Kia Takatū ā-Matihiko
Digital Readiness

Rauemi Pīkau | Resource Toolkit

Te Manaaki i a Papatūānuku

Curriculum Level 3 – Years 7 to 8

Technology Nature of Technology – Level 3

Technology Technological Knowledge – Level 3

Technology Technological Practice – Level 3

Technology Computational thinking for digital technologies – PO3

Technology Designing and developing digital outcomes – PO2

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TE TĀHUHU O TE MĀTAURANGA

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Rauemi Pīkau

Kia Takatū ā-Matihiko are pleased to share with you our Rauemi Pīkau | Resource Toolkits. Rauemi Pīkau are intended to be a comprehensive exemplar or model of how you might integrate Digital Technologies (DT), and Hangarau Matihiko (HM), into your local curriculum in relevant and authentic contexts.

Please note:

- Rauemi Pīkau are not an integrated unit plan and should not be directly taught from.
- Rauemi Pīkau have included all of the Technology achievement objectives, as well as progress outcomes, for the year levels for which they were developed however there is much more here than you need. Teachers should collaborate with colleagues across multiple year levels in order to develop a broad learning programme that covers all of the Technology strands over time. This is preferable to trying to incorporate learning from all the achievement objectives, as well as all the progress outcomes, at once.
- We have suggested possible curriculum levels and year groups that Rauemi Pīkau might be appropriate for however we encourage teachers of students in higher or lower year levels to adapt these resources as they wish to best meet the needs of their students.

How to use this resource

We suggest you might use this resource in the following way.

- Read through the Rauemi Pīkau to support your own understanding.
- Download your own copy of our blank template.
- Work alongside your colleagues to explore ways in which you might integrate DT and HM into your local curriculum, using your own authentic and meaningful concepts and contexts.
- Pick aspects of our Rauemi Pīkau and personalise the learning to your context by considering how you might adapt them to meet your needs and the ages and stages of your students.
- Share your learning to support the learning of others by sharing your integrated plan with others in Ngā Kiriahi!

Concepts and context

We have pre-selected **concepts** and **contexts** in order to provide a wide range of meaningful and relevant **possible learning activities**.

- The **Concepts** we have selected are based on bicultural themes in keeping with our uniquely Aotearoa approach to learning in the Kia Takatū ā-Matihiko | National Digital Readiness programme.
- The **Contexts** were selected to align with the concepts. We have been mindful to select contexts that could be easily adapted to your local curriculum. Authentic and meaningful contexts support students to take action. They'll contribute to their local community as well as having a positive impact on themselves and others such as their whānau, iwi/hapū and wider community.

Connections to the strands

Teachers should make connections to the technology strands via the achievement objectives and progress outcomes to support a coherent pathway of learning for students.

Achievement objectives support you to start considering learning intentions, planning, and explicit teaching concepts. Progress outcomes are what you are aiming for, the desired learning performance. It's important to understand that the progress outcomes build year by year and are used to identify learning progression.

Relationships to support learning

Our Rauemi Pīkau support you to think about how you build relationships with others to enhance student learning. In particular, we've shown how these relationships can have an impact when supporting students to take action. This might include people in your community, local businesses, iwi/hapū, other schools etc. People, expertise and materials are required to enrich your local curriculum and create engaging learning opportunities for students. It's important that schools draw on their existing relationships, as well as create new ones, to support their learning programmes.

Concept

The theme of Manaaki i a Papatūānuku is to support developing rich opportunities of learning for all ākonga/students. It provides a basis for ākonga to actively engage with and connect with their wider community, iwi and hapū, and to apply their learning in an authentic context.

Context

As part of developing your local curriculum, select a context that supports you to engage with your ākonga and the wider community to identify authentic questions, issues and opportunities that matter to them. Consider the impact that ākonga may be able to have on the wider community by engaging with your chosen context.

Our context example

Recently a group of ākonga have returned from a week long national sports tournament. While they were at the tournament they noticed how many different stalls of food there were and how much rubbish and waste was accumulating over the week at the event. They were especially concerned about the large amount of single-use plastics that were piling up in all the rubbish bins.

How might we encourage the stall holders and organisers of this event, and other events like it, to take more responsibility for looking after Papatūānuku and to use more sustainable products, in order to be more environmentally conscious so that less single-use plastics end up in our landfills?

Students learn to know *why*

Technology Achievement Objectives

Students will:

Characteristics of technology

- Understand how society and environments impact on and are influenced by technology in historical and contemporary contexts and that technological knowledge is validated by successful function.

How does technology relate to and influence people, the environment, and itself? How does this change over time, both positively and negatively?

Characteristics of technological outcomes

- Understand that technological outcomes are recognisable as fit for purpose by the relationship between their physical and functional natures.

Distinguish between manufactured outcomes and natural outcomes. Identify who uses outcomes, understand an outcome's nature by its look (physical) and how it works (functional).

Don't understand a term?
Click a word with dotted underline to see the definition

Teaching and Learning

Students come to understand technology as an intervening force in the world and learn that technological developments are inevitably influenced by (and influence) historical, social, and cultural events.

Students have opportunities to engage in informed debate about contentious issues and increase their understanding of the complex moral and ethical aspects that surround technology and technological developments. They also have opportunities to examine the fitness for purpose of earlier technological outcomes and make informed predictions about future technological directions at a societal and personal level.

There are two components in this strand: characteristics of technology and characteristics of technological outcomes:

Possible Learning Activities:

Explore examples of ancient rubbish. Look at the types of objects that have survived, and those that are missing. Work out what might exist for an archaeologist if they were to examine our rubbish dumps in 1000 years time.
Social Sciences

Test the fitness for purpose, both physical and social, of rubbish bins.

Investigate the rubbish created at the event, and/or the school. What materials make up the bulk of it?
Mathematics and Statistics

Explore the different products available for the same purpose and assess their impact on the environment ie reusable versus biodegradable versus polystyrene cups.
Science

Research why recycling has become such an important idea, and how attitudes have changed over the last 30 years.
Social Sciences

Test the function and social messages implied by using different biodegradable fast-food packaging.

Technology Achievement Objectives

Students will:

Technological modelling

- Understand that different forms of functional modelling are used to inform decision making in the development of technological possibilities and that prototypes can be used to evaluate the fitness of technological outcomes for further development.

Students learn to compare simulations of reality to the reality itself, and come to appreciate the power and limitations of functional modelling.

Technological products

- Understand the relationship between the materials used and their performance properties in technological products.

How does a material behave in certain environments and under certain processes? Butter is soft and melts at moderate temperatures, timber is tough and doesn't melt. You should probably therefore make a chair out of timber, rather than butter (assuming you want to sit in it regularly).

Technological systems

- Understand that technological systems are represented by symbolic language tools and understand the role played by the "black box" in technological systems.

How does an input change into an output? Do you know what each of the parts are, and how they work together to make that change happen?

Teaching and Learning

Students come to understand key concepts that underpin all technological development and the resulting technological outcomes.

There are three components in this strand: technological modelling, technological products, and technological systems:

Possible Learning Activities:

Test how different biodegradable/compostable products break down. Can they be broken down better with a different process?

Design a rubbish bin that is weather (wind/rain) and scavenger proof. 3D print models to test design.

Recognise that waste doesn't just disappear after we throw it away. Explore the behind the scenes (black box) system of rubbish disposal.

Analyze what is the most common piece of rubbish, then design, create, and test a replacement that is a more environmentally friendly option.

Collect examples of different fast food packaging. Explore the different materials and identify any ways they have been processed to make them fit for purpose (e.g. a waxy coating on cardboard to make it grease-proof).

Use a vacuum former to design and test different plastics and functional models to explore the possibilities of new packaging.

Use a laser-cutter to design and test different cardboard based food packaging.

Technology Achievement Objectives

Students will:

Planning for practice

- Undertake planning to identify the key stages and resources required to develop an outcome. Revisit planning to include reviews of progress and identify implications for subsequent decision making.

What are the basic steps to make the outcome, and what resources (materials, equipment, people) are needed at each step?

Brief development

- Describe the nature of an intended outcome, explaining how it addresses the need or opportunity. Describe the key attributes that enable development and evaluation of an outcome.

Can you say why the outcome is being made? What are the key features of what is being made? Can you justify why the outcome is good for the user? Attributes should be broad descriptors of what is intended rather than measurable specifications.

Outcome development and evaluation

- Investigate a context to develop ideas for potential outcomes. Evaluate these against the identified attributes, select, and develop an outcome. Evaluate the outcome in terms of the need or opportunity.

Can you describe/give details (drawings/models/verbally) of your outcome before it is made? How does the idea square against your key features (what it will look like and what it will do)? When you've made your outcome a reality, evaluate it against your key features. How does it rate? Does it look as expected, and do what was needed?

Teaching and Learning

Students are given opportunities to engage in their own technological practice and to reflect on the practice of others.

Students gain a sense of what they may be able to achieve as they undertake their own technological practice to find solutions to identified needs and/or realise opportunities.

There are three components in this strand: Planning for practice, Brief development, and Outcome development and evaluation:

Possible Learning Activities:

Work with stall holders to find a way to reduce the amount of rubbish created by their business.

Research what has been done in the past in relation to the rubbish. Has it always been a problem?

Test rubbish bin designs for animal proofness, and packaging for human usability.

Create a plan to design, create and test environmentally friendly food packaging. Identify the required stages and resources required. Log how the plan has changed over the process.

Survey stall holders and/or users (stakeholders) for their ideas of what could be done.

Test prototypes of food packaging with relevant foods and stakeholders/users.

Computational thinking for digital technologies

Progress Outcome 3

In authentic contexts and taking account of end-users, students decompose problems into step-by-step instructions to create algorithms for computer programs. They use logical thinking to predict the behaviour of the programs, and they understand that there can be more than one algorithm for the same problem. They develop and debug simple programs that use inputs, outputs, sequence and iteration (repeating part of the algorithm with a loop). They understand that digital devices store data using just two states represented by binary digits (bits).

Simple tasks are broken down into sequenced steps and tested by someone else in non-computerised contexts. Instructions need to be able to be followed without input from anyone else and need to give the same result/output every time. Can students take a set of instructions and turn them into a simple computer program? Audio, text or a dancing virtual cat are all examples of outputs.

Teaching and Learning

Computational thinking for digital technologies enables students to express problems and formulate solutions in ways that means a computer (an information processing agent) can be used to solve them.

In this area, students develop algorithmic thinking skills and an understanding of the computer science principles that underpin all digital technologies. They become aware of what is and isn't possible with computing, allowing them to make judgments and informed decisions as citizens of the digital world.

Possible Learning Activities:

Explore how binary digits work and can be used using 'How binary digits work - Codes for letters using binary representation'.

CS Unplugged

How would a computer use 'off' and 'on' to store the numbers from the recyclable packaging? (introduction to binary digits).

Design and write a computer program to assist users with how to sort their rubbish, and remind them of the correct day to put out their recycling.

Program a game in which users are able to sort different rubbish items into recyclable, compostable, and rubbish and are supported to make the correct identification.

Compare their programs with those of their peers. See that different programs can give similar results.

Create a program that allows the user to compare the environmental impact of different types of plastics or biodegradable materials.

Click here to learn more about Computational thinking on Technology Online

Designing and developing digital outcomes

Progress Outcome 2

In authentic contexts and taking account of end-users, students make decisions about creating, manipulating, storing, retrieving, sharing and testing digital content for a specific purpose, given particular parameters, tools, and techniques. They understand that digital devices impact on humans and society and that both the devices and their impact change over time.

Students identify the specific role of components in a simple input-process-output system and how they work together, and they recognise the "control role" that humans have in the system. They can select from an increasing range of applications and file types to develop outcomes for particular purposes.

A digital outcome needs to be designed to meet a real need, for real people. Do students understand what each digital device does, and how it will help them meet their desired outcome? Where and how do they store/use the files they create? Do they understand the difference between what people feed into a system, versus what comes out? Students can use different applications to complete a task and understand that choosing the right application can make the task easier.

Teaching and Learning

In Designing and developing digital outcomes students understand that digital applications and systems are created for humans, by humans. They develop increasingly sophisticated understandings and skills for designing and producing quality, fit-for-purpose, digital outcomes. They develop their understanding of the technologies people need in order to locate, analyse, evaluate and present digital information efficiently, effectively and ethically.

Possible Learning Activities:

Digitally design posters to be sent electronically to users to support an increase in recycling or showing how the components of digital devices can be recycled/reused. Understand the file types used in the process of making the posters.

Create advertisements for use on a digital screen to raise awareness of recycling.

Use a physical computing device connected to a light emitter and detector to detect when the beam is interrupted and the rubbish bin is full. A light or other attention attracting device is attached to alert the event crew that the bin needs to be emptied.

Also incorporates CTDT

Design and 3D print a rubbish bin that supports users to separate their rubbish correctly. The 3D file could be made available to others so they can print their own version.

Visit the local transfer station and learn about how they separate the recycling (there will be computers running it, inputs, outputs etc).

Create a series of audio files, or 'bumpers', for the sound system at the venue to encourage responsible disposal of rubbish.

Click here to learn more about Designing and developing digital outcomes on Technology Online

Essential resources

Available at kiatakatu.ac.nz

Pīkau 8 CTDT:PO3

Making the computer do the work: programming with loops

Pīkau 13

Creating digital outcomes using digital images and digital photography

Pīkau 14

Physical Computing

Pīkau 15 CTDT:PO3-5

Representing data in binary

Additional support resources

General resources

- Towards a 'waste-wise' school: A guideline for principals, Board of Trustees members and teachers (Nelson Environment Centre, Nelson City Council, Tasman District Council).
- Set some goals to reduce your waste: A NZ Ministry for the Environment Manatū Mō Te Taiao website. Ideas on how to reduce rubbish and keep NZ beautiful.
- Living Waste Free: Recycle.co.nz website that includes links to local NZ rubbish initiatives.
- Litter Less: Keep New Zealand Beautiful Kiki Kiwi & Friends 'Litter Less' education hub for Year 1 to Year 7 students.

English: Reading resources

- **Mr Trask's trash** by Angie Belcher. School Journal 1998, Part 04, No.2, Year 7. When Mr Trask visited Te Puke Intermediate School and said he wanted to talk rubbish, the students were surprised. It wasn't until he delivered his reuse, reduce, and recycle message that everyone understood exactly what he meant.
- **Turning Old into New** Connected L4 2017. Everything we have made is formed from earth's natural resources. But like all resources there is a limit to how much of any kind is available - and so we need to think carefully about recycling and the impact that our current methods and materials are having on the earth.
- **Dear Helen Clark** by Shanelle Louise White. Children as Authors No. 1, 2001, Year 8. Shanelle wrote a letter to Helen Clark, asking her to do something about the problem of rubbish on the beaches. She included a poem about the effects of pollution on wildlife and on "The fading glistening / Of the dark blue sea".
- **Down the Drain** Connected L2 2017. Year 4. How much rubbish actually goes into our stormwater gutters and into the sea? A group of Petone students decided to collect data to find out what was actually happening in their area. And they were not the only ones who were shocked by what they discovered!
- **Accidental Plastics** by Kate Potter. Connected No. 04 : 2013: pp.23 - 26 Year 7. Plastics are a part of our everyday lives. But the invention of new plastics has not always been straight-forward, and some discovered purely by accident.

Science / Social Sciences

- Investigating middens: How to 'read' what is found in archeological sites.
- Love food, hate waste: Don't let food go to waste. The rubbish bin is no place for food.
- How to live zero waste: Alphabeticalised, itemised suggestions for how to reduce waste, from appliances to yoghurt containers.
- 'Lunch on the go' habit generates 11bn items of packaging waste a year: UK Guardian article about lunch waste.
- Takeaway throwaways: A campaign to get single use takeaway containers banned in New Zealand (includes information about alternatives).
- Science Learning Hub Pokapū Akoranga Pūtaiao: General rubbish resources.
- Small Changes: An award winning short film from Waitākiri School about the future impact of small changes. Designed to change attitudes and behaviour in their school, and a good example of a digital outcome.
- The Impact of Pollution on Our Planet and Our Lives: International examples and perspectives of pollution including Global Goals for Sustainability Development.

Technology

- Redesigning Plastic Packaging: Includes indepth information and lesson plans from the UK.
- Taking on single-use culture, one takeaway coffee at a time: A story about a Wellington-based reusable cup scheme.
- NZ's great disposable coffee cup conundrum: Article includes discussion on alternative options.
- Recycling at McDonalds: NZ Herald article about recycling stations being introduced at McDonalds.
- Takeout creates a lot of trash. It doesn't have to: An engaging, easy to watch Youtube video from the University of California about takeaway packaging and what alternatives are available.
- Waste and Resources: A NZ Ministry for the Environment Manatū Mō Te Taiao website focused on waste. Includes reduce, reuse, recycle and the circular economy approach.
- Packaging free lunch: A lesson plan from the Environmental Protection Agency in Tasmania.
- CS Unplugged Binary Numbers: Unit and lesson plan for how to teach the concept of binary numbers.

Useful online tools

- Scratch: Free, online programming language designed for 8-16 years.
- Code Club Aotearoa: Coding Clubs run nationally for 9-13 year olds.
- Hour of Code: Hour long activities to support learning to code.
- Poster My Wall: Create amazing posters, videos and graphics.
- Do ink: Animation and drawing app.

Glossary

Simplifying the terms

Algorithm:
Step-by-step instructions (algorithm) need to give the same outcome every time they are followed. Instructions need to be able to be followed by anyone without any input from others ie precise and unambiguous.

Attributes:
Broad descriptors of what is intended (safe, work well etc), not measurable like specifications.

Concepts:
Ideas created that solve a defined problem. Can be drawn, 3d modelled, discussed.

Context:
Where you are working, the physical and social place/environment. Every solution has a context, which is the place, situation, users, and environment that the outcome is developed for. The context for a garden chair, for example, could be 'outside on the lawn, used by family members aged from 3-65 years.'

Controlled transformations:
What happens, and what changes in the middle of a system, as a result of an external action. When you set an alarm to wake you on your phone, you change settings in the software, but it is the controlled electronic 'black-box' (unknown/unseen) systems inside the phone circuits, that enable it to be changed.

Debugging:
When errors (bugs), are corrected in the instructions it is called 'debugging'. Debugging is as much an 'attitude' as a process. It is a natural part of the process of programming, and success comes with finding and fixing bugs, not generating error-free instructions on your first attempt.

Design concepts:
Ideas created in response to a need.

Develop:
The process used to produce an outcome.

Digital outcome/content:
Something that can be stored or manipulated in a digital format. If it can be captured in a digital file (stored on a digital device), it is a digital outcome.

End-user:
An end-user is whomever will be using, or will be affected by, the completed outcome. The end-user should be able to use the completed outcome independent of the creator.

Fit-for purpose:
Ongoing development and refinement attempts to ensure the outcome performs as intended, it does what it is supposed to do.

Functional modelling:
Functional modelling is used to evaluate design ideas and interim steps.

Input (computational thinking):
Any way that a human can communicate with a computer (e.g. clicking the mouse, pushing a button). Information fed into a set of instructions (e.g. the temperature from a sensor).

Input (design & developing digital outcomes):
What the creator brings to the final outcome. Examples include images, choice of typeface, image manipulation etc.

Intervention by design:
How humans create outcomes to solve problems (improve or damage our world) e.g. Cars are faster/easier than walking, a glass holds water to drink from that can be cleaned and reused.

Key stages:
Significant steps taken that are required to have a completed/fit for purpose outcome.

The made world:
Any related issues that affect or influence anything changed, implemented, or produced by humans that isn't naturally occurring.

Manipulate:
Using specific applications to take input and change, or use, as part of a new output.

Model/modelling:
A physical representation of a technological solution that enables a solution's feasibility to be tested/predicted, usually made in substitute materials like card, paper etc.

The natural world:
That which exists from nature, has not had human intervention.

Need:
Requirement of person, group or place/environment. There are many potential outcomes that could be made to solve the identified issue/problem. What is needed and why is it needed?

Opportunity:
A new situation or a place where a technology could be useful and successful.

Output (computational thinking):
Any way that a computer can communicate with a human (e.g. words on a screen or a sound), or something that happens as a result of a set of instructions being run (e.g. the heater turns on).

Output (design & developing digital outcomes):
The digital outcome created e.g. a photo or sound file.

Glossary

Simplifying the terms

Performance:
What materials do in certain situations.

Performance properties:
How a material behaves in certain environments and under certain processes determines how it is used (e.g. butter melts in moderate temperatures, timber doesn't). You can easily cut through butter with a blunt knife and you need a saw and more effort to cut timber. You can therefore make a chair out of timber, you couldn't make a chair out of butter.

Planning:
Why we keep records to manage resources, progress, reflect on decision making. Records explain decisions, suggest new directions, can answer outside questions.

Planning tools:
Visual and organisational, flow charts, lists etc.

Potential outcomes:
Design concepts aim to describe the nature of potential outcomes.

Product:
A human made product is one you can hold/touch/see.

Properties:
Why materials behave the way they do.

Prototype:
Literally, "creating the first of a kind":

A physical representation, made in the actual materials to test function and feasibility. Prototyping is used to evaluate the fitness for purpose of systems and products that have been developed.

Retrieved:
Accessing stored information.

Reuse:
There are opportunities to find a new use for something. The outside part of an old pen has the opportunity to be used as a straw or to support a pot-plant to grow straight. An old ipad can be used as a digital photo display.

The social world:
Involving human relationships.

System (designing & developing digital outcomes):
Anything that can take an input and manipulate it to produce an output.

System (general technology):
The way something works, like communication, transport, collaboration.

Technological challenge:
A problem that can be solved by designing and developing technology.

Technological change:
How outcomes change over time, and how those changes affect human behaviour.

Technological impact:
The positive and negative effects of technology on society and/or the environment, and of society and/or the environment on technology.

Technological outcome:
What the student creates, either a product or a system. Technological outcomes can be categorised as products and systems but distinguishing between the two is not always straightforward. It depends on how you look at the outcome concerned.

For example, you could describe a cell phone as a technological system, comprising interconnected components that work together to achieve a purpose. But you could also describe the same phone as a technological product, focusing on the materials used in its manufacture and not on the many interconnected components inside it.

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