 Sustainable schools

Stage 4 Sustainability and Literacy

Outcomes

Values and attitudes

SC4-1VA appreciates the importance of science in their lives and the role of scientific inquiry in increasing understanding of the world around them

SC4-2VA shows a willingness to engage in finding solutions to science-related personal, social and global issues, including shaping sustainable futures

SC4-3VA demonstrates confidence in making reasoned, evidence-based decisions about the current and future use and influence of science and technology, including ethical considerations

Working scientifically

SC4-5WS collaboratively and individually produces a plan to investigate questions and problems

* WS5.1 Students identify [data](http://syllabus.bostes.nsw.edu.au/glossary/sci/data/?ajax) to be collected in an [investigation](http://syllabus.bostes.nsw.edu.au/glossary/sci/investigation/?ajax) by:

b. proposing the type of information and data that needs to be collected in a range of investigation types, including first-hand and secondary sources

c.  locating possible sources of data and information, including [secondary sources](http://syllabus.bostes.nsw.edu.au/glossary/sci/secondary-sources/?ajax), relevant to the investigation

SC4-7WS processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions

* WS7.1 Students process data and information by:

a. summarising data from students’ own investigations and secondary sources (ACSIS130, ACSIS145)

c. extracting information from diagrams, flowcharts, tables, databases, other texts, multimedia resources and graphs including histograms and column, sector and line graphs

* WS7.2 Students analyse data and information by:

c. identifying data which supports or discounts a question being investigated or a proposed solution to a problem

d. using scientific understanding to identify relationships and draw [conclusions](http://syllabus.bostes.nsw.edu.au/glossary/sci/conclusions/?ajax) based on students’ data or secondary sources (ACSIS130, ACSIS145)

SC4-9WS presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations

* WS9 Students communicate by:

b. using appropriate [text types](http://syllabus.bostes.nsw.edu.au/glossary/sci/text-types/?ajax) in presentations, including a discussion, explanation, exposition, procedure and recount

Knowledge and understanding

| Strand | Stage 4 outcomes  A student: |
| --- | --- |
| Physical world | **SC4-11PW discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformations**  PW4 Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations. (ACSHE120, ACSHE135)   * research ways in which scientific knowledge and technological developments have led to finding a solution to a contemporary issue, e.g. improvements in devices to increase the efficiency of energy transfers or conversions   Additional content   * debate intergenerational implications of the use of non-renewable energy resources |
| Earth and Space | **SC4-13ES explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource use and management**  ES3 Scientific knowledge influences the choices people make in regard to the use and management of the Earth's resources.   * classify a range of the Earth's resources as renewable or non-renewable (ACSSU116) * investigate some strategies used by people to conserve and manage non-renewable resources, e.g. recycling and the alternative use of natural and made resources * outline the choices that need to be made when considering whether to use scientific and technological advances to obtain a resource from Earth's spheres   ES4 Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management. (ACSHE121, ACSHE136)   * demonstrate how scientific knowledge of the water cycle has influenced the development of household, industrial and agricultural water management practices * research how Aboriginal and Torres Strait Islander peoples' knowledge is being used in decisions to care for country and place, e.g. terrestrial and aquatic resource management   Additional content   * debate the economic and environmental impacts of mining and resource exploration |
| Living world | **SC4-15LW explains how new biological evidence changes people's understanding of the world**  LW5 Science and technology contribute to finding solutions to conserving and managing sustainable ecosystems.   * describe how scientific knowledge has influenced the development of practices in agriculture, e.g. animal husbandry or crop cultivation to improve yields and sustainability, or the effect of plant-cloning techniques in horticulture   Additional content   * research the contributions of Australian scientists to the study of human impact on environments and to local environmental management projects |
| Chemical world | **SC4-17CW explains how scientific understanding of, and discoveries about, the properties of elements, compounds and mixtures relate to their uses in everyday life**  CW3 Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques. (ACSSU113)   * investigate the application of a physical separation technique used in everyday situations or industrial processes, e.g. water filtering, sorting waste materials, extracting pigments or oils from plants, separating blood products or cleaning up oil spills   CW4 In a chemical change, new substances are formed, which may have specific properties related to their uses in everyday life.   * propose reasons why society should support scientific research, e.g. in the development of new pharmaceuticals and polymers |

Learning across the curriculum

Cross-curriculum priorities

Aboriginal and Torres Strait Islander histories and cultures

Asia and Australia's engagement with Asia

Sustainability

General capabilities

Critical and creative thinking

Ethical understanding

Information and communication technology capability

Intercultural understanding

Literacy

Numeracy

Personal and social capability

Other areas of learning

Civics and citizenship

Difference and diversity

Work and enterprise

Teacher notes

This task incorporates an inquiry question to engage students in researching sustainability and to come up with original ideas to create a sustainable school environment or solve a problem within a school. Aspects of the task can be changed to suit the context of individual learners, for example the final text can be an email, a letter, an essay etc. Students could be encouraged to conduct an energy audit using online electricity consumption tools or water usage or even going around various areas of the school to find out where lights are on in unoccupied rooms.

The task focuses on the cross curricular priority of sustainability, reflected in the content strands which can be chosen to assess, including the general capability of literacy. There is a focus to develop students’ values and attitudes. Teachers can choose from a variety of sustainability linked knowledge and understanding outcomes (provided) including other content descriptors to frame the task and adapt it to their own school environment.

The task is intended to be sequenced in three parts which model the writing of a persuasive text and extracting and summarising information. Part C has a checklist for students to check that they have followed the scaffolds and developed a persuasive text.

This task provides resources, including scaffolds, for students to create a persuasive text. Teachers can use this as the basis of classroom lessons to teach persuasive writing by jointly constructing sample texts with students.

There is scope to tie in with Stage 4 Agricultural Technology syllabus across a number of enterprises.

Introduction

Inquiry question: Should our school act to be more sustainable?

Students are asked to research a product, innovation or process that can be used in a building or in the school environment to improve sustainability (energy, emissions, resource use etc.). They will apply this knowledge to construct a persuasive text in the form of an email to their school principal to argue their position on the question ‘should this sustainable product/process be used in our school?’

Task

| Part | Task |
| --- | --- |
| A | An example is given to students (rainwater collection) to model the process of extracting, collating and summarising information, and using this information to answer a series of questions. A model of a persuasive text is also provided. |
| B | Students will be given information sources for another product (such as vertical gardens). Students are given questions and will practice skills of extracting and summarising from given resources to answer these questions. This information will then be used to jointly construct a persuasive text in the form of an email to their school principal (a scaffold is provided). |
| C | Students will select one of the suggested innovations below, or another of their choosing to research. They will identify and extract reliable and relevant information to form a persuasive text of their own.   * Solar power/storage * green roofs * vertical gardens * native landscapes * LED lighting * water efficiency devices * aquaponics * Improved recycling practices |

Persuasive texts

Knowledge and Understanding

To show the depth of your understanding you must be able to go beyond just identifying a feature and recognising how it might reduce energy or wastes etc.

You must be able to show a broader impact on either sustainability or the environment beyond the immediate area to that of the broader community and environment.

For example:

* Design Feature Identified: Rain/Grey water tanks installed for toilet use
* Basic Environmental or Energy Impact Identified: This will reduce the amount of clean drinking water used by the people living in the house.
* Sustained argument showing a follow on effect on how sustainability or efficiency is improved: Utilising the rainwater that would normally become runoff for sewage purposes, pumping the water into the toilets for use, will reduce the impact on stormwater drains during peak times. It will also allow for a more economical way of using clean drinking water, reducing the volume of water requiring treatment. This saves both money on water bills as well as preserves the amount of clean drinking water available for consumption on a continent that regularly is drought affected.

Structure of the Argument

In structuring an effective letter, it is important that it has a thesis or argument that is built upon before providing a concluding statement which draws together points that have been made.

For this to occur there should be:

* A clear introduction that outlines the aim or intent of the letter.
* Several paragraphs with each presenting different features or arguments being addressed. The purpose of the paragraph should be clear and have some elaboration and details on the point being made. The paragraph structure must be clearly apparent and each new idea raised should begin a new paragraph.
* A concluding statement that reviews points previously made, relating back to the aim or intent of the letter and draw those arguments together in a logical conclusion.
* Grammar and punctuation should be used correctly as the target audience is a potential client. Attention to this is an indication of your professionalism.

Persuasiveness

To make a persuasive argument you should appeal to the reader using several methods to attempt to influence their opinion on some matter. These can include:

Language choice

The language being used appropriate for the situation, considering the audience they are addressing and their relationship to the audience.

Ethos (Ethical appeal)

Shows credible sources to support their arguments (e.g. statistical data about how much energy or water etc. can be saved and/or quotes the opinions of an expert in the field)

Logos (Logical)

The argument is based on logical reasoning and considers possible objections and attempts to build a case against those. The logic can then be stated clearly and succinctly. Ideas remain focussed on the topic without getting side-tracked.

Pathos (Emotional connection)

Tries to develop an emotional connection with the reader. This can be done using words that bring clear images or emotions to mind or through the use of anecdotes or metaphors to connect with what would be familiar to the audience.

Clear call to action

Leaves the reader with no doubt as to your stance on the issue and has provided them with a clear call to action for them to also follow.

Scaffold 1

Sample text 1 – persuasive text

What is insulation?

Insulation is a barrier between the floors, ceiling and walls. It is a cost-effective way of maintaining a stable internal temperature, keeping a house cooler in summer and warmer in winter. It does this by minimising the heat moving though the walls, and as a result can reduce energy costs by more than 40%.

Why is insulation important?

More effective insulation leads to less reliance on heating and cooling systems which reduces energy consumption. Further to this, energy bills are lower as are greenhouse gas emissions, which reduces negative impacts on the environment.

How can insulation be used to save energy in a house?

There are two major types of insulation, bulk and reflective. Bulk insulation works by keeping heat in, minimising heat flow though the structures of the house or building. Thick cotton wool, recycled paper or similar structures between the walls, ceilings/roof and under the floorboards, as well as double glazing the glass are utilised to stop the flow through structures.

Reflective structures, placed in the ceiling, stop radiating heat coming through the structure.

When can insulation best be installed?

It is best to insulate your home when you are building it. It is possible to insulate pre-existing structures; however, it is not always possible to access the areas where insulation should be installed and the costs and energy used to remove and reinstall walls may be higher than the savings made. The installation of insulation in roof cavities is usually a simple process and it is important to do this as buildings can lose up to 45% of their heating through the roof and roofing structures without insulation allow heat to radiate through.

Why should we improve the insulation standards at our school?

By improving the insulating structures in our school, we will save money on energy costs, which will provide more money to invest back into the students meaning we can buy more sporting equipment, computers and maybe make some improvements to the buildings. Also, the installation of insulation will lower the greenhouse gasses meaning that our school will be helping to reduce carbon emissions which is better for the environment.

Sample text 2 – model letter

Dear Principal

During my studies in Science I have been learning about insulation. I think we should improve our school's insulation, especially as we don’t have air conditioning in every room. This will not only improve the comfort of the students at our school, but also reduce the energy wastage and lower the energy costs of our school.

Insulation has the potential to improve student comfort by maintaining a more stable environment in the classroom. By improving our insulation in the school, we could minimise the temperature increase during the hottest parts of the day during summer and reduce the amount of time that the gas heaters need to be on in the winter. This might help the students focus when they are in class as they won’t have to be asking the teachers to turn the heater on all the time.

Insulation also potential to reduce energy wastage because it stops heat flow into and out of the room, this means that when a room is warm in winter it will stay warm, and when a room is cool in summer it will stay cool. As a result, the rooms that have air conditioners and heaters will not need to use them for as long because they will be able to maintain the temperature. Also, if we were to put reflective structures in the ceiling there would be less heat radiating through the building, keeping the temperature from getting too high in the summer.

Insulation is better for the environment because there is less energy usage. This means there will be a lower carbon emission as there are less fossil fuels burnt to heat and cool our classrooms. By making this improvement, our school we will be demonstrating to the community that we care for the environment and what it is going to be like for future generations. If we do this, we may become known as the school who cares about the environment and then we could be in the news and maybe some companies will want to try their energy saving products at our school.

Finally, the amount of money that we will spend paying gas and electricity bills will be lower, which will mean that there is more money to spend on more important things in the school like sporting equipment, computers and other improvements in the school, improving the educational standards for all our students.

Saving energy is important for a number or reasons, and hopefully from the points I have raised you can see that insulation is a great way to do it.

Yours sincerely

[insert name]

Scaffold 2

Vertical Gardens

Persuasive text

Using the websites below answer the following questions by jointly constructing in groups or as a class.

* <http://www.yourhome.gov.au/materials/green-roofs-and-walls>
* <http://vertikal.com.au/benefits/>

Questions

* What are vertical and rooftop gardens?
* What are the environmental benefits of installing a rooftop or vertical garden?
* What thermal benefits from installing vertical or rooftop gardens?
* How could vertical or rooftop gardens provide an alternative benefit such as food production, or a learning tool?

Email Scaffold

Dear Principal

During my science studies, I have been reading about sustainability. A type of sustainability that is relatively new are vertical and rooftop gardens. These are [definition].

|  |  |
| --- | --- |
| **PEEL** | **Text** |
| P | Vertical and rooftop gardens are good for the environment. They… |
| E |  |
| E |  |
| L |  |
| P | Vertical and rooftop gardens have thermal benefits to the buildings by helping maintain… |
| E |  |
| E |  |
| L |  |
| P | Vertical and rooftop gardens have educational benefits, including… |
| E |  |
| E |  |
| L |  |
| P | Most importantly by installing a vertical garden at our school we could harvest… |
| E |  |
| E |  |
| L |  |

In all, the benefits of rooftops and vertical gardens are [insert advantages].

I would appreciate it if you took my research into consideration.

Yours sincerely

[Insert name]

Checklist for persuasive text

Processing and analysing information

Forms questions to guide the collection of relevant data.

Reliable sources of information are selected.

References information appropriately (either throughout text or in a reference list using an appropriate format).

Information is collated from a range of sources, including books, reliable sites and journal articles.

Information is summarised in own words.

Information that is included is relevant to the questions.

Valid conclusions with links to evidence are drawn.

At least three substantial points are mentioned for or against the argument.

Communicating

Scientific language is used correctly and appropriately.

Written text contains aspects of persuasive language.

The written text is appropriate to audience.

There is extensive evidence of proper structure and format.

Introduction includes a clear thesis statement (argument).

Introduction includes an outline of each point in order.

The main body contains points and appropriate topic sentences for each paragraph.

Paragraphs include specific details, examples, and other facts which support the explanation of the points mentioned.

The conclusion contains a succinct summary of the thesis statement and a summary of each point.

There is evidence of logical conclusions and a concluding statement.

Does the text serve to influence the reader?

Is the text engaging and interesting to read?

Are persuasive words and phrases used?