Common graphical representations

Encountered by students in Years P–6

<table>
<tr><th>Representation type</th><th>Graphing conventions</th><th>Common difficulties</th><th>Considerations for use</th><th>Possible teaching and learning strategies</th></tr>
<tr><td colspan="5">Table</td></tr>
<tr>
<td>
How students in 1A travel to school
<table>
<tr><th>Transport type</th><th>Number of students</th></tr>
<tr><td>walk</td><td>10</td></tr>
<tr><td>bike</td><td>0</td></tr>
<tr><td>car</td><td>12</td></tr>
<tr><td>bus/train</td><td>0</td></tr>
<tr><td>car-pool</td><td>0</td></tr>
</table>
Introduced in the Australian Curriculum

Prep Year Mathematics, Science and HASS: collect information in (prepared) tables and make simple inferences
Year 2 Mathematics: create and interpret data in tables

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includes a title
records data using numbers, tally marks or similar
presents data in a one-way table for one categorical variable (observed number or frequency)
presents data in a two-way table for two variables, e.g. ‘Lunchtime activity preferences of students in different year levels'

rows are one category
columns are the other category

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requires correct use of tally marks

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provides an easy method for gathering and organising both categorical and numerical data
shows frequencies for categories in a one-way table
examines relationships between categorical variables in a two-way table

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use ‘think-alouds’ to demonstrate to students how to construct a table
add data to a pre-constructed table — teacher with students, students in pairs then individually
conduct directed activities related to texts (DARTs), e.g.

provide a table without a title, without some of the category labels or with information missing, for students to complete and justify their choices
demonstrate the types of questions that could be answered with the data, then ask students to construct their own questions

compare data from different populations and lead class conversations related to any similarities and differences

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</tr>
<tr><td colspan="5">Picture graph</td></tr>
<tr>
<td>
Goal scorers for Under 10s netball 2019 season
<table>
<tr><th>Student name</th><th>Netball goals</th></tr>
<tr><td>Hai-Long</td><td>●●●●◖</td></tr>
<tr><td>Regini</td><td>●◖</td></tr>
<tr><td>Walid</td><td>◖</td></tr>
<tr><td>Armen</td><td>◖</td></tr>
<tr><td>Isabella</td><td>●●●◖</td></tr>
<tr><td>Nerida</td><td>●●●●◖</td></tr>
<tr><td colspan="2">Each ● = 10 goals
Each ◖ = 5 goals</td></tr>
</table>
Introduced in the Australian Curriculum

Year 2 Mathematics: create and interpret 1:1 picture graph
Year 4 Mathematics: construct and interpret 1:many picture graph

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includes a title
requires a key
usually presents data in a table format
can be constructed horizontally or vertically
uses pictures to represent the amount in a category

simplifies representation with recognisable, simple pictures
usually uses a whole or half a picture for 1:many graphs

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requires a selection of symbols/images that

can be time consuming to create
offer a poor choice of ratio for 1:many graphs due to inaccurate calculation of factors and multiples
make representation of fractions and fractional proportions difficult in 1:many graphs, e.g. $\frac{1}{2}$, $\frac{1}{4}$…

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represents

discrete numerical data
both types of categorical data

is not suitable for continuous data

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construct a class graph using students or objects as ‘pictures’; photograph and discuss
demonstrate grouping data by multiples
examine examples that use detailed pictures to highlight how these are time consuming to create and make representation of fractions difficult in 1:many graphs
conduct directed activities related to texts (DARTs), e.g.

provide a picture graph without a title and have students predict the title and justify their choice
leave the label off the most popular/least popular categories and have students complete the table and justify their choices
demonstrate the types of questions that could be answered with the data and ask students to construct their own questions

provide a range of vertical and horizontal graphs for students to examine graphing conventions across formats

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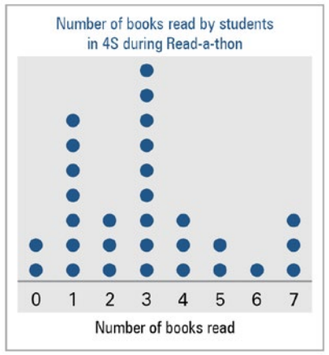
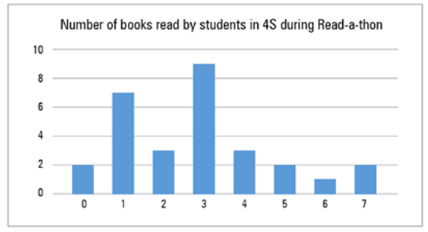
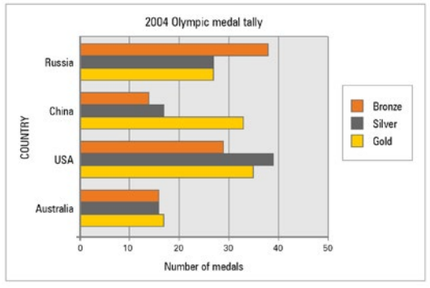
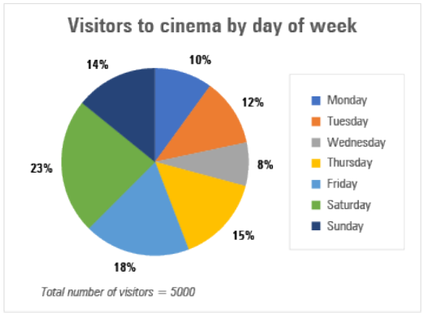
</table>

Representation type	Graphing conventions	Common difficulties	Considerations for use	Possible teaching and learning strategies
Dot plot				
 **Introduced in the Australian Curriculum** Year 5 Mathematics: construct and interpret	• includes a title • has one axis labelled • can be constructed horizontally or vertically — horizontal is usually preferred • presents dots evenly spaced so they can be clearly delineated • lists ordinal data along the axis • includes the total number of observations	• uses unordered order data to construct a graph • requires correct alignment of dots either vertically and/or horizontally • presents possibility for placement of data in wrong column	• offers an easy method for finding the mode, range and median • is used to represent – discrete numerical data – both types of categorical data	• construct a class graph using students or objects as 'pictures'; photograph and discuss • conduct directed activities related to texts (DARTs), e.g. – provide a dot plot without a title or without an axis label and ask students to predict and justify what it could be – demonstrate the types of questions that could be answered from the data and then ask students to construct their own questions • expose students to vertical and horizontal graphs • demonstrate the link to column graphs by drawing boxes around the columns, e.g. this example dot plot is recreated as a column graph in the representation below
Column graph (bar graph)				
  **Introduced in the Australian Curriculum** • Year 3 Mathematics and Science: construct and interpret simple column graphs • Year 6 Mathematics: interpret side-by-side column graphs	• includes a title • has two labelled axes – one axis for categories or values – other axis for frequencies or relative frequencies • provides spaces between columns • presents the option for each group of data to be organised into two or more categories in a side-by-side column graph • includes a key for side-by-side column graphs	• requires – spaces between columns to clearly define the categories or values as failure to include them affects interpretation – appropriate choice of scale range to fit the data range – appropriate choice of scale increments to accurately reflect trends in the data	• is used to represent – discrete numerical data – both types of categorical data • is not suitable for continuous numerical data • can be used to find mean, median, mode and range for discrete data	• conduct directed activities related to texts (DARTs), e.g. – provide a graph with missing information and have students predict and justify what it could be – demonstrate the types of questions that could be answered from the data and then ask students to construct their own questions • analyse vertical and horizontal graphs from a range of contexts. Focus on – graphing conventions across formats – impacts of changing the scale used • compare data from different populations and lead class conversations related to any similarities and differences

Representation type	Graphing conventions	Common difficulties	Considerations for use	Possible teaching and learning strategies
Pie chart				
 **Introduced in the Australian Curriculum** • Year 5 HASS and Year 7 and 8 Languages: read, interpret and analyse pie charts (content elaborations) • Year 6 Mathematics: interpret and compare a range of data displays	• includes a title • represents the total number in the data sample, i.e. the circle is 100% • calculates each sector as a part of the whole • uses the area of each sector to represent the relative frequency of a category • labels sectors and/or provides a key • presents the option of including the – total number, fraction or percentage of each category in the chart to aid interpretation • total number of the sample size, which is essential if wanting to compare two sets of data	• is open to misinterpretation of the visual representations of sector sizes as fractional sizes, e.g. $\frac{1}{2}, \frac{1}{4}, \frac{1}{3}, \frac{1}{5} \ldots$ • prevents correct comparison of datasets when the total number in each sample size has not been included	• is used to represent – discrete numerical data – both types of categorical data • is not suitable for continuous data • is commonly used in media	• conduct directed activities related to texts (DARTs), e.g. – provide a pie chart either without a title or without labels for the most popular/least popular sector categories and ask students to predict and justify what they could be – demonstrate the types of questions that could be answered from the data and then ask students to construct their own questions • analyse pie charts presented in a variety of formats. Focus on – graphing conventions across formats – links to fractions and/or percentages • expose students to stacked bar graphs which are constructed in a similar manner and commonly used in the media

Notes	
Variables	**DARTS**
Two broad groupings of variables can be included in data collection — categorical and numerical. • Categorical variables are variables whose values are categories, e.g. blood group is a categorical variable with the common categories being: A, B, AB or O. Categorical variables can be further divided into two sub-groups: – Ordinal — an adjective describes the numerical position, e.g. satisfaction rating, report grades, Olympic medal colour – Nominal — data is sorted into named categories, e.g. blood type, method of travel, hair colour, ice cream flavour. • Numerical variables are variables whose values are numbers, and for which processes such as calculating an average make sense. Numerical variables can be further divided into two sub-groups: – Discrete — usually a whole number count, e.g. school population, cricket score, number in a family. – Continuous — usually a measurement, e.g. temperature, weight, volume, swim race times	Directed activities related to texts (DARTs) are, in this context, activities designed to encourage critical analysis of representations. DARTs are used as a strategy for enhancing understanding of conventions and improving data comprehension, e.g. • reconstruction activities where students complete information that has been intentionally omitted from a graphical representation (title, labels, key, frequencies) and discuss their decisions • questioning activities that encourage a more critical examination of the data, its source and the type of questions that could be answered by the data.

References

Australian Curriculum, Assessment and Reporting Authority (ACARA), *Australian Curriculum Version 8,* www.australiancurriculum.edu.au/f-10-curriculum.

British Council, *Interacting with Texts*: *Directed activities related to texts (DARTs)*, www.teachingenglish.org.uk/article/interacting-texts-directed-activities-related-texts-darts.

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