

Rationale

In an increasingly technological and complex world, it is important to develop knowledge and confidence to critically analyse and creatively respond to design challenges. Knowledge, understanding and skills involved in the design, development and use of technologies are influenced by and can play a role in enriching and transforming societies and our natural, managed and constructed environments. The Australian Curriculum: Design and Technologies enables students to become creative and responsive designers. When they consider ethical, legal, aesthetic and functional factors and the economic, environmental and social impacts of technological change, and how the choice and use of technologies contributes to a sustainable future, they are developing the knowledge, understanding and skills to become discerning decision-makers. Design and Technologies actively engages students in creating quality designed solutions for identified needs and opportunities across a range of technologies contexts. Students manage projects independently and collaboratively from conception to realisation. They apply design and systems thinking and design processes to investigate ideas, generate and refine ideas, plan, produce and evaluate designed solutions. They develop a sense of pride, satisfaction and enjoyment from their ability to develop innovative designed products, services and environments. Through the practical application of technologies including digital technologies, students develop dexterity and coordination through experiential activities. Design and Technologies motivates young people and engages them in a range of learning experiences that are transferable to family and home, constructive leisure activities, community contribution and the world of work.

Years 7 and 8 Achievement Standard

By the end of Year 8, students explain factors that influence the design of products, services and environments to meet present and future needs. They explain the contribution of design and technology innovations and enterprise to society. Students explain how the features of technologies impact on designed solutions and influence design decisions for each of the prescribed technologies contexts. Students create designed solutions for each of the prescribed technologies contexts based on an evaluation of needs or opportunities. They develop criteria for success, including sustainability considerations, and use these to judge the suitability of their ideas and designed solutions and processes. They create and adapt design ideas, make considered decisions and communicate to different audiences using appropriate technical terms and a range of technologies and graphical representation techniques. Students apply project management skills to document and use project plans to manage production processes. They independently and safely produce effective designed solutions for the intended purpose.

Aims

In addition to the overarching aims for the Australian Curriculum: Technologies, Design and Technologies more specifically aims to develop the knowledge, understanding and skills to ensure that, individually and collaboratively, students:

- develop confidence as critical users of technologies and designers and producers of designed solutions
- investigate, generate and critique innovative and ethical designed solutions for sustainable futures
- use design and systems thinking to generate design ideas and communicate these to a range of audiences
- produce designed solutions suitable for a range of technologies contexts by selecting and manipulating a range of materials, systems, components, tools and equipment creatively, competently and safely; and managing processes
- evaluate processes and designed solutions and transfer knowledge and skills to new situations
- understand the roles and responsibilities of people in design and technologies occupations and how they contribute to society.

Key Ideas

Overarching idea: Creating preferred futures

The Technologies curriculum provides students with opportunities to consider how solutions that are created now will be used in the future. Students will identify the possible benefits and risks of creating solutions. They will use critical and creative thinking to weigh up possible short- and long-term impacts. As students progress through the Technologies curriculum, they will begin to identify possible and probable futures, and their preferences for the future. They develop solutions to meet needs considering impacts on liveability, economic prosperity and environmental sustainability. Students will learn to recognise that views about the priority of the benefits and risks will vary and that preferred futures are contested.

Project management

Students will develop skills to manage projects to successful completion through planning, organising and monitoring timelines, activities and the use of resources. This includes considering resources and constraints to develop resource, finance, work and time plans; assessing and managing risks; making decisions; controlling quality; evaluating processes and collaborating and communicating with others at different stages of the process. Students are taught to plan for sustainable use of resources when managing projects and take into account ethical, health and safety considerations and personal and social beliefs and values.

Thinking in Technologies

Systems thinking

A system is an organised group of related objects or components that form a whole. Systems thinking is a holistic approach to the identification and solving of problems where the focal points are treated as components of a system, and their interactions and interrelationships are analysed individually to see how they influence the functioning of the entire system.

In Design and Technologies, the success of designed solutions includes the generation of ideas and decisions made throughout design processes. It requires students to understand systems and work with complexity, uncertainty and risk. Students recognise the connectedness of and interactions between people, places and events in local and wider world contexts and consider the impact their designs and actions have in a connected world.

Participating in and shaping the future of information and digital systems is an integral part of learning in Digital Technologies. Understanding the complexity of systems and the interdependence of components is necessary to create timely solutions to technical, economic and social problems. Implementation of digital solutions often has consequences for the people who use and engage with the system, and may introduce unintended costs or benefits that impact the present or future society.

Design thinking

Design thinking involves the use of strategies for understanding design needs and opportunities, visualising and generating creative and innovative ideas, planning, and analysing and evaluating those ideas that best meet the criteria for success.

Design thinking underpins learning in Design and Technologies. Design processes require students to identify and investigate a need or opportunity; generate, plan and realise designed solutions; and evaluate products and processes. Consideration of economic, environmental and social impacts that result from designed solutions are core to design thinking, design processes and Design and Technologies.

When developing solutions in Digital Technologies, students explore, analyse and develop ideas based on data, inputs and human interactions. When students design a solution to a problem they consider how users will be presented with data, the degree of interaction with that data and the various types of computational processing. For example, designing a maze; writing precise and accurate sequences of instructions to move a robot through the maze or testing the program and modifying the solution.

Computational thinking

Computational thinking is a problem-solving method that is applied to create solutions that can be implemented using digital technologies. It involves integrating strategies, such as organising data logically, breaking down problems into parts, interpreting patterns and models and designing and implementing algorithms.

Computational thinking is used when specifying and implementing algorithmic solutions to problems in Digital Technologies. For a computer to be able to process data through a series of logical and ordered steps, students must be able to take an abstract idea and break it down into defined, simple tasks that produce an outcome. This may include analysing trends in data, responding to user input under certain preconditions or predicting the outcome of a simulation.

This type of thinking is used in Design and Technologies during different phases of a design process when computation is needed to quantify data and solve problems. Examples include when calculating costs, testing materials and components, comparing performance or modelling trends.

Information and communication technology in the Australian Curriculum

In the Australian Curriculum, there are opportunities in all learning areas to develop information and communication technology (ICT) capability. These are described in the ICT general capability learning continuum, which is a statement about learning opportunities in the Australian Curriculum for students to develop their ICT capability.

In Digital Technologies the ICT capability is more explicit and foregrounded. Students develop explicit knowledge, understanding and skills relating to operating and managing ICT and applying social and ethical protocols while investigating, creating and communicating. The study of Digital Technologies will ensure that ICT capability is developed systematically. While specific elements are likely to be addressed within Digital Technologies learning programs, key concepts and skills are strengthened, complemented and extended across all subjects, including in Design and Technologies. This occurs as students engage in a range of learning activities with digital technologies requirements.

The clear difference between the Digital Technologies curriculum and the ICT general capability is that the capability helps students to become effective *users* of digital technologies while the Digital Technologies curriculum helps students to become confident *developers* of digital solutions.

Safety

Identifying and managing risk in Technologies learning addresses the safe use of technologies as well as risks that can impact on project timelines. It covers all necessary aspects of health, safety and injury prevention and, in any technologies context, the use of potentially dangerous materials, tools and equipment. It includes ergonomics, safety including cyber safety, data security, and ethical and legal considerations when communicating and collaborating online.

Technologies learning experiences may involve the use of potentially hazardous substances and/or hazardous equipment. It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students and that school practices meet the requirements of the *Work Health and Safety Act 2011*, in addition to relevant state or territory health and safety guidelines.

In implementing projects with a focus on food, care must be taken with regard to food safety and specific food allergies that may result in anaphylactic reactions. The Australasian Society of Clinical Immunology and Allergy has published guidelines for prevention of anaphylaxis in schools, preschools and childcare. Some states and territories have their own specific guidelines that should be followed.

When state and territory curriculum authorities integrate the Australian Curriculum into local courses, they will include more specific advice on safety. For further information about relevant guidelines, contact your state or territory curriculum authority.

Animal ethics

Any teaching activities that involve caring, using, or interacting with animals must comply with the *Australian code of practice for the care and use of animals for scientific purposes* in addition to relevant state or territory guidelines.

When state and territory curriculum authorities integrate the Australian Curriculum into local courses, they will include more specific advice on the care and use of, or interaction with, animals.

For further information about relevant guidelines or to access your local animal ethics committee, contact your state or territory curriculum authority.

Years 7 and 8 Band Description

Learning in Design and Technologies builds on concepts, skills and processes developed in earlier years, and teachers will revisit, strengthen and extend these as needed.

By the end of Year 8 students will have had the opportunity to create designed solutions at least once in the following four technologies contexts: Engineering principles and systems, Food and fibre production, Food specialisations and Materials and technologies specialisations. Students should have opportunities to design and produce products, services and environments.

In Year 7 and 8 students investigate and select from a range of technologies – materials, systems, components, tools and equipment. They consider the ways characteristics and properties of technologies can be combined to design and produce sustainable designed solutions to problems for individuals and the community, considering society and ethics, and economic, environmental and social sustainability factors. Students use creativity, innovation and enterprise skills with increasing independence and collaboration.

Students respond to feedback from others and evaluate design processes used and designed solutions for preferred futures. They investigate design and technology professions and the contributions that each makes to society locally, regionally and globally through creativity, innovation and enterprise. Students evaluate the advantages and disadvantages of design ideas and technologies.

Using a range of technologies including a variety of graphical representation techniques to communicate, students generate and clarify ideas through sketching, modelling, perspective and orthogonal drawings. They use a range of symbols and technical terms in a range of contexts to produce patterns, annotated concept sketches and drawings, using scale, pictorial and aerial views to draw environments.

With greater autonomy, students identify the sequences and steps involved in design tasks. They develop plans to manage design tasks, including safe and responsible use of materials and tools, and apply management plans to successfully complete design tasks. Students establish safety procedures that minimise risk and manage a project with safety and efficiency in mind when making designed solutions.

Subject structure

The Australian Curriculum: Design and Technologies (F–10) comprises two related strands:

- Design and Technologies knowledge and understanding – the use, development and impact of technologies and design ideas across a range of technologies contexts
- Design and Technologies processes and production skills – the skills needed to create designed solutions.

In Design and Technologies, creating designed solutions is also expressed as ‘designing and producing’ or ‘design and produce’ as a means of abbreviating the skills needed to create designed solutions by investigating and defining, designing, producing and implementing, evaluating, and collaborating and managing.

Relationship between the strands

Together, the two strands provide students with knowledge, understanding and skills through which they can safely and ethically design, plan, manage, produce and evaluate products, services and environments. Teaching and learning programs should balance and integrate both strands. Students learn about technologies and society through different technologies contexts (knowledge and understanding) as they create designed solutions (processes and production skills).

Design and Technologies knowledge and understanding

This strand focuses on developing the underpinning knowledge and understanding of technologies (materials, systems, components, tools and equipment) across technologies contexts and developing understanding of the relationship between technologies and society.

Technologies and society

The technologies and society content descriptions focus on how people use and develop technologies taking into account social, economic, environmental, ethical, legal, aesthetic and functional factors and the impact of technologies on individuals; families; local, regional and global communities; the economy; and the environment now and into the future.

Technologies contexts

The technologies contexts content descriptions provide a framework within which students can gain knowledge and understanding about technologies and design across a range of technologies contexts. These content descriptions focus on the characteristics and properties of technologies and how they can be used to create innovative designed solutions. The technologies contexts provide a progression of learning from Foundation to Year 8 and optionally to Year 9–10 or lead to more specialised Technologies subjects in Year 9 and 10. They also reflect national priorities including workforce needs, food security and sustainable food and fibre production and health and wellbeing priorities.

The prescribed technologies contexts for Foundation – Year 8 are described below. The band descriptions show how many times each technologies context is addressed in a band.

Engineering principles and systems

Engineering principles and systems is focused on how forces can be used to create light, sound, heat, movement, control or support in systems. Knowledge of these principles and systems enables the design and production of sustainable, engineered solutions. Students need to understand how sustainable engineered products, services and environments can be designed and produced as resources diminish. Students will progressively develop knowledge and understanding of how forces and the properties of materials affect the behaviour and performance of designed engineering solutions.

Food and fibre production

Food and fibre are the human-produced or harvested resources used to directly sustain human life and are produced in managed environments such as farms and plantations or harvested from wild stocks. Challenges for world food and fibre production include an increasing world population, an uncertain climate and competition for resources such as land and water. Students need to engage in these challenges by understanding the processes of food and fibre production and by investigating innovative and sustainable ways of supplying agriculturally produced raw materials. Students will progressively develop knowledge and understanding about the managed systems that produce food and fibre through creating designed solutions. (Food and fibre production includes food specialisations from Foundation to Year 6.)

Food specialisations

Food specialisations include the application of nutrition principles (as described in Health and Physical Education) and knowledge about the characteristics and properties of food to food selection and preparation; and contemporary technology-related food issues. There are increasing community concerns about food issues, including the nutritional quality of food and the environmental impact of food manufacturing processes. Students need to understand the importance of a variety of foods, sound nutrition principles and food preparation skills when making food decisions to help better prepare them for their future lives. Students will progressively develop knowledge and understanding about the nature of food and food safety, and how to make informed and appropriate food preparation choices when experimenting with and preparing food in a sustainable manner.

Materials and technologies specialisations

Materials and technologies specialisations is focused on a broad range of traditional, contemporary and emerging materials and specialist areas that typically involve extensive use of technologies. We live in and depend on the human-made environment for communication, housing, employment, medicine, recreation and transport; however, we also face increasing concerns related to sustainability. Students need to develop the confidence to make ethical and sustainable decisions about solutions and the processes used to make them. They can do this by learning about and working with materials and production processes. Students will progressively develop knowledge and understanding of the characteristics and properties of a range of materials either discretely in the development of products or through producing designed solutions for a technologies specialisation; for example, architecture, electronics, graphics technologies or fashion.

Types of designed solutions

Across each band from Foundation to Year 8, students will have the opportunity to produce at least three types of designed solutions (product, service and environment) through the technologies contexts identified for a band.

These different designed solutions have been specified to give students opportunities to engage with a broad range of design thinking and production skills. For example, in Year 5–6 students may design and produce an engineered product, a food and fibre production/food specialisations environment and a materials or technologies specialisations service. Whereas in another school students may design and produce an engineered environment, a food and fibre production/food specialisations service, and a materials and technologies specialisation product. The combination of contexts and types of designed solutions is a school decision.

Design and Technologies processes and production skills

The Design and Technologies processes and production skills strand is based on the major aspects of design thinking, design processes and production processes. The content descriptions in this strand reflect a design process and would typically be addressed through a design brief.

The Design and Technologies processes and production skills strand focuses on creating designed solutions by:

- investigating and defining
- generating and designing
- producing and implementing
- evaluating
- collaborating and managing.

The processes and production skills that students will use throughout a design project are described below.

Investigating and defining

Investigating and defining involves students critiquing, exploring and investigating needs, opportunities and information. As creators and consumers they will critically reflect on the intention, purpose and operation of technologies and designed solutions. Critiquing encourages students to examine values, analyse, question and review processes and systems. Students reflect on how decisions they make may have implications for the individual, society and the local and global environment, now and in the future. Students explore and investigate technologies, systems, products, services and environments as they consider the needs of society. They progressively develop effective investigation strategies and consider the contribution of technologies to their lives and make judgements about them. Students may respond to design briefs or develop design briefs in response to needs and opportunities.

Generating and designing

Generating and designing involves students in developing and communicating ideas for a range of audiences. Students create change, make choices, weigh up options, consider alternatives and document various design ideas and possibilities. They use critical and creative thinking strategies to generate, evaluate and document ideas to meet needs or opportunities that have been identified by an individual, group or wider community. Generating creative and innovative ideas involves thinking differently; it entails proposing new approaches to existing problems and identifying new design opportunities considering preferred futures. Generating and developing ideas involves identifying various competing factors that may influence and dictate the focus of the idea. Students will evaluate, justify and synthesise what they learn and discover. They will use graphical representation techniques when they draw, sketch, model and create innovative ideas that focus on high-quality designed solutions.

Producing and implementing

Students learn and apply a variety of skills and techniques to make products, services or environments designed to meet specific purposes and user needs. They apply knowledge about components, materials and their characteristics and properties to ensure their suitability for use. They learn about the importance of adopting safe work practices. They develop accurate production skills to achieve quality designed solutions. Students develop the capacity to select and use appropriate materials, systems, components, tools and equipment; and use work practices that respect the need for sustainability. The use of modelling and prototyping to accurately develop simple and complex physical models supports the production of successful designed solutions.

Evaluating

Students evaluate and make judgements throughout a design process and about the quality and effectiveness of their designed solutions and those of others. They identify criteria for success. In the early years, the teacher may guide the development of these criteria. Progressively, students develop criteria which become increasingly more comprehensive. Students consider the implications and consequences of actions and decision-making. They determine effective ways to test and judge their designed solutions. They reflect on processes and transfer their learning to other design opportunities.

Collaborating and managing

Students learn to work collaboratively and to manage time and other resources to effectively create designed solutions. Progressively, students develop the ability to communicate and share ideas throughout the process, negotiate roles and responsibilities and make compromises to work effectively as a team. Students work individually and in groups to plan, organise and monitor timelines, activities and the use of resources. Students progress from planning steps in a project through to more complex project management activities that consider various factors such as time, cost, risk and quality control.

Years 7 and 8 Content Descriptions

Design and Technologies Knowledge and Understanding

Investigate the ways in which products, services and environments evolve locally, regionally and globally and how competing factors including technologies and designed solutions for preferred futures.

Analyse how motion, force and energy are used to manipulate and control electromechanical systems when designing simple, engineered solutions.

Analyse how food and fibre are produced when designing managed environments and how these can become more sustainable.

Analyse how characteristics and properties of food determine preparation techniques and presentation when designing solutions for healthy eating.

Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment.

Design and Technologies Processes and Production Skills

Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas.

Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques.

Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions.

Independently develop criteria for success to evaluate design ideas, processes and solutions and their sustainability.

Use project management processes when working individually and collaboratively to coordinate production of designed solutions.