

Feet First term 4: walking and helping our planet

Updated 2023



Key understanding: Walking benefits people, places and our planet.

Driving question: Walking – what difference can I make?

- Define walking.
- Explain the benefits of walking.
- Predict how using sustainable transport such as walking might improve people, places and the planet.

Activity 4.3 Mathematics: statistical investigation

Achievement objectives – see New Zealand Curriculum levels 1-4 statistical investigation and statistical literacy.

Example learning intentions

Statistical investigation

Define the problem and the population concerned.

Describe the variables to be measured.

Collect data.

Sort and summarise the data.

Present the data.

Analyse the data.

Compare and contrast data.

Draw a conclusion from the data analysis.

Make a generalisation from a multitude of data.

Statistical literacy

Interpret statements from statistical investigations.

Compare statements from statistical investigations.

Evaluate the effectiveness of different statistical data displays.

Evaluate statistical generalisations.

Learning experiences

Select the learning experiences that best match the abilities of your student and that support your learning intentions.

Can we help the planet by using statistics to investigate travelling to school?

Investigate the difference that choosing to walk (to school) rather than use private cars makes to our planet.

Define the problem to be investigated. Examples:

- How far do I travel by car or walk to school and back in one week?
- How do the staff and students get to and from school?
- What is the distance travelled by the staff and students getting to and from school each day?
- What is the carbon dioxide emissions from the staff and students getting to and from school each day?

Define the population concerned, such as all the staff and students at school, or the students of just your classroom.

Describe the variables to be measured, such as different methods of transport (discrete data), distance travelled (continuous data).

Describe the sample size.

Collect data. Examples:

- Keep a travel log of the distance you travel to school by car in a week.
- Keep a pedometer record of the distance you walk to school in a week.
- Use surveys, observations, questionnaires, or interviews.
- Survey the distance staff and students travel to get to school each day.
- Survey the transport method used by staff and students to get to school each day.

Sort data, e.g. record this survey data in a tally chart.

Summarise the data.

Present the data. Choose the most appropriate method – bar charts, histograms, frequency tables, tally charts, pictograph, strip graph, pie chart, table, graph, dot plots, time series.

Analyse the data. Use average, mean, mode.

Compare and contrast data, e.g. the average distance travelled by staff compared to the average distance travelled by students. Compare and contrast walking to school with driving to school.

Compare and contrast your data with national survey data on walking in New Zealand.

Draw a conclusion from the data analysis about the problem you have investigated.

Make a generalisation from a multitude of data.

Using an online carbon calculator to calculate the average amount of carbon dioxide gas released each day by your school community getting to and from school.

[Carbon calculator](#)

Make a generalisation from your data about how your local community can help our planet by choosing to walk (to school) rather than use private cars.

Evaluate your generalisation.

Suggested research data to support your generalisation

Define 'fuel'.

Explain how burning fuels in cars releases carbon dioxide gas into the atmosphere.

Define 'fuel efficiency'.

Refer:

[One the move: lower emissions transport options \(Gen Less\)](#)

Explain how using cars releases carbon dioxide gas into the atmosphere.

Explain the effects of increasing the level of carbon dioxide gas in the atmosphere.

Explain how electrically-powered cars may still be responsible for the release of some carbon dioxide gas into the atmosphere.

Explain how fuel efficiency can reduce the carbon dioxide gas emissions from a car.

Gather data about carbon dioxide gas emissions, cars and car use in New Zealand.

Chart the relative proportion of carbon dioxide emissions involved in car use, e.g. extraction of raw materials (4%), assembly (2%), fuel production (19%), and vehicle use (75%).

Find out:

- how many tonnes of carbon dioxide gas the average New Zealand private car produces in a year
- how many tonnes of carbon dioxide gas is produced in the manufacture of cars
- the number of new cars being put on the road each day in New Zealand
- the number of cars per person in New Zealand
- the percentage of carbon dioxide gas emissions released by private cars in New Zealand each year.

List the methods of transport used in New Zealand.

Rank the methods of transport used in New Zealand from most common to least common.

Classify the methods of transport used in New Zealand, e.g. methods requiring fossil fuels, methods using electricity, methods requiring human activity etc.

Assessment

Learning area: Mathematics and statistics

	Can reflect on findings and make a generalised statement/justification about investigation.
	Can formulate relevant questions to gather information. Can compare data between graphs and explain trends and patterns.
	Can use a range of simple graphs to show information and can interpret data.
	Can use a tally chart to record information.
	Requires teacher assistance to use tally/simple graphs.

Key competency: thinking

	Can reflect on questions and modify to improve the data being collated.
	Can explain the reasons why certain questions are being asked and can sequence the questions to improve quality of data.
	Can formulate several relevant questions to gather information.
	Can formulate one relevant question to gather information.
	Requires teacher assistance to formulate questions to gather information.

Internet resources

[New Zealand Household Travel Survey](#)

[New Zealand Maths: Units of Work: Statistical Investigations](#)

[Stats NZ topic: transport](#)

[Ministry of Transport – statistics and insights](#)

[Waka Kotahi open data portal](#)

[Electric vehicles and Aotearoa \(EECA insights\)](#)

[Efficient and low emissions transport \(EECA\)](#)

Thinking resources

Compare and contrast walking to school with driving to school in a private car.

Do a PMI on using public transport to get to school.

Classify the different methods of getting to school by fuel type.

Explain the causes of people driving children to school.

Explain the consequences of people driving to school.

What if questions

Use these for class and group discussion or writing.

What if it was unsafe to walk?

What if private cars were banned?

What if everyone had to attend a local school they could walk to?

What if cars were only allowed to be used at the weekend?

What if students and staff had to live on the school site during the week?

Activity 4.4 Science: helping our planet for clean air and water

Achievement objectives – see New Zealand Curriculum levels 1-4 Earth systems and nature of science.

Example learning intentions

Planet Earth and Beyond: Earth systems, interacting systems

Describe Earth's natural features and a natural feature in your local area.

Describe a natural resource in your local area.

Describe natural events in your local area.

Describe human actions in your local area.

Sequence the steps in changing a natural feature by human action.

Compare and contrast human actions with natural events.

Describe the three states of water (solid, liquid and gas) and where they are located on planet Earth.

Explain the effect of air pollution on water.

Analyse the water cycle in relation to planet Earth.

Compare and contrast the properties of water as a liquid, a solid and a gas.

Explain the effect of water as a liquid, a solid and a gas on climate, landforms and life.

Explain how human actions change natural features.

Compare and contrast two spheres in the Earth system.

Explain the relationship between the spheres of the Earth system.

Classify the Earth's resources by categories based upon the Earth's spheres.

Explain how the Earth's spheres can also be understood as the Earth's resources.

Analyse the spheres of the Earth system.

Evaluate the future availability of the Earth's resources.

Generalise about human actions and the Earth's resources.

Predict how water (as liquid, solid and gas) will affect life, landforms and climate in the future.

Nature of Science

Describe carbon cycle.

Sequence the stages (parts and processes) in the carbon cycle.

Compare and contrast levels of carbon dioxide gas in the atmosphere in the past with levels of carbon dioxide gas in the atmosphere today.

Compare and contrast patterns of transport in the past with the present day.

Explain how using cars releases carbon dioxide gas into the atmosphere.

Explain the effects of increasing the level of pollutants in the atmosphere.

Explain the effects of increasing the level of carbon dioxide gas in the atmosphere.

Analyse the sources of carbon dioxide gas in the atmosphere.

Analyse the sources of pollutants in the atmosphere.

Make a generalisation about the difference that choosing to walk rather than use private cars makes to Planet Earth.

Learning experiences

Select the learning experiences that best match the abilities of your student and that support your learning intentions.

Explore how human action affects natural features and resources. Explore how car emissions create air pollution. Explore how walking reduces car emissions which helps reduce air pollution.

Earth's natural features and resources

Describe the spheres making up Planet Earth: water (hydrosphere), air (atmosphere), rocks and soil (geosphere), life forms (biosphere).

Go on a "walking in, on and through the Earth's spheres" field trip, e.g. paddle in a water source, lie on your back and gaze at the atmosphere (but not at the sun), and walk barefoot over the earth. Draw pictures and take photographs and use see>think>wonder to describe your experiences exploring the spheres.

Take a walking field trip around your local area to observe the Earth's resources, natural features, natural events and human actions.

View videos and images of the Earth's natural features.

Describe a natural feature in your local area, e.g. the atmosphere.

Describe a natural resource in your local area, e.g. clean air.

Describe a natural event in your local area, e.g. surface flooding, volcanic activity.

Describe human actions in your local area, e.g. burning fossil fuels to keep warm and when using private transport.

Describe the spheres in the Earth's system.

Sequence the movement of water as a liquid, gas and solid through the spheres of the Earth system.

Compare and contrast the hydrosphere and the atmosphere in the Earth system.

Analyse the relationship between the four spheres of the Earth system.

Explain how the Earth's spheres can also be understood as the Earth's resources.

Evaluate the future availability of the Earth's natural features and resources.

Sequence the steps in changing a natural feature by human action, e.g. sequence how gaseous and particulate emissions from car exhausts enter and change the quality of the atmosphere.

Explain how human actions change natural features, e.g. how human actions in burning fossil fuels contributes to pollution of the atmosphere.

Generalise about human actions and the Earth's resources, e.g. explain how polluting the atmosphere affects Earth's resource of clean air water locally and globally.

Focus on the atmosphere as an Earth resource

“Look at your feet. You are standing in the sky. When we think of the sky, we tend to look up, but the sky actually begins at the earth.” --Diane Ackerman

List all the places where air is found on Planet Earth, for example, above seas and lakes, in cracks in the soil, dissolved in water etc.

Find out the average mass of the atmosphere. Answer: 5 quadrillion tonnes.

Explain why, as you move away from the Earth, the atmosphere gets less dense, until at 1000km you reach a vacuum where there is no atmosphere (or air). Fifty percent of the mass of the atmosphere is below 6km.

Explain why mountain climbers need to carry oxygen.

Explain why the Earth's atmosphere does not float off into space.

Draw a diagram to explain how the atmosphere protects us from the heat of the sun.

Explain why if the surface of the earth receives different amounts of the sun's energy, the atmosphere moves (wind).

List the gases that make up the air.

Rank the gases in order from greatest proportion to lowest proportion.

Draw a large circle in the playground and mark out the relative amounts of gases in the air.

Analyse the importance of the gases that make up the air, e.g. oxygen is used to oxidise food and provide energy in all living things, and nitrogen is used by nitrogen fixing bacteria to produce nitrates which plants convert into plant protein, green plants use carbon dioxide gas to make carbohydrates during the process of photosynthesis. This is the main source of food for all living things.

Explain why almost all living things depend on air to stay alive.

Carbon dioxide gas is heavier than air. Make some carbon dioxide gas by adding vinegar (a weak acid) to baking soda (sodium bicarbonate). Pour the gas you make over a small lit candle in an open fireproof container. The carbon dioxide gas should displace the oxygen-containing air and extinguish the flame.

Explain how you can tell that there is water in air, e.g. condensation on windows, glasses, vegetation, clouds, fog, mist.

Explain where the water in the air (clouds and water vapour) comes from.

Measure how much moisture (water) is in the air by making a hair hygrometer and using it to calculate the percent of moisture in the air.

[Hairy science: measuring humidity with a hair hygrometer](#)

Choose an atmospheric gas. Identify its constituent atoms. Investigate where they are found in the other spheres. Search for evidence of cycles of carbon, nitrogen or water between the spheres.

Carbon in the Earth's spheres

Define 'carbon dioxide gas', 'photosynthesis' and 'respiration'.

Define 'fossil fuels'.

List all the ways that carbon dioxide gas is added to and removed from the atmosphere.

List all the processes that move carbon through the environment.

List all the carbon-based components in the carbon cycle.

Sequence the stages in the carbon cycle. Include process stages and carbon-based parts in your cycle, carbon dioxide in the atmosphere, respiration, photosynthesis, plants, herbivores, carnivores, decomposers, excretory products, combustion, fossil fuels (coal, oil, natural gas) carbon dioxide in the oceans, carbonate skeletons of marine animals, chalk and limestone rock.

Identify how many parts of carbon dioxide would be found in 10,000 parts of air.

If plants use carbon dioxide from the air to make food (carbohydrates), explain why the levels of carbon dioxide in the air do not decrease.

Explain where carbon dioxide gas in the atmosphere comes from and where it goes. For example, carbon dioxide is absorbed in oceans, in organic matter in bodies of living things (carbohydrates, lipids, proteins, nucleic acids), trapped in bodies of once living things, used up in photosynthesis of plankton and green plants, released through respiration of all living things, released by burning fossil fuels, released by decomposition.

Describe the greenhouse effect. Explain how carbon dioxide gas in the atmosphere traps heat radiated from the ground.

Define 'air pollution' – air that contains matter that is harmful to living things.

View images of air pollution from all over the world. For example:

Research the threat to the atmosphere using data and information from the air pollution monitoring currently undertaken in New Zealand.

Identify the major pollutants in New Zealand's atmosphere and their source, such as nitrogen oxides and carbon monoxide from car emissions.

Invite people involved with monitoring the quality of New Zealand's atmosphere in your local area to talk about their work and their predictions for the future challenges to keeping our air clean.

Explain how burning fossil fuels in cars, and buses can pollute the air we breathe.

Invite an owner of an electric car to visit the school with the car and talk about the differences between the EV and a standard motor vehicle.

Sticky Tape Air Particle Test:

- Make air quality monitors by cutting identically sized windows in small pieces of card.
- Fill the window with clear sticky tape. Put the cards at different places and leave for 24 hours.
- Collect the cards and examine the particles trapped on the tape with a digital microscope, hand lens or binocular microscope.
- Use a grid to estimate the percentage cover of the windows from different locations.
- Compare your experimental results with those from a school in another place or another country with different air quality.

Describe what people mean when they talk about climate change.

Explain why increasing the level of carbon dioxide gas in the atmosphere could create climate change.

Explain the consequences of a rise in world temperature, e.g. a rise in sea level, changing rainfall and wind patterns, increasing rate of photosynthesis.

Sequence the changes in transport over time, e.g. steam train, bicycle, car.

Explain how using cars releases carbon dioxide gas into the atmosphere.

Complete a SWOT analysis (Strengths, weaknesses, opportunities and threats) of the air resource in New Zealand.

Identify the areas in New Zealand where the quality of the air resource is under threat.

Visualise yourself as a carbon atom. Plan the story of your life as you change into different carbon based molecules in the carbon cycle. Include reference to air pollution and climate change. Present your story.

Identify places in your life story where you contribute positively to Planet Earth and places where your presence creates problems for Planet Earth.

[The carbon cycle \(Science Learning Hub\)](#)

Evaluate the future wellbeing of the earth's spheres if we continue to pollute the air resource in the atmosphere with carbon-based gas emissions from cars and open fires.

Focus on the hydrosphere as an Earth resource

Explore how all the air in the world affects the water in the world and how the water in the world affects the air in the world.

Find out how much of the Earth's surface is covered in water, how much is below the ground in aquifers, and how much is in the air as vapour and clouds and precipitation.

Draw a large pie chart or bar graph or human graph in chalk in the playground to represent the different amounts.

Find out how much of the water on the surface of the earth is held in the oceans (salt water), how much is held in glaciers and ice caps, and how much is held in rivers lakes and ponds.

Draw a large pie chart or bar graph or human graph in chalk in the playground to represent the different amounts.

Describe water as a solid, liquid and gas.

For example, conduct observations on solids, liquids and gases.

- Solids do not easily change their shape or volume – they do not take up the shape of the container they are in like a liquid does
- Liquids maintain volume but not shape
- Gases are squeezable – they change volume and shape.

Describe how water changes state from solid to liquid to gas etc.

Think of three states of matter as rungs on a ladder – solid at bottom then liquid then gas at top. To change state by climbing the ladder, energy must be added to the matter. To change state by going down the ladder, the matter must lose energy it must be cooled.

Observe the water that appears on the outside of a pre-dried and chilled sealed jar of water. Discuss where this water has come from.

Define these changes of state: condensation, melting, evaporation, freezing.

Describe the forms of water found in the atmosphere, e.g. water vapour (water in a gaseous state), cloud droplets (water in liquid state), precipitation (water in liquid state - rain, sleet, and water in solid state - snow and hail).

Describe how water in its gaseous state changes to water in its liquid state in the atmosphere to form clouds.

Sequence the steps that form a raindrop in a cloud. For rain to fall, tiny droplets of water condense on the surface of particles in the atmosphere. These particles can be dust, smoke or even salt. These droplets grow when they collide with other droplets. When they grow large enough they are too heavy to remain in the cloud and fall as rain (precipitation).

Explain how rain re-distributes particles in the atmosphere to the land.

Explain how the amount of particulate matter in the atmosphere might affect rainfall.

Explain how rainwater that falls to earth gets back into the atmosphere.

Generalise about human actions and the Earth's resources. Explain how polluting the atmosphere affects Earth's resource of clean water on the land.

Plan and implement a human action you can take that will reduce the amount of pollutants you and your local community add to the atmosphere.

Assessment

Learning area: science

	I can identify the steps that lead to pollution of the atmosphere, put them in order, explain why this order is correct, and predict the consequences of an interrupt in the process.
	I can identify the steps that lead to pollution of the atmosphere, put them in order, and explain why this order is correct.
	I can identify the steps that lead to pollution of the atmosphere, and put them in order.
	I can identify some of the steps that lead to pollution of the atmosphere.
	I need help to sequence the steps that lead to pollution of the atmosphere.

Key competency: thinking

	I can ask complex questions that go beyond the pollution of the atmosphere and look at the pollution in a new way.
	I can ask questions that link information relevant to the pollution of the atmosphere.
	I can ask questions that bring in more than one idea relevant to the pollution of the atmosphere.
	I can ask questions that bring in one idea relevant to the pollution of the atmosphere.
	I need help to ask a question about pollution of the atmosphere.

Internet resources

[NZ air quality monitoring map and data \(LAWA\)](#)

[Air pollutant emissions \(Stats NZ\)](#)

[Topic: water \(Science Learning Hub\)](#)

[Topic: climate change \(Science Learning Hub\)](#)

[Environmental Challenges \(BBC Bitesize\)](#)

[Environmental ratings \(Rightcar\)](#)

[What the government is doing about air \(Ministry for the Environment\)](#)

[What the government is doing about climate change \(Ministry for the Environment\)](#)

[NIWA educational resources](#)

[Live Science: Air pollution cuts rainfall over mountains](#)

[The impact of urban pollution on rain \(NASA\)](#)

[Infosthetics: All the water in the world](#) Graphical representation of the water and atmosphere in the world.

[How much water is there on Earth? \(USGS\)](#)

Thinking resources

Complete a PMI on living on a planet where we are surrounded by a layer of air.

Compare and contrast Earth's water resource with Earth's air resource.

List the different states of water found in the air.

Explain why we are unaware of the air pressure pushing down on us.

Make an analogy between air and a loaf of bread.

What if questions

Use these for class and group discussion or writing.

What if the atmosphere were suddenly to disappear?

What if the proportions of oxygen and nitrogen in the air were swapped around?

What if we could see the air?

What if you paid for bottled air like we do for bottled water?

What if oxygen in the air could not dissolve in water?

What if you could control the quality of the air you breathe in the same way you can control the quality of the water you drink?