Level 7 – Statistics and Probability

Overview

Activity name	Mean, median, mode
Learning intention	To construct dot plots and calculate the mean, median and mode for data sets
Duration	50 minutes

Links to Victorian Curriculum

These work samples are linked to Level 7 of the Mathematics curriculum.

Extract from Mathematics Level 7 achievement standard

They construct stem-and-leaf plots and dot plots. Students identify or calculate mean, mode, median and range for data sets … They describe the relationship between the median and mean in data displays.

Relevant content descriptions

- Construct and compare a range of data displays including stem-and-leaf plots and dot plots (VCMSP269)
- Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data (VCMSP270)
- Describe and interpret data displays using median, mean and range (VCMSP271)

Links to NAPLAN

Minimum standards – numeracy

Year 7: Measurement, chance and data – Chance and data

They use and interpret a range of graphs and tables.

Student work samples – Constructing and interpreting a dot plot Part 1

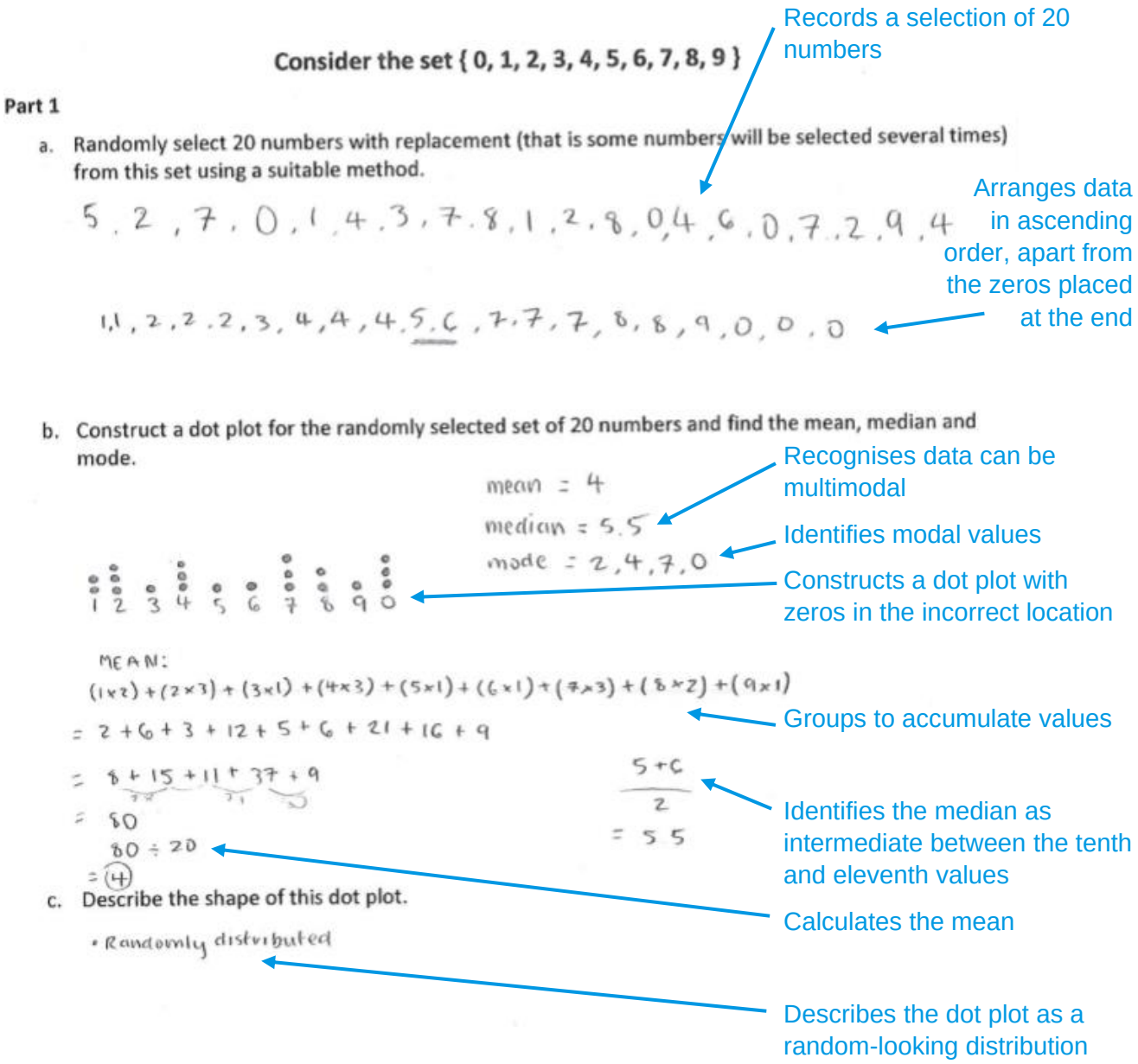
These work samples were created by students working at Level 7. Evidence of student achievement has been annotated.

Victorian Curriculum links

Construct and compare a range of data displays including stem-and-leaf plots and dot plots (VCMSP269)

Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data (VCMSP270)

Describe and interpret data displays using median, mean and range (VCMSP271)



Consider the set { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 }

Part 1

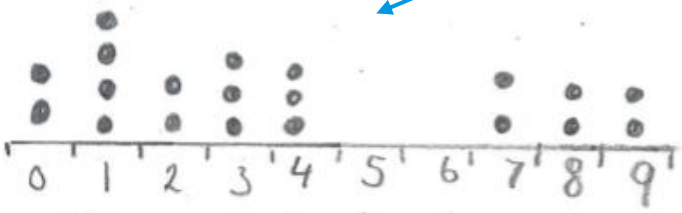
a. Randomly select 20 numbers with replacement (that is some numbers will be selected several times) from this set using a suitable method.

4, 0, 1, 8, 4, 9, 9, 2, 3, 7, 4, 3, 0, 1, 1, 8, 1, 2, 3, 7

Records a selection of 20 numbers

b. Construct a dot plot for the randomly selected set of 20 numbers and find the mean, median and mode.

Creates a dot plot using a ruler, creating even scale and spacing



mean: 3.75 mode: 1

median: 3

Identifies the mode

Identifies the median and calculates the mean

c. Describe the shape of this dot plot.

skewed

Identifies the dot plot as 'skewed', without indicating direction

Consider the set {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

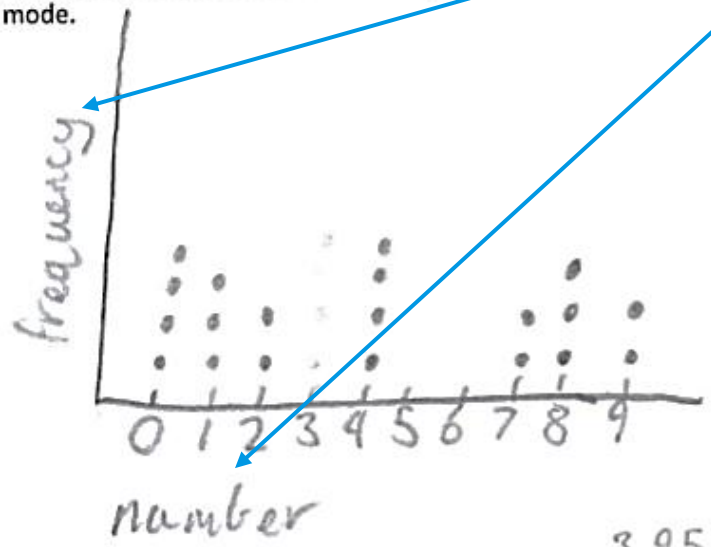
Part 1

a. Randomly select 20 numbers with replacement (that is some numbers will be selected several times) from this set using a suitable method.

0, 0, 0, 0, 1, 1, 1, 2, 2, 4, 4, 4, 4, 7, 7, 8, 8, 8, 9, 9

Records a selection of 20 numbers in ascending order

b. Construct a dot plot for the randomly selected set of 20 numbers and find the mean, median and mode.



Labels the horizontal and vertical axes

mean = ~~7.4~~ 3.95
median = 4
mode = 0 & 4

States the mean, median and modes

0 0 0 0 1 1 1 2 2 4 4 4 4 7 7 8 8 8 9 9
+ 9
79

Calculates the total of the collected data using column addition

3.95
20|79

Calculates the mean

c. Describe the shape of this dot plot.

The dot plot has no real shape, it is up and down 2 numbers have four and some numbers dont have any of themselves in the set

Describes the shape of the dot plot, noting some values are not represented

Consider the set { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 }

Part 1

a. **Randomly select 20 numbers with replacement (that is some numbers will be selected several times) from this set using a suitable method.**

0, 0, 1, 1, 2, 2, 3, 3, 4, 4, 5, 5, 6, 6, 7, 7, 8, 8, 9, 9.

Records a selection of 20 numbers in ascending order

b. **Construct a dot plot for the randomly selected set of 20 numbers and find the mean, median and mode.**

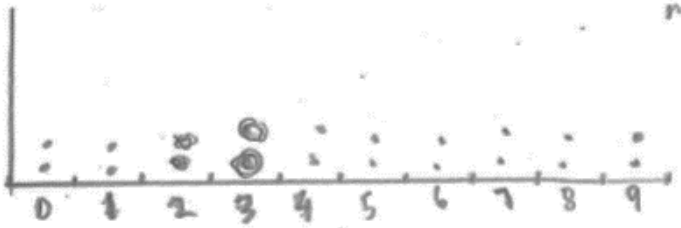
$\text{mean} = \frac{90}{20}$

$= 4.5$

Calculates the mean

median = 4.5

mode = No mode



Identifies the median and that there is no mode

c. **Describe the shape of this dot plot.**

It is equal and balanced, (Symetrical)

Describes the features of the dot plot as a constant distribution

Student work samples – Constructing and interpreting a dot plot Part 2

These work samples were created by students working at Level 7. Evidence of student achievement has been annotated.

Victorian Curriculum link

Construct and compare a range of data displays including stem-and-leaf plots and dot plots (VCMSP269)

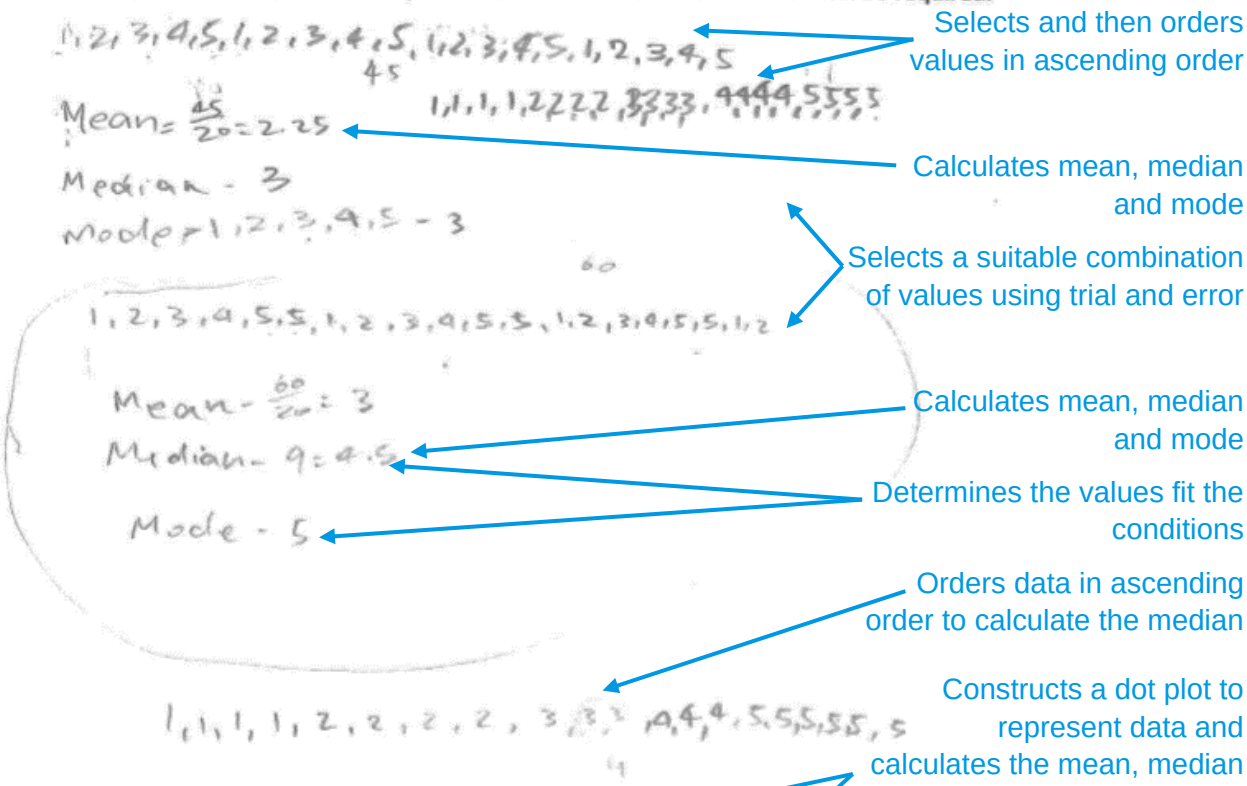
Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data (VCMSP270)

Describe and interpret data displays using median, mean and range (VCMSP271)

Part 2

a. Select 20 numbers from the set {0, 1, 2, 3, 4, 5, 6, 7, 8, 9} so that the *mean is less than the median which is less than the mode.*

Some experimentation with different combinations of selected numbers will be required.



b. Construct a dot plot for this selected set of 20 numbers and clearly identify the mean, median and mode.

Mean - 3
Median - 4.5
Mode - 5

Constructs a dot plot to represent data and calculates the mean, median and mode of the data set

Provides basic description of the distribution

c. Describe the shape of this dot plot.

All of the dots are 1-5 and no numbers are 6-10

Part 2

a. Select 20 numbers from the set {0, 1, 2, 3, 4, 5, 6, 7, 8, 9} so that the *mean is less than the median which is less than the mode.*

Some experimentation with different combinations of selected numbers will be required.

- mean less than median
- median less than mode

mode → median → mean
largest smallest

Describes the condition for the problem

Selects a set of numbers

9, 9, 8, 7, 3, 2, 6, 6, 7, 9, 9, 2, 1, 2, 3, 7, 1, 4,
1, 4 (1, 1, 1, 2, 2, 2, 3, 3, 4, 4, 7, 7, 7, 8, 8, 8, 9, 9,
9, 9) 7

Sorts set in ascending order

Mode = 9
Median = 4
Mean = 5.05

Calculates the mean, median and mode and identifies that the set does not meet the condition

Mode = 9
Median = 5.5
Mean = 5.2

Calculates the mean, median and mode for the second set

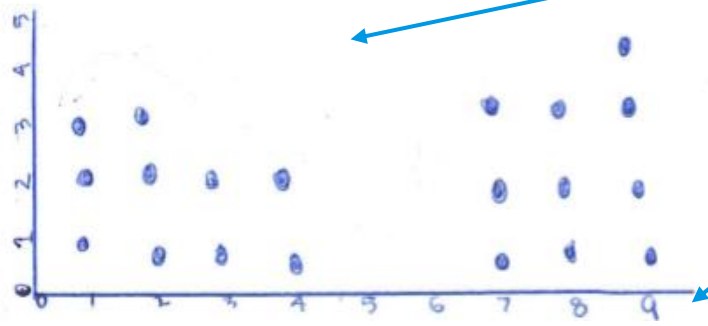
Mode =
Median =
Mean =

Creates a second set of numbers and sorts them into ascending order

1, 1, 1, 2, 2, 2, 3, 3, 4, 4, 7, 7, 7,
8, 8, 8, 9, 9, 9, 9

b. Construct a dot plot for this selected set of 20 numbers and clearly identify the mean, median and mode.

Creates a dot plot for the second set



Labels the vertical and horizontal axes with frequency

c. Describe the shape of this dot plot.

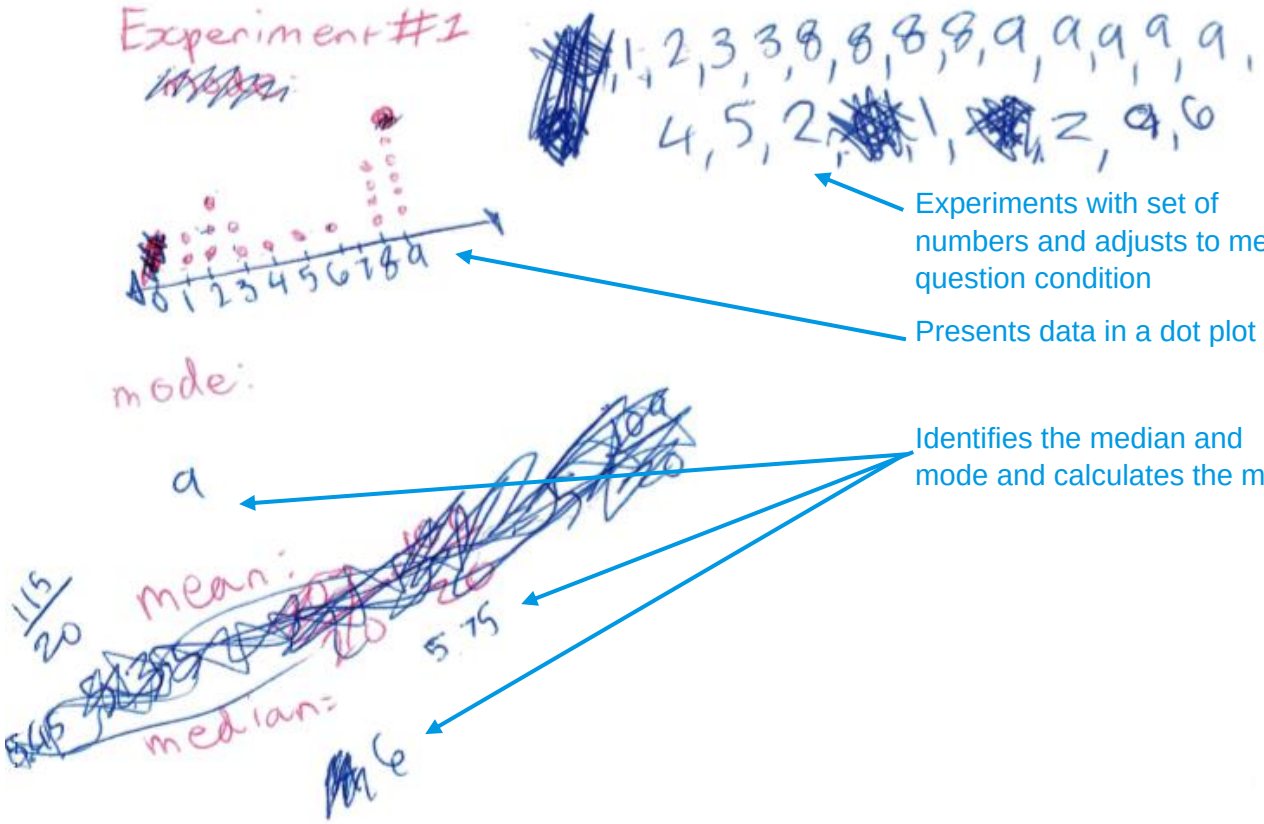
This plot is skewed. It is not symmetric or bimodal

Describes the shape of the dot plot as 'skewed' without further explanation

Part 2

a. Select 20 numbers from the set {0, 1, 2, 3, 4, 5, 6, 7, 8, 9} so that the *mean is less than the median which is less than the mode.*

Some experimentation with different combinations of selected numbers will be required.

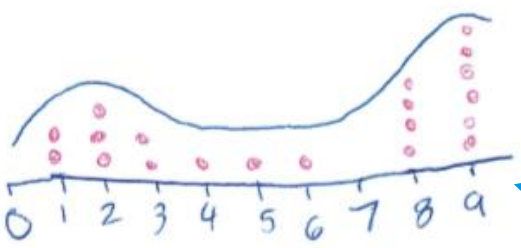


Experiments with set of numbers and adjusts to meet question condition

Presents data in a dot plot

Identifies the median and mode and calculates the mean

b. Construct a dot plot for this selected set of 20 numbers and clearly identify the mean, median and mode.



mode: 9

mean: 5.75

median: 6

States the mean, median and mode

Creates a dot plot reflecting the adjusted distribution then a curve to indicate shape

c. Describe the shape of this dot plot.

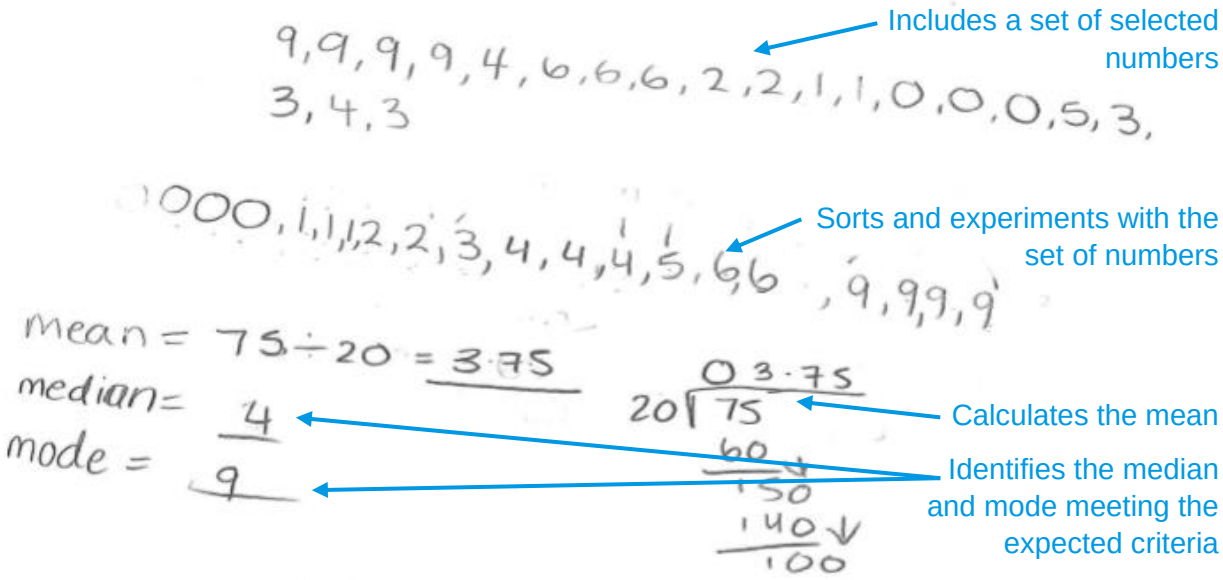
This shape of the dot plot is not symmetrical since we had to make the mode the largest

Describes shape and how the mode affects the distribution

Part 2

a. Select 20 numbers from the set {0, 1, 2, 3, 4, 5, 6, 7, 8, 9} so that the *mean is less than the median which is less than the mode.*

Some experimentation with different combinations of selected numbers will be required.



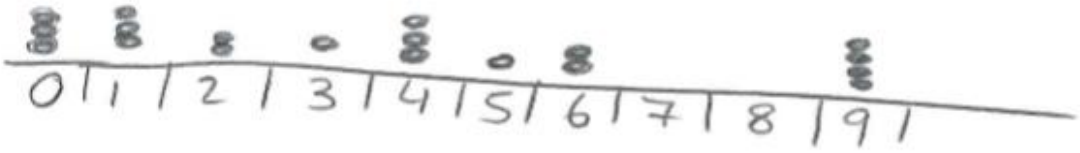
Includes a set of selected numbers

Sorts and experiments with the set of numbers

Calculates the mean

Identifies the median and mode meeting the expected criteria

b. Construct a dot plot for this selected set of 20 numbers and clearly identify the mean, median and mode.



Constructs a dot plot to represent the set of numbers meeting the condition

c. Describe the shape of this dot plot.

majority of the numbers are less than 5.

Comments on the distribution of numbers and its direction

Where to next for the teacher?

When the task on which these annotated student work samples is based has been used as a classroom activity, there is opportunity to gather data on student achievement and to help inform further teaching.

An analysis of student responses, on an individual, group or whole class basis, can be used to develop and direct student learning with respect to the following content.

For students needing to review underpinning knowledge and skills at Level 6

- Construct, interpret and compare a range of data displays, including side-by-side column graphs for two categorical variables (VCMSP235)

For students consolidating knowledge and skills at Level 7

- Construct and compare a range of data displays including stem-and-leaf plots and dot plots (VCMSP269)
- Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data (VCMSP270)
- Describe and interpret data displays using median, mean and range (VCMSP271)

For students moving on to new knowledge and skills at Level 8

- Explore the variation of means and proportions of random samples drawn from the same population (VCMSP299)
- Investigate the effect of individual data values including outliers, on the range, mean and median (VCMSP300)

Resources

- Mathematics Sample Programs, Victorian Curriculum and Assessment Authority (VCAA) – This set of sample programs covering the Victorian Curriculum Mathematics: F–10 were developed *as examples* to illustrate how the Mathematics curriculum could be organised into yearly teaching and learning programs.
- Numeracy Learning Progressions, Victorian Curriculum and Assessment Authority (VCAA) – The Numeracy Learning Progressions amplify, extend and build on the numeracy skills in the Victorian Curriculum Mathematics F–10 and support the application of numeracy learning within other learning areas.
- FUSE, Victorian Department of Education and Training (DET) – The FUSE website provides access to digital resources that support the implementation of the Victorian Curriculum F–10, including an extensive range of activities and other resources for Primary Mathematics and Secondary Mathematics.
- Mathematics Teaching Toolkit, Victorian Department of Education and Training (DET)
- Mathematics Curriculum Companion, Victorian Department of Education and Training (DET)
- Victorian Numeracy Portal, Victorian Department of Education and Training (DET)
- Aligned Australian Curriculum Resources (Mathematics), Australian Curriculum, Assessment and Reporting Authority (ACARA)