

Read in conjunction with *Facilitating evidence based discussions*.

## Introduction

A graph is a representation; it represents and summarises information so that patterns and relationships can be identified. Understanding the conventions of constructing and using graphs is an important aspect of scientific literacy.

During a scientific investigation, observations and measurements are made and measurements are usually recorded in a table. Graphs can be used to organise the data to identify patterns, which help answer the research question and communicate findings from the investigation.

Once you have decided to construct a graph, two decisions need to be made:

- What type of graph? and
- Which variable goes on each axis of the graph?

## What type of graph?

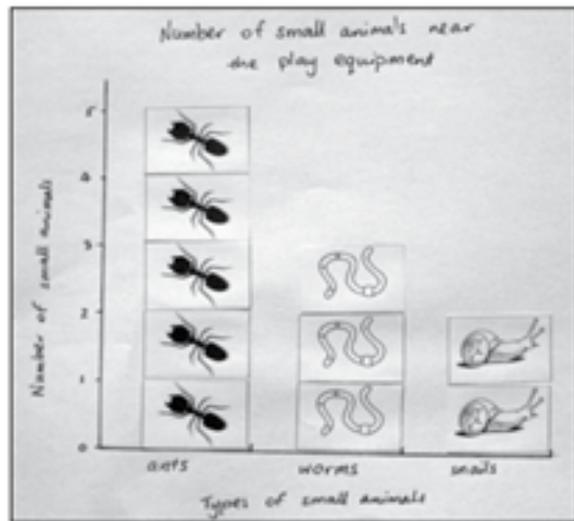
### Picture graph

**Picture graphs** support students in the transition from using physical representations to representing information using symbols or pictures in columns. The symbols or pictures must be the same size.

Table A shows the results recorded for an investigation of the types of small animals found in different environments. This information is represented in Graph A by using one small picture for each animal in Table A.

Types of small animals	Number of small animals
ant	5
worm	3
snail	2

**Table A:**  
Number of small animals near the play equipment



**Graph A:**  
Number of small animals near the play equipment

In the graph, each picture might also represent a number of animals, for example, 1 picture = 5 animals found.

## Analysis

Analysis of Graph A shows that different numbers of small animals were found near the play equipment. Students could compare graphs of different environments to determine which environments suit which animals. For example, if lots of ants were found in the garden, near the play equipment and in the lunch area, students might conclude that ants can live in lots of places in the schoolyard. If ants were only found in the garden, students might conclude that the ants prefer a garden habitat because they aren't found in other places.

## Column graph

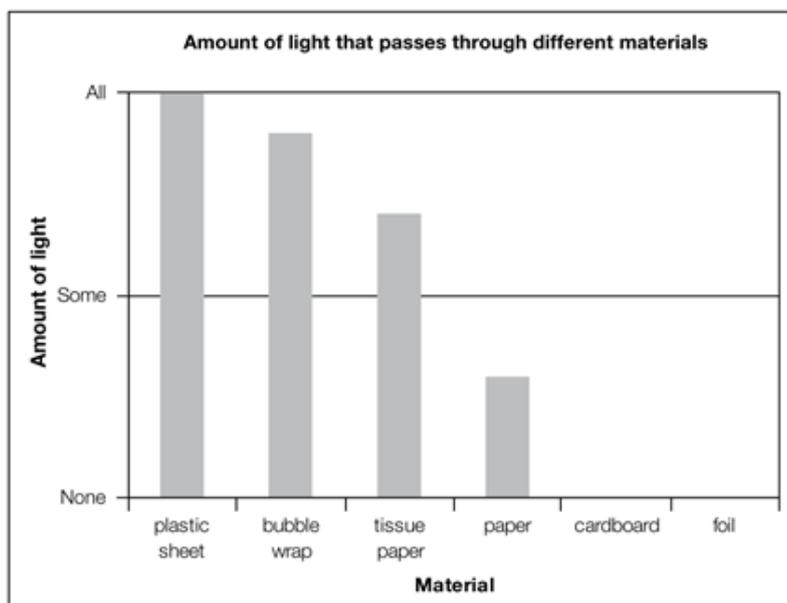
Where data for one of the variables are in **categories** (that is, we use **words** to describe it, for example, earthquake location) a **column graph** is used.

Graph B below shows how the results of an investigation of the effect of material type on the amount of light that passes through it (**data in categories**) have been constructed as a **column graph**.

Material	Amount of light
plastic sheet	all
bubble wrap	almost all
tissue paper	most
paper	not much
cardboard	none
foil	none

**Table B:**

**The effect of material on the amount of light that passes through**



**Graph B:**

**The effect of material on the amount of light that passes through**

## Analysis

Analysis of Graph B shows that the amount of light that passes through materials changes according to the type of material. This is because the more transparent or translucent the material is, the more light can pass through it.

## Which variable goes on each axis?

It is conventional in science to plot the variable that has been changed on the horizontal axis (X axis) and the variable that has been measured/observed on the vertical axis (Y axis) of the graph.

## Graph titles and labels

Graphs have titles and each variable is labelled on the graph axes, including the units of measurement. The title of the graph is usually in the form of 'The effect of one variable (the thing we are changing/ independent variable) on the other variable (the thing we are measuring or observing/dependent variable)'.

For example, 'The effect of material on the amount of light that passes through.'

## Steps in analysing and interpreting data

Analysing and interpreting data is a fundamental part of the scientific process and helps students draw conclusions from the data they have collected. See samples of analysis underneath both Graphs A and B above.

**Step 1** — Organise the data (for example, construct a graph) so you can see the pattern in data or the relationship between data for the variables (things that we change, measure/observe or keep the same).

**Step 2** — Identify and describe the pattern or relationship in the data.

**Step 3** — Explain the pattern or relationship using science concepts.

## Questioning for analysis

Teachers use effective questioning to assist students to develop skills in interrogating and analysing data represented in graphs.

For example:

- What is the story of your graph?
- Does the data in your graph reveal any patterns?
- Is this what you expected? Why?
- Can you explain the pattern? Why did this happen?
- What do you think the pattern would be if you continued the line of the graph?
- How certain are you of your results?

## The Australian Curriculum

The [Australian Curriculum: Mathematics](#) describes data representation and interpretation for as follows:

Foundation	Year 1	Year 2	Year 3
<p><b>Achievement Standard</b> Students answer simple questions to collect information and make simple inferences.</p> <p><b>Content Description</b> Answer yes/no questions to collect information and make simple inferences. (ACMSP011)</p>	<p><b>Achievement Standard</b> Students collect data by asking questions, draw simple data displays and make simple inferences.</p> <p><b>Content Description</b> Represent data with objects and drawings where one object or drawing represents one data value. Describe the displays. (ACMSP263)</p>	<p><b>Achievement Standard</b> Students collect, organise and represent data to make simple inferences.</p> <p><b>Content Description</b> Create displays of data using lists, table and picture graphs and interpret them. (ACMSP050)</p>	<p><b>Achievement Standard</b> Students interpret and compare data displays.</p> <p><b>Content Description</b> Collect data, organise into categories and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies. (ACMSP069)</p>
Year 4	Year 5	Year 6	
<p><b>Achievement Standard</b> Students construct data displays from given or collected data.</p> <p><b>Content Description</b> Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values. (ACMSP096)</p>	<p><b>Achievement Standard</b> Students pose questions to gather data, and construct data displays appropriate for the data.</p> <p><b>Content Description</b> Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies. (ACMSP119)</p>	<p><b>Achievement Standard</b> Students interpret and compare a variety of data displays including those displays for two categorical variables.</p> <p><b>Content Description</b> Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values. (ACMSP096)</p>	

<https://www.australiancurriculum.edu.au/f-10-curriculum/mathematics/>

# Using graphing to support development of Science Inquiry Skills

with Primary Connections

The [Australian Curriculum: Science](#) describes processing and analysing data and information as follows:

Foundation	Year 1	Year 2	Year 3
<p><b>Achievement Standard</b> Students share and reflect on observations.</p> <p><b>Content Description</b> Engage in discussions about observations and represent ideas. (AC SIS233)</p>	<p><b>Achievement Standard</b> Students follow instructions to record and sort their observations and share them with others.</p> <p><b>Content Description</b> Use a range of methods to sort information, including drawings and provided tables and through discussion, compare observations with predictions. (AC SIS027)</p>	<p><b>Achievement Standard</b> Students use informal measurements to make and compare observations. They record and represent observations.</p> <p><b>Content Description</b> Use a range of methods to sort information, including drawings and provided tables and through discussion, compare observations with predictions. (AC SIS040)</p>	<p><b>Achievement Standard</b> Students follow procedures to collect and record observations and suggest possible reasons for their findings, based on patterns in their data.</p> <p><b>Content Description</b> Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends. (AC SIS057) Compare results with predictions, suggesting possible reasons for findings. (AC SIS215)</p>
Year 4	Year 5	Year 6	
<p><b>Achievement Standard</b> Students use provided tables and column graphs to organise data and identify patterns. Students suggest explanations for observations and compare their findings with their predictions.</p> <p><b>Content Description</b> Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends. (AC SIS068) Compare results with predictions, suggesting possible reasons for findings. (AC SIS216)</p>	<p><b>Achievement Standard</b> Students construct tables and graphs to organise data and identify patterns in the data. They compare patterns in their data with predictions when suggesting explanations.</p> <p><b>Content Description</b> Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate. (AC SIS090) Compare data with predictions and use as evidence in developing explanations. (AC SIS218)</p>	<p><b>Achievement Standard</b> Students collect, organise and interpret their data, identifying where improvements to their methods or research could improve the data. They describe and analyse relationships in data using appropriate representations.</p> <p><b>Content Description</b> Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate. (AC SIS107) Compare data with predictions and use as evidence in developing explanations. (AC SIS221)</p>	

<https://www.australiancurriculum.edu.au/P-10-curriculum/science/>