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Learning-first approaches in NCEA Level 1 Science

Science uses subject-specific literacy to communicate knowledge

Te Tāhuhu o te Mātauranga
Ministry of Education

Science directions

The NCEA Change Programme has led to an expanded range of products for each subject in the Science Learning Area:

- Teachers can use the **Learning Matrix** as a tool to construct learning programmes that cover all of the *not-to-be-missed* learning in a subject.
- In NCEA Level 1 Science the **Big Ideas** are *about* science and the way scientists work and communicate.
- The contexts for learning include Big Ideas *of* science and this will be where traditional content is included.
- The **Subject Learning Outcomes** make clear to teachers what to include in their teaching and learning programmes and what student capabilities to check for, in the lead up to assessment.

This slide deck exemplifies how teachers can access a **learning-first approach** in Science.

Kaupapa o te rā

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This slide deck is designed to stimulate thinking, discussion, and practice that:

- adopts a learning-first approach in Science, focusing on ***Big Idea: Science uses subject-specific literacy to communicate knowledge***
- unpacks relevant Significant Learning, including in teaching and learning activities and resources
- identifies assessment opportunities
- links to the Big Ideas of Literacy across the Curriculum.

Science Big Ideas and Significant Learning

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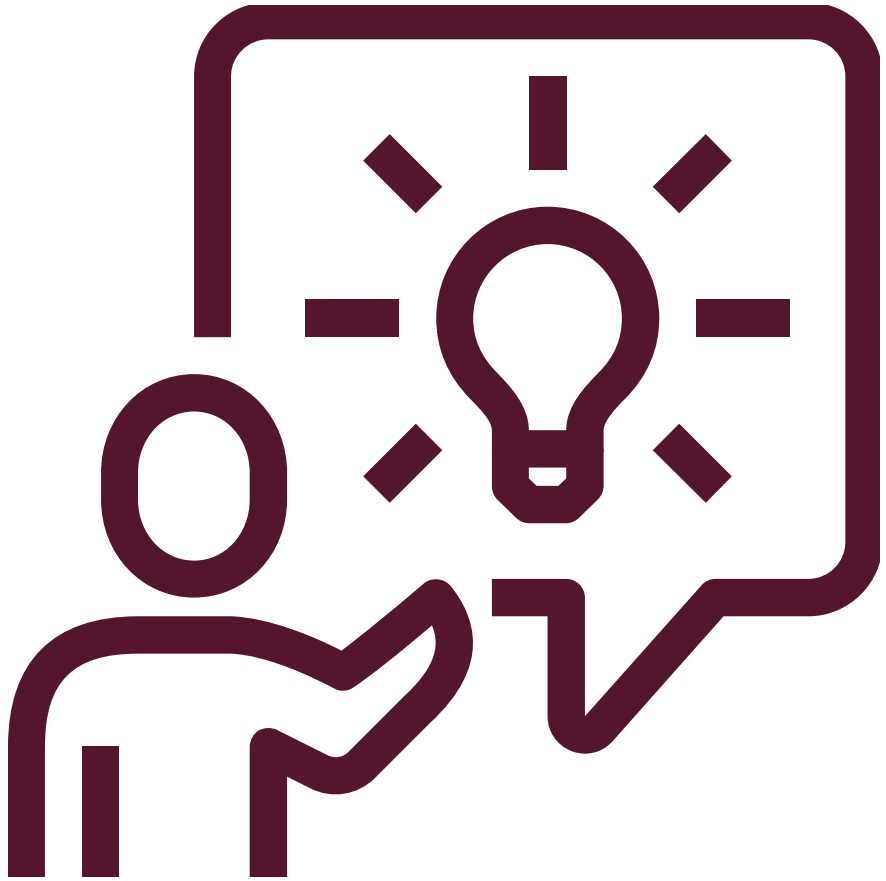
Big Idea: Science uses subject-specific literacy to communicate knowledge



Significant Learning

Ākonga will:

- recognise that scientific ideas are developed through critical and creative thinking, regulated by evidence
- recognise that science ideas are communicated using a range of methods with discipline-specific practices
- use science understanding to critique claims or predictions made in communicated information.

Literacy Big Idea

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We are all kaiako of literacy.

The Big Idea that '*Science uses subject-specific literacy to communicate knowledge'* aligns to the Big Idea of Literacy: '*Learners read critically'.*

Make explicit connections to the literacy skills ākonga are developing. Example resources for ākonga are given throughout this slide deck. The following are some questions that can be asked in relation to these resources:

- Who wrote the text, for whom, and why?
- Does the text have purposes that are not immediately apparent?

- What is Literacy about?
- Literacy Learning Matrix

Science uses subject-specific literacy to communicate knowledge

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Each link on the following slide will take you to an activity or article on the *Science Learning Hub — Pokapū Akoranga Pūtaiao*.

These highlight pertinent science ideas and how **Science uses subject-specific literacy to communicate knowledge.**

Science uses subject-specific literacy to communicate knowledge

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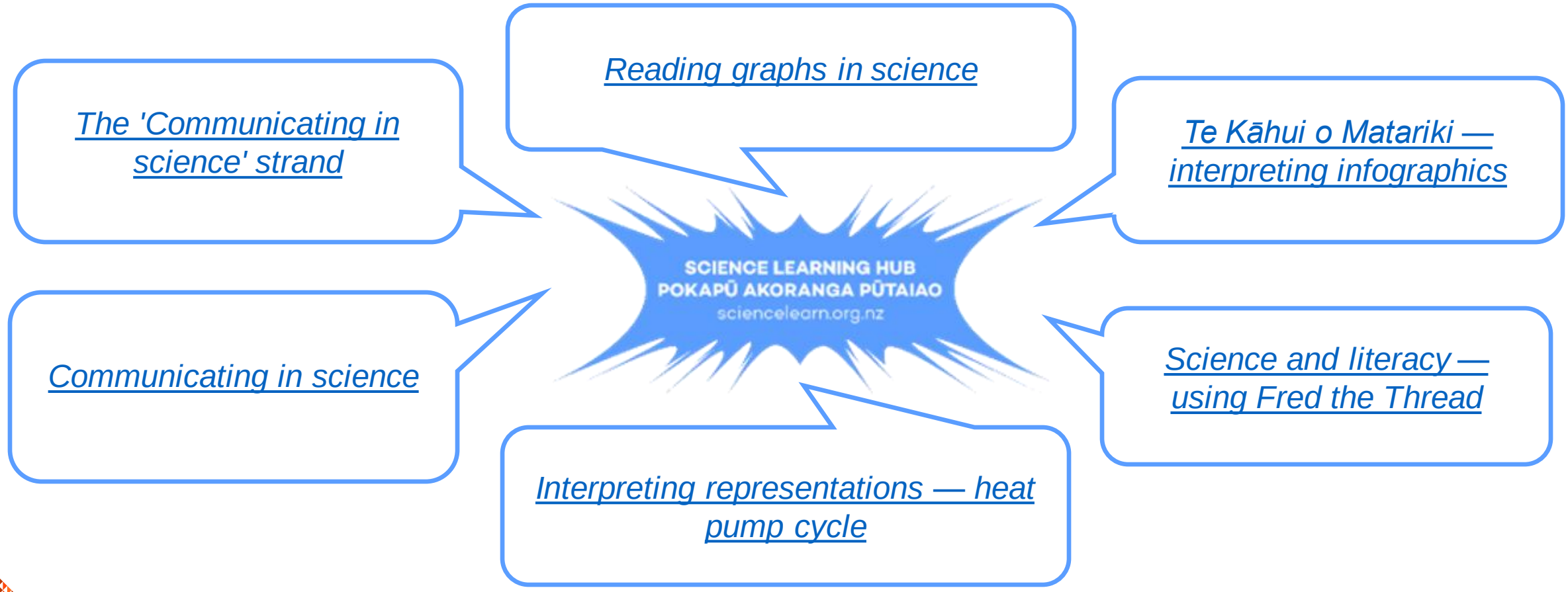
The links below take you to range of activities that support science and literacy



Reading Big Idea 2: Learners make sense of written texts

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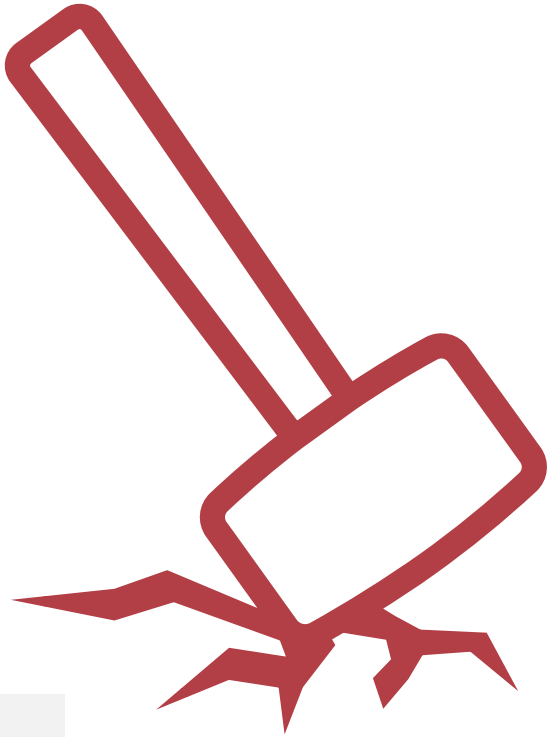


This may be an opportunity to go into greater depth in one content area.

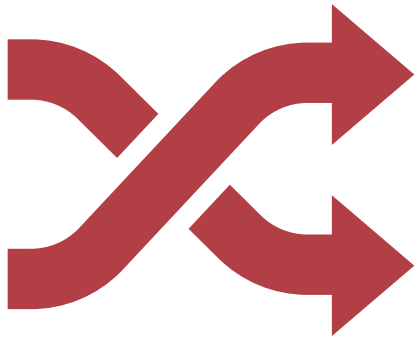
Which topic will showcase the specific communication techniques?

For example, Mechanics is rich in the use of units, force diagrams, speed time and distance time graphs, and the use of formulae.

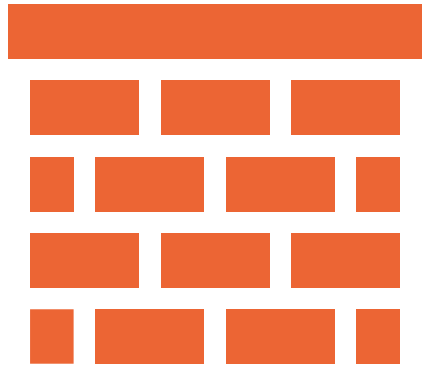
Slide 9 refers to the language of mechanics.
Units, force, speed, time, and formulae are all words that could be new to ākonga.

Reading Big Idea 1: Task

Try using a **‘mix and match’** activity. Give ākonga words and definitions. Make sure they are out of order. Ask them to match the correct word with the correct definition. You could do this on a worksheet or on a set of cards. Repeating this activity at the end of the unit is a good way to show ākonga how much they now know.



You could then ask ākonga to paste or write this into their notes as a glossary for future reference. They could also create a **‘word wall’** in your classroom with these key words on display.



Significant Learning: Recognise that scientific ideas are developed through critical and creative thinking, regulated by evidence

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Tenets of the Nature of Science (Science Learning Hub)

Explore this article and its many links and examples.

Think about how the tenets relate back to the Significant Learning above.

Use these connections to highlight the tenets of the nature of science:

- The tentative nature of scientific knowledge.
- The empirical nature of science.
- The inferential, imaginative and creative nature of science.
- The subjective and theory-laden nature of science.
- The socially and culturally embedded nature of science.

Significant Learning: Recognise that scientific ideas are developed through critical and creative thinking, regulated by evidence

[Animals in factory farms](#) | [Animals in science](#)

Critical thinking is required when we consider difficult ethical questions. These resources produced by SAFE challenge students on the treatment of animals in Aotearoa New Zealand. Is there any bias in the information presented?

[Kiwi farmers need science-led methane review (B+LNZ)](#)

Critical thinking is also required when we read articles and look behind the information. Who has written this and what might their motivation be? Is there any bias in the information presented?

Reading Big Idea 2: Learners read critically

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Slide 12 asks ākonga to read and think about the writer's purpose, the writer's bias, and how this has affected what they have written. Scientific texts can often be complicated texts for students to access. Make sure they have the literacy strategies they need for this task.

Reading Big Idea 2: Task

- Select a piece of reading that you want ākonga to understand. For each paragraph create a **'summary statement'** that sums up the main point made in each paragraph of the reading.
- Once you have read the text together, put ākonga into pairs. Ask them to decide which statement belongs to each paragraph. They can discuss their answers with another pair or as a class.
- They could then paste the article into their notes and attach the summary statements as appropriate.

Significant Learning: Recognise that scientific ideas are developed through critical and creative thinking, regulated by evidence

[Seven scientific discoveries from 2022 that may lead to new inventions (Smithsonian Magazine)]

Scientists must be creative. The examples in this article look at the innovative thinking in their research. What did they do differently? What are the possible applications?

[Incorporating cultural knowledge (Kudos Science Trust)]

[Ngā tohu o te taiao (NIWA)]

[Combining knowledge systems (NZ History)]

Evidence comes in many different forms. Examine the resources linked above. What sorts of evidence can you find?

Significant Learning: Recognise that scientific ideas are developed through critical and creative thinking, regulated by evidence

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This may be an opportunity to go into greater depth in one content area.

For example, there are several ideas about climate change and data. This could lead into looking at evidence for climate change and the consequences for your local area or places that are important to ākonga.

Significant Learning: Recognise that science ideas are communicated using a range of methods with discipline-specific practices

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[A day in the life of a marine biologist (Sea&me)]

[How do scientists communicate? (Sea&me)]

- Watch both videos on the left.
- In the first video look for examples of what data the experiment is collecting. Look for how they are trying to make the data as reliable and accurate as possible.
- In the second video make notes on how scientists communicate with other scientists.

Writing Big Idea 1: Learners write meaningful texts for different purposes and audiences

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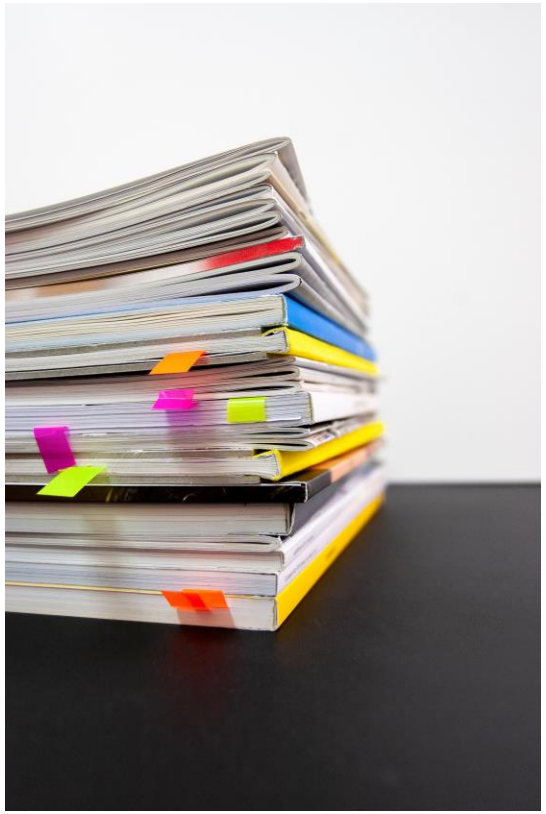
Slide 17 asks ākonga to watch two videos and collect information.

Consider how this information is going to be collected and then what ākonga are going to do with that information.

All reading and viewing should have a purpose. Ākonga should know what that purpose is *before they begin*.



Writing Big Idea 1: Task

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During the texts: Use a **comparison chart**:

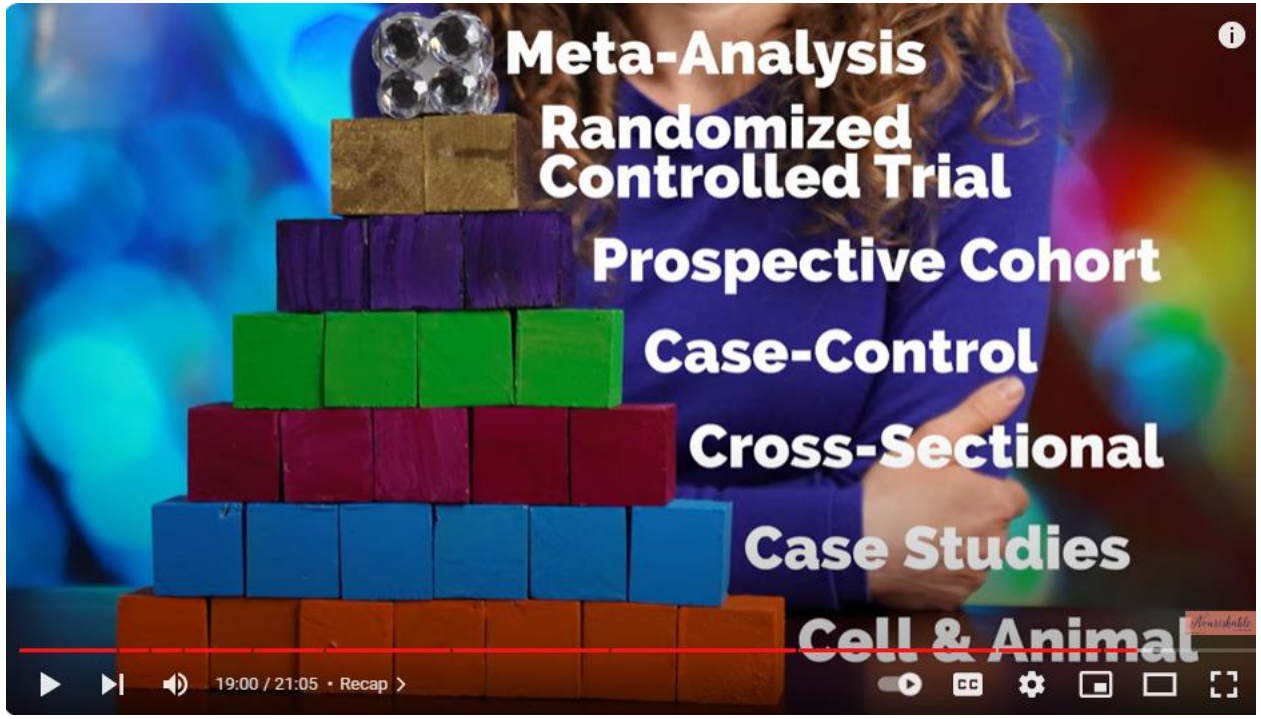
Question	Video 1	Video 2
What data is being collected?		
How are they making sure it is reliable and accurate?		
How do scientists communicate information?		

(Consider stopping the video and doing the first one together.)

After the texts:

1. Make a Venn diagram showing the differences and similarities of the information, ie 'compare and contrast'.
2. Write one paragraph answering each of the questions. You should model this by doing the first one together on the board.
3. Alternatively, you could ask the students to write a report and provide a writing frame.

Significant Learning: Recognise that science ideas are communicated using a range of methods with discipline-specific practices



[How to study studies, explained by a nutrition scientist (Nourishable)]

Not all research is equal.

This video explains some different types of research studies in the context of a particular question. “Do sugary drinks cause diabetes?”

- Make notes about the different types of research so you could explain them to another student who is absent today.

This demonstrates that not all scientific ideas should be given the same value.

Significant Learning: Recognise that science ideas are communicated using a range of methods with discipline-specific practices

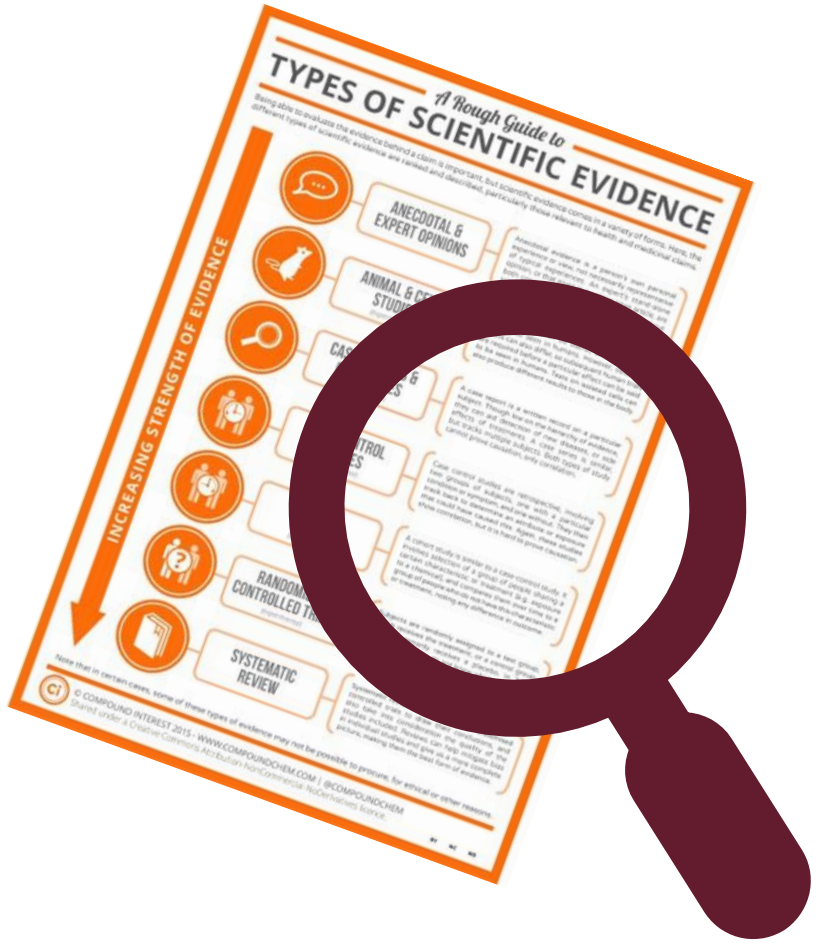
- Go to the Science Journal for Kids and filter the results for ‘upper high school’. Find two articles that use different types of evidence.
- Use the Rough Guide to Types of Scientific Evidence to decide which provides the strongest evidence.
- Compare and contrast the two articles. What methods have they used to communicate? Focus on discipline-specific practices.

Reading Big Idea 3: Learners read for different purposes

Slide 21 asks ākonga to find two articles that use different types of evidence. How will they find these?

Some students will not have the reading strategies to do this efficiently. They may read all the articles from start to finish.

(Note: It is always important to make it clear to ākonga at the start what the purpose of the reading is).



Reading Big Idea 3: Task

- Look at the Rough Guide to Types of Scientific Evidence (Compound Interest). Discuss the **keywords** that students should be looking for to select their two articles.

- Let ākonga know that when they are searching, they do not need to read the whole article. They should **scan** the text looking for those particular keywords. They can then look to ensure the they have two different types. Communicate your expectations around the two types.

- After you have done this activity several times you should not need to explain keywords or scanning. The first few times you may have to teach ākonga how to do the task as well as what to do.

Significant Learning: Use science understanding to critique claims or predictions made in communicated information

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Help save the endangered Pacific Northwest Tree Octopus!

DHMO.org
Dihydrogen Monoxide Research Division

Raising awareness of the dangers of dihydrogen monoxide.

Diamond water — alkaline water infused with diamond energy!

Significant Learning: Use science understanding to critique claims or predictions made in communicated information

By Gavin Mouldey, copyright © Crown 2019

Fake Facts (Tāhūrangi)

WICKED PROBLEMS:

CLIMATE CHANGE

1080

Water fluoridation

Genetically modified foods

Significant Learning: Use science understanding to critique claims or predictions made in communicated information

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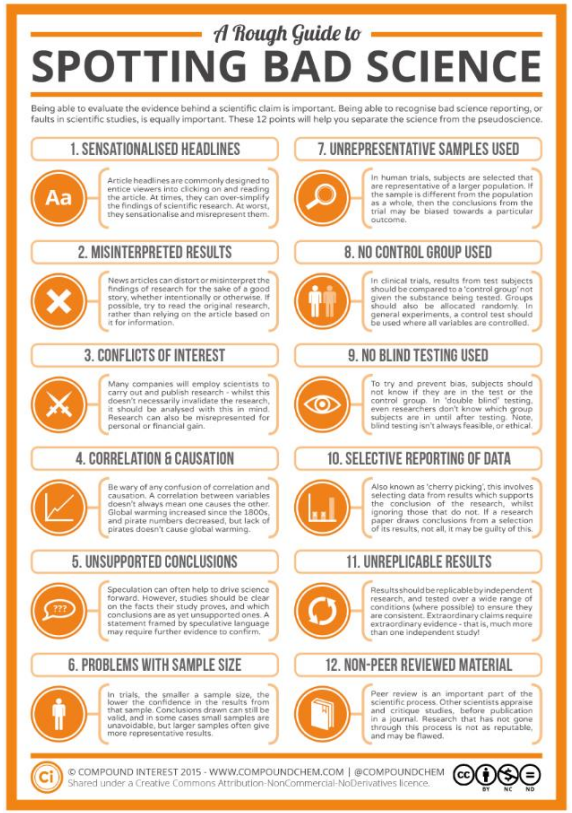

A rough guide to spotting bad science (Compound Interest)

Not all science articles are equal. Even if a source looks scientific it might not be when you look at the details. How might you judge the following articles about the health effects of **vaping**?

- Nicotine and other potentially harmful compounds in “nicotine-free” e-cigarette liquids in Australia (MJA)
- New research sheds light on vapers transitioning to smoking (RNZ)
- Can vaping damage your lungs? (Harvard Health Publishing)
- New vaping restrictions come with nicotine limits, no more fancy names but loophole remains (NZ Herald)

Writing Big Idea 2: Learners use written language conventions appropriately to support communication

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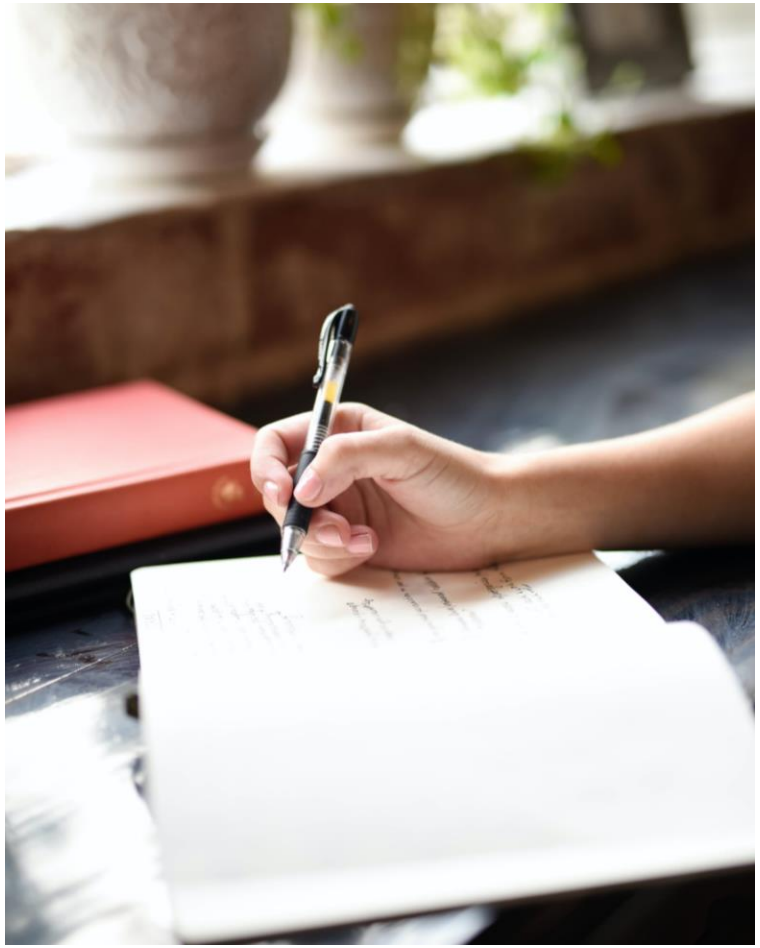
Slide 26 discusses how some things ‘sound’ scientific but are not. This is typically because of the language used. This should be highlighted and discussed with ākonga.



Writing Big Idea 2: Task

- Ask ākonga to choose one of the articles about vaping. They should rewrite their chosen article for the school magazine. The idea is to see how changing the audience changes the language.

- Ensure ākonga understand the words in the original article and can do this task effectively. A number of pre-writing tasks could be considered.

- Show ākonga how to write the report using a **template** or **scaffold**. Remind the students that correct punctuation is important. They must use a capital letter at the start of every sentence and a full-stop, question mark, or exclamation mark at the end.

Opportunities for local curriculum links

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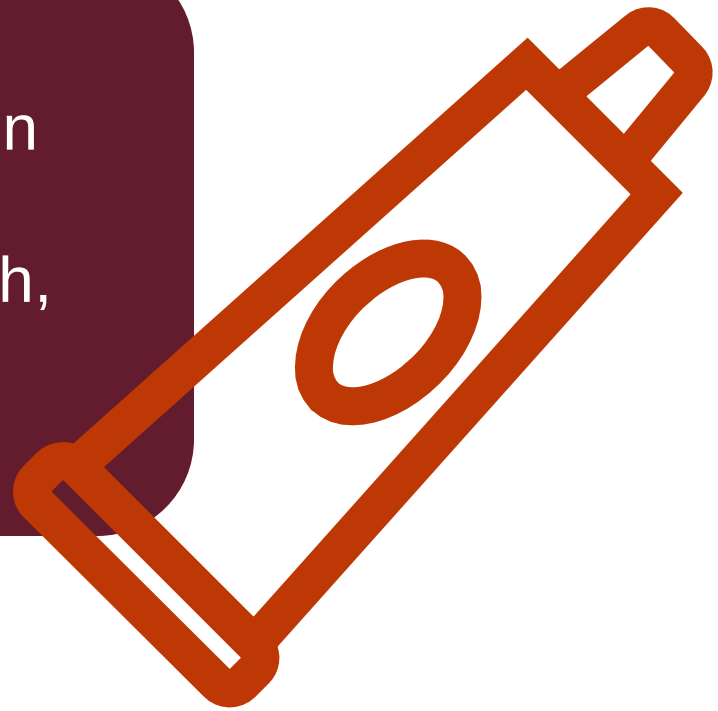
This may be an opportunity to go into greater depth in an area of research that is relevant to your ākonga. For example, diabetes, climate change, mental health, 1080, vaccination rates, 5G, or fluoridation.



Significant Learning: Use science understanding to critique claims or predictions made in communicated information

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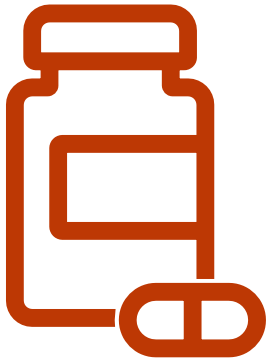
[Pacific Invasion: The hidden threat of the Coconut Rhinoceros Beetle (SPC)]

Is the coconut rhinoceros beetle a real threat?

[Proof that the moon causes earthquakes? (PredictWeather)]

Did the Moon cause these earthquakes?



[Placebo effect (Better Health)]

Is the placebo effect real?

Assessment opportunity — AS91923 (Science 1.4)

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This Achievement Standard requires ākonga to **demonstrate understanding of science-related claims in communicated information**.

Science-related claims use scientific evidence to justify a conclusion. Communicated information is information from any source. These types of information are further explained on the next slide.

Candidates:

- will be provided with three sources of information and select one
- will identify and critique the selected resource information and use their science-specific literacy skills in their response
- may complete additional research on the selected science claim topic outside of the provided resource.

Teachers can use the Science Learning Outcomes to check students are ready to be assessed.

Possible contexts

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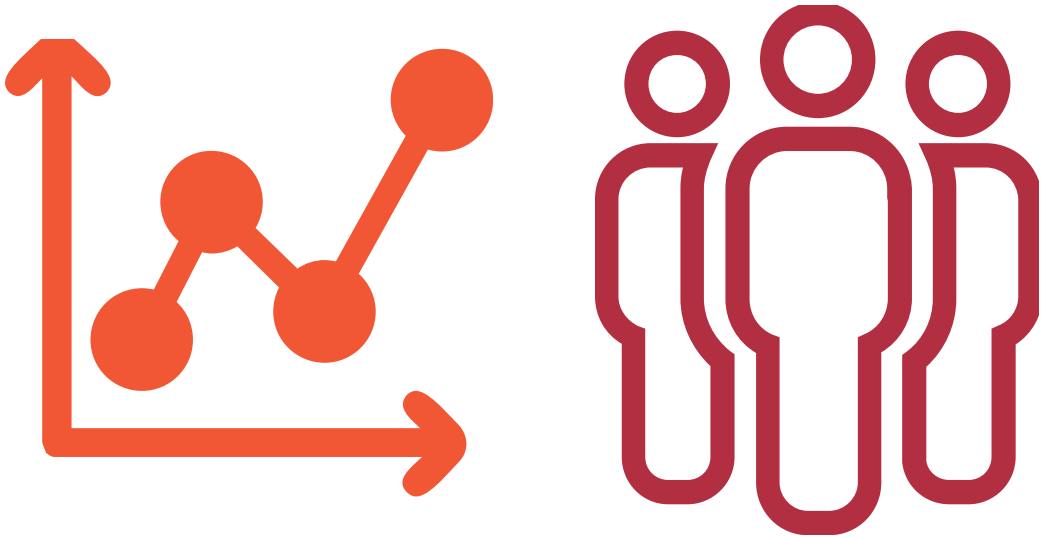
Possible contexts could include science communications or apparent science communications. They should present data and information using science vocabulary and conventions.

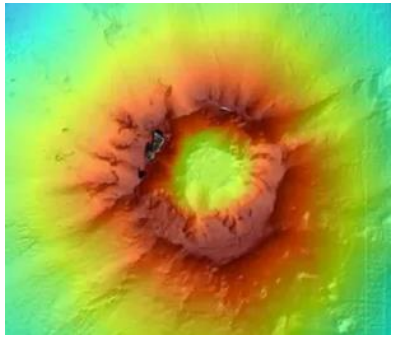
The communicated information could be from any channel, source, or media. They could be transcribed conversations, radio shows, published research, advertising, and online content.

These communications could include:

- representation of data and graphs
- conflicts of interest
- claims about correlation and causation
- quotations
- sample sizes
- use of controls, blind testing, or peer review.



Formative assessment



[Tonga eruption update (NZASE)]

[Why offshore wind projects are on the rocks (CNN)]

[A beginner's guide to crystals (Harper's Bazaar)]

[How is heart disease different for women and men? (Science Journal for Kids)]

This resource provides examples that ākonga can use to build their understanding of how science uses subject-specific literacy to communicate knowledge.

Here are some new examples that they can analyse using their newfound learning. Ākonga must show that they are able to identify, interpret, and critique the use of science information and conventions, and examine claims related to scientific ideas.

Summary

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This document encourages you to start programme design with the Learning Matrix. It focuses on one Big Idea and related Significant Learning.

Learning activities designed using the Big Ideas and Significant Learning will support the use of relevant content as contexts. The final stage is to assess the learning.

The slides also indicate how you could incorporate the Literacy Big Ideas into the same activities.

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Slide 30: "Male coconut rhinoceros beetle horn" by Durham Field Office –Forest Health Protection is licensed under CC BY-NC-SA 2.0.

Slide 33: HTHH crater and caldera after the 2022 eruption. By SungHyun Park/ Korea Polar Research Institute, licensed under CC BY-SA 4.0.

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