# Science 7–10 (2023): Stages 4 and 5 – Advice on writing

## Creating written texts across the curriculum

A written text could be a sentence, paragraph or more extended text. Creating written texts facilitates learning as it promotes explicit communication, encourages integration of ideas, supports reflection, fosters personal engagement and helps students to think about the significance and implication of ideas. Creating written texts refers to the act of composing and constructing texts for a particular purpose, audience and context. Various methods of transcription may be employed and a student’s [preferred communication form(s)](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/diversity-in-learning/special-education/adjustments) should be considered when teaching writing. Writing about content enhances understanding across subjects and stages of learning.

In designing learning opportunities for students, teachers should consider how students’ creation of written texts can serve as a tool for students to develop and communicate their understanding of key principles in the subject.

### Creating written texts to develop understanding

Many writing activities can be designed to help develop students’ understanding of subject content. Tasks are often completed in short sections and result in an informal written product. The intended audience is primarily the student but might also include their peers and the teacher.

These activities can help students to build and consolidate knowledge, generate ideas, engage personally, challenge assumptions and articulate complex understanding.

### Creating written texts to communicate understanding

More formal writing activities often serve the purpose of communicating information, ideas and arguments to an implied or real audience beyond the classroom. The types of texts that result from this work tend to take specific forms, governed by recognisable codes and conventions of the field of study. In these tasks, students are expected to learn and reproduce organisational and linguistic features typical of the specific type of text.

Creating a specific type of text can help students in developing a more complex understanding of subject content. By focusing on the purpose of communicating their understanding, students are also encouraged to consider the importance of ideas and arguments beyond the classroom.

# Sample: Advice on writing

## Creating written texts in Science 7–10

The following are some examples of how syllabus content on creating written texts can be addressed in the classroom. To demonstrate different ways of using writing to assist students’ learning, examples describe approaches for **writing to develop understanding** and **writing to communicate understanding**.

### Example 1:

### Written explanation – developing understanding (Stage 4)

When students are creating written explanations to accompany visual information as a part of learning new information, they are writing to **develop understanding**. This process helps students to process and consolidate knowledge.

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| **Focus area** | Living systems |
| **Syllabus content** | Create written texts to explain how energy pyramids show the amount of energy or matter at each trophic level |
| **Possible related syllabus content** | Identify the components that make up an ecosystem  Identify how matter and energy are cycled through an ecosystem  Create a food web and ecological energy pyramid based on local area observations to describe how matter and energy move through an ecosystem |
| **Possible context of learning** | As a part of a unit on Living systems, students have conducted a field study in their local area on the interconnectedness of living organisms and their environment. They have used observations from this field study to create a food web and an ecological energy pyramid. |
| **Possible writing activity** | Using the ecological energy pyramids they have created, students create written explanations that outline each component of the pyramid, including key details such as:   * the flow of energy or biomass through different trophic levels within an ecosystem * how visual features represent distribution of energy within a food chain or food web * the names and quantities of organisms in each trophic level * the different energy or biomass available at each trophic level, and causes of energy loss between each trophic level * relationships between each level (for example, between primary consumers and secondary consumers). |
| **Some key organisational features** | numbered headings to make visual connections to the pyramid diagram  paragraphs to articulate connections between ideas about each trophic level |
| **Some key language features** | **simple sentences** and **compound sentences** to describe details of the energy pyramid or diagram:   * Simple: ‘[Energy flows from trophic level 1 to trophic level 2].’ * Compound: ‘[Energy flows from trophic level 1 to trophic level 2], and [the stored energy at each trophic level decreases].’   **complex sentences** to describe relationships that can be observed in the pyramid:   * ‘Because [predators eat their prey], [they are in a higher trophic level].’ * ‘When [one organism consumes another organism], [approximately 10% of the stored energy is passed on].’   **simple present tense** to describe the ongoing relationships between levels in the pyramid:   * ‘Consumers [get] their energy from producers.’ * ‘Decomposers, like worms, [break down] dead organisms at every level.’ * Not all languages use grammatical tense. Some EAL/D learners may not be familiar with present tense and may need explicit teaching of the function of present tense and the verb forms required. |

### Example 2:

### Investigative report – communicating understanding (Stage 4)

When students are representing their understanding in an investigative report for an audience beyond the learning context, they are writing to **communicate understanding**.

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| **Focus areas** | Working scientifically; Solutions and mixtures |
| **Syllabus content** | Create written texts to communicate scientific concepts, ideas or investigations using conventional scientific text structures |
| **Possible related syllabus content** | Model how a body of water can become polluted, and plan and conduct a practical investigation that attempts to remove the pollutants  Identify the 3 main states of matter and how they are represented in the movement of water on Earth  Explain how the physical properties of substances are used to separate mixtures  Investigate what substances dissolve in water and discuss findings using key terms, including soluble, insoluble, solubility, solute, solvent and solution |
| **Possible context of learning** | Students have modelled how a body of water can be polluted, and then planned and conducted a practical investigation to ‘clean’ the water they have polluted. Students have conducted a second-hand research activity after researching their local water catchment area and identifying where that water comes from. |
| **Possible writing activity** | Students create a written investigative report to describe the processes that have caused a body of water to become polluted, make recommendations about how some of the pollutants could be removed, and advise ways to prevent further pollution in the future.  The report should be written for a specific audience that has interactions with or responsibility for the body of water (for example, a local council, a corporation or a community group). |
| **Some key organisational features** | Subheadings to sequence information and distinguish between the focus and purpose of each section  Structure for each section that provides purpose, background information, key points and evidence, and evaluation |
| **Some key language features** | **Adjectival clauses** to build detailed descriptions of pollutants and pollution processes:   * ‘Fertilisers and effluent [that are produced on farmland] leach from soils into nearby rivers.’   **Modal verbs** to describe possible courses of action:   * ‘Single use plastics are harmful and [should] be replaced by biodegradable alternatives.’ * ‘Organisations [can] advocate for changes to packaging and promote recycling and reuse practices.’ * In some languages, the forms and function of modal verbs may be different than in English. Some cultures or languages may have preference for low modality. Representing the strength of modal verbs such as on a modal cline may support some EAL/D learners to select the appropriate verb to represent the possibility of a course of action. |

### Example 3:

### Scientific argument – communicating understanding (Stage 5)

The creation of a written argument requires students to consider the audience for whom the ideas are being framed. This will shape the way they select content and use language to **communicate understanding**.

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| **Focus areas** | Working scientifically; Genetics and evolutionary change |
| **Syllabus content** | Use an ethical framework to construct evidence-based written arguments about the implications of a genetic technology, including the ethical implications of the continued use of the HeLa stem cell line |
| **Possible related syllabus content** | * Identify examples of current and emerging genetic technologies * Discuss applications of genetic technologies in conservation, agriculture, industry and medicine * Discuss the applications of genetic testing and its associated social, economic and ethical implications * Select and extract information from texts, diagrams, flow charts, tables, databases, graphs and multimedia resources * Present scientific arguments using evidence, correct scientific language and terminology, as appropriate to audience and purpose * Recognise that scientific texts develop arguments by encouraging the reader to adopt a specific perspective and positioning them to accept the authority of a text |
| **Possible context of learning** | As a part of their study of DNA structure, function and variation, students have researched a range of genetic technologies to examine their applications and implications for use. Students have learned about the application of ethical frameworks through investigation of Henrietta Lacks and the scientific community’s use of the HeLa stem cell line. |
| **Possible writing activity** | Students create a written argument about the social, economic and ethical implications of one of the genetic technologies they have researched. Students make a case for the continued use of their chosen genetic technology by:   * selecting and applying an appropriate ethical framework * applying their understanding of principles of genetics * drawing on relevant evidence from a range of appropriate scientific sources. |
| **Some key organisational features** | Argument structure, including introduction, body and conclusion  Paragraphs that each have a unique focus and explore a number of points in support of this focus |
| **Some key language features** | **Embedded quotations** to reference evidence and perspectives from other sources:   * ‘Professor Sarah Wheeler observes that [“public attitudes and negative media portrayal are named as the largest barriers facing further adoption of agricultural genetic engineering in Australia”].’ * ‘Rebecca Skloot describes how HeLa cells have [“helped with some of the most important advances in medicine”].’ * Some languages may have different conventions to embed quotations. Some EAL/D learners may benefit from explicit teaching of English conventions such as use of quotation marks.   **Conjunctions** to describe relationships between ideas within the same sentence (such as ‘although’, ‘whenever’, ‘because’):   * ‘Insulin made from genetically modified bacteria overcomes ethical concerns [because] it is not taken from a pig pancreas.’   **Adverbs** and **adverbial phrases** to connect, sequence or contrast ideas between sentences (such as ‘as a result’, ‘however’):   * ‘Genetic technologies have many applications in agriculture. [However], their use requires regulation and ethical considerations.’ |

### Example 4:

### Research notes – developing understanding (Stage 5)

When students synthesise relevant information from reliable secondary sources, they are writing to **develop understanding**. Students evaluate the information they read to draw conclusions that are consistent with evidence.

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| **Focus areas** | Working scientifically; Reactions |
| **Syllabus content** | Evaluate the societal benefits and considerations of using radioisotopes in medicine, industry and environmental monitoring |
| **Possible related syllabus content** | Outline the impacts on the environment of nuclear reactions, including the raw materials used, the various stages of production and nuclear waste  Create written texts to communicate scientific investigations, explain scientific theories and principles, structure a scientific argument, and evaluate findings in light of scientific knowledge  Recognise that scientific texts develop arguments by encouraging the reader to adopt a specific perspective and positioning them to accept the authority of a text  Analyse the validity of information from secondary sources |
| **Possible context of learning** | As a part of their study of nuclear reactions, students have learned to describe the process and products of nuclear decay. They have plotted a half-life curve and compared fission and fusion using annotated diagrams. They have also discussed the structure and function of a nuclear reactor. Students have explored ethical issues associated with the concept of radioactivity, including the use of radioisotopes in medical procedures. |
| **Possible writing activity** | Students create a set of research notes about the societal benefits and considerations of using radioisotopes in medicine, industry and environmental monitoring. For each of these 3 fields, they make notes in response to the following questions:   * What types of radioisotopes are used in this field? * What makes the use of these radioisotopes beneficial to society? * Why is each of these uses considered preferable to alternative solutions?   For their notes on each field, students should:   * make reference to multiple reliable and valid sources of research and evidence * provide written evaluations of the reliability and validity of each source |
| **Some key organisational features** | Table with headings for fields and questions  Dot point summaries |
| **Some key language features** | **Sentence fragments** to note specific details:   * Alternative solutions: ‘Positive emission tomography (PET) using sodium fluoride for bone scans.’ (noun phrase) * Validity and reliability of source: ‘Reliable based on peer review and agreement between sources.’ (adjectival phrase)   **Ellipsis** of some articles and verbs to summarise:   * Benefit of radioisotope: ‘Diagnosis shows ~~the~~ structure and function of ~~the~~ body; nuclear imaging ~~is~~ safe and painless.’ * Some EAL/D learners may be unfamiliar with sentence fragments and ellipsis to represent complete meanings. While receiving explicit instruction in these aspects, students might also benefit from use of short, simple sentences. |

### Example 5:

### Discussion in practical report – communicating understanding (Stage 5)

When students are writing a discussion in a practical report, they are writing to **communicate understanding**. The intended audience of this writing is people working in fields of scientific research, and this informs the structure, language features and register of the writing.

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| **Focus areas** | Working scientifically; Waves and motion |
| **Syllabus content** | Create written texts to communicate scientific investigations, explain scientific theories and principles, structure a scientific argument, and evaluate findings in light of scientific knowledge |
| **Possible related syllabus content** | Conduct investigations to analyse the relationship between distance, time and speed, and draw and analyse a line graph of the results  Use mathematical representations, including graphs and the algebraic formulas , and , to quantitatively relate force, distance, time, speed, displacement, acceleration, velocity and mass  Processing data and information  Analysing data and information |
| **Possible context of learning** | As a part the unit Waves and motion, students have used mathematical representations to relate force, distance, time, speed, displacement, acceleration, velocity and mass. As part of the application of the Working scientifically processes, students have learned to explain the use of variables and experimental controls in a valid scientific investigation, systematically and accurately collect and record data, and select and use a range of representations to organise data, including graphs, diagrams, tables and spreadsheets. |
| **Possible writing activity** | Following their investigation into an object rolling down an inclined plane, students construct a written practical report to present the findings of their investigation. They create a discussion section in this report, which includes considerations such as re-stating the aim and hypothesis to frame the discussion, calculation of results and errors, interpretation of results, comparison with expected results, discussion of errors and limitations, scientific implications, and suggestions for future research. |
| **Some key organisational features** | Subheadings to sequence and identify sections  Short paragraphs to isolate each piece of information |
| **Some key language features** | **Passive voice** to describe all observations and suggestions, removing the active subject:   * ‘The ball [was timed] from release point to the end of the slope.’ * ‘Future investigations [might be focussed on] changing the mass of the object.’   **Nominalisation** to describe relationships between processes and phenomena:   * ‘[Increasing the angle of the slope] increases the component of acceleration down the slope.’ * ‘[Releasing the ball from rest] means that the initial velocity is always 0 m s–1.’ * Passive voice and nominalisation are advanced language features and may be unfamiliar to some EAL/D learners. They may need visual references to show the noun and the related adjective or verb in order to use nominalisation and passive voice. |

## Strategies for supporting writing

Strategies for the explicit teaching of writing should be selected based on the learning needs of each student, which might include:

building the context or field – reading, viewing, listening to a range of short texts to engage with key concepts, relevant background information, content and vocabulary that build knowledge and understanding, including:

* group discussion and/or debate of key ideas and issues to prompt personal engagement
* analysis of selected examples and case studies, including note-making and annotation
* guided and independent research

modelling – engaging with the writing demands of model texts to deepen understanding, including:

* analysis and annotation of model texts, such as sample and exemplar responses, to familiarise students with typical text features
* co-development of a writing plan and/or scaffold using success criteria
* provision of support materials, such as word banks, graphic organisers, sentence-starters and writing prompts, to target the use of key language and ideas
* joint construction of sample responses to model processes and decision-making

independent practice – applying knowledge, understanding and skills to develop independent writing, including:

* planning, monitoring, revising and reflecting in recursive phases
* seeking, evaluating and implementing feedback

### Supporting EAL/D learners

EAL/D learners enter Australian schools at different ages and stages of schooling, at any time during the academic year and at different stages of English language learning. They may also have varying levels of literacy in their home language or dialect and may be continuing to learn the writing conventions of their own language while simultaneously developing language skills in English. EAL/D learners may produce writing that is commensurate with their level of [language progression](https://docs.acara.edu.au/resources/EALD_Learning_Progression.pdf) and which may not reflect the extent of their knowledge, understanding and skills in the subject.

Many Aboriginal students in NSW use Aboriginal English as their home dialect. This means that they may require additional EAL/D support.

EAL/D learners may require specific support to develop writing skills, particularly students at early phases of English language learning. Along with the strategies listed above, the following may be required:

* enabling students to use their home language or dialect to build their field of understanding, and talk about and plan their writing
* making connections between grammatical structures in English and their home language or dialect.