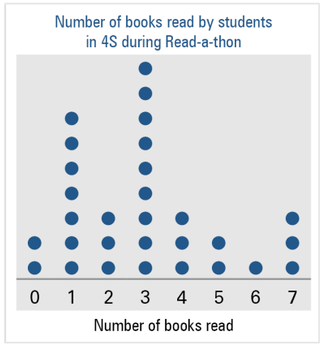
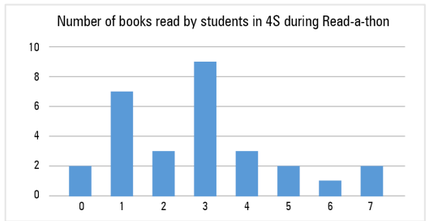
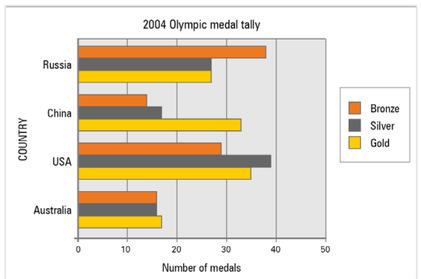
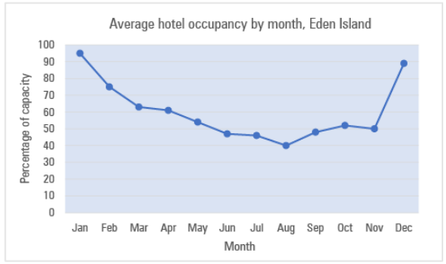
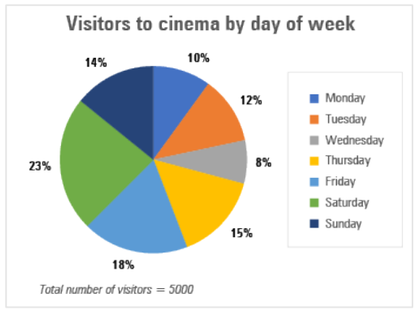
Common graphical representations

Encountered by students in Years P–6

ACiQ v9.0

Representation type	Graphing conventions	Common difficulties	Considerations for use	Possible teaching and learning strategies
Table				
How students in 1A travel to school **Transport type** / **Number of students** walk: 10 bike: 0 car: 12 bus/train: 0 car pool: 0 **Introduced in the Australian Curriculum** • Prep Mathematics, Year 1 Science and Year 2 HASS: collect information in (prepared) tables and make simple inferences • Year 2 Mathematics and Year 3 Science: create and interpret data in tables	• 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	• requires correct use of tally marks	• 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	• 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
Picture graph				
Goal scorers for Under 10s netball 2019 season **Student name** / **Goals** Hai-Long: 5 Regini: 2 Walid: 1 Armen: 1 Isabella: 4 Nerida: 5 Each ball = 10 goals Each half ball = 5 goals **Introduced in the Australian Curriculum** • Year 1 Mathematics, Science and HASS: create and interpret 1:1 picture graph • Year 4 Mathematics: construct and interpret 1:many picture graph	• 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 – clear representation with recognisable, simple pictures – generally uses a whole or half a picture for 1:many graphs	• 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. $\frac{1}{2}$, $\frac{1}{4}$…	• represents – discrete numerical data – both types of categorical data • is not suitable for continuous data	• 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 – remove 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

Representation type	Graphing conventions	Common difficulties	Considerations for use	Possible teaching and learning strategies
Dot plot				
 **Introduced in the Australian Curriculum** • Year 2 Mathematics: construct and interpret simple dot plots	• 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 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 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 chart)				
  **Introduced in the Australian Curriculum** • Year 2 Mathematics, Year 3 Science and HASS: construct and interpret simple 1:1 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 – space between columns to clearly define the categories or values, as failure to include space affects interpretation – appropriate choice of scale 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 • 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
Line graph				
 **Introduced in Australian Curriculum** • Year 5 Mathematics and HASS, Year 6 Science: construct and interpret line graphs • Year 6 Mathematics: construct and interpret stacked line graphs	• often uses time as the independent variable • plots the independent variable on the *x*-axis (horizontal) • places the dependent variable on the *y*-axis (vertical) • creates suitable scale increments based on range of data • connects points with a line	• requires – that order of *x*- and *y*-coordinates are not confused when plotting – that independent and dependent variables are placed on the correct axes – an appropriate choice of scale to fit the data range – an appropriate choice of scale increments to accurately reflect trends in the data	• is used to represent changes to a variable over time • time is always plotted on the *x*-axis	• construct a class graph — students use coordinates to position themselves on a graph, connect the points with a string, photograph and discuss • conduct directed activities related to texts (DARTs), e.g. – provide a graph with missing information for students to complete and justify their choices – demonstrate the types of questions that could be answered from the data, then ask students to construct their own questions • ask students to analyse a line graph in groups and discuss possible scenarios matching the line trajectory before whole-class sharing • examine the effect of changing the scale increments; discuss how this affects the apparent message of the graph
Pie graph				
 **Introduced in the Australian Curriculum** • Year 4 Mathematics: interpret other displays or visualisations	• 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 graph 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 graph either without a title or without labels for the most popular/least popular sector categories – ask students to predict what the title or labels could be and then justify their choices – demonstrate the types of questions that could be answered from the data – ask students to construct their own questions • analyse pie graphs presented in a variety of formats. Focus on – graphing conventions across formats – links to fractions and/or percentages • expose students to stacked bar charts that are constructed in a similar manner and also 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 and O. Categorical variables can be further divided into two sub-groups – ordinal — data has a rank or numerical position, e.g. satisfaction rating, report grades, Olympic race placegetters – nominal — data is sorted into named categories, where there is no rank to the 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 it could answer.

References

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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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