

How much electricity do I use?



Activity description

Students will conduct geographic research into their energy use and factors which influence this.

Curriculum level 7

NCEA Level 2

Geography

Teaching rationale

Electricity usage is a geographic topic because it is related to sustainability and the interaction between people and the environment.

Students will use geographic research techniques and methodologies to research their energy use and factors influencing this, for example, the weather. Genesis has equipment for collecting weather data available for schools to borrow.

Curriculum and NCEA Links

NCEA Level 2

Achievement standard 91244

Geography 2.5 Conduct geographic research with guidance

Version 3

Credits 5

Level 7 Geography

Achievement objective

Understand how the processes that shape natural and cultural environments change over time, vary in scale and from place to place, and create spatial patterns.

Understand how people's perceptions of, and interactions with, natural and cultural environments differ and have changed over time.

NCEA Level 2 Geography

2.5 Conduct geographic research with guidance (91244)

Student learning outcomes

By the end of this study, students will:

1

Identify a research aim.

5

Explain findings, incorporating the relevance of geography concepts.

2

Plan geographic research.

6

Provide a conclusion that relates to the aim of the research.

3

Collect and record data.

7

Explain strength(s) and weakness(es) of the research process, and how this impacts on the validity of the research findings and/or conclusions.

4

Present spatial, statistical, and visual data, using the correct conventions and geographic terminology (for Excellence).

8

Discuss ways the research process could be improved.

Teacher background

- ▲ Students will choose their own research aims, which may include reading electricity usage from power bills. If this is the case, this research activity could take one to two months as students wait for the electricity billing cycle to be complete.

- For a background on factors influencing electricity use in New Zealand households, read https://comcom.govt.nz/__data/assets/pdf_file/0024/62871/ENA-submission-on-proposed-DPPs-for-EDBs-2015-Sapere-Trends-in-Residential-Demand-15-August-2014.PDF

Running the activity

- 1 **Introduce** your students to the topic of electricity usage and hold a geographic class discussion relating values to electricity usage – this might cover topics such as cost, sustainability, climate. Encourage students to use geographic concepts, such as sustainability and perspectives, and terminology during the discussion. Refer to media, for example:
 - <https://www.stuff.co.nz/business/107891655/creaking-and-groaning-new-zealand-energy-system-poses-risk-to-economy>
 - <https://www.stuff.co.nz/business/106988949/rising-power-prices-pushing-kiwi-households-into-power-poverty?rm=m>
 - <https://www.stuff.co.nz/business/108478579/we-need-to-diversify-electricity-supplies-now-to-keep-prices-low>
- 2 **Create** a class list of wonderings they could research related to electricity usage. It is recommended to include wonderings that involve:
 - a spatial component, and considers aspects of a natural or cultural environment, and/or the interaction of people with that environment.
 - primary data collection, e.g. weather, aspect, household composition, household values.

- 3 **Introduce** geographic concepts and encourage students to link geographic concepts to each wondering.
- 4 **Introduce** primary and secondary data. Sort the wonderings list into those that require primary data collection and those that don't. Keep the primary data wonderings for the class to refer to again.
- 5 **Introduce** your students to Achievement Standard 91244 v3 – ensure they understand the keywords, geographic concepts, and criteria for Achievement, Merit and Excellence from Explanatory Note 2.
- 6 **Divide** the class into research groups. Guide each group as they use the student worksheet for the internal assessment task. As each stage is reached, offer students guidance so they can meet the geographic requirements of the Achievement Standard. This research standard specifies the teacher's role is guidance which is defined as: "candidates being supported to identify the aim(s) and methods of collecting, recording, and presenting data."

- **Provide** groups time to read the Student worksheet: Factors affecting home electricity use.
- **Aim:** Each group should decide on a research aim related to the reading and the primary data wonderings. Each student should individually include the aim with their assessment. Clearly explain the requirements for choosing a research aim: -
 - » investigating at least one factor that influences electricity use, which includes collecting data related to electricity use
 - » a spatial component, and considers aspects of a natural or cultural environment, and/or the interaction of people with that environment.
 - » two forms of primary data collection, e.g. weather (NB. digital weather stations are secondary, so manual weather data collection would be necessary), aspect, natural environment, household composition, household values.
- **Planning:** Teacher guidance is vital at the planning stage. Planning can be completed as a group. Teachers may guide groups as to methods of collecting, recording and presenting data. A particular area of need may be what equipment is needed for primary data collection and how to use it. Groups should complete the form outlining what, where and when they will collect data and who is responsible. Each student must submit a copy of the planning with their assessment.
 - » **Collection of data** must include a combination of the following methods: observing, measuring, précis sketching, photographing, surveying, using questionnaires, interviewing, accessing secondary sources.
 - » **Presenting** a combination of spatial, statistical, and visual data
 - » **Presenting** data using a combination

of visuals such as graphs, maps, tables, photographs, or diagrams, following appropriate conventions.

- **Collecting and recording:** Offer guidance as groups collect and record their data according to their plan. Data collection and recording can be done in a group, however each student must submit a copy of the collected/recorded data with their assessment.
- **Continue offering guidance as students process the data and write up their research through the remaining individual stages:** presentation, findings incorporating geographic concepts; conclusion; strengths and weaknesses; and improving the research process

7 Conditions of assessment:

Students should have at least three weeks of in-class and at-home time, including preteaching, planning, collecting data, presenting and evaluating. Students can collect data in groups, however all other assessment tasks should be completed individually. Authenticity should be monitored using school procedures.

- 8 **Students** should have access to devices for research and to present their answers. The task allows students to use a presentation application of their choice to present their answers. However teachers may choose to limit students' choice of presentation applications to make marking more manageable.

- 9 **Collect and mark** using the assessment schedule and Exemplars of student work from www.nzqa.govt.nz/geography. To ensure authenticity, no exemplars of student work have been made available online, however schools should keep student exemplars at Achievement/Merit/Excellences as benchmarks and for moderation purposes.

Extending your students

- Conduct a spatial analysis by comparing where electricity is produced in New Zealand with where it is consumed. See <https://www.transpower.co.nz/power-system-live-data>
<https://data-transpower.opendata.arcgis.com/>
<https://www.ea.govt.nz/dmsdocument/20410-electricity-in-new-zealand>
- ▲ Electricity game:
www.electrocity.co.nz/

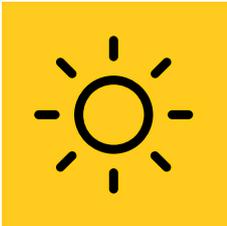
- Design an energy efficient house: See www.schoolgen.co.nz/wp-content/uploads/2018/04/SchoolGen_EnergyEfficientHouse_v1.pdf
- Make a sun inclinometer: See www.schoolgen.co.nz/wp-content/uploads/2018/01/Educ%20Resource_Sunlinometer_.pdf and www.schoolgen.co.nz/maker-projects/make-a-sun-inclinometer/

Supporting resources

- ▲ Teacher resource: Factors affecting household electricity consumption in NZ (from p. 4) https://comcom.govt.nz/_data/assets/pdf_file/0024/62871/ENA-submission-on-proposed-DPPs-for-EDBs-2015-Sapere-Trends-in-Residential-Demand-15-August-2014.PDF
- Factors affecting energy use: www.saskpower.com/efficiency-programs-and-tips/saving-power-at-home/saving-tips-and-programs/factors-affecting-power-use (be aware there are some specifically Canadian terms used)
- Home energy use in NZ: www.level.org.nz/energy/
- ▲ Average electricity consumption per household in NZ <https://figure.nz/chart/4uo7UXI7WRE0CsL6> Also search for other relevant graphs and maps.
- Residential electricity consumption by region (map and data) www.emi.ea.govt.nz/Retail/Reports/
- Seasonal electricity consumption by region (p.9): www.ea.govt.nz/dmsdocument/20410-electricity-in-new-zealand

- ▲ EECA Energywise at home: www.energywise.govt.nz/at-home/
- How much electricity do your gadgets really use? (US dollar values, but the kWh information is useful) www.forbes.com/sites/christopherheman/2013/09/07/how-much-energy-does-your-iphone-and-other-devices-use-and-what-to-do-about-it/#2633aeef2f70
- Household electricity use around the world
 - Selected countries, not including NZ: <http://shrinkthatfootprint.com/average-household-electricity-consumption>
 - Map showing most countries: www.ovoenergy.com/guides/energy-guides/how-much-electricity-does-a-home-use.html
- ▲ Understanding electricity meters: www.genesisenergy.co.nz/energy-insights/power-facts/understanding-power-meter

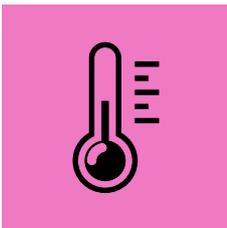
Factors affecting home electricity use



Weather

Weather: what it feels like at a particular place on a specific day. It is influenced by solar energy and precipitation in a location. Components of weather include sunshine hours, temperature, wind, precipitation and humidity.

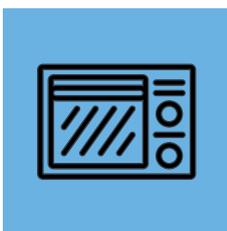
Weather affects electricity usage on a day to day basis – if it is cold on a specific day there will be a spike in electricity usage due to people heating their homes. If it is hot, people may cool their homes by using fans or heat pumps/air conditioning. High humidity or precipitation over a few days may cause people to dry clothes in the dryer rather than outdoors.



Climate

The climate is the average weather in a particular location. Climate is related to latitude and features of the natural landscape. It also includes the seasons and how these present in a location.

Climate affects electricity usage because it relates to how prepared people are for changes in weather. A home in the south of New Zealand may get colder in the winter, and so its occupants may invest in more cost efficient form of heating, e.g. a heat pump or fire. Whereas a home in the north of New Zealand may be more humid, and so its occupants may invest in a fan or air conditioning.



Appliances and devices

Standby mode: Leaving appliances on standby rather than turning them off means they keep using a little energy while not being used.

Appliance efficiency: Older appliances are less energy efficient. New appliances are labelled with energy stars indicating energy efficiency – similar appliances can have quite different energy requirements. LCD TVs are more energy efficient than plasma TVs.

The same appliance in multiple rooms: Do household members watch TV together on one TV or separately on several TVs? Does the house have two freezers?

Heating: Different forms of heating use different amounts of electricity, and some forms can use wood or LPG instead of electricity.



Housing design and construction

Insulation and double glazing: Insulation and double glazing keep homes cool in the summer, and can help with keeping the heat where it is meant to be during the winter. This can help to reduce electricity use. New homes require insulation and many require double glazing. Landlords are required to insulate their properties.

Lighting: Considerations related to electricity usage include: the number of lights in each room; what kind of lights are used; and how long lights are on for.

House size and shape: The bigger the home, the more space there is to heat, and the more rooms there are to consume electricity in. Apartments and townhouses with one, two or three windowless require more lighting.

Drafts and ventilation: Cold air entering a home can make it harder to heat. A lack of ventilation, especially in the bathroom and kitchen can trap dampness in a home and also make it harder to heat.

Aspect: How a house faces the sun makes a big difference in making sure a house is not cold and damp.

Shading: Deciduous trees planted in appropriate places can reduce indoor heat from the sun in the summer while allowing it inside in the winter.

Heat store: Tiles and concrete floors and walls absorb heat, which may help to heat a home in the winter or make it too hot in the summer.



People

Number of people: The more people in the house, the more showers, phones, food etc. there will be.

Habits: There are many ways to reduce individual electricity consumption, such as shorter showers, closing curtains, turning off lights.

When people are home: People who work from home or care for young children at home may use more electricity during the day when there is peak demand and peak prices.

Budget/income: Although all households are affected by increases in electricity prices, those on lower budgets/incomes are more likely to.

Sources:

- Batstone, S. and Reeve, D. 2014. Trends in residential electricity consumption. Retrieved from: https://comcom.govt.nz/__data/assets/pdf_file/0024/62871/ENA-submission-on-proposed-DPPs-for-EDBs-2015-Sapere-Trends-in-Residential-Demand-15-August-2014.PDF
- SaskPower. n.d. Factors affecting power usage. Retrieved from: www.saskpower.com/efficiency-programs-and-tips/saving-power-at-home/saving-tips-and-programs/factors-affecting-power-use

How much electricity do I use?

Achievement standard information

NCEA Level 2
 Achievement standard 91244
 Geography 2.5 Conduct geographic research with guidance
 Version 3
 Credits 5

Achievement criteria

Achievement	Achievement with Merit	Achievement with Excellence
Conduct geographic research with guidance.	Conduct in-depth geographic research with guidance.	Conduct comprehensive geographic research with guidance.

Introduction

Electricity usage is a geographic topic because it is related to sustainability and the interaction between people and the environment. There are a number of geographic factors that affect electricity use.

In this activity you will apply geographic thinking to investigate some of the factors that affect electricity usage.

The planning, collecting and recording data can be completed as a group, but the

remainder of the internal assessment must be completed individually. You will be assessed on how well you undertake and evaluate the geographic research process.

Make sure you use specific information such as quotes and facts throughout your answer. Use geographic terminology and geographic concepts such as environments, perspectives, processes, patterns, interaction, change, sustainability.

Conditions and due date

Complete the following with your teacher

When is this assessment due?

Where should it be completed?

Authenticity

- This is my own work completed this year.
- I understand that there are penalties for plagiarism and collusion.
- I have acknowledged all sources.

Signed:

Date:

Before you start: Decide on how you will present your work (Individual task)

Choose a presentation application to present your answers to Tasks 1-8. Make sure the application you choose allows you to fully describe your geographic thinking and present your data using a combinations of spatial (maps) statistical and visual methods with correct geographic conventions. Complete the following eight tasks and submit together with the signed authenticity cover sheet.

Task 2: Planning (Group task)

Plan the research (for Achievement).

Plan how you will answer your research aim. Planning includes how you will collect data, how you will record it, how you will present it, and what geographic concepts you plan to use.

Use the tables to plan your research. Copy extra primary and secondary data tables depending on what you plan to research. Make sure each group member has their own copy of the planning. Create tables and charts to record the data you collect.

Things to consider about Achievement standard 91244:

- Primary data must be collected from the field.
- The collection of data must include a combination of the following methods: observing, measuring, précis sketching, photographing, surveying, using questionnaires, interviewing, accessing secondary sources.
- The data must be presented using a combination of visuals such as graphs, maps, tables, photographs, or diagrams, following appropriate conventions.
- Geographic concepts: environments, perspectives, processes, patterns, interaction, change, sustainability.

Data

List all the data will you need to collect to answer your research aim:

- Electricity use

Match the data you need with the method you will use to collect it:

1. observing
2. measuring
3. précis sketching
4. photographing
5. surveying
6. using questionnaire
7. interviewing
8. accessing secondary sources

Match the data you need with the visuals you will present:

- A. graphs
- B. maps
- C. statistical maps
- D. tables
- E. photographs
- F. diagrams

Check you have at least two kinds of primary data. Check you have a combination of spatial, statistical and visual data.

Check you will use a combination of methods.

Check you will use a combination of visuals.

Task 2: Primary data planning (Group task)

What primary data will you need to collect?	
How will you measure it?	When will you collect it?
What equipment will you need? How will you learn to use it?	Where will you collect it?
How will you record it?	What roles will group members have?
How will you present this data in your report?	What other information might help? E.g. address, date and time, weather.
What geographic concept/s are relevant?	

Task 2: Primary data planning (Group task)

What primary data will you need to collect?	
How will you measure it?	When will you collect it?
What equipment will you need? How will you learn to use it?	Where will you collect it?
How will you record it?	What roles will group members have?
How will you present this data in your report?	What other information might help? E.g. address, date and time, weather.
What geographic concept/s are relevant?	

Task 2: Secondary data planning (Group task)

What secondary data will you need to collect?	
How will you collect and record it?	When will you collect it?
How will you record it?	What roles will group members have?
How will you present this data in your report?	What information will you need to correctly reference this data? E.g. Author, publication date, publisher, page numbers, URL.
What geographic concept/s are relevant?	

Task 2: Planning (Group task)

Equipment list	Schedule/Method

Task 3: Data collection (Group task)

Collect and record data relevant to the aim of the research (for Achievement).

Things to consider about Achievement standard 91244:

- Primary data must be collected from the field.
- The collection of data may be done individually or in a group.
- The collection of data must include a combination of the following methods: observing, measuring, précis sketching, photographing, surveying, using questionnaires, interviewing, accessing secondary sources.

1. Follow your research plan to collect data and record relevant data.
2. Make sure each group member has a copy of the recorded data that was collected.
3. There is no need to write it out neatly.

Before you hand in your collected and recorded data, check that it is informative by including conventions such as:

1. Title stating what;
2. Where and when;
3. Frame;
4. Labels or captions;
5. Scale; key and colour;
6. North point.

Task 4: Data presentation (Individual task)

Accurately and effectively present a combination of spatial, statistical, and visual data, using the correct conventions and geographic terminology (for Excellence).

Follow your research plan to create visuals that accurately and effectively present your data in a way that is relevant to your research aim. Where possible make your presentation effective by grouping or integrating more than one type of data into a visual. Check every presentation visual includes correct conventions and geographic terminology.

Things to consider about Achievement standard 91244:

- The data must be presented using a combination of visuals such as graphs, maps, tables, photographs, or diagrams, following appropriate conventions.
- For the presentation to be considered effective, data may be grouped or integrated, e.g. statistical maps combining both spatial and statistical data.
- Conventions include (depending on the visual): title stating what, where and when; frame/border; north point or latitude and longitude; scale; key/legend; appropriate use of colour; labels; annotations; captions.

Task 5: Findings and geographic concepts (Individual task)

Fully explain findings, incorporating the relevance of geography concepts (for Excellence).

Write paragraphs fully explaining what information your visuals show, how and why the visuals relate to each other, and how and why your visuals show information that answers your research question from your aim.

Make clear the significance of each of your visuals to the overall research.

Throughout your findings paragraphs incorporate relevant geographic concepts, use geographic terminology, refer to the visuals (e.g. as seen in Graph 1, Map 1), and incorporate specific information from your visuals and collected data.

Things to consider about Achievement standard 91244:

- Findings: These involve understandings gained from reviewing presented materials such as maps, graphs, tables, diagrams, or photographs.
- When explaining the research findings, students should demonstrate understanding of their evidence through accounting for it (how and/or why), and making its significance to the overall research clear.
- The findings need to incorporate relevant geographic concepts and supporting evidence from the collected and presented data.
- Geographic concepts: environments, perspectives, processes, patterns, interaction, change, sustainability.
- Specific information includes supporting evidence from the data collected and presented, facts, names or other explicit information.

Task 6: Conclusion (Individual task)

Provide a conclusion, in detail, that relates to the aim of the research (for Merit).

Write a conclusion paragraph(s) in detail that summarise findings and how they relate to the research aim. Answer the research aim. Incorporate geographic terminology, and specific information from your collected and presented data and findings.

Things to consider about Achievement standard 91244:

- Specific information includes supporting evidence from the data collected and presented, facts, names or other explicit information.

Task 7: Strengths and weaknesses (Individual task)

Fully explain the strength(s) and weakness(es) of the research process, and how this impacts on the validity of the research findings and/or conclusions (for Excellence).

Write paragraphs fully explaining at least one strength and one weakness of the research process (aim, planning, collecting and recording, presenting).

Fully explain how the strength(s) and weakness(es) impact on the validity of the research findings and/or conclusions.

Incorporate geographic terminology, geographic concept/s and specific information from your research process.

Things to consider about Achievement standard 91244:

- The evaluation needs to focus on the research process, showing explicit links between strengths and weaknesses and the validity of the findings and/or conclusions.
- Specific information includes evidence from the data collected and presented, facts, names or other explicit information, such as the research process.

Task 8:

Improvements to the process (Individual task)

Discuss ways the research process could be improved (for Excellence).

Write paragraph(s) discussing ways the research process could be improved, by expanding on your strength(s) and weakness(es) and/or considering alternative methods. Discuss how and why these things would improve the validity of your findings and/or conclusions.

Things to consider about Achievement standard 91244:

- This could be approached through an explanation of different data collection methods that would improve the overall validity of the research results.

Helpful websites

- Home energy use in NZ: www.level.org.nz/energy/
- Average electricity consumption per household in NZ
<https://figure.nz/chart/4uo7UXI7WRE0CsL6> Also search for other relevant graphs and maps.
- Residential electricity consumption by region (map and data)
www.emi.ea.govt.nz/Retail/Reports/DUOM0B?DateFrom=20170101&DateTo=20171231&si=v|5
- Seasonal electricity consumption by region (p. 9):
www.ea.govt.nz/dmsdocument/20410-electricity-in-new-zealand
- EECA Energywise at home: www.energywise.govt.nz/at-home/
- How much electricity do your gadgets really use? (US dollar values, but the kWh information is useful) www.forbes.com/sites/christopherhelman/2013/09/07/how-much-energy-does-your-iphone-and-other-devices-use-and-what-to-do-about-it/#2633aeef2f70
- Household electricity use around the world
 - Selected countries, not including NZ:
<http://shrinkthatfootprint.com/average-household-electricity-consumption>
 - Map showing most countries:
www.ovoenergy.com/guides/energy-guides/how-much-electricity-does-a-home-use.html
- Understanding electricity meters:
www.genesisenergy.co.nz/energy-insights/power-facts/understanding-power-meter

Assessment schedule

Level 2 Achievement standard 91244

5 Credits

Geography 2.5 Conduct geographic research with guidance

Version 3

	Tick	Achievement	Tick	Achievement with Merit	Tick	Achievement with Excellence
Achievement Criteria		Conduct geographic research with guidance.		Conduct in-depth geographic research with guidance.		Conduct comprehensive geographic research with guidance.
Task 1: Research Aim		Student identifies the aim of the research.		As for Achievement		As for Achievement
Task 2: Planning		Student plans the research.		As for Achievement		As for Achievement
Task 3: Data collection Primary data must be collected from the field.		<p>Student collects and records data relevant to the aim of the research.</p> <p>Raw data collection is included. This may be a photocopy of group data.</p> <p>The collection of data must include a combination of the following methods: observing, measuring, précis sketching, photographing, surveying, using questionnaires, interviewing, accessing secondary sources.</p>		As for Achievement		As for Achievement

<p>Task 4: Data presentation The data must be presented using a combination of visuals such as graphs, maps, tables, photographs, or diagrams, following appropriate conventions.</p>		<p>Student presents, using the correct conventions, a combination of spatial, statistical, and/or visual data.</p> <p>Conventions include (depending on the visual): title stating what, where and when; frame/border; north point or latitude and longitude; scale; key/legend; appropriate use of colour; labels; annotations; captions.</p>	<p>Student accurately presents a combination of spatial, statistical, and visual data, using the correct conventions</p>	<p>Student accurately and effectively presents a combination of spatial, statistical, and visual data, using the correct conventions and geographic terminology</p> <p>For the presentation to be considered effective, data may be grouped or integrated, e.g. statistical maps combining both spatial and statistical data.</p>
<p>Task 5: Findings and geographic concepts</p>		<p>Student explains findings incorporating the relevance of geographic concepts</p> <p>Student demonstrates understanding of their evidence through accounting for it (how and/or why), and making its significance to the overall research clear.</p> <p>Student incorporates supporting evidence from the collected and presented data.</p>	<p>Student explains findings, in detail, incorporating the relevance of geographic concepts.</p> <p>The response has complexity showing greater understanding that differentiates it from an Achieved level answer.</p> <p>The response incorporates specific information, case study, facts, names or other explicit information which enhances the answer.</p>	<p>Student fully explains findings, incorporating the relevance of geography concepts.</p> <p>The response is complete and demonstrates an understanding of all facets. It uses appropriate geographic terminology.</p>
<p>Task 6: Conclusion</p>		<p>Student provides a conclusion(s) that relates to the aim of the research</p>	<p>Student provides a conclusion, in detail, that relates to the aim of the research</p>	<p>As for Merit</p>

<p>Task 7: Strengths and weaknesses</p>		<p>Student provides an evaluation of the research that describes the strength(s) and/or weakness(es) of the research process and how this affects the validity of the research findings.</p> <p>Student explains one strength or weakness.</p> <p>Links between strength/weakness and validity are explicit.</p>	<p>Student explains, in detail, the strength(s) and weakness(es) of the research process and how this impacts on the validity of the research findings and/or conclusions.</p> <p>Student explains in detail one strength and one weakness.</p> <p>The response has complexity showing greater understanding that differentiates it from an Achieved level answer.</p> <p>The response incorporates specific information, case study, facts, names or other explicit information which enhances the answer.</p>	<p>Student fully explains the strength(s) and weakness(es) of the research process, and how this impacts on the validity of the research findings and/or conclusions.</p> <p>The response is complete and demonstrates an understanding of all facets. It incorporates relevant geographic concept(s) and uses appropriate geographic terminology.</p>
<p>Task 8: Improvements to the process</p>		<p>Not required</p>	<p>Not required</p>	<p>Student discusses ways the research process could be improved.</p> <p>e.g. an explanation of different data collection methods that would improve the overall validity of the research results.</p>

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.

<p>Final grade</p>	<p>Achievement</p>	<p>Achievement with Merit</p>	<p>Achievement with Excellence</p>
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