Victorian Essential Learning Standards

Sample Unit

The Ins And Outs Of Waste

Level 6 - Personal Learning, Science, Thinking Processes

Contents

Victoria The Place To Be

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Introduction

In *The ins and outs of waste* students learn about the scope and effect of resource use that supports their lifestyle and the implications of associated waste generation and disposal. They investigate a Life Cycle Analysis (LCA) and assessment of a product, identifying and analysing the inputs (resources) and outputs (wastes) at each stage of a product's life.

As part of their work, students monitor their management of a personal project and evaluate its effectiveness.

Suggested duration: 12 hours

For further information see the Teaching, learning and assessment activities section.

Assessment

This unit provides opportunities for students to demonstrate achievement of elements of Level 6 standards in Personal Learning, Science and Thinking Processes.

It will also help teachers identify ways in which the Level 6 standards support students to develop facets of employability skills.

For further information see the VELS and Employability Skills section.

Students are assessed on their ability to:

- explain scientific concepts related to sustainable resource management
- collect, organise, synthesise and analyse information in relation to resource use and the management of waste
- solve problems creatively
- monitor and evaluate their management of a personal project
- communicate ideas and information about a chosen related issue
- present an LCA and assessment on a selected product.

For further information see the Assessment section.

Acknowledgments

The VCAA acknowledges teachers from Sebastopol College and Ballarat High School who contributed ideas or materials that helped shape this unit.

Victorian Essential Learning Standards

The ins and outs of waste is an example of how to assess students against elements of Level 6 standards and facets of employability skills as detailed below:

For further information see the Employability Skills section.

Strand	Domain	Dimension	Element of standard	Related employability skill
Physical, Personal and Social Learning	Personal Learning	Managing personal learning	… monitor and evaluate the effectiveness of their task and resource management skills.	Planning and organising …*evaluates and monitors own performance.*
Discipline-based Learning	Science	Science knowledge and understanding	… identify and classify the sources of wastes generated, and describe their management, within the community and in industry. … use a specific example to explain the sustainable management of a resource.	
		Science at work	… construct visual aids that demonstrate scientific ideas.	
Interdisciplinary Learning	Thinking Processes	Reasoning, processing and inquiry	… complete activities focusing on problem solving and decision making which involve a wide range and complexity of variables and solutions.	Problem solving … *takes a creative and practical approach to problems.*
		Creativity	… experiment with innovative possibilities within the parameters of a task	

For further information see the Assessment section.

Teaching, Learning and Assessment Activities

In *The ins and outs of waste* students learn about the scope and effect of resource use that supports their lifestyle and the implications of associated waste generation and disposal. They investigate a Life Cycle Analysis (LCA) and assessment of a product, identifying and analysing the inputs (resources) and outputs (wastes) at each stage of a product's life.

The activities include:

- Activity 1: Reduce, recycle, reuse and refuse
- Activity 2: Introduction to Life cycle analysis (LCA)
- Activity 3: Research of a Life cycle analysis
- Activity 4: Prepare and present a Life cycle analysis

Activity 1: Reduce, recycle, reuse and refuse

Activities	Supporting the activities	Assessment
Key Question **How can we reduce the amount of rubbish in the world?** Introduce the unit's focus of resource use and waste management, individual activities and assessment.	It would be useful to emphasise that students will not only be assessed on their Science knowledge and skills but also on their ability to monitor and manage their personal learning and generate solutions to the issues related to waste management at a local or wider level.	
Explore the whole concept of rubbish with students to determine their prior knowledge and develop a general understanding of the relationship between resource use and waste generation when using everyday items. Ask students to think of a range of options in response to the question: • How can we reduce the amount of rubbish in the world?	It would be useful to explore the following questions. • What is rubbish? • What examples of rubbish can you give? • Is rubbish an appropriate way of describing the things we throw away? • In what ways could rubbish become a resource? This could be done as a Think, Pair, Share activity. Student options could be represented in a variety of ways eg: mind map, concept map, data chart. Information about concept maps and other teaching and learning strategies can be found at Teaching and Learning Resource. Possible student responses for strategies to reduce the amount of rubbish in the world include:	Collect the list of options to compare students' initial solutions on the issue with their solutions by the end of the unit as part of their assessment for: Thinking Processes – *Creativity*. See Assessment rubric (See Assessment page 9).

	• Encouraging people to live by the slogan, 'Reduce, Recycle, Reuse, Refuse' • Placing a tax on plastic bags • Purchasing products with limited/no packaging which may influence manufacturers.	
Ask students to select their top three options and write a short explanation of why these options have been chosen including the strategies they used to make their choices.	Strategies could include students engaging in discussing and debating the options or ranking their options.	Collect students' work to assess: Thinking Processes – *Reasoning Processing and inquiry*. See Assessment rubric (See Assessment page 9).
Encourage students to share their responses with the rest of the class and to take notes of others' responses to inform their thinking.	Student responses could be shared using strategies such as a graffiti wall or jigsaw. Information on graffiti wall as well as other teaching and learning strategies can be found at Teaching and Learning resource.	

Activity 2: Introduction to a Life Cycle Analysis (LCA)

Activities	Supporting the activities	Assessment
Key Question: What are the implications of using our resources and producing these wastes? Introduce the concept of an ecological footprint. Ask each student to complete an online ecological footprint calculation. Discuss ecological implications of their footprint in terms of range of resources. Introduce the concept of sustainability by asking students to define sustainability and arrive at a common understanding.	An eco footprint is the total amount of land that is required to supply all the resources required to support a person's lifestyle. By exploring any of the following links, you can learn what an ecological footprint is, what Australia's footprint looks like in comparison to the rest of the world, and how you can calculate your own ecological footprint. Powerhouse Museum's Interactive Bigfoot website (www.powerhousemuseum.com/ education/ecologic/games.htm) Earth Day's Footprint Quiz website (www.earthday.net/footprint)	

	EPA Victoria website (www.epa.vic.gov.au/ ecologicalfootprint/default.asp) Possible questions to ask students about their ecological footprint are: • How many 'worlds' did you use up? • Is your current practice environmentally sustainable? • What will happen to the world if we keep living this way? • What questions can you pose as a result of your reflection on these findings? Sustainability is defined by the World Commission of Environment and Development as 'forms of progress that meet the needs of the present without compromising the ability of future generations to meet their needs.'	
Introduce the concept of a life cycle analysis of a consumer product (e.g. a litre of milk). When introducing the concept, explain about inputs and outputs in terms of resources and wastes.	See the United Nations Environment Programme's Agri-Food forum (www.agrifood-forum.net/practices/lca.asp) for an example of a life cycle analysis diagram. The circular LCA model on this site can be adapted to a linear diagram which may be more helpful for some students. Possible questions are: • Where does milk come from? • How was the milk transported? • How is milk packaged? • What is in the packaging? • What happens to the packaging?	

Introduce students to the Project planning sheet which they will use to help them manage their learning. Explain to students that the project plan is a document that will assist them to keep track of the way they manage their time and tasks when researching their chosen product for a Life Cycle Analysis (LCA). It will need to be filled in at the end of each session and they will review their project plan at the end of each week (i.e.at least twice during their research phase).	Provide students with a copy of the Project planning sheet (See *Unit Resources* page 13) It would be useful to discuss with students that their Project plan reviews will be used to assess: • how well they manage their time and resources and • maintain a record of references for their research • how effectively they demonstrate a preferred management of materials in a life cycle analysis for their chosen product. • how well they reflect on their original plan • how the plan was changed if the need arose with an explanation for any changes.	

Activity 3: Research of a Life cycle analysis

Activities	Supporting the activities	Assessment
Clarify the purpose of the activity by telling students that their task is to choose a product, complete the research and present findings to the class as a visual aid/representation. Their research will include: • the LCA of their chosen consumer product • the treatment or disposal of wastes • the sustainability of the practices. Working individually or in pairs, students use the Project planning sheet to assist them in their research task.	Before undertaking their research, students will need to select an everyday item (consumption product) such as packaged food product. This choice could be widened to include a piece of clothing, an electronic gadget such as an mp3 player, mobile phone or calculator, a plastic container, an electrical appliance … that they will use to carry out an LCA. Direct students to sustainability websites such as those listed for this unit. See Resources	

Individually or in pairs, students complete their research. Provide students with time to review their project plans at appropriate intervals in the research phase.		
		Collect students' project plans to assess: Personal Learning - *Managing personal learning.* See Assessment rubric (See Assessment page 9).

Activity 4: Prepare and present a Life cycle analysis

Activities	Supporting the activities	Assessment
Provide students with time to prepare their research findings as a visual aid/representation. Students will present their visual aid/representation to the rest of the class.		Collect students' visual aids/representations to assess: Science – *Science knowledge and understanding* and Science – *Science at work*. See Assessment rubric (See Assessment page 9).

Assessment

The Victorian Essential Learning Standards support a combination of assessment practices:

- Assessment of learning (summative)
- Assessment for learning (formative)
- Assessment as learning (formative).

The assessment tasks in this unit focus on collection of evidence of student learning for summative purposes. Some components could also be used to support assessment for learning and assessment as learning.

Assessment guide

When assessing student achievement, assessment criteria can be developed from relevant standards and associated tasks or activities. The table below shows the assessment criteria related to the assessment task/s and relevant Standards and the expected evidence to be used as the basis for assessment.

The table can also be used to assist teachers to make judgments about whether students are working *at* the standard (achieved the standard), progressing *towards* the standard (have not met expectations of the standard) or progressing *beyond* the standard (have exceeded expectations of the standard) for specific assessment criteria. It is provided as a guide only and may be adapted or modified to suit particular classrooms and/or student reporting.

See the Assessment Resource for advice on developing rubrics.

Assessment Task: The ins and outs of waste

Evidence	Element of standard	Assessment criteria	Progressing towards the standard	At the standard	Progressing beyond the standard
Thinking Processes – Creativity					
List of options. (Activity 1)	… experiment with innovative possibilities within the parameters of a task.	Ability to generate a range of solutions to a problem.	Generates a range of solutions that reflect a level of maturity and knowledge of the world but creativity is likely to lead to a lack of practicality.	Considers problems from many angles and perspectives. Is more likely to address problems/questions at a global/national level. Creativity shows an awareness of practical limitations in real life contexts.	Makes connections to cutting edge practices and other fields of study.
Thinking Processes – Reasoning, processing and inquiry					
Explanation of three selected options. (Activity 1)	… complete activities focusing on problem solving and decision making which involve a wide range and	Ability to prioritise and provide a rationale.	Provides a rationale for solutions that illustrates a level of maturity and understanding of implications but tend to view solutions	Provides carefully considered solutions where limitations, practicalities and outcomes are addressed. Students' solutions are often considered in	Demonstrates awareness of the impact on a range of stakeholders.

	complexity of variables and solutions.		in isolation i.e. not as a package to achieve a goal. The practicality of solutions may not be addressed.	relation to each other i.e. a 'big picture' view of problem is taken.	
Personal Learning – Managing personal learning					
Project plan and reviews. (Activity 3)	… monitor and evaluate the effectiveness of their task and resource management skills.	Ability to evaluate the appropriateness of their project plan.	Provides a limited sense of evaluating project plan. (May be a diary of tasks accomplished).	Evaluates project plan and makes modifications where appropriate.	Critically reflects on and modifies project plan.
Science – Science knowledge and understanding					
Visual aid/ representation of LCA. (Activity 4)	… identify and classify the sources of wastes generated, and describe their management, within the community and in industry.	Ability to identify, classify sources of waste and describe the management and use of resources and treatment or disposal of wastes.	Provides simple descriptions of inputs and outputs. Limited demonstration of management of inputs and outputs. May only focus on outputs.	Considers and clearly describes management of waste generated from both inputs and outputs.	Critically evaluates the management of waste generated from both inputs and outputs.
	… use a specific example to explain the sustainable management of a resource.	Ability to explain levels of sustainability.	Shows basic knowledge of the concept of sustainability.	Clearly explains the levels of sustainability of practices.	Considers alternative sustainability practices.
Science – Science at work					
Visual aid/ representation of LCA. (Activity 4)	… construct visual aids that demonstrate scientific ideas.	Ability to construct an effective visual aid. Note: The focus of the visual aid is on effectiveness of communication rather than content.	Presentation interferes with communication of ideas.	Presentation effectively communicates ideas.	Presentation actively enhances communication of ideas.

Unit Resources

Websites

At the time of publication the URLs (website addresses) cited were checked for accuracy and appropriateness of content. However, due to the transient nature of material placed on the Internet, their continuing accuracy cannot be verified. Teachers are strongly advised to prepare their own indexes of sites that are suitable and applicable to this unit of work, and to check these addresses prior to allowing student access.

For information on the Department of Education and Early Childhood Development's Assessment Advice (www.education.vic.gov.au/studentlearning/assessment/default.htm)

For information on the Department of Education and Early Childhood Development's Principles of Learning and Teaching (PoLT)
(www.education.vic.gov.au/studentlearning/teachingprinciples/default.htm)

Examples of Lifecycle Analysis Diagrams can be found at the following links:

United Nations Environment Program (UNEP) Possible solutions: Life cycle assessment/analysis
www.agrifood-forum.net/practices/lca.asp
www.agrifood-forum.net/db/agrifood/cases/lca_peas_unilever.htm
http://buildlca.rmit.edu.au/CaseStud/Stadium/Stadium.html
www.uneptie.org/pc/pc/tools/lca.htm
www.esru.strath.ac.uk/EandE/Web_sites/01-02/sus_buildings/LCA1.gif
www.dantes.info/Images/LCA-web.gif
http://i.treehugger.com/epa-lca-cd.jpg
www.rivm.nl/milieuportaal/images/lca_tcm115-40224.jpg
www.gdrc.org/uem/lca/enviro.gif
http://webpub.allegheny.edu/dept/envisci/ESInfo/ES110sp2007/readings/LifeCycleAnalysis001.jpg
www.global-hydrogen-bus-platform.com/images/LIfeCycleGraphic.gif
www.lcafood.dk/LCA/LCA-milk2209.png

Australian Bureau of Statistics (ABS)
Data on Residential waste management in Australia (1301.0 Year Book Australia 2006)
(www.abs.gov.au/ausstats/abs@.nsf/Previousproducts/D00EAD1420DDD1A7CA2570DE001AAF97?opendocument)

Pollution and waste management (www.australia.gov.au/Pollution_&_Waste_Management)

Environment Australia Online (www.environment.gov.au)
The website of the Federal Government's Department of Environment and Heritage. It covers a range of environmental topics and has an education section and an internal search function.

Australian Conservation Foundation
Reduce waste (www.acfonline.org.au/default.asp?section_id=91)

Department of Sustainability and the Environment (DSE), Victoria
(www.dse.vic.gov.au/dse/index.htm)

Conducting a waste audit
(www.dse.vic.gov.au/DSE/nrence.nsf/LinkView/2ABD4B8AF937571CCA25707B0021016A1DCCD95AC0A4E586CA25708900041AAE)

Reducing waste
(www.dse.vic.gov.au/DSE/nrence.nsf/LinkView/0EBF468D1DC47023CA25706700246E0E490478C443632491CA25703C000A857A)

Environment Victoria (www.envict.org.au)
Follow the link to Zero Waste campaign.

Environment Protection Authority, Victoria (www.epa.vic.gov.au)
Information on local issues, particularly air and water quality and waste management.

CSIRO: Minimising waste - overview (www.csiro.au/org/ps16t.html)

Ecohouse: Waste Management Australia (www.eco-house.com.au/waste-management-australia.htm)

Teacher resources

Teaching and Learning Resource
This document provides information about teaching and learning strategies referred to in the task.

Assessment Resource
This document provides information about assessment strategies referred to in the task.

Student resources

Project planning sheet (See page 13)

Project planning sheet

Student Materials

Researching and creating a Life Cycle Analysis of a consumer food product

Task

Your task is to research and create a Life Cycle Analysis of a consumer food product.

You will be working with a partner and planning and reviewing your progress throughout the project. You will have about 2 weeks of class time to research your ideas, and then another 2 weeks to create the final LCA which communicates your findings.

- An important part of the project is to plan which parts of the work each person will be doing and then to critically review your individual progress.
- list the steps involved in constructing an LCA
- negotiate with your partner which steps each student will undertake.
- consider whether these tasks will fit into the timeline and make adjustments as necessary.

Assessment

	Task	*Standard*	*Assessment criteria*	*Progressing towards the standard*	*At the standard*	*Progressing beyond the standard*
Personal Learning						
	Research plan and reviews	Students monitor and evaluate the effectiveness of their task and resource management skills	Ability to: Evaluate the appropriateness of their project plan	Limited sense of evaluating project plan (may be a diary of tasks accomplished).	Evaluates project plan in relation to tasks and makes modifications where appropriate.	Critically reflects on and modifies project plan.
Science						
	Visual representation of LCA	Students identify and classify the sources of wastes generated, and describe their management, within the community and in industry.	Ability to: Research the management of the use of resources and treatment or disposal of wastes	Simple descriptions of inputs and outputs. Limited demonstration of management of inputs and outputs. May only focus on outputs.	Considers and clearly describes management of waste generated from both inputs and outputs.	Critically evaluate the management of waste generated from both inputs and outputs.
	Visual representation of LCA	They use a specific example to explain the sustainable management of a resource.	Ability to: Describe levels of sustainability	Shows basic knowledge of the concept of sustainability.	Clearly describes the level of sustainability of practices.	Considers alternative sustainability practices.
	Visual representation of LCA	Students construct … visual aids that demonstrate scientific ideas.	Ability to: Construct an effective visual aid (effectiveness of communication NOT content)	Presentation interferes with communication of ideas.	Presentation effectively communicates ideas.	Presentation actively enhances communication of ideas.

Critical Dates

Today's date …… Research until ……. Final LCA due ……..

Project Planning Sheet

Students : …… ……

Use these questions and the table to plan your project with your partner.

- What are the tasks in the project?
- How will these tasks fit into the timeline?

Tasks	Student Responsible	Completion Date

For each of the steps you have identified above, write the date that you expect to have achieved each step.

- Negotiate with your partner which tasks each of you will be doing.

  Write each student's initials next to each step that they will be responsible for.

- What will our final presentation look like? How will we show the amount of detail required?

Project planning sheet

Student Materials

My Individual Project Plan ……

Today's Date: …….

Which tasks am I responsible for?

- ☐
- ☐
- ☐
- ☐
- ☐

How will I allocate my time?

Write how long you will spend on each of the steps you are responsible for on the list above.

Where will I find my information? What resources will I use? What keywords will be important in my research?

- ☐
- ☐
- ☐
- ☐

Tasks	Time Required	Resources	Keywords

Project plan review

Today's Date : ……

Record the work you have done this week and explain how it links to your project plan. You may need to make changes to your project plan and these should be explained.

What did I achieve this week? (be specific)

Does this match what is in my project plan?

Do I need to review or change my plan? Explain why or why not.

What will I do in the next session? (be specific)

