NCEA Level 1 Numeracy - Statistics

Calculate the median and range for a set of data and compare the median and range for two sets of data

Content

This resource supports the teaching and learning of calculating the median and range of a set of data for the purpose of comparing sets of data. The sequence is suitable for learners in any context which requires comparison of sets of data and also where tutors are gathering naturally occurring evidence for the achievement of the NCEA Level 1 Numeracy Unit Standard 26626.

Alignment

The content aligns with Step 4/5 of the *Reason Statistically* strand of the Learning Progressions, in particular the *Preparing Data for Analysis* and *Analysing Data for Interpretation* Progressions.

Intent

After completing the teaching and learning sequence learners will understand:

- that the median and range are numbers ('statistics') used to summarise and describe a set of data
- that the median is the middle value of a set of data, put in order from smallest to largest or largest to smallest
- that the range is the difference between the highest and lowest value
- how to calculate the median and range for a data set.

Sequence

There are four parts to this sequence. Learners will:

1. discuss the differences between two sets of data
2. brainstorm what they already know about measures of centre and spread and define the median and range
3. calculate the median and range for two sets of data
4. discuss the differences between two sets of data and whether the comparison is easier when the median and range are known.

Key learning points

Measures of centre - commonly called 'averages'

There are three: median, mean and mode and they all measure different things.

Measures of spread

The simplest measure of spread is the range.

Other measures are the interquartile range and the standard deviation.

1. *Discuss the differences between two sets of data*

The following are Literacy and Numeracy for Adults Assessment Tool (LNAAT) scale score results for numeracy for two groups of learners. Ask learners to compare the numeracy scales scores of the two groups and, if necessary, prompt the learners to describe the overall ability of each group and how spread out they are. Record their responses. Listen for the use of the term average.

Group A:

182, 423, 512, 500, 478, 69, 190, 78, 430, 444, 51, 382, 360, 240, 213, 54, 460, 520, 400, 395, 312, 79

Group B

832, 543, 62, 282, 294, 114, 160, 72, 280, 422, 258, 198, 360, 374, 76, 389, 840, 206, 456

2. *Brainstorm what learners know about measures of centre and spread and define the median and range*

Step one: Ask learners the following questions:

- What does average mean to you?
- Do you know any other words for average? Prompt for mean, median and mode.
- Do you know any measure for how spread out the scores are? Prompt for range.

Key learning point

Measures of centre: 'Averages'

The **median** is the middle score of a data set in order of from smallest to largest or largest to smallest.

The **mode** is the most commonly occurring value – the sets of data above have no mode.

The **mean** is a calculated 'central' value found by adding up the values and dividing by how many values there are.

Step two: Establish that the **median** is one measure of centre and is the middle value when the data are put in order.

Step three: Establish that the **range** is one measure of spread and is the difference between the highest and lowest value.

3. Calculate the median and range for the two sets of data

Step one: Ask learners to work in pairs and put the two sets of data in order from smallest to largest.

Group A:

51, 54, 69, 78, 79, 182, 190, 213, 240, 312, 360, 382, 395, 400, 423, 430, 444, 460, 478, 500, 512, 520

Group B

62, 72, 76, 114, 160, 198, 206, 258, 280, 282, 294, 360, 374, 389, 422, 456, 543, 832, 840

Step two: Ask learners to record how many values there are in each set of data (A: 22; B:19).

Step three: Ask learners to find the middle value and share how they did it. Possibilities include marking off equal number of values at each end as below.

Group A:

~~51~~, ~~54~~, ~~69~~, ~~78~~, ~~79~~, ~~182~~, ~~190~~, ~~213~~, ~~240~~, ~~312~~, 360, 382, ~~395~~, ~~400~~, ~~423~~, ~~430~~, ~~444~~, ~~460~~, ~~478~~, ~~500~~, ~~512~~, ~~520~~

Group B

~~62~~, ~~72~~, ~~76~~, ~~114~~, ~~160~~, ~~198~~, ~~206~~, ~~258~~, ~~280~~, 282, ~~294~~, 360, ~~374~~, ~~389~~, ~~422~~, ~~456~~, ~~543~~, ~~832~~, ~~840~~

Key learning point

If the data set has an even number of values, the median will not be a value in the data set but a new value, halfway between the two middle values. (Group A)

If the data set has an odd number of values, the median will be one of the values of the data set (Group B)

Key learning point

To find a value halfway between two other values:

- add them up (360 + 382 is 742)
- divide by 2 (742 ÷ 2 is 371)

The median of Group A is 371

Step four: Discuss with the learners that the most efficient way to find the median is to find its place in the ordered values by:

- adding 1 to the number of values
- dividing this number by 2

and then counting out the place.

See below an example of finding the median values of the two sets of data.

Group A:

51, 54, 69, 78, 79, 182, 190, 213, 240, 312, 360, 382, 395, 400, 423, 430, 444, 460, 478, 500, 512, 520

There are 22 values. 22 + 1 is 23. 23 ÷ 2 is 11½. The 11^{th} value is 360, the 12^{th} value is 382. The $11½^{th}$ value is halfway between. The median is 371.

Group B

62, 72, 76, 114, 160, 198, 206, 258, 280, 282, 294, 360, 374, 389, 422, 456, 543, 832, 840

There are 19 values. 19 + 1 is 20. 20 ÷ 2 is 10. The 10^{th} value is 282. The median is 282.

Step five: Ask learners to find the range.

Group A:

51, 54, 69, 78, 79, 182, 190, 213, 240, 312, 360, 382, 395, 400, 423, 430, 444, 460, 478, 500, 512, 520

The range is 520 – 51 which is 469.

Group B

62, 72, 76, 114, 160, 198, 206, 258, 280, 282, 294, 360, 374, 389, 422, 456, 543, 832, 840

The range is 840 – 62 which is 778.

(These subtractions provide a great opportunity to encourage learners to use and share mental strategies for working them out.)

4. Discuss the differences between the two sets of data and whether the comparison is easier when the median and range are known

Step one: Summarise the two data sets for the learners.

Summary of the two data sets	
Group A:	**Group B**
Median 371, Range 469	Median 282, Range 778

Step two: Ask learners to compare the numeracy ability of the two groups. Responses should include that Group A has a higher level of numeracy ability than Group B, but a smaller range of ability. While Group B has a lower overall level of ability, there are some people with higher levels of numeracy ability.

Step three: Ask learners whether comparing the two sets of data was easier when they knew the median and range.

Step four: The supporting resource Exercises for comparing two data sets using the median and range includes examples of data sets where learners can practise calculating the median and range and comparing the data sets.