. |

**Extension activity:**

* This is a tricky problem-solving puzzle – each piece of information should be taken one at a time and children should try and see if they can use it to work out at least one of the heights.
* As they go through, they’ll begin to complete the puzzle.
* Some children may need extra guidance – the information points are given in a really helpful order, so start with the first one! And then work through till the final point.

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| **Anticipated Student Responses** |
| * The median is 198 cm, so one of the sunflowers is **198 cm**. This also means that two sunflowers are taller and two are shorter than 198. * The mode is 192 cm, so two sunflowers are **192 cm** and **192 cm**. (These are below the median, so the final two sunflowers must be taller than the median.) * The range is 11 cm, and the smallest sunflower is 192, so the tallest is 192 + 11 = **203 cm**. * The mean is 197 cm, so the total height is 197 × 5 = 985 cm. The heights of the four known sunflowers add up to 785, so the final sunflower is 985 – 785 = **200 cm**. * So the five sunflowers are: **192, 192, 198, 200, 203** |