MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

Supporting NCEA Literacy in Science

Language is an integral part of science, and offers authentic and diverse contexts to explore language and literacy.

As Pearson, Moje and Greenleaf explain, ākonga "fine-tune their literacy tools not only when they read and write science texts but also when they engage in science investigations precisely because so many of the sense-making tools of science are consistent with, if not identical to, those of literacy" (2010, p.460).

The 2007 New Zealand Curriculum specifically acknowledges the importance of literacy in the key competencies related to language, symbol and text. Through Science, ākonga can learn to:

- develop knowledge of the vocabulary, numeric and symbol systems, and conventions of science such as graphs, significant figures, formulae, units, and diagrams.
- use appropriate ways to communicate their own science ideas and understanding of evidence.

There are also key competencies in relating to others and participating and contributing which have a focus on literacy. Through Science, ākonga can learn to:

- define the problem or issue to be investigated and establish what knowledge they already bring and what new knowledge they may need to gain
- debate evidence and justify points of view using a scientific perspective.

In line with the key competencies, there are the five Science capabilities which are reliant on sound literacy knowledge and skills. These are:

- Gather and interpret data
- Use evidence
- Critique evidence
- Interpret representations - including models, graphs, charts, diagrams and written texts.
- Engage with science in "real life" contexts.

The NCEA Literacy standards are composed of a reading and writing strand, each of which have their own Big Ideas. These are unpacked by the Significant Learning statements, which have a connection with the key competencies and capabilities identified above. They share, for example, the view that ākonga need to become critical readers, with the ability to identify and understand a writer's point of view and to evaluate evidence presented. They also share the view that ākonga need to write with a clear structure – and in a way that meets the conventions of a text type.

The Literacy Pedagogy Guide (LPG) for Science takes the Big Ideas and Significant Learning and poses two questions:

- *What can literacy look like in Science?*
- *What can I do as a kaiako of Science?*

The LPG is not exhaustive, but illustrative of small, but effective steps that any kaiako of Science can select, trial and ultimately embed in their teaching practice.

Science Literacy Pedagogy Guide

Reading

	Significant Learning	What can this look like in Science?	What can I do as a kaiako of Science?
Big Idea 1: Ākonga make sense of written texts.	Ākonga use: » a processing system to decode and comprehend text. Readers develop expertise in using sources of information and comprehension strategies to make sense of text. » knowledge of text structures and features. Readers develop their knowledge of text features and use this to navigate and understand texts. » vocabulary knowledge. Successful comprehension depends on understanding most of the meanings of the words in the text.	Sources of information include written texts, visual texts (such as diagrams, graphs, videos), and texts that are multimodal or infographic where the written and visual are combined. Science texts often incorporate other modes of communication including symbols and mathematical notations. Readers need to build knowledge of how common text types in Science are structured. These include but are not limited to: » procedural recounts » process » explanation » argument or persuasive text, and specific text forms such as lab reports Information needs to be synthesised across sources. Subheadings are important signposts of content. Understanding vocabulary means ākonga need to distinguish between everyday meanings and scientific (technical) meanings of words e.g. “culture” means growing of live material. There are three tiers of vocabulary to focus on: » Everyday words which ākonga must have a knowledge of. These make up the majority of texts. » Words that appear or are useful across all curriculum areas. (See the Academic Word List). » Discipline-specific vocabulary (or technical words) which are less frequent, though essential to a topic within a curriculum area.	» Unpack infographics with ākonga, analyse their purpose and evaluate their effectiveness. See: Understanding infographics — Science Learning Hub and Using infographics — Science Learning Hub. » Model how to skim a text quickly to get an idea of what it is about using questions such as: › What is this text about? › What does the heading say? › What do the diagrams show? » Model how to scan the text to locate specific information. Support ākonga to scan by providing questions as cues and analysing subheadings. » Share and analyse exemplars of common text types with ākonga e.g. elements of an argument include a statement of the main idea (or hypothesis), claims to elaborate on the main idea, and evidence to support the claims. » Use graphic organisers (a framework of the structure and content) to support ākonga to predict text structure and content, to make notes, to summarise information, and as a guide to writing a text, e.g. Main Idea/Supporting Ideas » Use concept frames to develop understanding of the technical meaning of a word. These can also be used to contrast the everyday and technical meanings of a word by doing a concept frame for each. » To support ākonga to build their vocabulary, they can: › circle the words they don’t know › underline the words they have some understanding of › predict/identify which words are necessary for the topic › predict/identify which words are useful for this and all subjects » Share the Academic Word List (AWL) in the form of Sublists of the Academic Word List. » Co-construct lists of topic specific vocabulary with ākonga, and revisit often. » Support ākonga to identify prefixes and suffixes and build knowledge of their meanings.

Big Idea 2: Ākonga read critically	Ākonga: » develop a critical awareness that enables them to consider who wrote a text, for whom, why, and whether it may have purposes that are not immediately apparent.	Authors have different purposes. Texts on the same topic can differ in terms of content and ideas. Texts that require ākonga to read critically are largely those that present or argue a point of view. The text type is argument or persuasive text.	» Support ākonga to scan the written and visual texts for clues as to author, text type, purpose, and intended audience e.g. use specific questions about purpose and audience. » Use a thinking tool like de Bono's OPV (Other People's Views) to consider a writer's point of view, and others' points of view. » Use elements of the Rauru Whakarare Evaluation Framework (Feekery & Jeffrey, 2019) which examines a text in terms of its mana (authority), its māramatanga (content), its whakapapa (background), and its aronga (lens or perspective). » Support ākonga to read text closely and critically by: › identifying argument indicators: e.g. *thus*, *hence*, and *so* › recognising any emotive vocabulary › identifying and evaluating the validity of claims and evidence › analysing reader-oriented features e.g. *you*, *we*.
Big Idea 3: Ākonga read for different purposes	Ākonga: » are clear about their purpose for reading and have appropriate strategies to meet that purpose » understand and use ideas in texts » locate and evaluate the ideas and information within and across a range of print and digital texts to meet their purpose.	Ākonga need to know when to skim, scan or read text more closely. Not all texts are equal in terms of information. Visual texts have varying relationships to written texts: they can be parallel, they can add new information, they can be only loosely linked, or present different information from the written text.	» Discuss reading strategies[1] with ākonga and model how you read texts and compare them. » Use an Inquiry Chart (I-Chart) to find key information in different texts, to compare information and synthesise across different texts. » Compare and evaluate written and visual texts. » Develop ākonga strategies for "reading" visual texts e.g. use Describe, Analyse, Interpret, Extrapolate. » Use KWL (Know/Want to know/Learned) charts to embed reading strategies of drawing on prior knowledge, predicting and summarising. » Support ākonga to ask and answer questions by reformulating subheadings as questions.

[1] (Dymock & Nicholson, 2010)

Writing

	Significant Learning	What can this look like in Science?	What can I do as a kaiako of Science?
Big Idea 1: Ākonga write meaningful texts for different purposes and audiences.	Ākonga: » use strategies within a writing process to plan and create texts » select content, text structure and language choices appropriate to purpose and audience » select and use vocabulary that is specific to their topic, purpose and audience » revise and edit their work.	The writing process involves the recursive use of strategies of planning, composing and reviewing. As writing unfolds, good writers review how their text (at the level of language choice, content, and organisation) addresses audience and purpose. This guides further planning and composing. Types of texts include but are not limited to: » procedural recounts » process » explanation » argument or persuasive text » and specific text forms such as: » lab reports Vocabulary knowledge entails not only conceptual understanding but also connotation, grammatical context and collocation.	» With ākonga, regularly identify the audience and purpose for writing at the beginning of the process. » Model the regular process of taking and making notes of ideas, discussion points and questions which ākonga can revisit for writing. » Provide opportunities to discuss and rehearse ideas in pairs or in small groups before writing. » Provide templates that match the text type, for example, one based on the subheadings of a Lab Report. » Provide guidance for structuring paragraphs, for example TEXAS (developed for History but useful for some writing in Science). » Provide or co-construct checklists for ākonga[2] to revise and edit their work. » Build and record word family members with ākonga, for example, concentrate, concentrated, concentration. » Plot keywords on clines (formal to informal; friends to unknown unfamiliar audience; etc). » Use cloze exercises to guide vocabulary selection.

[2] *(Rowlands, 2007). https://www.jstor.org/stable/30046754*

Big Idea 2: Ākonga use written language conventions appropriately to support communication.	Ākonga: » develop their expertise in sentence construction, grammar, punctuation, spelling, and word choice.	Sentence structures, including: » Simple sentences » Compound sentences that use coordinating conjunctions e.g. “but”, “as”, “yet” which allow the reader to unify two related points often for greater detail. » Complex sentences e.g. those that use “because”, “while” to combine two different but conneacted ideas Text within Science presents a range of challenges related to grammatical structure, including: » Nominalisation, which is when complex processes are described using a single noun e.g. evaporation. » Nouniness, which refers to the number of elements that precede and follow a noun e.g. interesting physical [characteristics] common to earthworms. These elements provide specificity. This is a factor in lexical density. » High lexical density, which refers to the high ratio of content words (nouns, adjectives, verbs, adverbs) to function words (pronouns, prepositions, conjunctions etc). » Passive verbs e.g the precipitate was filtered. This makes the text more impersonal and objective by removing the “person”/writer when reporting findings. » Modal verbs e.g. can, may, must, will, shall, could, might, ought to, would and should. These are important ways to signal degrees of certainty e.g An average global temperature rise of two degrees Celsius will result in higher death rates.	» Deconstruct and reconstruct sentences so ākonga can see what complex sentences and their parts do. » Scaffold ākonga to write increasingly specific noun phrases by adding adjectives (premodifiers) before the head noun and phrases or clauses after the head noun (postmodifiers). » With ākonga, identify chains of verbs through a text and unpack these verbs. Group them according to their form. » Plot modal verbs on clines (highly likely to unlikely, etc). » Practice changing active sentences to passive ones e.g. “I filtered the precipitate” to “The precipitate was filtered”. » Expand ākonga knowledge of understanding word families for general academic words, for example, investigate, investigation, and investigator. » Practise changing verbs to nouns e.g. “investigate” to “investigation”. » Draw the attention of ākonga to the function of different punctuation marks with, for example, a fill in the blanks activity. Or create a punctuation worksheet of your own to illustrate its importance. » Encourage ākonga to mark words in their writing for later checking with an online dictionary.

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