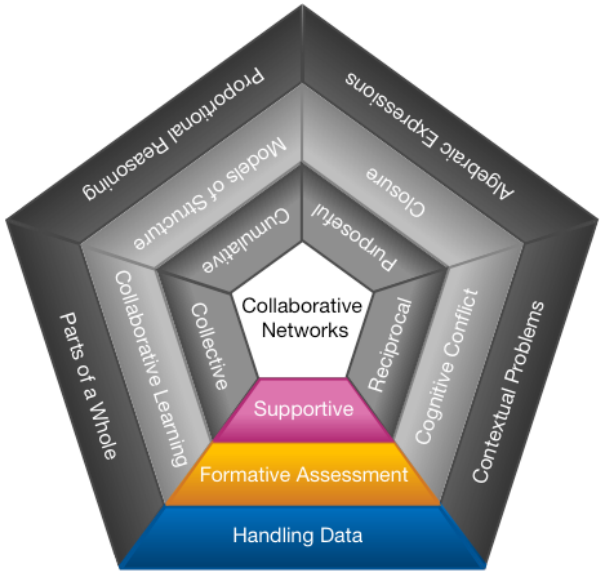
Lesson 5 Handling Data

Overview

The focus in the lesson, **Handling Data**, is on how **formative assessment** contributes towards **supportive** dialogue.



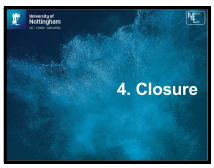
Formative assessment is assessment that provides information on what to do next.

Supportive dialogue is when ideas are expressed freely, without risk of embarrassment.

Research Question

How does the use of **formative assessment** help to develop an environment of **supportive** dialogic learning?

LessonSummary

Phase	Timings (minutes)	Notes
		Students must complete **L5.5 Pre-Lesson Assessment** and feedback provided prior to this lesson.
	**15 - 20**	Students work on the initial problem. *Students should have the opportunity to consider the various definitions of averages. Ensure that students understand how to construct a table and bar chart from their own class data on fruit and vegetables eaten. Also, students together, should establish how to work out averages from the bar chart.*
	**10**	Students match tables to bar charts on the template. *Observe what students are doing, ask students questions. The purpose of these questions should be to both support students learning and understand better their thinking. The Common Issues table can be used as a supportive teaching tool.*
	**5 - 10**	Check understanding of the activity using the review slides in the electronic presentation.
	**10 - 15**	The purpose of the activity is to both check students' understanding of key concepts, and extend their thinking. As such Closure provides an opportunity for both teacher and students to consider the extent the learning goals have been met.
	**10**	The extension consists of one problem. Students first provide an answer, and then consider the mistakes other students have made.

L5 Lesson Outline: Handling Data

Mathematical goals

To help students:

- understand the relationship between data and its representations;
- understand and be able to find measures of location and spread.

Starting points

Too often students will have been asked to simply find measures of location and spread from a decontextualised set of numbers. This can lead to a procedural understanding of finding summary statistics.

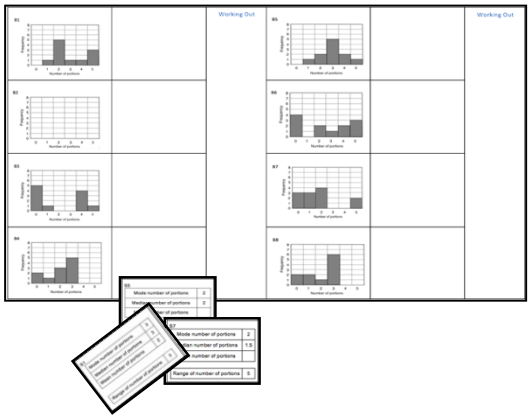
This problem is often compounded when data is displayed in the form of a frequency diagram. Students have particular difficulty in understanding how the data in the frequency diagram relates to an actual event.

Materials required

- L5.6 Presentation;
- L5.7 Spreadsheet.

For each group of students, you will need:

- a calculator;
- L5.2 Template printed on to A3 paper;
- L5.3 Cards;
- glue sticks;
- L5.4 Data Summary Sheet;
- L5.5 Pre-lesson Assessment;
- mini-whiteboards and pen.



Time needed

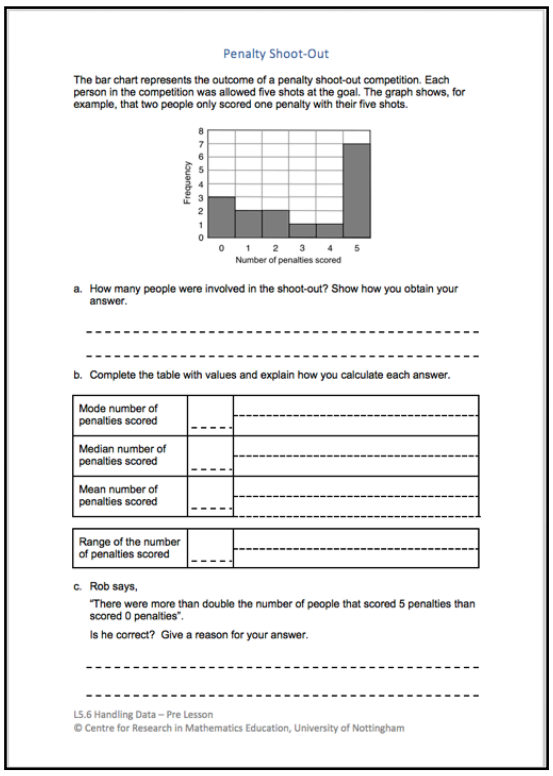
Approximately 1 – 1 ½ hours.

Lesson structure

Before the lesson

"The assessment task helps to motivate students to really want to understand."

Have students attempt **L5.5 Pre-lesson Assessment**, in class or for homework, a few days before the lesson. This will give you an opportunity to assess the work, to find out the kinds of difficulties students have and help you target your lesson effectively.



Penalty Shoot-Out

The bar chart represents the outcome of a penalty shoot-out competition. Each person in the competition was allowed five shots at the goal. The graph shows, for example, that two people only scored one penalty with their five shots.

a. How many people were involved in the shoot-out? Show how you obtain your answer.

b. Complete the table with values and explain how you calculate each answer.

Mode number of penalties scored		
Median number of penalties scored		
Mean number of penalties scored		
Range of the number of penalties scored		

c. Rob says,

"There were more than double the number of people that scored 5 penalties than scored 0 penalties".

Is he correct? Give a reason for your answer.

L5.6 Handling Data – Pre Lesson

It is important that, as far as possible, students are allowed to answer the questions without your assistance. Students should not worry too much if they cannot understand or do everything, because in the next lesson they will work on a similar task, which should help them. Explain that by the end of the next lesson, they should be able to answer questions such as these confidently.

1. How will the information you find out about the students' understanding affect the way you teach this lesson?

Before the main lesson, collect students' responses to the task. Make some notes on what their work reveals about their current levels of understanding and their different approaches.

It is suggested that you do not put a mark on student's work. Research shows that this will be counter-productive, as it will encourage students to compare their scores and distract their attention from what they can do to improve their mathematics. Instead, help students to progress by summarising their difficulties with one or two questions.

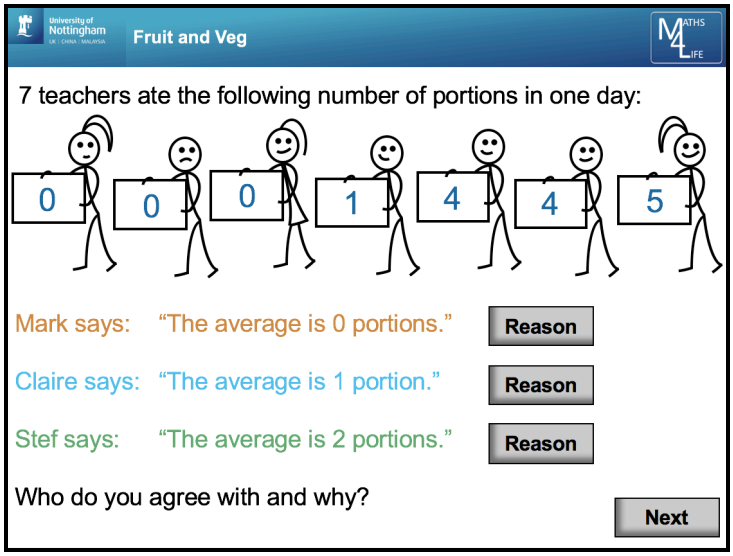
Some suggestions for these are given in the common issues table on the next page. These have been drawn from common difficulties observed in trials of this unit. Although the issues concern the specifics of the pre-lesson task, they are common to other lessons.

Common Issues	Suggested questions and prompts
Misinterprets the axes on the bar chart For example: The student states that there were five people involved in the shoot-out. Or: The student does not understand the term 'Frequency'.	• *What does the term 'frequency' mean?* • *How many people scored two goals? How many scored three?*
Reads off the frequency of the tallest bar as the mode, rather than the score For example: The student gives the mode as 7.	• *How many penalties did each person take?* • *Which score happened the most? How can you tell?*
Confuses the position of the median with the value for the median For example: The student adds one to the total frequency and divides by two to give a median of 8.5. Or: The student just halves the frequency. Or: The student assumes the median is 2.5, half way between 0 and 5. Or: The student writes two values for the median, 3 and 4.	• *The median is the middle score when all the scores are in order. Is this what you have found?* • *Try writing the scores in order: 0, 0, 0, 0, 1, 1, 2, …Which is the middle score?* • *How could you do this directly from the frequency graph without writing a list?*
Uses incorrect values to calculate the mean For example: The student finds the total of the frequencies rather than the total number of goals. Or: The student divides by six rather than the total frequency. Or: The student adds the scores (0+1+2+3+4+5) and divides this total by six.	• *How many goals were scored?* • *Five goals were scored seven times. So, what is the total number of goals? Compare this to your total, what do you notice?* • *Imagine writing the scores out as a list. From this list, how would you work out the mean?*
Presents the range as two figures, the highest and the lowest scores	• *What calculation is needed to obtain the range?*
Calculates the range in frequencies rather than the range of goals scored	• *What was the highest number of goals scored?* • *What was the lowest number of goals scored?*

Completes the task The student needs an extension task.	• *Can you produce a different bar chart that would have the same statistical measures? What is the same and what is different?*

Setting the scene

First provide a general overview of how students' work on the pre-lesson assessment has helped guide the learning goals of the lesson. Then introduce the lesson by displaying the following slides:

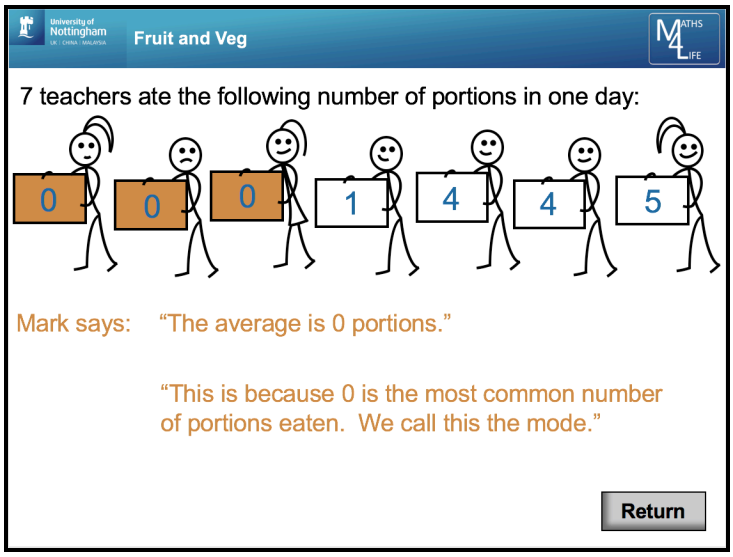


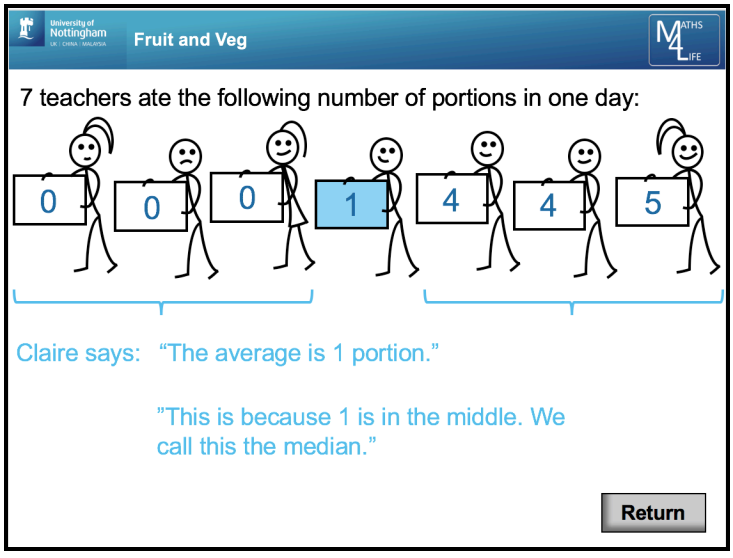
"Be sensitive to students' mistakes. Point out that they are in line with what many students think."

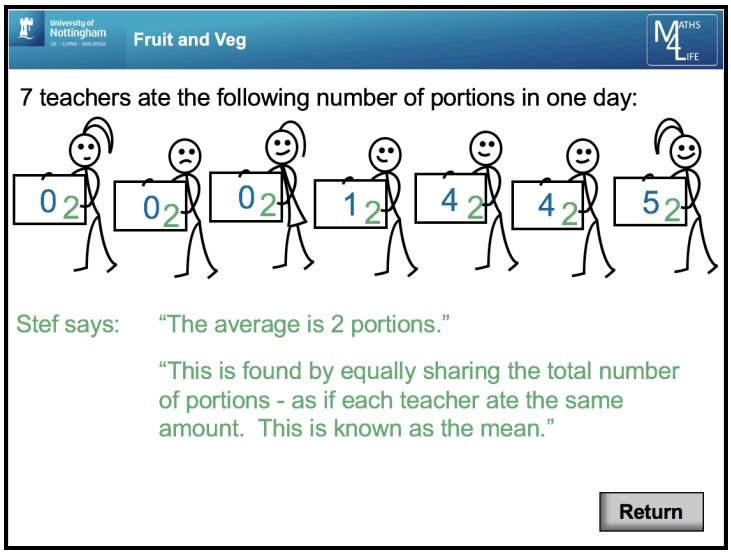
Ask students to decide on their own who they agree with and why, before sharing their ideas with a partner.

Ask students to share their ideas with the whole class before clicking on the appropriate button to see an explanation and definition. Be sure to emphasise that average is the value representing a data set. Although it could be argued that all three are correct, presented separately could be misleading.

2. Is this the 'best' definition of the median?

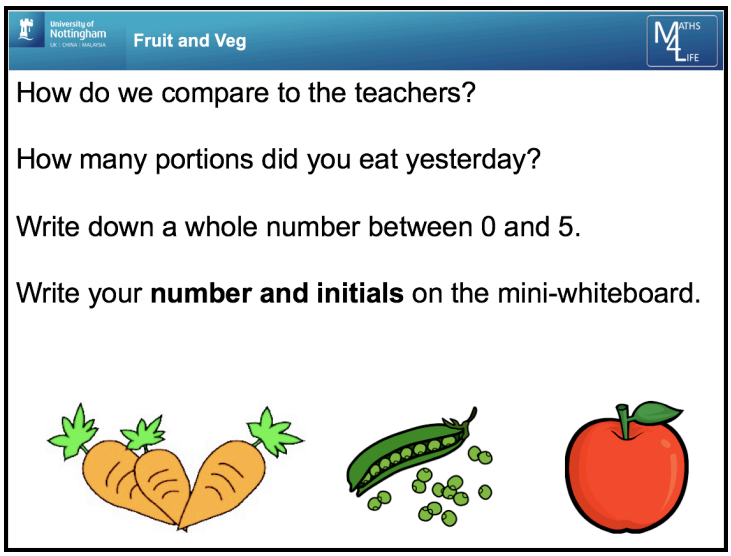






3. How can you ensure that the data you collect from students and yourself is as helpful as possible?

Now ask students to write the number of portions of fruit or vegetables that they ate yesterday on their mini-whiteboards.



"Involve students personally in the data they will work with"

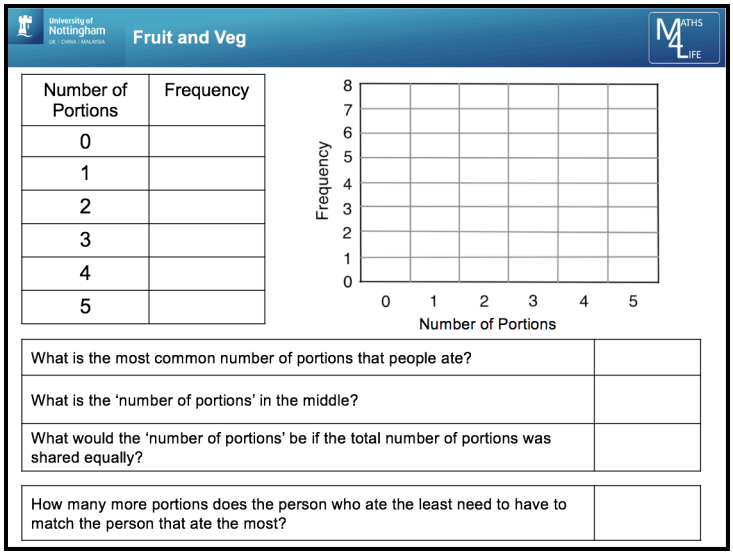
"Use A4 sheets of paper if mini whiteboards are not available"

On your whiteboard show me how many portions of fruit or vegetables you ate yesterday.
It must be a whole number between 0 and 5, so 2½ would not be allowed.
If you ate more than 5 then just write 5 for what we're doing.
Please also write your initials on the whiteboard.

Collect the mini-whiteboards from everyone who said 0, then everyone who said 1, and so on. Spread the mini-whiteboards out on the floor in a line from the least to the most portions.

Data can now be recorded on the electronic presentation (both the table and the bar chart), or on L5.7 Spreadsheet which will automatically generate the bar chart. For each student, add their number of portions into the section of the spreadsheet 'Raw Scores'. Then, if you would like them sorted in numerical order, press the 'Sort' button. The 'Show' buttons will show the respective statistics. Although this is a very straightforward spreadsheet, it may be useful to practice your understanding of it before the lesson.

Students may record the data on L5.4 Data Summary Sheet if required.



4. Why do we use the word 'frequency'?

Check that students understand the term 'Frequency'.
In this case, can you think of an equivalent phrase?
Why do we use 'Frequency' instead of (the equivalent phrase)?

Ask students for the average number of portions eaten. This will allow comparison with the teacher data.

The first measure of location suggested by students is usually the mode. Point out how this can be seen easily on both the frequency table and the bar chart.

5. What different ways can be used to help students make sense of finding the median?

Using the mini-whiteboards, find the median number of portions by counting to the middle from each side. Now re-arrange the mini-whiteboards on the floor to form a bar chart. Maintain the order of the whiteboards by keeping the left most whiteboard in the line as the base of the bar. Ask students how they would be able to identify the median directly from a bar chart.

Now ask students to identify what would be the number of portions if everyone ate the same.

Finally, ask students to identify the range of the number of portions eaten.

Can you say how many more portions the person that eats the lowest number would need to eat to match the person that eats the most?

"Involve students by asking them questions about where they are in relation to the statistical measures."

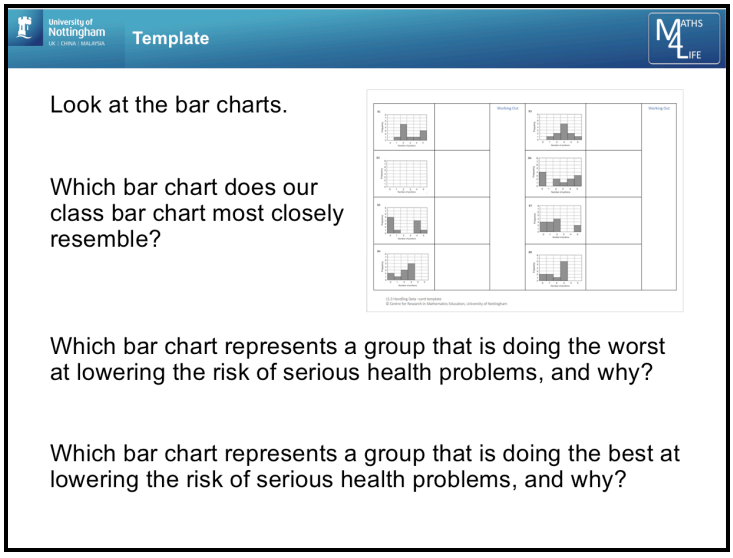
Note that visually this is moving the lowest bar the 'range number' of columns to get to the highest bar.

Collaborative Learning using Cards

Organise the class into pairs of students and give each group the card template, the matching cards and a glue stick.

Ask students to look at the bar charts and make comments using the following slide.

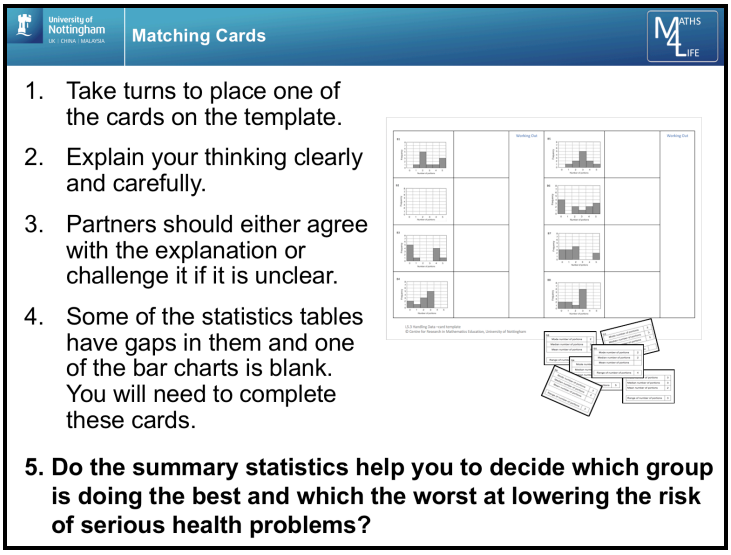
6. Why is this an important stage in the lesson?



Give students a couple of minutes to discuss and listen to a few ideas. Explain that we will now look at the summary statistics to see if they support their suggestions. Remind students that a purpose of finding summary statistics is to allow comparisons. Furthermore, it is still possible to compare, when we have a different number of pieces of data.

Explain how students are to work collaboratively using these instructions.

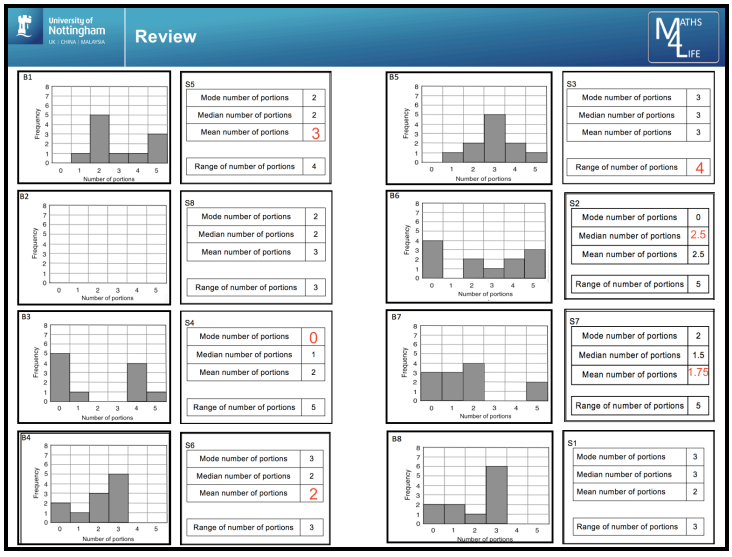
7. How will you react if students are finding the task difficult?



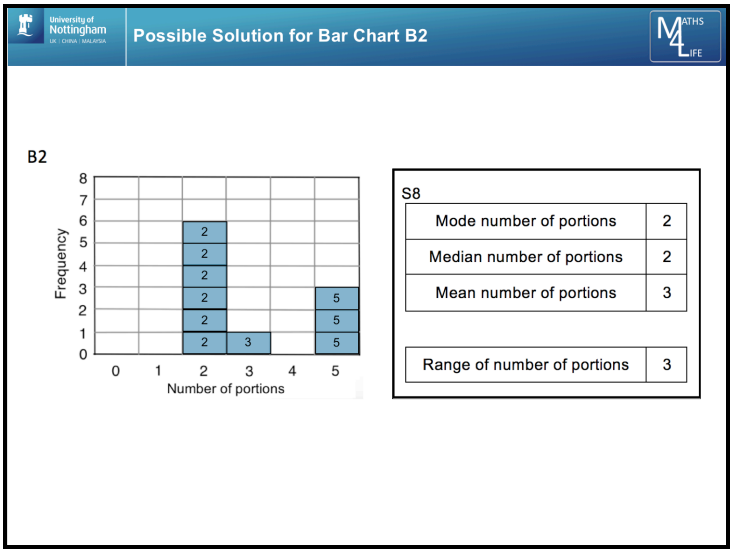
"Anticipate students' likely misconceptions and how you will respond"

Review

Draw the learning together by projecting the matchings to students and checking any questions or issues that they have.



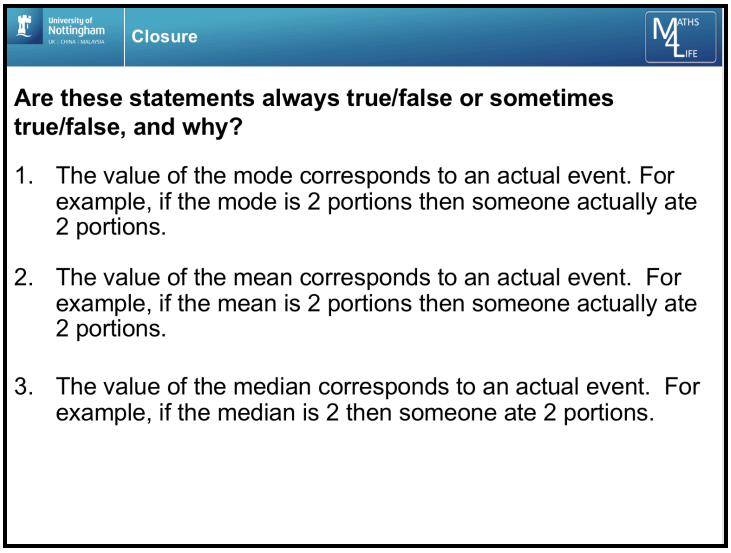
A possible answer for bar chart B2 is also included in the PowerPoint presentation.



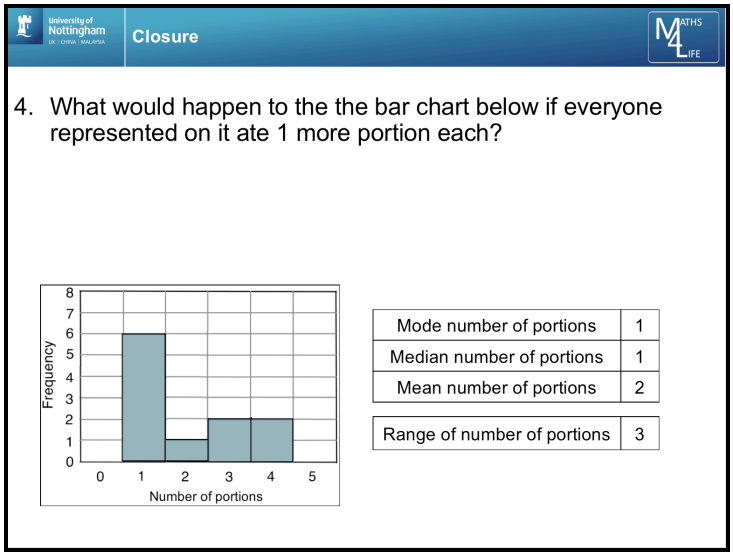
Closure

Use the following slide in whole class discussion to develop a better understanding of the measures of location and the measure of spread.

8. Which bar charts in the matching can be referred to in these questions?



The next three slides are designed to help students consider what-if style questions. Leaners should be encouraged to recalculate values and offer a reasoned explanation. (The slides are animated to aid understanding).



Extension

The final set of slides may be used during this lesson or in a subsequent lesson to review understanding. They give the opportunity for some further formative assessment by asking the students to write down anything they can tell from the bar chart. Subsequent slides are more structured with a number of common mistakes and misconceptions included.