

# PrintACar – A Primary Inquiry Unit

## By Laburnum Primary School

Level 5/6

Learning Area: Technologies

Term 1/2

### Overview

Technologies enrich and impact on the lives of people and societies globally. Australia needs enterprising individuals who can make discerning decisions about the development and use of technologies and who can independently and collaboratively develop solutions to complex challenges and contribute to sustainable patterns of living. Technologies can play an important role in transforming, restoring and sustaining societies and natural, managed, and constructed environments.

The Australian Curriculum: Technologies describes two distinct but related subjects:

- Design and Technologies, in which students use design thinking and technologies to generate and produce designed solutions for authentic needs and opportunities.
- Digital Technologies, in which students use computational thinking and information systems to define, design and implement digital solutions.

The Australian Curriculum: Technologies will ensure that all students benefit from learning about and working with traditional, contemporary and emerging technologies that shape the world in which we live. This learning area encourages students to apply their knowledge and practical skills and processes when using technologies and other resources to create innovative solutions, independently and collaboratively, that meet current and future needs.

The practical nature of the Technologies learning area engages students in critical and creative thinking, including understanding interrelationships in systems when solving complex problems. A systematic approach to experimentation, problem solving, prototyping and evaluation instills in students the value of planning and reviewing processes to realise ideas.

All young Australians should develop capacity for action and a critical appreciation of the processes through which technologies are developed and how technologies can contribute to societies. Students need opportunities to consider the use and impact of technological solutions on equity, ethics, and personal and social values. In creating solutions, as well as responding to the designed world, students consider desirable sustainable patterns of living, and contribute to preferred futures for themselves and others.

This rationale is extended and complemented by specific rationales for each Technologies subject.

Achievement Standard	Content Descriptions
<p><b>The achievement standard for that year:</b></p> <p>By the end of Level 6, students explain the functions of digital system components and how digital systems are connected to form networks that transmit data.</p> <p>Students explain how digital systems use whole numbers as a basis for representing a variety of data types. They manage the creation and communication of ideas, information and digital projects collaboratively using validated data and agreed protocols.</p> <p>Students define problems in terms of data and functional requirements and design solutions by developing algorithms to address the problems. They incorporate decision-making, repetition and user interface design into their designs and develop their digital solutions, including a visual program. Students explain how information systems and their developed solutions meet current and future needs taking sustainability into account.</p> <p>By the end of Level 6 students describe how design and technologies contribute to meeting present and future needs. Students explain how the features of technologies impact on designed solutions for each of the prescribed technologies contexts.</p> <p>Students create designed solutions for each of the prescribed technologies contexts, suitable for identified needs or opportunities. They suggest criteria for success, including sustainability considerations and use these to evaluate their ideas and designed solutions. They combine design ideas and communicate these to audiences using graphical representation techniques and technical terms. Students record project plans including production processes. They select and use appropriate technologies and techniques correctly and safely to produce designed solutions.</p>	<p><b>Technologies.</b></p> <p><b>Digital Technologies</b></p> <p><b>Digital Systems</b></p> <p>Examine the main components of common digital systems, and how such digital systems may connect together to form networks to transmit data (<a href="#">VCDTDS026</a>)</p> <p><b>Data and Information</b></p> <p>Examine how whole numbers are used as the basis for representing all types of data in digital systems (<a href="#">VCDTDI027</a>)</p> <p>Acquire, store and validate different types of data and use a range of software to interpret and visualise data to create information (<a href="#">VCDTDI028</a>)</p> <p>Plan, create and communicate ideas, information and online collaborative projects, applying agreed ethical, social and technical protocols (<a href="#">VCDTDI029</a>)</p> <p><b>Creating Digital Solutions</b></p> <p>Define problems in terms of data and functional requirements, drawing on previously solved problems to identify similarities (<a href="#">VCDTCD030</a>)</p> <p>Explain how student-developed solutions and existing information systems meet current and future community and sustainability needs (<a href="#">VCDTCD034</a>)</p> <p><b>Design and Technologies.</b></p> <p><b>Creating Designed Solutions</b></p> <p>Generate, develop, communicate and document design ideas and processes for audiences using appropriate technical terms and graphical representation techniques (<a href="#">VCDSCD039</a>)</p> <p><b>Planning and managing</b></p> <p>Develop project plans that include consideration of resources when making designed solutions (<a href="#">VCDSCD042</a>)</p>

Inquiry Skills (Below Level)	Inquiry Skills (At Level)	Inquiry skills (Above Level)
<p><b>Questions and Possibilities</b></p> <p>Construct and use open and closed questions for different purposes (VCCCTQ010)</p> <p>Explore reactions to a given situation or problem and consider the effect of pre-established preferences (VCCCTQ011)</p> <p>Investigate different techniques to sort facts and extend known ideas to generate novel and imaginative ideas (VCCCTQ012)</p> <p><b>Reasoning</b></p> <p>Examine and use the structure of a basic argument, with an aim, reasons and conclusion to present a point of view (VCCCTR013)</p> <p>Distinguish between main and peripheral ideas in own and others information and points of view (VCCCTR014)</p> <p>Investigate why and when the consequences of a point of view should be considered (VCCCTR015)</p> <p>Identify and use ‘If, then...’ and ‘what if...’ reasoning (VCCCTR016)</p> <p>Explore distinctions when organising and sorting information and ideas from a range of sources (VCCCTR017)</p>	<p><b>Questions and Possibilities</b></p> <p>Examine how different kinds of questions can be used to identify and clarify information, ideas and possibilities (VCCCTQ021)</p> <p>Experiment with alternative ideas and actions by setting preconceptions to one side (VCCCTQ022)</p> <p>Identify and form links and patterns from multiple information sources to generate non-routine ideas and possibilities (VCCCTQ023)</p> <p><b>Reasoning</b></p> <p>Investigate common reasoning errors including contradiction and inconsistency, and the influence of context (VCCCTR024)</p> <p>Consider the importance of giving reasons and evidence and how the strength of these can be evaluated (VCCCTR025)</p> <p>Consider when analogies might be used in expressing a point of view and how they should be expressed and evaluated (VCCCTR026)</p> <p>Examine the difference between valid and sound arguments and between inductive and deductive reasoning, and their degrees of certainty (VCCCTR027)</p> <p>Explore what a criterion is, different kinds of criteria, and how to select appropriate criteria for the purposes of filtering information and ideas (VCCCTR028)</p>	<p><b>Questions and Possibilities</b></p> <p>Consider how to approach and use questions that have different elements, including factual, temporal and conceptual elements (VCCCTQ032)</p> <p>Suspend judgements temporarily and consider how preconceptions may limit ideas and alternatives (VCCCTQ033)</p> <p>Synthesise information from multiple sources and use lateral thinking techniques to draw parallels between known and new solutions and ideas when creating original proposals and artefacts (VCCCTQ034)</p> <p><b>Reasoning</b></p> <p>Examine common reasoning errors including circular arguments and cause and effect fallacies (VCCCTR035)</p> <p>Investigate the difference between a description, an explanation and a correlation and scepticism about cause and effect (VCCCTR036)</p> <p>Investigate when counter examples might be used in expressing a point of view (VCCCTR037)</p> <p>Consider how to settle matters of fact and matters of value and the degree of confidence in the conclusions (VCCCTR038)</p> <p>Examine how to select appropriate criteria and how criteria are used in clarifying and challenging arguments and ideas (VCCCTR039)</p>

<p><b>Meta-Cognition</b></p> <p>Consider concrete and pictorial models to facilitate thinking, including a range of visualisation strategies (<a href="#">VCCCTM018</a>)</p> <p>Examine an increased range of learning strategies, including visualisation, note-taking, peer instruction and incubation, and reflect on how these can be applied to different tasks to reach a goal (<a href="#">VCCCTM019</a>)</p> <p>Investigate a range of problem-solving strategies, including brainstorming, identifying, comparing and selecting options, and developing and testing hypotheses (<a href="#">VCCCTM020</a>)</p>	<p><b>Meta-Cognition</b></p> <p>Investigate thinking processes using visual models and language strategies (<a href="#">VCCCTM029</a>)</p> <p>Examine learning strategies, including constructing analogies, visualising ideas, summarising and paraphrasing information and reflect on the application of these strategies in different situations (<a href="#">VCCCTM030</a>)</p> <p>Investigate how ideas and problems can be disaggregated into smaller elements or ideas, how criteria can be used to identify gaps in existing knowledge, and assess and test ideas and proposals (<a href="#">VCCCTM031</a>)</p>	<p><b>Meta-Cognition</b></p> <p>Consider a range of strategies to represent ideas and explain and justify thinking processes to others (<a href="#">VCCCTM040</a>)</p> <p>Examine a range of learning strategies and how to select strategies that best meet the requirements of a task (<a href="#">VCCCTM041</a>)</p> <p>Consider how problems can be segmented into discrete stages, new knowledge synthesised during problem-solving and criteria used to assess emerging ideas and proposals (<a href="#">VCCCTM042</a>)</p>
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Key Inquiry Questions	Understandings
<p> <b>How can my product be used?</b>  <b>How does my product answer the design brief?</b>  <b>What sustainable materials can I use?</b>  <b>What considerations e.g. safety do I need to make?</b>  <b>How can I challenge myself to improve my design?</b>  <b>How can I test and assess my product?</b>  <b>How can I communicate with the community about the purpose of my product?</b>  <b>What were the strengths/difficulties/improvements for next time?</b>  <b>Would my client be satisfied with the outcome?</b> </p>	<p>Students will become confident and creative developers of digital solutions through the application of information systems and specific ways of thinking about problem solving.</p> <p>Students acquire a deep knowledge and understanding of digital systems, data and information and the processes associated with creating digital solutions so they can take up an active role in meeting current and future needs.</p> <p>Students will explore the capacity of information systems to systematically and innovatively transform data into digital solutions through the application of computational, design and systems thinking.</p> <p>Students will become discerning decision makers by considering different ways of managing the interactions between digital systems, people, data and processes (information systems) and weighing up the possible benefits and potential risks for society and the environment.</p> <p>Students will develop knowledge and confidence to critically analyse and respond creatively to design challenges. Technologies can play a crucial role in both enriching and transforming societies, and in the management of natural and constructed environments.</p> <p>Students will create quality-designed solutions across a range of technologies contexts. Students consider the economic, environmental and social impacts of technological change and how the choice and use of technologies may contribute to a sustainable future. Students also take into account the ethical, legal, aesthetic and functional factors that inform the design processes.</p> <p>Students will plan and manage projects from conception to realisation. They apply design and systems thinking and design processes to investigate ideas, generate and refine ideas, plan and manage, produce and evaluate designed solutions. They develop a sense of pride, satisfaction and enjoyment from their ability to create innovative designed solutions.</p> <p>Students develop dexterity and coordination. This curriculum offers students a broad range of learning experiences, readily transferable to their home, life, leisure activities, the wider community, and to work.</p>

Key Concepts	Snapshot of unit (overview)
<p>Design, create, manage and evaluate innovative digital solutions to meet and redefine current and future needs</p> <p>Use computational thinking and the key concepts of abstraction; data collection, representation and interpretation; specification, algorithms and development to create digital solutions</p> <p>Apply systems thinking to monitor, analyse, predict and shape the interactions within and between information systems.</p> <p>Confidently use digital systems to efficiently and effectively automate the transformation of data into information and to creatively communicate ideas in a range of settings</p> <p>Apply protocols and legal practices that support safe, ethical and respectful communications and collaboration with known and unknown audiences.</p> <p>Become critical users of technologies, and designers and producers of designed solutions</p> <p>Can investigate, generate and critique designed solutions for sustainable futures</p> <p>Use design and systems thinking to generate innovative and ethical design ideas, and communicate these to a range of audiences</p> <p>Create designed solutions suitable for a range of contexts by creatively selecting and safely manipulating a range of materials, systems, components, tools and equipment</p> <p>Learn how to transfer the knowledge and skills from design and technologies to new situations</p>	<p>In this unit the students will use a variety of 3D design software that can be used to create models for printing. They will then be presented with the challenge from the Quantum PrintACar competition.</p> <p>The PrintACar challenge sees teams of 1-4 students designing, printing and racing cars. All parts of the car must be printed using a 3D printer, with the exception of the axles, which may be made of another material (e.g. metal rod). A small CO2 canister will fuel the cars. Teams will present a poster and at least one car for the challenge.</p> <p>There will be a school-based competition for interested students and 4-6 teams will be selected to enter the PrintACar Competition.</p>

## Resources

E-Learning		Teacher References	Literature Sets	Media	Incursions and Excursions
<p style="text-align: center;"><b>Websites</b></p> <p>Beginner - Tinkerplay, 123D Sculpt+, Minecraft</p> <p>Intermediate - TinkerCAD, 123D Design, OpenSCAD</p> <p>Advanced – Inventor, Solidworks</p> <p><a href="http://3dprintingsystems.com/">http://3dprintingsystems.com/</a></p> <p><a href="http://www.makerbot.com/">http://www.makerbot.com/</a></p> <p><a href="https://www.youtube.com/watch?v=ZVGXcqVHCaw">https://www.youtube.com/watch?v=ZVGXcqVHCaw</a></p> <p><a href="https://www.youtube.com/playlist?list=PLu8TYSQ5jCFhVBwi6ZB827ceVh1JoBSu6">https://www.youtube.com/playlist?list=PLu8TYSQ5jCFhVBwi6ZB827ceVh1JoBSu6</a></p> <p><a href="https://www.youtube.com/playlist?list=PLPiaZv0_eph2ciobjUfnA0WJBqsOGgApG">https://www.youtube.com/playlist?list=PLPiaZv0_eph2ciobjUfnA0WJBqsOGgApG</a></p>	<p style="text-align: center;"><b>Apps</b></p> <p><a href="http://3dprintingsystems.com/education-stem-apps/">http://3dprintingsystems.com/education-stem-apps/</a></p>				<p>Quantum PrintACar Competition.</p>

# TUNING IN-

*What do I already know about the topic?*

WALT: we are learning to...	ACTIVITIES	ASSESSMENT	TEAM REFLECTION
Understand how a 3D printer works	<b>CONTENT DESCRIPTION</b> Examine the main components of common digital systems and how they may connect together to form networks to transmit data.	Can the students identify the hardware related to the 3D printers?	
	<b>INQUIRY SKILLS</b> Posing questions, making predictions, observation		
	<ol style="list-style-type: none"> <li>1. <b>What is 3D printing?</b>              Using the Prezi “3D Printing”  <a href="http://prezi.com/klzwrxsdwv7s/?utm_campaign=share&amp;utm_medium=copy">http://prezi.com/klzwrxsdwv7s/?utm_campaign=share&amp;utm_medium=copy</a>              guide students through identifying the process of using a 3D printer and how it works. Discuss the terminology and have student identify the parts on the actual 3D printer.</li> <li>2. <b>Exploration through play:</b>              Students are to explore TinkerPlay on the iPads and Thingiverse on their netbooks to look at designs and to see the process of printing out one of the designs. (Students work in small groups)              Evaluate the 3D prints: What changes would you make? How would you make those changes? How is size and ratio important in 3D print designs?</li> <li>3. <b>Upgrading from 2D to 3D:</b>              Pose the question: What is 3D thinking? Have students complete a Think/Pair/Share.             <ul style="list-style-type: none"> <li>• History</li> <li>• How did it start? – refer to timeline on <a href="https://www.youtube.com/watch?v=M-MTI8uBprs">https://www.youtube.com/watch?v=M-MTI8uBprs</a> (stop at 1:27)</li> </ul> </li> </ol>		

	<p><b>Discuss what is the difference between 2D and 3D.</b></p> <p>A square has two dimensions: length and width Simply put, it is this: Two dimensional or 2D means that something has two geometrical dimensions, just length and width. Examples are a square, a circle or an illustration, such as a picture. Although a picture is two dimensional, it can suggest depth and seem three-dimensional. In computer gaming we find the term 3D a lot and here it means that perspective images are used.</p>	<p>Can students articulate the difference between 2D &amp; 3D?</p>	
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# FINDING OUT-

*How can I gather information?*

WALT: we are learning to...	ACTIVITIES	ASSESSMENT	TEAM REFLECTION
Research various designs for 3D design and printing.	<p><b>CONTENT DESCRIPTION</b> Continue to examine the main components of common digital systems and how they may connect together to form networks to transmit data.</p>		
	<p><b>INQUIRY SKILLS</b> Posing questions, making predictions, observation.</p>		
	<p><b>Open the software: Tinkercad. Create an account in Tinkercad.</b></p> <ul style="list-style-type: none"> <li>• What do you know about design? Write down a number of key words.</li> <li>• Explore the software by following the navigational guide and completing the tasks.</li> <li>• Choose one of the tasks to print. Record the results, problems with the print and recommendations for next time.</li> <li>• Once all of the Learning Tasks have been completed experiment with the software and create something of interest to you.</li> </ul> <p><b>Open the software: 123D Design.</b></p> <ul style="list-style-type: none"> <li>• What do you know of about design? Write down a number of key words.</li> <li>• Explore the software by working through the youtube videos - <a href="https://www.youtube.com/playlist?list=PLPiaZv0_eph2ciojqUfnA0WJBqsOGgApG">https://www.youtube.com/playlist?list=PLPiaZv0_eph2ciojqUfnA0WJBqsOGgApG</a></li> <li>• Choose one of the tasks to print.</li> <li>• Record the results, problems with the print and recommendations for next time.</li> <li>• Once all of the Learning Tasks have been completed experiment with the software and create something of interest to you.</li> </ul>		

## SORTING OUT-

*How can I make sense of the data I have gathered?  
How will I process, sort out and organise my ideas?*

WALT: we are learning to...	ACTIVITIES CONTENT DESCRIPTION INQUIRY SKILLS	ASSESSMENT	TEAM REFLECTION
<p>Evaluate the products that have been used and choose an appropriate programme to meet specific requirements.</p>	<p><b>CONTENT DESCRIPTION</b></p>	<p>Final product – Pencil Holder. Peer and self-assessments in line with the specifications set.</p>	
	<p>Use the main components of a common digital system to create an object that have designed.</p>		
	<p><b>INQUIRY SKILLS</b></p> <p>Posing questions, making predictions, observation.</p>		
	<p>The students will decide which program (Tinkercad/123D Design) they are going to use for their Personal Inquiry. They will be given a specific design brief and have to produce an object that meets these requirements.</p> <p>Such a design could be a pencil holder. The pencil holder can be any shape but has to be between 10-12 cms high and 7-9 cms wide.</p>		

## GOING FURTHER-

*To extend and challenge my understanding of the topic  
Group/ Personal Inquiry*

<b>WALT: we are learning to...</b>	<b>ACTIVITIES</b>	<b>ASSESSMENT</b>	<b>TEAM REFLECTION</b>
Understand and follow the specifications of a design brief to create a design for a specific purpose.	<b>CONTENT DESCRIPTION</b> Use the main components of a common digital system to create an object that can be successfully printed.	Completed 3D object.	
	<b>INQUIRY SKILLS</b> Posing questions, making predictions, observation		
	Students will have made contact with a special buddy (this may be a person from a local retirement village, a Foundation buddy etc). Their buddy will visit the student in their classroom for an extended session. Every student will share their experiences with 3D programing and design with their buddy. The pair will choose a simple object to design and create together during this time. The students will continue to work on their design during class time and when they have completed their design the object will be printed.  The students and their buddies will meet up again and the students will present their buddies with the completed object.		

# TAKING ACTION-

*To make links between school, home and the wider community  
to make links between your understandings and the world*

WALT: we are learning to...	ACTIVITIES	ASSESSMENT	TEAM REFLECTION
Apply the knowledge and skills that we have learnt to design a car according to the PrintACar specifications.	<p><b>CONTENT DESCRIPTION</b> Use the main components of a common digital system to create an object that satisfies the requirements stated in the Quantum PrintACar competition.</p> <p><b>INQUIRY SKILLS</b> Posing questions, making predictions, observation.</p> <p>Early in 2016 visit the Quantum Victoria website: <a href="https://www.quantumvictoria.vic.edu.au/latest-news/">https://www.quantumvictoria.vic.edu.au/latest-news/</a></p> <p>This website will have all of the information you will need for students to enter the PrintACar competition. Only students who have developed appropriate skills in 3D printing and design will be encouraged to enter the competition. This work will be done in the students' own time.</p>	Successful car to take to the PrintACar Competition 2016.	

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## DRAWING CONCLUSIONS & REFLECTING

*How can you pull it all together and reflect on your learning?*

WALT: we are learning to...	ACTIVITIES	ASSESSMENT	TEAM REFLECTION
Reflect on the process and the success of the PrintACar challenge.	<p><b>CONTENT DESCRIPTION</b> Use the main components of a common digital system to create an object that satisfies the requirements stated in the Quantum PrintACar competition.</p>	Blog reflection and PrintACar poster.	
	<p><b>INQUIRY SKILLS</b> Posing questions, making predictions, observation</p>		
	<p>Students reflect on the success of their PrintACar entry. They will record their findings on the School Science Blog. This can be presented in any format e.g. photos, movies, Prezie etc.</p>		