Kaitiakitanga: Sustainable 3D Printing Project

This overview unpacks possible opportunities and cross-curricular learning opportunities related to 3D printing. In this programme we will explore the world of plastic and how we can make sustainable outcomes for our communities.

The diagram below shows the overarching Technological strands focussed on in this programme. Curriculum levels are indicated at the top of the chart - they show the progression of student learning. A "big idea" shows how a fully developed understanding of the concept may look. A full understanding may not be achieved until level 7 or 8, however lower levels can progress when understanding is achieved. The areas highlighted with **red** dash lines are the main focus for the resource that follows.

CURRICULUM LEVEL

1-3   4-5   6-8

BIG TEACHING IDEAS

	1-3	4-5	6-8
NATURE of TECHNOLOGY Waste: Impact on society & environment.	LOCAL Effects of waste in our own schools.	LOCAL/NATIONAL Effects of waste in our local communities & nationally.	GLOBAL Effects of waste globally.
TECHNOLOGICAL KNOWLEDGE Technological Modelling	IN THE HIVE Understand different models are used to explore, test and evaluate design concepts & prototypes evaluate fitness for purpose.	IN OUR COMMUNITY Understand how evidence, reasoning & decision making in functional modelling contribute to development and how prototyping justifies ongoing refinement of outcomes.	IN THE WORLD Understand the role of technological modelling as technological development, justifying its importance on moral, ethical, sustainable, cultural, political, economic & historical grounds.
TECHNOLOGICAL PRACTICE/DDDO Developing sustainable outcomes.	DESIGN THINKING Following a process and learning skills new practical to design and make a reusable product for a stakeholder or need.	DESIGN THINKING Following an evaluative process and learning new practical skills to design, develop and manufacture a reusable product for a stakeholder or need.	DESIGN THINKING Following an iterative, evaluative process and trialling and analysing new skills and techniques to design, develop, modify and manufacture a reusable product for a stakeholder or need.

UNIT TITLE: Kaitiakitanga: Sustainable 3D Printing Project **Curriculum levels: Level 1 to 5** **Duration: 20 sessions**

Description of Context:	Technical skills required / to be taught:	Resources - equipment:
Kaitiakitanga has been described as guardianship or protection. The basic meaning of 'tiaki' is to guard, it also means to preserve, keep, conserve, nurture, protect and watch over. The prefix 'kai' with the verb 'tiaki' denotes the agent of the action of 'tiaki'. Therefore, a kaitiaki is a guardian, keeper, preserver, conservator or protector. The addition of 'tanga' denotes preservation, conservation and protection. Humans have had a huge impact on our land and waters in and around Aotearoa. The impact of plastic and plastic products in our world is an environmental issue that is frequently in the news. In this program students will explore the impact of plastics and learn how to nurture the reciprocal relationship between tangata (people) and the whenua (land) by designing and making sustainable 3D printed outcomes that can repurpose items that would normally be thrown away, thus protecting our environments.	Measurement, Use of CAD modelling, design thinking process, technological modelling, 3D printing.	Rulers, Scissors, craft knives, pencils, computers with TinkerCAD/Sketchup CAD access, wifi, files, pliers, sandpapers, cellotape, adhesives.
	Any Safety Issues? Sharp tools - scissors, knives, files. Hot equipment - 3D printer Digital devices - cords (trip hazard)	Link to teacher slides for each lesson.

Key Competency Learning Links:

Thinking	Relating To Others	Using Symbols, Language & Text	Managing Self	Participating and Contributing
Critical Thinking Reflective Thinking Evaluative Thinking Creative Thinking	Collaboration Respect for others Responsibility Stakeholders	Recording Using Symbols Using specific language	Working with others Self Evaluation Planning for practice	Communication Asking Questions Making observations

Values:
- Excellence
- Innovation, inquiry, and curiosity
- Diversity
- Equity
- Community and participation
- Ecological sustainability
- Integrity
- Respect

Resources - consumables:
3D printing plastics (ABS, PLA)
Card
Modelling clay

CURRICULUM INTEGRATION
This project has been designed to integrate with many other curriculum subjects, in particular;
- Science - Living World, Material World, Nature of Science.
- Mathematics - Measurement, Statistics, Geometry.
- Literacy - Listening, viewing & presenting, evaluative writing, sequential planning.

LOCAL CURRICULUM
Possible links:
- Local waste audit (home, school, nz)
- Local waterways

UNIT PLAN OVERVIEW

- Social Sciences - History, Geography

Assessment Opportunities - Technology	Sustainable Development Goals links	Practical Outcome/s from this unit
- Characteristics of Technology: Characteristics of Technology - Technological Knowledge: Technological Modelling *Other Technology strand coverage:* - Technological Practice: Brief development, Outcome development & evaluation & Planning for Practice - Characteristics of Technology: Characteristics of Technological Outcomes - Technological Knowledge: Technological Products and Technological Systems	- Quality Education - Sustainable cities & communities - Responsible consumption & production - Climate action - Life below water - Life below land https://www.un.org/sustainabledevelopment/sustainable-development-goals/	3D printed 'widget' to repurpose an existing outcome that would normally be thrown away.

	LEARNING INTENTIONS & COVERAGE	LEARNING OUTCOMES	SESSION PLAN BREAKDOWN	RESOURCES/ EXTENSION

1	*LI:* What is the impact of plastics on our world?
	
	Technology Assessment Achievement Objective: Nature of Technology: Characteristics of Technology
	
	Other Technology strand coverage: N/A
		Technology Indicators:
		Level 1: I can identify that technology helps to create the 'made' world.
		Level 2:
		I can describe examples of technology that have had a positive impact on society/environment.
		I can describe examples of technology that have had a negative impact on society/environment.
			Lesson Title
			Kaitiakitanga - link to Te ao Maori perspective.
			Global Picture - Plastic pollution in Our World
			
			Primary: (Year 5/6)
			- Introduce Kaitiakitanga Story
			- Global Picture
			  - Why are plastics a concern?
			  - Research Questions
			Intermediate: (Year 7/8)
			- Introduce Kaitiakitanga Story
			- Global Picture
			  - Why are plastics a concern?
				Extension:
				
				Home Learning: Waste audit @ home. What rubbish gets thrown out/recycled etc?
				
				Resources: Kaitiakitanga:

	Digital Technologies Link:
	DDDO
	
	Tech Area links:
	generic technology
	
	Other curriculum subjects links:
	Social Sciences
	Science
	Te ao Māori
	Literacy
		I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes.
		
		Level 3:
		
		I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes.
		
		Level 4:
		
		I can explain if these new technologies should happen. (impact of them)
		
		Level 5: N/A
			○ Research Questions
			Senior: (Year 9/10)
			 ● Introduce Kaitiakitanga Story
			 ● Global Picture
			  ○ Why are plastics a concern?
			  ○ Research Questions
				https://www.sciencelearn.org.nz/resources/2544-understanding-kaitiakitanga
				
				https://teara.govt.nz/en/kaitiakitanga-guardianship-and-conservation

2	*LI:* What impact can a designer have on the environment?
	
	Technology Assessment Achievement Objective:
	Nature of Technology:
	Characteristics of Technology
	
	Other Technology strand coverage:
	Technological Knowledge:
	Technological Products
	
	Digital Technologies Link:
	DDDO
		Technology Indicators:
		
		Level 1:
		
		I can identify that technology helps to create the 'made' world.
		
		Level 2:
		
		I can describe examples of technology that have had a positive impact on society/environment.
		
		I can describe examples of technology that have had a negative impact on society/environment.
		
		I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes.
		
		Level 3:
		
		I can identify social/environmental issues that may have changed how
			Lesson Title
			What impact can a designer have on the environment?
			
			Primary:
			 ● Life cycle of a product - Old versus New
			  ○ choose a product and describe the attributes of this product. How has it changed?
			Intermediate:
			 ● Life cycle of a product - Old versus New
			  ○ choose a product and compare and contrast the changes over time. How has it changed? What impact has it had?
			
			Senior:
			 ● Life cycle of a product - Old versus New
			  ○ choose a product and compare and contrast the changes over time. Why and how has it changed? How has it changed? What impact has it had? Why does a designer need to be aware of this issue?
				Extension:
				
				Home Learning:
				Waste audit @ home. What rubbish gets thrown out/recycled etc?
				
				Resources:

	Tech Area links: Generic Technology	things are made or the attributes of the outcomes.		
	Other curriculum subjects links: Science - pollution & impact on environment & animals. Literacy.	**Level 4:** I can explain if these new technologies should happen. (impact of them) **Level 5: N/A**		
3	*LI: What is sustainability?* *Technology Assessment Achievement Objective:* Nature of Technology: Characteristics of Technology *Other Technology strand coverage:* Technological Practice: Brief Development *Digital Technologies Link:* DDDO *Tech Area links:* Generic Technology *Other curriculum subjects*	Technology Indicators: **Level 1:** I can identify that technology helps to create the 'made' world. **Level 2:** I can describe examples of technology that have had a positive impact on society/environment. I can describe examples of technology that have had a negative impact on society/environment. I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes. **Level 3:** I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes. **Level 4:**	**Lesson Title** What is sustainability? *Primary:* ● Discuss what sustainability is as a class ● Link to UN SDGs ● Find three small disposable products that are plastic. e.g clothes peg, describe them and explain how they have changed over time. *Intermediate:* ● Discuss what sustainability is as a class ● Link to UN SDGs ● Find a range of small disposable products that are plastic e.g clothes peg. Create a timeline and describe how and why these have changed. What has been the impact on the environment and society? *Senior:* ● Discuss what sustainability - find examples of sustainability ● Link to UN SDGs ● Find a range of small disposable products that are plastic. e.g clothes peg. Create a timeline and describe how and why these have changed. What has been the impact on the environment and society? Should these technologies have been developed? why?	*Extension:* Explore and discuss the links between the SDG's and Kaitiakitanga *Home Learning:* Waste @ school audit *Resources:* SDG's: https://www.un.org/sustainabledevelopment/sustainable-development-goals/

	links: Science, Social Sciences, Literacy.	**I can explain if these new technologies should happen. (impact of them)** **Level 5: N/A**		
4	*LI: how can we develop a brief?* *Technology Assessment Achievement Objective:* Nature of Technology: Characteristics of Technology *Other Technology strand coverage:* Technological Practice: Brief Development *Digital Technologies Link:* DDDO *Tech Area links:* *Other curriculum subjects links:*	Technology Indicators: **Level 1:** **I can identify that technology helps to create the 'made' world.** **Level 2:** **I can describe examples of technology that have had a positive impact on society/environment.** **I can describe examples of technology that have had a negative impact on society/environment.** **I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes.** **Level 3:** **I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes.** **Level 4:** **I can explain if these new technologies should happen. (impact of them)** **Level 5: N/A**	**Lesson Title** Brief Introduction - what is a design brief? What is a conceptual statement? What are attributes? What is a specification? ***Primary:*** ● Attributes - explain physical and functional attributes - use an example e.g. pen, chair ● Introduce Given Brief and attributes. ● Brainstorm products that could be repurposed. Discuss apps they could use to do this. ***Intermediate:*** ● Attributes - explain physical and functional attributes - use an example e.g. pen, chair ● Introduce Brief and Attributes/Specifications . ● Brainstorm products that could be repurposed. Discuss apps they could use to do this. ***Senior:*** ● Attributes - explain physical and functional attributes - use an example e.g. pen, chair ● Introduce Brief and Specifications, students to update for their product. ● Specifications/Constraints ● Brainstorm products that could be repurposed. Discuss apps they could use to do this.	*Extension:* *Home Learning:* Collect examples of a range of waste products. *Resources:* upcycling: https://www.sculpteo.com/blog/2018/01/22/upcycling-and-3d-printing-how-to-give-a-second-life-to-objects/

| 5 | LI: How to develop a brief through research.

Technology Assessment Achievement Objective:
Nature of Technology: Characteristics of Technology

Other Technology strand coverage:
Technological Practice: Brief Development

Digital Technologies Link:
DDDO

Tech Area links:

Other curriculum subjects links: | Technology Indicators:

Level 1:

I can identify that technology helps to create the 'made' world.

Level 2:

I can describe examples of technology that have had a positive impact on society/environment.

I can describe examples of technology that have had a negative impact on society/environment.

I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes.

Level 3:

I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes.

Level 4:

I can explain if these new technologies should happen. (impact of them)

Level 5: N/A | **Lesson Title**
Research: End user Data

Primary:
● Research - the environment and ergonomics associated with your product. End user feedback from your stakeholder.

Intermediate:
● Research - the environment and ergonomics associated with your product.End user feedback from your stakeholder.

Senior:
● Research - the environment and ergonomics associated with your product. End user feedback from your stakeholder. | Extension:

Home Learning: NZ Waste audit

Resources: |
| 6 | LI: How to develop a brief through research and summarisation.

Technology Assessment Achievement Objective:
Nature of Technology: | Technology Indicators:

Level 1:

I can identify that technology helps to create the 'made' world.

Level 2: | **Lesson Title**
Research: End user research and summarisation

Primary:
● Finish research
● Summarise your findings.

Intermediate: | Extension:

Home Learning: Audit NZ Waste

Resources: |

	Characteristics of Technology *Other Technology strand coverage:* Technological Practice: Brief Development *Digital Technologies Link:* DDDO *Tech Area links:* *Other curriculum subjects links:*	I can describe examples of technology that have had a positive impact on society/environment. I can describe examples of technology that have had a negative impact on society/environment. I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes. **Level 3:** I can identify social/environmental issues that may have changed how things are made or the attributes of the outcomes. **Level 4:** I can explain if these new technologies should happen. (impact of them) **Level 5: N/A:**	• Finish research • Choose an app to summarise your findings. *Senior:* • Finish research • Choose an app to summarise your findings. • Planning forward - what are your next steps?	
7	*LI: Revisit Brief Introduce Ideation* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand coverage:* Technological Practice: Outcome Development and Evaluation	*Technology Indicators:* **Level 1:** *I can describe what a functional model is.* **Level 2:** I can identify the design idea being tested in some functional models. **Level 3:** I can state the benefits of particular functional models. I can state the limitations of particular functional models	**<u>Lesson Title</u>** Revisit Brief The Design Process - Ideation ***Primary:*** • Revisit the brief and make any updates • Introduce the design process and how we ideate • See example ***Intermediate:*** • Revisit the brief and make any updates • Introduce the design process and how we ideate • See example ***Senior:***	*Extension:* *Home Learning:* *Resources:*

	Digital Technologies Link: DDDO *Tech Area links:* Generic Technology, DVC *Other curriculum subjects links:* Visual Art	**Level 4:** **I can identify and discuss information that has been gathered from models to help decide suitability of the design** **I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should be done'** **Level 5:** I can *explain how evidence gathered from* functional modelling *was used to justify design ideas.* *I can identify how modelling can help to set up maintenance requirements for the outcome. (what does it need to last a long time?* *I can explain how models help to decide technical feasibility (functional) and if the outcome is socially acceptable (reasoned)*	• Revisit the brief and make any updates • Introduce the design process and how we ideate • See example	
8	*LI: Ideation and Conceptual Designs* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand coverage:*	Technology Indicators: **Level 1:** *I can describe what a functional model is.* **Level 2:** **I can identify the design idea being tested in some functional models.** **Level 3:**	**Lesson Title** Ideation Conceptual Designs Use analysis to choose an idea to develop further. *Primary:* • Ideation of your possible design ideas • Sketch a range of conceptual designs *Intermediate:* • Ideation of your possible design ideas	*Extension:* *Home Learning:* Finish any unfinished work *Resources:*

	Technological Practice: Outcome Development and Evaluation *Digital Technologies Link:* DDDO *Tech Area links:* Generic Technology, DVC *Other curriculum subjects links:* Visual Art	**I can state the benefits of particular functional models.** **I can state the limitations of particular functional models** **Level 4:** **I can identify and discuss information that has been gathered from models to help decide suitability of the design** **I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should be done'** **Level 5:** **I can *explain how evidence gathered from* functional modelling *was used to justify design ideas.*** **I can *identify how modelling can help to set up maintenance requirements for the outcome. (what does it need to last a long time?*** **I can *explain how models help to decide technical feasibility (functional) and if the outcome is socially acceptable (reasoned)***	● Sketch a range of conceptual designs and annotate your designs linking them to your attributes *Senior:* ● Ideation of your possible design ideas ● Sketch a range of conceptual designs, annotate and analyse and link to your attributes.	
9	*LI: How to select materials for an outcome.* *Technology Assessment Achievement Objective:*	Technology Indicators: **Level 1:** *I can describe what a functional model is.* **Level 2:**	**Lesson Title** 3D Printing Materials - Properties of Materials *Primary:* ● Introduce 3D Printing Materials ● Research ○ performance properties	*Extension:* *Home* Learning: see lesson 10

	Technological Knowledge: Technological Modelling
	
	Other Technology strand coverage:
	
	Technological Knowledge: Technological Products
	
	Digital Technologies Link: DDDO
	
	Tech Area links:
	Hard Materials, Generic Technology
	
	Other curriculum subjects links:
		I can identify the design idea being tested in some functional models.
		
		Level 3:
		
		I can state the benefits of particular functional models.
		
		I can state the limitations of particular functional models
		
		Level 4:
		
		I can identify and discuss information that has been gathered from models to help decide suitability of the design
		
		I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should be done'
		
		Level 5:
		
		I can *explain how evidence gathered from* functional modelling *was used to justify design ideas.*
		
		I can *identify how modelling can help to set up maintenance requirements for the outcome. (what does it need to last a long time?*
		
		I can *explain how models help to decide technical feasibility (functional) and if the outcome is socially acceptable (reasoned)*
			○ uses of materials
			
			Intermediate:
			● Introduce 3D Printing Materials
			● Research
			    ○ performance properties
			    ○ uses of materials
			    ○ sustainability
			Senior:
			● Introduce 3D Printing Materials
			● Research
			    ○ performance properties
			    ○ uses of materials
			    ○ sustainability
			● Test and trial materials - select and state why chosen.
				Resources:

| 10 | *LI: What are the benefits and limitations of technological models?*

Technology Assessment Achievement Objective:
Technological Knowledge: Technological Modelling

Other Technology strand coverage:
Technological Practice - Outcome development and evaluation

Digital Technologies Link:
DDDO

Tech Area links:
Hard Materials, Generic Technology, DVC

Other curriculum subjects links:
Maths - measurement, scale, geometry
Visual Art | Technology Indicators:

Level 1:

I can describe what a functional model is.

Level 2:

I can identify the design idea being tested in some functional models.

Level 3:

I can state the benefits of particular functional models.

I can state the limitations of particular functional models

Level 4:

I can identify and discuss information that has been gathered from models to help decide suitability of the design

I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should be done'

Level 5:

I can explain how evidence gathered from functional modelling was used to justify design ideas.

I can identify how modelling can help to set up maintenance requirements for the outcome. (what does it need to last a long time? | <u>**Lesson Title**</u>
Technological Modelling - Functional Models
1. Functional Models - what are they and why do we need them?
2. Benefits & limitations of models used by designers.
Primary:
● Develop own functional models - Final sketch in chart
● End user Feedback
● Explain the benefits and limitations for a designer using that particular type of model in their development.

Intermediate:
● Develop own functional models - Final sketch in chart
● End user Feedback
● Explain if the design still meets the intended need. Why?
● Explain the benefits and limitations for a designer using that particular type of model in their development.

Senior:
● Develop own functional models - Final sketch(s) in chart
● End user Feedback
● Explain if the design still meets the intended need. Why?
● Explain the benefits and limitations for a designer using that particular type of model in their development. | *Extension:*

Home Learning:
Functional Model. Testing to be Technologically feasible/socially acceptable

Resources: |

		I can explain how models help to decide technical feasibility (functional) and if the outcome is socially acceptable (reasoned)		
11	*LI: What are the benefits and limitations of technological models?* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand coverage:* Technological Practice - Outcome development and evaluation *Digital Technologies Link:* DDDO *Tech Area links:* Hard Materials, Generic Technology, DVC. *Other curriculum subjects links:* Maths - measurement, scale, geometry Visual Art	**Technology Indicators:** **Level 1:** *I can describe what a functional model is.* **Level 2:** **I can identify the design idea being tested in some functional models.** **Level 3:** **I can state the benefits of particular functional models.** **I can state the limitations of particular functional models** **Level 4:** **I can identify and discuss information that has been gathered from models to help decide suitability of the design** **I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should be done'** **Level 5:** I can *explain how evidence gathered from* functional modelling *was used to justify design ideas.*	**Lesson Title** 2D Modelling using card **Primary:** ● Using card to make 2D Card models ● Get end user feedback and analyse ● Explain the benefits and limitations for a designer using that particular type of model in their development. **Intermediate:** ● Using card to make 2D Card models ● Get end user feedback and analyse ● Explain if the design still meets the intended need. Why? ● Explain the benefits and limitations for a designer using that particular type of model in their development. **Senior:** ● Using card to make 2D Card models ● Get end user feedback and analyse ● Explain if the design still meets the intended need. Why? ● Explain the benefits and limitations for a designer using that particular type of model in their development.	*Extension:* *Home Learning: Innovation in Design* *Resources:*

		I can identify how modelling can help to set up maintenance requirements for the outcome. (what does it need to last a long time? *I can explain how models help to decide technical feasibility (functional) and if the outcome is socially acceptable (reasoned)*		
12	*LI: What are the benefits and limitations of technological models?* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand coverage:* Technological Practice - Outcome development and evaluation *Digital Technologies Link:* DDDO *Tech Area links:* Hard Materials, Generic Technology, DVC. *Other curriculum subjects links:*	Technology Indicators: **Level 1:** *I can say why we functional model* **Level 2:** **I can identify the design idea being tested in some functional models** **Level 3:** **I can discuss examples of models used to test specific information about suitability of designs** **Level 4:** **I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should be done'** **Level 5:** I can *explain how evidence gathered from* functional modelling *was used to justify design ideas.*	**Lesson Title** 3D Modelling - Clay *Primary:* ● Using card to make 3D clay models ● Get end user feedback and analyse ● Explain the benefits and limitations for a designer using that particular type of model in their development. *Intermediate:* ● Using card to make 3D clay models ● Get end user feedback and analyse ● Explain if the design still meets the intended need. Why? ● Explain the benefits and limitations for a designer using that particular type of model in their development. *Senior:* ● Using card to make 3D clay models ● Get end user feedback and analyse ● Explain if the design still meets the intended need. Why? ● Explain the benefits and limitations for a designer using that particular type of model in their development.	*Extension:* *Home Learning: Innovation in Design* *Resources:*

	Maths - measurement, scale, geometry Visual Art	*I can identify how modelling can help to set up maintenance requirements for the outcome. (what does it need to last a long time?* *I can explain how models help to decide technical feasibility (functional) and if the outcome is socially acceptable (reasoned)*		
13	*LI: Testing & trialling software to develop and outcome* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand coverage:* Technological Practice: Outcome development & evaluation *Digital Technologies Link:* DDDO *Tech Area links:* Hard Materials, DVC, Generic Technology *Other curriculum subjects links:* Maths - measurement, scale, geometry Art - 3D models	*Technology Indicators:* **Level 1:** *I can say why we functional model* **Level 2:** **I can identify the design idea being tested in some functional models** **Level 3:** **I can discuss examples of models used to test specific information about suitability of designs** **Level 4:** **I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should be done'** **Level 5:** I can *explain how evidence gathered from* functional modelling *was used to justify design ideas.*	**Lesson Title** Testing & trialling software CAD **TinkerCAD** *Primary:* ● Introduce students to TinkerCAD - watch the introduction video. ● Explore TinkerCAD and test and trial the tools in the video. *Intermediate:* ● Follow on from the Primary lesson ● Create a model in TinkerCAD - choose an animal to create using geometric shapes. *Senior:* ● Follow on from the primary & intermediate lesson ● Create a model in TinkerCAD - creating organic shapes in TinkerCAD.	*Extension:* *Home Learning: Testing & trialling software* *Resources:*

		I can identify how modelling can help to set up maintenance requirements for the outcome. (what does it need to last a long time? *I can explain how models help to decide technical feasibility (functional) and if the outcome is socially acceptable (reasoned)*		
14	*LI: Testing & trialling software to create an outcome* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand coverage:* Technological Practice: Outcome development & evaluation *Digital Technologies Link:* DDDO *Tech Area links:* Hard Materials, DVC, Generic Technology *Other curriculum subjects links:* Maths - measurement, scale, geometry Art - 3D models	*Technology Indicators:* **Level 1:** *I can say why we functional model* **Level 2:** **I can identify the design idea being tested in some functional models** **Level 3:** **I can discuss examples of models used to test specific information about suitability of designs** **Level 4:** **I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should be done'** **Level 5:** **I can *explain how evidence gathered from* functional modelling *was used to justify design ideas.***	<u>**Lesson Title**</u> Testing & trialling software CAD **3D CAD - Sketchup** ***Primary:*** ● Create a functional model in Sketch up. Follow the video to make a simple house. ***Intermediate:*** ● Create a functional model in TinkerCAD. Follow the description to make a LEGO brick. ***Senior:*** ● Test and trial a new tool in Sketch up building on prior knowledge - explore the follow me tool.	*Extension:* *Home Learning: Testing & trialling software* *Resources:* *https://www.youtube.com/c/AutodeskTinkercad/videos*

		I can identify how modelling can help to set up maintenance requirements for the outcome. (what does it need to last a long time? *I can explain how models help to decide technical feasibility (functional) and if the outcome is socially acceptable (reasoned)*		
15	*LI: how to design & create prototypes* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand coverage:* Technological Practice: outcome development & evaluation *Digital Technologies Link:* DDDO *Tech Area links:* DT, Hard materials *Other curriculum subjects links:* Maths, Science, Social studies	Technology Indicators: **Level 1:** **I can describe what a prototype is** **I can identify why we prototype** **Level 2:** **I can say why prototyping is important in technology** **I can identify the specifications used to evaluate certain prototypes** **Level 3:** **I can explain why functional modelling and prototyping are both needed to support decisions when developing an outcome** **I can describe examples of prototypes that did not meet their specifications** **Level 4:** **I can explain how functional modelling and prototyping allows designers to consider**	**<u>Lesson Title</u>** 3D Printing ***Primary:*** ● What is 3D printing? ● Print first iteration of model ● What is the difference between a functional model & a prototype? ***Intermediate:*** ● What is 3D printing? ● Print first iteration of model ● What is the difference between a functional model & a prototype? ***Senior:*** ● What is 3D printing? ● Print first iteration of model ● What is the difference between a functional model & a prototype?	*Extension:* *Home Learning: Research into 3D printing - impact on society* *Resources: 3D printer, CAD files, Printing material*

			Lesson Title	
		what 'can' be done and what 'should' be done **I can identify information that has been gathered from prototyping and describe how the designer used this information** **Level 5:** **I can explain how evidence for prototyping was used to justify an outcome on fit for purpose or in need of further development**		
16	*LI: how to design and create prototypes* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand coverage:* Technological Practice: Outcome development & evaluation *Digital Technologies Link:* DDDO, *Tech Area links:* DT, Hard materials	*Technology Indicators:* **Level 1:** **I can describe what a prototype is** **I can identify why we prototype** **Level 2:** **I can say why prototyping is important in technology** **I can identify the specifications used to evaluate certain prototypes** **Level 3:** **I can explain why functional modelling and prototyping are both needed to support decisions when developing an outcome** **I can describe examples of prototypes that did not meet their specifications** **Level 4:**	**Lesson Title** 3D Printing - Testing and Trialling ***Primary:*** ● Complete the print ● Remove rafting & extra parts ● Testing and trialling first iteration of model ***Intermediate:*** ● Complete the print ● Remove rafting & extra parts ● Testing and trialling first iteration of model ***Senior:*** ● Complete the print ● Remove rafting & extra parts ● Testing and trialling first iteration of model	*Extension:* *Home Learning: What is a prototype? Find examples of real life prototypes and explain* *Resources: 3D printer , Hard materials tools.*

	Other curriculum subjects links: Maths, Science	**I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should' be done** **I can identify information that has been gathered from prototyping and describe how the designer used this information** **Level 5:** **I can explain how evidence for prototyping was used to justify an outcome on fit for purpose or in need of further development**		
17	*LI: how to design and create prototypes* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand coverage:* Technological Practice: outcome development & evaluation *Digital Technologies Link:* DDDO *Tech Area links:* DT, Hard materials	*Technology Indicators:* **Level 1:** **I can describe what a prototype is** **I can identify why we prototype** **Level 2:** **I can say why prototyping is important in technology** **I can identify the specifications used to evaluate certain prototypes** **Level 3:** **I can explain why functional modelling and prototyping are both needed to support decisions when developing an outcome**	<u>**Lesson Title**</u> 3D Printing - Testing and Trialling - Modification ***Primary:*** ● Testing and trailing each print of model ● Modify the CAD models ● Re-print the prototype ● Remove any waste ● Test & trial - iterative process until it has successfully met the need. ***Intermediate:*** ● Testing and trailing each print of model ● Modify the CAD models ● Re-print the prototype ● Remove any waste ● Test & trial - Ask stakeholders their ideas & thoughts - iterative process until it has successfully met the need. ***Senior:*** ● Testing and trailing each print of model	*Extension:* *Home Learning: Prototype Analysis* *Resources: 3D printer, hard materials tools.*

	Other curriculum subjects links: Science, Maths, Literacy	**I can describe examples of prototypes that did not meet their specifications** **Level 4:** **I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should' be done** **I can identify information that has been gathered from prototyping and describe how the designer used this information** **Level 5:** **I can explain how evidence for prototyping was used to justify an outcome on fit for purpose or in need of further development**	• Modify the CAD models • Re-print the prototype • Remove any waste • Test & trial - ask stakeholders their thoughts & modify to suit. • Test & trial - in situ - modify & improve - iterative process until it has successfully met the need.	
18	*LI: how to design and create prototypes* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand coverage:* Technological Practice: outcome development & evaluation *Digital Technologies Link:*	*Technology Indicators:* **Level 1:** **I can describe what a prototype is** **I can identify why we prototype** **Level 2:** **I can say why prototyping is important in technology** **I can identify the specifications used to evaluate certain prototypes** **Level 3:**	<u>**Lesson Title**</u> 3D Printing - Testing and Trialling - Modification ***Primary:*** • Testing and trailing each print of model • Modify the CAD models • Re-print the prototype • Remove any waste • Test & trial - iterative process until it has successfully met the need. ***Intermediate:*** • Testing and trailing each print of model • Modify the CAD models • Re-print the prototype • Remove any waste	*Extension:* *Home Learning:* *Prototype Analysis* *Resources:* *3D printer, hard materials tools.*

	DDDO *Tech Area links:* DT, Hard materials *Other curriculum subjects links:* Science, Maths, Literacy	**I can explain why functional modelling and prototyping are both needed to support decisions when developing an outcome** **I can describe examples of prototypes that did not meet their specifications** **Level 4:** **I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should' be done** **I can identify information that has been gathered from prototyping and describe how the designer used this information** **Level 5:** **I can explain how evidence for prototyping was used to justify an outcome on fit for purpose or in need of further development**	• Test & trial - Ask stakeholders their ideas & thoughts - iterative process until it has successfully met the need. ***Senior:*** • Testing and trailing each print of model • Modify the CAD models • Re-print the prototype • Remove any waste • Test & trial - ask stakeholders their thoughts & modify to suit. • Test & trial - in situ - modify & improve - iterative process until it has successfully met the need.	
19	*LI: how to design and create prototypes* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling *Other Technology strand*	Technology Indicators: **Level 1:** **I can describe what a prototype is** **I can identify why we prototype** **Level 2:** **I can say why prototyping is important in technology**	**<u>Lesson Title</u>** 3D Printing Final Assembly ***Primary:*** • Make any final changes • Print Final Prototype ***Intermediate:*** • Make any final changes • Print Final Prototype	*Extension:* *Home Learning:* *Advertise their product eg poster, slide, movie* *Resources:* *3D printer, hard*

	coverage: *Technological Practice:* *Outcome Development and Evaluation* *Digital Technologies Link:* DDDO *Tech Area links:* DT, Hard materials *Other curriculum subjects links:* *Science, Maths, Visual Art*	**I can identify the specifications used to evaluate certain prototypes** **Level 3:** **I can explain why functional modelling and prototyping are both needed to support decisions when developing an outcome** **I can describe examples of prototypes that did not meet their specifications** **Level 4:** **I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should' be done** **I can identify information that has been gathered from prototyping and describe how the designer used this information** **Level 5:** **I can explain how evidence for prototyping was used to justify an outcome on fit for purpose or in need of further development**	***Senior:*** ● Make any final changes ● Print Final Prototype	*materials* *tools*
20	*LI: how to evaluate a final technological outcome* *Technology Assessment Achievement Objective:* Technological Knowledge: Technological Modelling	Technology Indicators: **Level 1:** **I can describe what a prototype is** **I can identify why we prototype**	**<u>Lesson Title</u>** Evaluation ***Primary:*** ● Evaluate your final outcome. ● Does it meet the need for the end-user?	*Extension:* *Home Learning:* *Advertise their product eg poster, slide, movie*

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Other Technology strand coverage:
Technological Practice: Outcome Development and Evaluation

Digital Technologies Link:
DDDO

Tech Area links:
Generic Technology

Other curriculum subjects links:
Literacy

Level 2:

I can say why prototyping is important in technology

I can identify the specifications used to evaluate certain prototypes

Level 3:

I can explain why functional modelling and prototyping are both needed to support decisions when developing an outcome

I can describe examples of prototypes that did not meet their specifications

Level 4:

I can explain how functional modelling and prototyping allows designers to consider what 'can' be done and what 'should' be done

I can identify information that has been gathered from prototyping and describe how the designer used this information

Level 5:

I can explain how evidence for prototyping was used to justify an outcome on fit for purpose or in need of further development

Intermediate:
- Evaluate your final outcome.
- Does it meet the need for the end-user?

Senior:
- Evaluate your final outcome.
- Does it meet the need for the end-user?
- Feedback from end-user
- Is it fit for purpose?
- How could you develop your product further?

Resources:
Paper, drawing materials.