The Australian Curriculum

Subjects	Design and Technologies,Digital Technologies
Year levels	Year 10

AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY

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The Australian Curriculum
Technologies

Technologies - How the Learning Area works

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.

Rationale

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 ensures that all students benefit from learning about and working with traditional, contemporary and emerging technologies that shape the world in which we live. By applying their knowledge and practical skills and processes when using technologies and other resources to create innovative solutions, independently and collaboratively, they develop knowledge, understanding and skills to respond creatively to 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 instils 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.

Aims

The Australian Curriculum: Technologies aims to develop the knowledge, understanding and skills to ensure that, individually and collaboratively, students:

- investigate, design, plan, manage, create and evaluate solutions
- are creative, innovative and enterprising when using traditional, contemporary and emerging technologies, and understand how technologies have developed over time
- make informed and ethical decisions about the role, impact and use of technologies in the economy, environment and society for a sustainable future
- engage confidently with and responsibly select and manipulate appropriate technologies − materials, data, systems, components, tools and equipment − when designing and creating solutions
- critique, analyse and evaluate problems, needs or opportunities to identify and create solutions.

These aims are extended and complemented by specific aims for each Technologies subject.

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.

The Australian Curriculum: Technologies Foundation – Year 10 comprises two subjects:

- Design and Technologies
- Digital Technologies.

The Australian Curriculum: Technologies is written on the basis that all students will study the two subjects from Foundation to the end of Year 8.

In Year 9 and 10, student access to technologies subjects will be determined by school authorities. These could include Design and Technologies and/or Digital Technologies as outlined in the Australian Curriculum: Technologies and/or subjects relating to specific technologies contexts, determined by state and territory school authorities or individual schools.

The curriculum for each of Design and Technologies and Digital Technologies describes the distinct knowledge, understanding and skills of the subject and, where appropriate, highlights their similarities and complementary learning. This approach allows students to develop a comprehensive understanding of traditional, contemporary and emerging technologies. It also provides the flexibility – especially in the primary years of schooling – for developing integrated teaching programs that focus on both Technologies subjects and other learning areas. Figure 1 shows the relationship between the overarching idea, key ideas and subjects of the Technologies learning area.

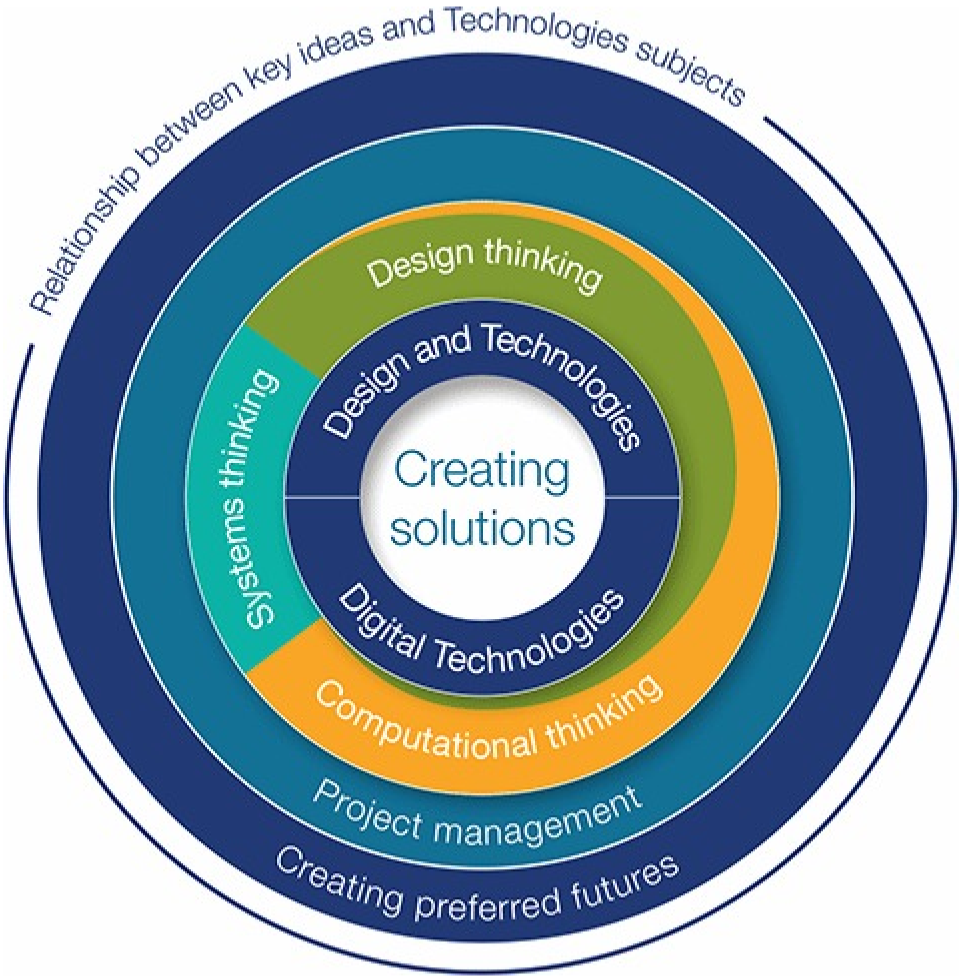


Figure 1: Relationship between key ideas and Technologies subjects

The curriculum for each Technologies subject is written in bands of year levels:

- Foundation – Year 2
- Years 3 and 4
- Years 5 and 6
- Years 7 and 8
- Years 9 and 10.

Strands

Knowledge, understanding and skills in each subject are presented through two related strands:

- Knowledge and understanding
- Processes and production skills.

Table 1 outlines the focus of knowledge, understanding and skills across the Technologies learning area Foundation – Year 10.

Table 1: Design and Technologies and Digital Technologies content structure

<table>
<tr><th>Design and Technologies</th><th>Digital Technologies</th></tr>
<tr><th>Knowledge and understanding</th><th>Knowledge and understanding</th></tr>
<tr><td>Technologies and society
the use, development and impact of technologies in people’s lives
Technologies contexts
technologies and design across a range of technologies contexts</td><td>Digital systems
the components of digital systems: hardware, software and networks and their use
Representation of data
how data are represented and structured symbolically</td></tr>
<tr><th>Processes and production skills</th><th>Processes and production skills</th></tr>
<tr><td>Creating designed solutions by:
investigating and defining
generating and designing
producing and implementing
evaluating
collaborating and managing</td><td>Collecting, managing and analysing data

Creating digital solutions by:
investigating and defining
generating and designing
producing and implementing
evaluating
collaborating and managing</td></tr>
</table>

Teachers can select technologies-specific content from the Knowledge and understanding strand and students can apply skills from the Processes and production skills strand to that content.

The common strand structure provides an opportunity to highlight similarities across the two subjects that will facilitate integrated approaches to teaching.

Glossary

absorbency

Power, capacity or tendency of a material to absorb or soak up another substance, usually a liquid.

abstraction

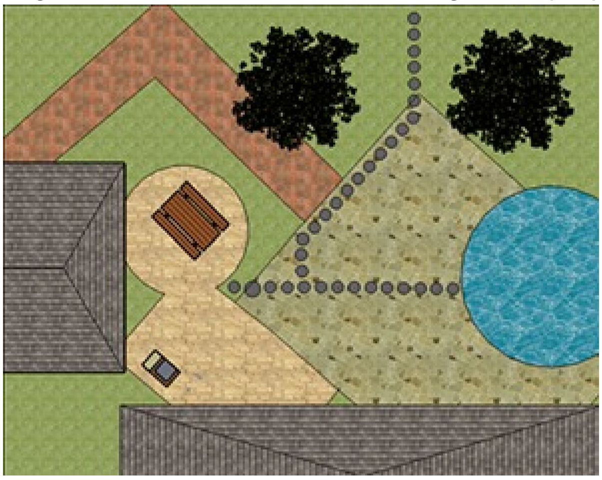
A process of reducing complexity to formulate generalised fundamental ideas or concepts removed from specific details or situation. For example, the idea that a cricket ball is a sphere in the same way that a soccer ball is, or the concept that *data* can be organised in records made up of fields irrespective of whether the data are numbers, text, images or something else.

accessibility

The extent to which a *system*, *environment* or object may be used irrespective of a user's capabilities or disabilities. For example, the use of assistive technologies to allow people with physical disabilities to use computer systems, or the use of icons in place of words to allow young children to use a *system*.

aerial view

A drawing from above (in the air) to show features of a building, landscape or environment. An *aerial view* is used, for example, in whole-farm plans to show the location of fences and gates, dams, waterways, specific vegetation, sheds and other buildings on a property so plans for changes can be made.



aerial view of garden

aesthetics

A branch of philosophy dealing with the nature of art, beauty and taste. It is more scientifically defined as the study of sensory-emotional values, sometimes called judgements of sentiment and taste. Aesthetic judgement is concerned with the visual impact or appeal of a *product* or *environment* and is influenced by social, emotional and demographic factors.

algorithm

Step-by-step procedures required to solve a problem. For example, to find the largest number in a list of positive numbers:

- Note the first number as the largest.
- Look through the remaining numbers, in turn, and if a number is larger than the number found in 1, note it as the largest.
- Repeat this process until complete. The last noted number is the largest in the list.

An *algorithm* may be described in many ways. Flowcharts are often useful in visualising an *algorithm*.

algorithmic logic

A logic behind breaking down computing problems and information systems into step-by-step processes in order to solve problems or achieve specified outcomes. It involves sequencing and *abstraction* and leads to algorithmic statements.

app

A software application with a very specific or narrow purpose designed to run on mobile devices (such as smartphones or tablets) through a web browser or on a personal computer. The *feature* set of an *app* is limited when compared with a full-featured desktop application for a similar purpose. For example, a photo-editing app has a smaller set of features than an industry-standard photographic suite.

augmented reality (AR)

A technology that replicates, enhances or overlays extra information about the real-world *environment,* using computer-generated *data* such as global positioning systems (GPS), sound, videos and images. Examples include a car windshield with a heads-up display (HUD) that projects three-dimensional navigation information and virtual lanes; and a swimming telecast using a line to indicate the position of the record holder in relation to the actual swimmers in the race.

automate

In Digital Technologies, any process of transforming and manipulating *data* that does not require user intervention. For example, through the use of formulas in a spreadsheet, new sets of data can be processed and the results recalculated automatically, or a webcam can be turned on as a result of movement sensor input.

ASCII (American Standard Code for Information Interchange)

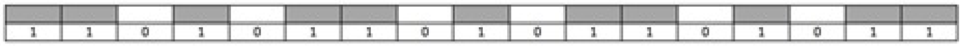
An early numeric code, later extended, used to represent 128 specific characters, including 0–9 and a–z, in computer systems. For example, capital A is represented by the *binary* code 100 0001.

back casting

A process that starts with defining a desirable future and then working backwards to identify policies and programs that will connect the future to the present.

binary

A use of two states or permissible values to represent *data*, such as ON and OFF positions of a light switch or transistors in a computer silicon chip that can be in either the electrical state of ON or OFF.
Binary data are typically represented as a series of single digits referred to as binary digits (or bits) due to each taking on the value of either 0 or 1. The image below shows how a dashed line might be represented in binary.



biomimicry

An inspiration of functions found in nature for use and adaptation in the design of a *product*, *service* or *environment* or to solve human problems. For example, velcro fastening was inspired by small hooks on the end of burr needles. Termite mounds that maintain a constant temperature through air vents inspired architects to *design* cooling for buildings.

bitmap

Mapping something to bits (*binary* digits 0 and 1). It is most often used in reference to graphics or images (but can be other forms of media). For a bitmapped graphic, each ‘dot’, or *pixel*, of the graphic is represented by a number giving the colour of the pixel. .bmp, .gif or .jpeg files are graphics represented as bitmaps (as opposed to *vector graphics*). If a graphic were stored or displayed using only 1 bit per pixel, it would be purely black and white (1 for black and 0 for white). If it were 2 bits per pixel, it could represent four ‘colours’ (typically greyscale colours). Using 24 bits per pixel gives over 16 million (2^{24}) different colours.

branching

Making a decision between one of two or more actions depending on sets of conditions and the data provided. For example, in testing whether a light works, the following *algorithm* uses branching:

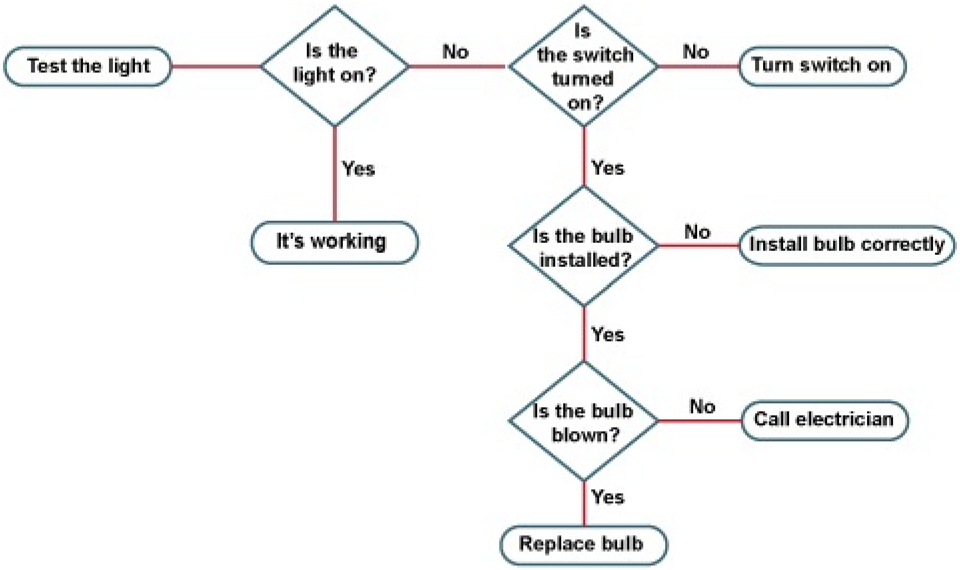


diagram illustrating *branching*

bunraku puppet

A traditional Japanese form of puppet theatre in which half life-sized dolls act out a chanted dramatic narrative using force and motion.

CAPTCHA™

A graphic image (and audio for vision impaired) recognition test to confirm a human, rather than a computer-automated response to a request. It is an acronym for Completely Automated Public Turing test to tell Computers and Humans Apart. It is commonly used with online forms over the internet to reduce the chance of hackers using computer programs to automatically fill in multiple bogus online forms.

an example of *CAPTCHA*

carbon footprint

The environmental impact of an individual or organisation's operation, measured in units of carbon dioxide. It includes primary emissions (the sum of the direct carbon dioxide emissions of fossil fuel burning and transportation such as cars and planes) and secondary, or indirect, emissions associated with the manufacture and breakdown of all products, services and food an individual or organisation consumes.

cascading style sheets (CSS)

A set of instructions to describe the formatting (for example, layout, font, size) of a document written in a markup language such as *HTML* for web pages. It is a special case of a style sheet that is a set of instructions to define the formatting of a structured document (for example, a word processed document could have a style sheet). For example, *CSS* for a website may define the font, colour and size of each type of text such as headings, body text, hyperlinks and captions for pictures.

categorical data

Data that are represented in discrete categories such as gender, eye colour or type of animal. For example, if age was represented as age groups (for example,. 0–5, 6–18, 19–60, 61+), then the data would be categorical rather than numerical.

characteristics

A set of distinguishing aspects (including attributes and behaviours) of an object, material, living thing, system or event.

In Design and Technologies, the qualities of a material or object usually detected and recognised by human senses such as its colour, taste, texture, sound (for example, crunch of bread) and smell. The term also may relate to the form of a material, for example, ‘corrugated’ cardboard. These qualities are used by humans to select suitable *materials* for specific uses, for example, because they are appealing or suitable for their purpose. The *characteristics* of materials usually determine the way people work with the materials. Also see *properties*.

In Digital Technologies, for example, the characteristics of a stored digital graphic may be the colour depth (maximum number of colours represented), the resolution (number of *pixels* per area, or height and width) and the compression used.

cloud computing

Distributing computing over a network where storage of files, processing of *data* and/or access to software occurs automatically on interconnected server computers to which the user’s device is connected. Typically, people use the term to refer to accessing files and software over the internet. For example, photo files may be stored in the ‘cloud’ from a smartphone to be accessed later from a different location; where they are actually stored can be anywhere in the world on a server computer used by the *cloudservice*.

codec

A piece of software that encodes or decodes digital audio-visual material, usually to allow it to be stored or transmitted in a compressed format. For example, the MP3 format compresses audio *data* and requires an MP3 *codec* (usually available by default in audio programs) to be read and played by a computer. Codecs can be downloaded or purchased and installed as plug-ins to most applications to extend the media capabilities of software. Also see *compression*.

collaborative document

A document that is created by more than one person, with authors working together to create a single document. This is readily achieved using digital technologies by having the document in an online *environment* so that many authors can access and edit the document at the same time.

components

Parts or elements that make up a *system* or whole object and perform specific functions. For example, the major *components* of a car include: a chassis (holds everything on it); an engine (to convert energy to make a car move); a transmission (including controlling the speed and output from the engine and to rotate the wheels); a steering system (to control the direction of movement); a brake system (to slow down or stop); a fuel delivery system (to supply fuel to the cylinders); an exhaust system (to get rid of gases) and an electrical system (for operating wipers, air conditioning, etc.).
Similarly, the components of a computer system may be a central processing unit (chips that follow instructions to control other components and move data); memory chips and a hard disk (for storing data and instructions); a keyboard, a mouse, a camera and a microphone (to input instructions and data for the central processing unit); a screen, a printer and speakers (to output data); USB and ethernet cards (to communicate with other systems or *components*). Also see *digital systems.*

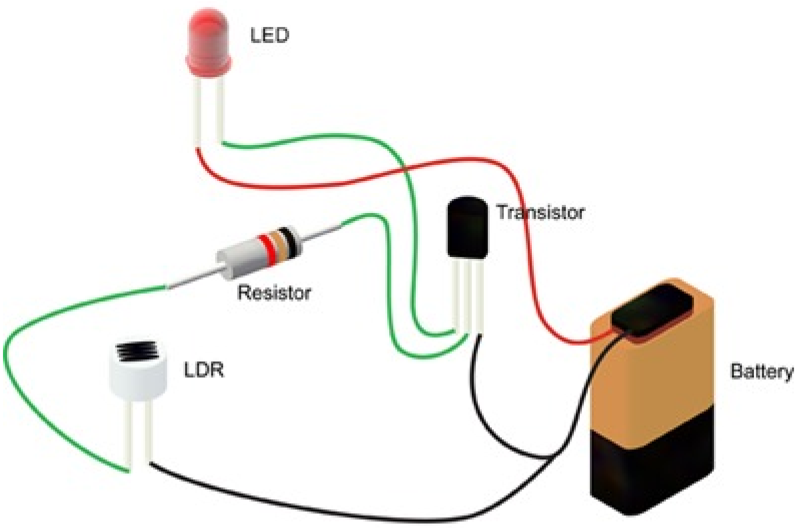


diagram showing *components* of an electronic system

compression

A process of encoding information using fewer bits, that is, 0 or 1, than an original representation, to reduce file size – typically using mathematical formulas to remove repeated *data*, combine related data or simplify data (for example, a line segment can be represented by the position of the end points instead of every dot on it). Common examples include:

- .zip files, which can contain one or more files or folders that have been compressed
- .jpg files in digital photography are produced by processing complete (lossless) data from a camera's sensor through compressing (looking for redundant/unnecessary data) into a smaller file size
- .mp3 files for audio, which compress an original audio source to reduce the file size significantly but still sound like an exact copy of the original.

compression scheme

a method of compressing *data*. Also see *compression.*

computational thinking

A problem-solving method that involves various techniques and strategies that can be implemented by *digital systems*. Techniques and strategies may include organising *data* logically, breaking down problems into parts, defining abstract concepts and *designing* and using algorithms, patterns and models.

computer-aided drawing

Software used by designers, architects and engineers to create lines, shapes and planes that can be combined, moved, rotated, adjusted and *rendered*. Measurements and calculations can be included. *Computer-aided drawing* can be used to create two- and three-dimensional models and drawings such as floor plans, interior and garden designs, and to represent objects and structures. Also known as computer-assisted design or CAD.

computer-aided manufacturing (CAM)

A use of geometric design *data* (coordinates) to control and monitor specially designed automated machines with onboard computers to produce objects. Numerical control (NC) computer software applications create detailed instructions, known as G-code, that drive the computer numeric control (CNC) machine *tools* for manufacturing *components* and objects.

constructed environment

An environment developed, built and/or made by people for human and animal activity, including buildings, streets, gardens, bridges and parks. It includes *naturalenvironments* after they have been changed by people for a purpose.

construction relationship

A relationship between *materials* and suitable methods of joining them, based on their *characteristics* and *properties*. For example, certain adhesives can be used to join specific materials. If an incorrect adhesive is chosen, the materials will not bond, or will be weak.

criteria for success

A descriptive list of essential *features* against which success can be measured. The compilation of criteria involves literacy skills to select and use appropriate terminology.

critiquing

A careful judgement in which opinions are given about positive and negative aspects of something. *Critiquing* considers good as well as bad performances, individual parts, relationships of individual parts and overall performance. Also see *evaluating*.

crop sensor

An advanced sensor to measure and record *data* about food or *fibre* crops and give real-time measurements of physiological factors such as nutrient status and moisture. It can be physically placed in the crop or remotely sensed from a satellite or aircraft.

cultivating gardens

Preparing and improving soil by digging and fertilising to promote the growth of crop plants.

danger zone temperatures

Temperature range between 5º Celsius and 60º Celsius. In this zone, bacteria that cause food poisoning can multiply quickly to unsafe levels. High-risk foods should be stored properly to avoid the *danger zone temperatures*.

data

In Digital Technologies, discrete representation of information using number codes. *Data* may include characters (for example, alphabetic letters, numbers and symbols), images, sounds and/or instructions that, when represented by number codes, can be manipulated, stored and communicated by *digital systems*. For example, characters may be represented using *ASCII* code or images may be represented by a *bitmap* of numbers representing each ‘dot’ or *pixel*.

database

A collection of *data* organised by records and fields that can be easily stored, accessed, managed and updated. Each discrete piece of data to be stored is represented by a field (for example, song title, song artist or bank account number, date of transaction); and values in the fields that are associated with an entity (for example, a song, a bank transaction) are a record. Interaction with a *database* usually takes place through a *user interface* designed specifically for the structure and use of the data stored in it.

data repository

A central place where *data* are stored and maintained. For example, a *database* on a server computer for the Australian Bureau of Statistics, a weather bureau or a bank.

dataset

A collection of *data* combined for a specific purpose. All *data* should be interconnected either by being in the same file or in files related to each other so they can be viewed together, and are usually collected together. Examples include data collected from a survey entered into a single spreadsheet, or a library of clip art.

decompose

To separate a complex problem into parts to allow a problem to be more easily understood. For example, to create an interactive story, one can *decompose* the problem to a list of characters and their characteristics (for example, clothing), the actions of the characters, the backdrops and the sequence of scenes with reference to which characters, actions and backdrops are involved in each scene. Decomposition may be represented in diagrams.

design process

A process that typically involves investigating and defining; generating and *designing*; *producing* and implementing; *evaluating*; and collaborating and managing to create a *designed solution* that considers social, cultural and environmental factors. In Design and Technologies, *technologies processes* include *design processes* and *production processes*.

desk checking

A method used by a human to check the logic of a computer program's *algorithm* to reduce the likelihood of errors occurring. This may be done on paper, using a diagram, or mentally trying a sample of typical *inputs* to see what the *outputs* would be. For example, to *desk check* a branching statement {IF age >65 THEN ‘retire’ ELSE ‘keep working’}, the values for age of 64, 65 and 66 could be tried to show that 64 and 65 would result in ‘keep working’ and 66 in ‘retire’ so that it could be decided if the statement worked as intended.

designed solution

In Design and Technologies, a product, service or *environment* that has been created for a specific purpose or intention as a result of *design thinking*, *design processes* and *production processes*.

digital citizenship

An acceptance and upholding of the norms of appropriate, responsible behaviour with regard to the use of digital technologies. This involves using digital technologies effectively and not misusing them to disadvantage others. *Digital citizenship* includes appropriate online etiquette, literacy in how digital technologies work and how to use them, an understanding of ethics and related law, knowing how to stay safe online, and advice on related *health* and safety issues such as predators and the permanence of *data*.

digital footprint

A total set of *data* left behind by a person using a *digital system*. A person's *digital footprint* includes all information actively provided by that person such as interactions on social networks (for example, comments, photographs), online purchases, website logons, emails and instant messages. It also includes passive information such as logs of software installed and used on a computer, metadata associated with files, a user's IP address, a device being used to access a web page, and a user's browsing history stored as cookies or by internet service providers.

digital information

The nature and forms of information stored digitally, and processes that transform digital *data* into information for various purposes and meanings, including structures, *properties*, *features* and conventions of particular forms of *digital information* and appropriate methods of storage, transmission and presentation of each form.

digital system

Digital hardware and software *components* (internal and external) used to transform *data* into a *digital solution*. When *digital systems* are connected, they form a network. For example:

- a smartphone is a digital system that has software (apps, an operating system), input *components* (for example, touch screen, keyboard, camera and microphone), output *components* (for example, screen and speakers), memory *components* (for example, silicon chips, solid state drives), communication components (for example, SIM card, wi-fi, bluetooth or mobile network antennas), and a processor made up of one or more silicon chips.
- a desktop computer with specific software and hardware *components* for dairy farming. The computer is connected via cables to milking *equipment* and via wi-fi to sensors that read tags on the cows. Through these hardware *components* the software records how much milk each cow provides. Such systems can also algorithmically control attaching milking *equipment* to each cow, providing feed and opening gates.

drawing standards

Australian standards for *engineering* and technical drawing. Identified as Australian Standard AS 1100, the standards include a number of parts that describe the conventions for Australian engineers, designers, architects and associated tradespeople such as builders and plumbers to follow. AS 1100 incorporates general principles for technical drawing, including dimensioning, types of lines and layouts to use, scales, symbols, abbreviations and their meanings. It also includes mechanical engineering drawing, including information for surface texture, welding, centre holes, gears, etc.

deconstructing

A process of dismantling or pulling a *product* or *system* apart to systematically identify and analyse components and their relationships. Also see *components*.

design brief

A concise statement clarifying a *project* task and defining a need or opportunity to be resolved after some analysis, investigation and research. It usually identifies users, *criteria for success*, constraints, available *resources* and timeframe for a *project* and may include possible consequences and impacts.

designing

In Design and Technologies, a process that typically involves investigating and defining; generating; *producing* and implementing; *evaluating*; and collaborating and managing to create a *designed solution*. In Digital Technologies, one step in a four-stage process of defining, *designing*, implementing and *evaluating* to create a *digital solution.*

design thinking

Use of strategies for understanding design problems and opportunities, visualising and generating creative and innovative ideas, and analysing and *evaluating* those ideas that best meet the *criteria for success* and planning.

digital environment

A situation, or sphere of activity, or simulated ‘place’ that is entirely presented or experienced with digital technologies. For example, a *social network* that provides a *digital environment* for communicating with friends, or software that provides a *digital environment* for editing photographs.

digitally signed data

Data that have information added (for example, a digital signature) before these data are sent over a network so that a receiving digital device knows what computer has sent the data and that the data have not been changed along the way. A digital signature is mathematically created using cryptography (hashed). For example, a digital signature may be added to a PDF document in Acrobat as a digital ID (or private key) that includes a name and email address in the added information.

digital solution

A result (or *output*) of transforming *data* into information or action using *digital systems*, skills, techniques and processes to meet a need or opportunity.

digital technology

Any *technology* controlled using digital instructions, including computer hardware and software, digital media and media devices, digital toys and accessories, and contemporary and emerging communication technologies. These technologies are based on instructions given, using *binary* (0 or 1) code, that invariably mean one or more processors are present to respond to these instructions. Computers, smartphones, digital cameras, printers and robots are all examples of digital technologies.

durability

An ability of an object or *system* to withstand or resist wear, pressure or damage over a long period of time and remain in good condition. For example, long-lasting outdoor furniture made of suitable *materials* and construction methods to withstand rain, heat and light from the sun; a sports uniform made of suitable materials to withstand frequent washing and wear and tear from the movement of the sportsperson. Also see *properties*.

e-commerce

The electronic (e) selling of a *product* or *service* online or through other electronic means, with an online mechanism for payment. Examples include online shopping sites and travel websites where hotel accommodation and airline tickets can be purchased.

economic sustainability

A set of practices that do not reduce economic opportunities of future economies, while recognising the finite nature of *resources,* and use resources optimally over a longer term without resulting in economic loss.

electronic planting calendar

An online or software-based month-by-month guide of suitable crops to plant, as well as typical garden maintenance tasks, which need to be performed. An *electronic planting calendar* may take a form of a *database* or simple table of information.

encryption of data

A process in cryptography of encoding (converting) *data*, using mathematical formulas, into a form that only an intended recipient can decode, often including a personal digital signature (see *digitally signed data*). For example, when connecting to an online banking or shopping website, typically on login a secure communication is set up based on encryption provided at the website, and this will be represented by a https://URL and a lock symbol on the user’s internet browser.

energy-efficient cooking

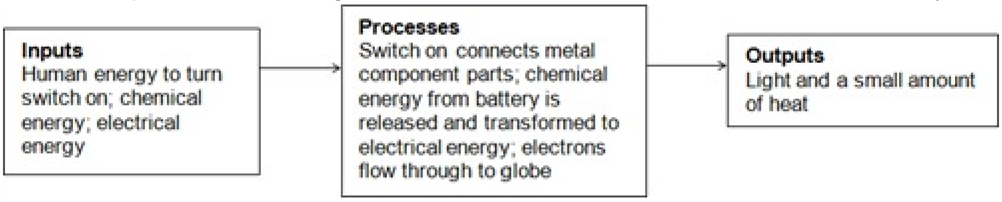
Energy efficiency is the use of less energy to provide the same *service*. Examples of *energy-efficient cooking* include microwave cooking; using energy-efficient cookware such as copper-bottom pans and woks; matching pan size to the cooking element; reducing cooking time by defrosting frozen food first; using a single hotplate with a saucepan and stacked steamer.

engineering

A practical application of scientific and mathematical understanding and principles as a part of the process of developing and maintaining solutions for an identified need or opportunity.

engineering principles and systems

A *technologies* context in Design and Technologies focused on how forces and energy can be used to create light, sound, heat, movement, control or support in systems. It involves manipulating and arranging systems and their *components*, often using modelling or simulation, so they work together (or interact) to meet required needs and functions or purposes. Systems have *inputs*, processes and *outputs*. For example, a torch as shown below. Scientific laws or theories can often be used to work out the necessary inputs, processes or outputs to support the development or operation of a system. These are known as *engineering principles*. An example of an *engineering principle* is Ohm's Law (a statement about the relationship between voltage, current and resistance in an electrical circuit).



inputs, processes and *outputs* of a torch, which is a simple system

enterprise

A *project* or activity that may be challenging, requires effort and initiative and may have risks.

enterprising

Showing initiative and willingness to take action and commitment to follow through on initiatives.

environment

One of the *outputs* of *technologies processes* and/or a place or space in which technologies processes operate. An *environment* may be natural, managed, constructed or digital.

environmental sustainability

Practices that have minimal impact on ecosystem's *health*, allow renewal of natural systems and value environmental qualities that support life.

equipment

Items needed for carrying out specific jobs, activities, functions or processes. For example, a bench hook is used to hold a piece of wood when making a straight cut across it; a tailor's chalk is used to make marks on fabric to show details of the location and type of construction; a soldering iron is used to solder *components* to a printed circuit board; scales are used to accurately weigh ingredients for a cake or feed for domestic animals.

ergonomics

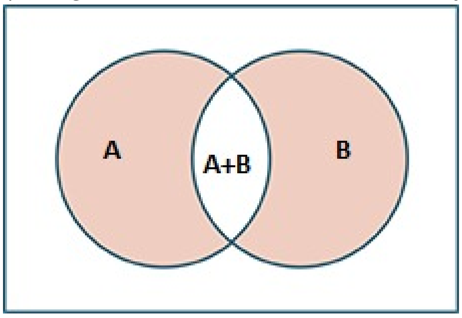
Understanding of the activity of humans within systems or in an *environment* to maximise the wellbeing of humans and their productive use of those systems or environments. In Digital Technologies,*ergonomics* is concerned with physical, mental and emotional impacts on users of the technologies. For example, it is understood that many people may get sore eyes if they look at screens for too long, and that if computer keyboard users do not sit up straight with arms at right angles to the body, they may get repetitive strain injury in their forearms.

evaluating

Measuring performance against established criteria. Estimating nature, quality, ability, extent or significance to make a judgement determining a value. Also see *critiquing*.

exclusive or (XOR)

An '*exclusive or*' (XOR) is a logical operator that is TRUE if both *inputs* to it are different, in the same way that AND is a logical operator that is TRUE only if both of the *inputs* are TRUE. For example, 'person is male' XOR 'person has blonde hair' results in all females with blonde hair and males without blonde hair. (Using AND here would result in only including males with blonde hair.)



the Venn diagram represents the *XOR* operator

exploded view

A drawing or photograph of an object with individual parts shown separately but arranged to show the relationship and position of the parts for assembly. For example, instructions that come with furniture sold in a flat pack that has parts and fittings, or a diagram of parts of a bicycle, to be assembled in a particular way and/or order by a purchaser.

exploded view of a chair

features

In Design and Technologies, distinctive attributes, *characteristics*, *properties* and qualities of an object, material, living thing, *system* or event.

fibre

In *food and fibre production*, plant- or animal-based *materials* that can be used for clothing or construction. *Fibre* includes materials from forestry. Animal-based (protein) fibres include wool and silk. Plant-based (cellulosic) fibres include cotton, bamboo, hemp, timber and wood chip.

file transfer protocol (FTP)

A set of rules or standards for transmitting files between *digital systems* on the internet. Also see *hypertext transfer protocol*.

food and fibre production

A process of *producing* food or *fibre* as natural *materials* for the design and development of a range of products.

food guides

The National Health and Medical Research Council and Australian government departments of health and nutrition publish guides that provide information on food consumption patterns to promote maximum *health*. These include the Australian Guide to Healthy Eating poster, which visually represents the proportion of the five food groups recommended, in a circular plate format; the *Australian Dietary Guidelines(2013 revision)*, which has five principal recommendations, and the Healthy Living Pyramid, which recommends food from the core food groups and encourages food variety balanced with physical activity.

food specialisations

Application of nutrition principles and knowledge about the *characteristics* and *properties* of food to food selection and preparation; and contemporary technology-related food issues.

forecasting

A process of predicting the future based on current trend analysis. It uses historical *data* to determine a direction of future trends.

flame-retardant fabrics

1. Inherently flame-resistant fibres that have flame resistance built into their chemical structure.
2. Flame-retardant treated (FRT) fabrics that are made flame-resistant by the application of flame-retardant chemicals.

functionality

Design of products, services or environments to ensure they are fit for purpose and meet the intended need or market opportunity and identified *criteria for success*. *Criteria for success* in relation to *functionality* are likely to include such things as operation, performance, safety, reliability and quality. That is, does the *product*, *service* or *environment* do what it was meant to do, or provide what it was meant to provide? (For example, does the torch provide light, is it easy to hold, and is it safe to use?)

futures thinking

Strategic thinking that envisages what can be, given existing knowledge, to propose scenarios for probable, possible and *preferred futures*. For example, making well-informed predictions or extrapolating using current economic, environmental, social and technological trends; using divergent thinking ('What if …' explorations) about a given futures scenario; hypothesis; or systems-driven thinking.

general-purpose programming languages

Programming languages in common use designed to solve a wide range of problems. They include procedural, functional and *object-oriented programming* languages, including scripting and/or dynamically typed languages. Examples of *general-purpose programming languages* include C#, C++, Java, JavaScript, Python, Ruby and Visual Basic. They do not include declarative programming languages such as Prolog or *structured query language* (SQL), or languages designed for solving domain-specific problems or for pedagogical reasons.

graphic organiser

A communication tool that uses visual symbols to represent structured thinking. *Graphic organiser* makes thinking processes visible by showing connections between ideas and *data*. Examples include concept maps, flowcharts and cause-and-effect patterns. The use of *graphic organisers* has become more popular with the availability of software to create, edit and display them.

graphics technologies

Visual images, pictorial representations or designs produced on a surface such as paper, canvas or a screen. Images generated by a computer are known as computer graphics. The purpose of these images, representations or designs is to inform, illustrate or entertain.

graphical representation technique

A technique used to communicate ideas and plans, for example, sketching, drawing, modelling, making patterns, technical drawing, *computer-aided drawing*. (The *graphical representation techniques* for each band are included in the band description.)

hardwood

Wood from broadleaved or angiosperm trees such as oak, ash, gum, jarrah.

hashing algorithm

A method of generating output of a fixed length that is used as a shorthand reference to larger amounts of *data*. Used extensively to speed up searching, or when a size of *data* being used becomes cumbersome. Hashing is especially useful in cryptography as a means of reliably and securely obscuring input for communication. A *hashing algorithm* is deterministic – it always produces the same output for any given input – ensuring that *data* retrieval and use are reliable.

health

A state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity (World Health Organization 1948).

healthy eating

Dietary patterns that aim to promote *health* and wellbeing, including types and amounts of foods and food groups that reduce the risk of diet-related conditions and chronic disease (National Health and Medical Research Council 2013).

hypertext markup language (HTML)

One of the first coding systems (or languages) designed to be used for web-page files so that an internet browser can efficiently display a page and elements for that page such as text, links and media in the intended position. There are newer versions of this language and alternative markup languages.

hypertext transfer protocol (HTTP)

A set of rules or standards for transferring files and messages on the World Wide Web, specifically to allow linking of files and text (see *file transfer protocol*). It provides a standard for web browsers to render pages (that is, to present them in an intended form) and servers to communicate.

IF statement

A conditional decision statement used to control the flow of a program (see *branching*). The structure of an *IF statement* evaluates an expression (for example, hour < 12) and performs a specified code block only if the condition is true. An example in Python would look like the following:

```
if hour < 12:
  print(“Good morning!”)
```

Here, the program would only print the words 'Good morning!' if the hour of the day is less than 12.

information system

A combination of digital hardware and software *components* (*digital systems*), *data*, processes and people that interact to create, control and communicate information.

input

Something put into a system to activate or modify a process, for example, people, raw *materials*, power, energy, *data*. Also see *engineering principles and systems*.

intellectual property

A legal concept that refers to creations of a mind for which exclusive rights are recognised. Common types of *intellectual property* include copyright, trademarks, patents, designs and plant breeder’s rights.

intitle

A prefix indicating a strategy to limit searches to the title field of a web page. It indicates that a word or phrase is included in the title.

inurl

A prefix indicating a strategy to limit searches to particular words in a URL.

irrigation methods

Different ways of applying supplementary water to crops, for example, spray, flood and drip irrigation.

iteration

A repetition of a process or set of instructions in computer programming where each repeated cycle builds on a previous (see *repeatstatement*). Typically this uses a FOR loop command with a counter such as the example below to add the numbers from 1 to 9.

```
for number = 1 to 9
sum = sum + number
```

jig

A custom-made *tool* or piece of equipment used to control a positioning and or motion of another tool to go into a work piece. *Jigs* are used when manufacturing products to ensure accuracy, alignment, repeatability and interchangeability. Some jigs are also called templates or guides. Examples are machining jigs, woodworking jigs such as a dowelling jig, jewellers' jigs and welders' jigs.

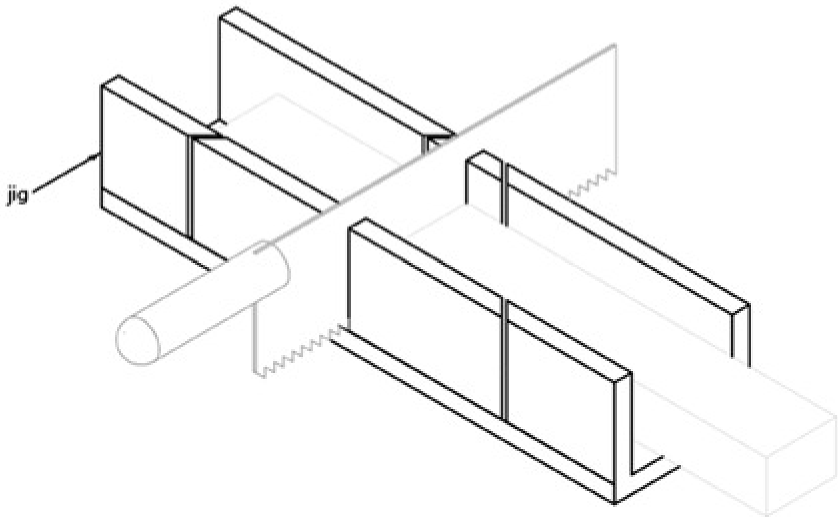
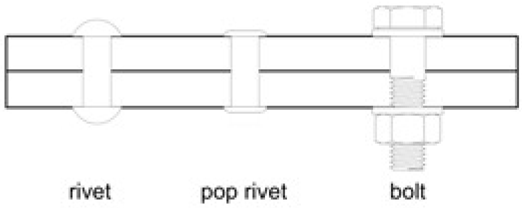


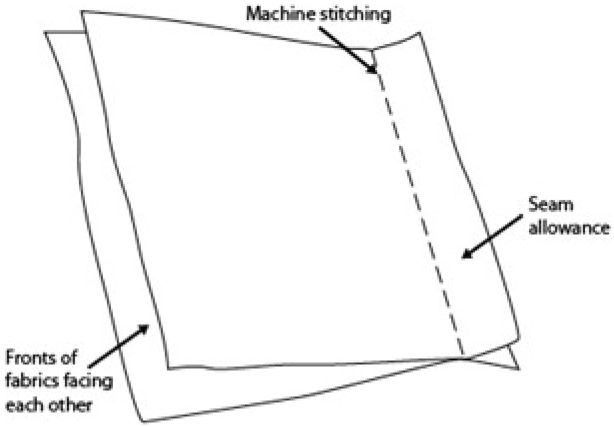
diagram of a *jig*

joining processes

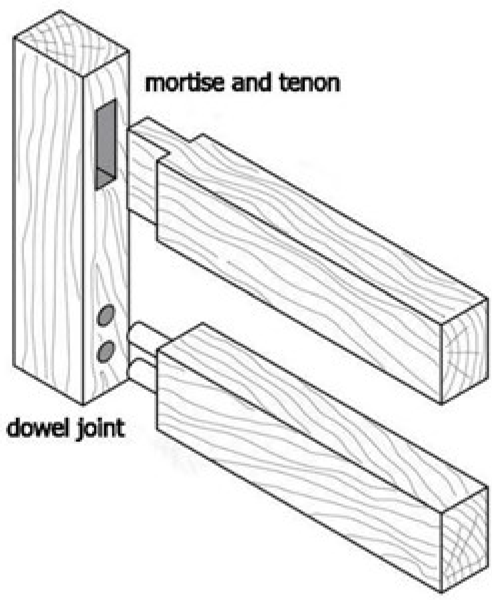
Methods of bringing together and permanently holding *materials* or components, for example, using joints such as a dowel joint to join legs and rails for a table frame; fasteners such as nails, rivets, bolts and screws; glues or adhesives; welding; sewing and binding; rubbing in or mixing food ingredients. Also see *components*.



examples of processes to join metal



example of processes to join fabric



examples of processes to join timber

land management

A process of developing land and monitoring its use in a *sustainable* way, usually for purposes of *producing* food and providing *fibre* for clothing and housing. Includes providing protection for flora and fauna, and preventing and controlling weeds. Also see *water management*.

life cycle thinking

A strategy to identify possible improvements to products, services and environments to reduce environmental impact and resource consumption while considering social and economic impacts. The cycle goes from the acquisition of *materials* through to disposal or recycling. *Life cycle thinking* in *food and fibre production* would consider nutrition, *health* and wellbeing, cultural identity and lifestyle as well as environmental impacts. When products and services are marketed or integrated together, customers may be more satisfied because the service supports the product's use through its life, and could lead to less consumption. Examples of how life cycle thinking can be demonstrated include product road maps and more complex life cycle analysis and assessment diagrams used by industry.

lossless compression

A type of *compression algorithm* that retains sufficient information to allow the original *data* to be perfectly reconstructed from the compressed *data*. It is used when it is important for the original *data* to be perfectly preserved, for example, in text documents, programming source code, application files or for archival purposes.

lossy compression

A type of *compression algorithm* that compresses *data* by discarding information that is not necessary to reproduce the original *data* with sufficient detail for the user not to notice the difference. It is used primarily for reducing the size of *multimedia* assets such as video, audio and photos, especially when streaming or transmitting the *data* over the internet. The original *data* cannot be restored from the compressed version, as is noticeable when attempting to increase the size of a compressed jpeg file.

low compression (41KB)

medium compression (24KB)

high compression (6KB)

low-input sustainable agriculture (LISA)

A way of thinking about *food and fibre production* that focuses on reducing purchased *inputs* (such as fertilisers and pesticides) and uses on-farm and environmental *resources* effectively. Concepts include crop rotations and soil and water conservation.

malware

Malicious software designed to interfere with the regular operation of a computer system. Often used to gain access to other people's computers or to gather sensitive information, it is usually hidden in other software to avoid user detection. Examples can include viruses, Trojan horses, key loggers and spyware. Anti-malware software is often relied on to help users detect and remove *malware* from their computers.

mammandur

A spinning top traditionally made from beeswax and a stick. It is spun by rubbing the stick between two palms or by using the thumbs and middle finger to twist it.

managed environment

In Design and Technologies, an environment coordinated by humans, for example, a farm, forest, marine park, waterway, wetland and storage facility.

materials and technologies specialisations

A *technologies* context in Design and Technologies focuses on a broad range of traditional, contemporary and emerging *materials* and specialist areas that typically involve extensive use and deep knowledge of specific *technologies*.

mass production

Making many standardised products very quickly, using assembly line techniques. *Components* or partially completed products are sent to workers, who each work on an individual step, rather than one worker working on a whole *product* from start to finish. Mass produced products are manufactured to attain a standardised and consistent quality.

material

A substance from which a thing is or can be made. Natural (e.g. animals, food, *fibre*, timber, mineral) and fabricated (e.g. metal alloys, plastics, textiles, composites) *materials*. *Materials* are used to create products or environments and their structure can be manipulated by applying knowledge of their origins, structure, *characteristics*, *properties* and uses.

meat tenderness

How easily meat is cut or chewed. *Meat tenderness* is influenced by age of the animal, breed, level of activity, fat content and cooking method.

minimum-tillage cropping

Methods of ploughing that provide minimum disruption to the soil, thus allowing soil to maintain its natural structure. *Minimum-tillagecropping* requires the use of specially designed machinery and control of weeds by the use of herbicides.

model

A representation that describes, simplifies, clarifies or provides an explanation of the workings, structure or relationships within an object, system or idea.
This can be either a physical *model*, such as in a *scalemodel* of a car or house, to show the form of a final production design, and is made with *tools*, jigs and fixtures; or virtual, such as a simulator program that demonstrates the capabilities of a vending machine through interaction with a computer user.

multimedia

The use of digital technologies to present combinations of text, graphics, video, animation and/or sound in an integrated way. Where there is facility for a user to interact with *multimedia,* the term ‘interactive *multimedia’* may be used. Examples include interactive games, media-rich websites, electronic books (ebooks) and animated short films.

natural environment

In Design and Technologies, an environment in which humans do not make significant interventions, for example, ocean environments, natural woodlands, national parks.

nutritious foods

Foods that supply the nutrients needed by a body to grow, develop and maintain *health*. As the type and quantity of nutrients found in foods varies, a body needs a variety of foods to be eaten each day to ensure optimum levels of *health* and wellbeing are achieved.

nutrition panel

Under the food standards code, all manufactured packaged foods must carry a *nutrition panel*. Only very small packages are exempt. The nutrition panel states the amount of energy (kilojoules), protein, fat (saturated and total), sodium and carbohydrate in a food. Figures are shown in two columns: per serve and per 100 grams or millilitres.

object-based coding application

An application that uses the *object-oriented programming* paradigm to represent attributes and actions of a real-world object. An example is the use of Lego Mindstorms to provide instructions to determine the movement of a robot.

object-oriented programming language (OOP)

A programming language that supports the *object-oriented programming* paradigm. In object-oriented programming, objects represent a combination of *data* (the attributes of an object) and actions that can be performed on or with those *data* (the methods of the object). An example might be a declaration of a ‘car’, which has attributes that describe its physical nature (such as the number of doors, its colour, the size of the engine) and the actions it can perform (such as accelerating, braking and turning).
The valid attributes and methods of an object are defined by its class, and these attributes and methods can be inherited from the definition of another class. Examples of *OOP* languages include C++, Eiffel, Java, Python and Scala.

online query interface

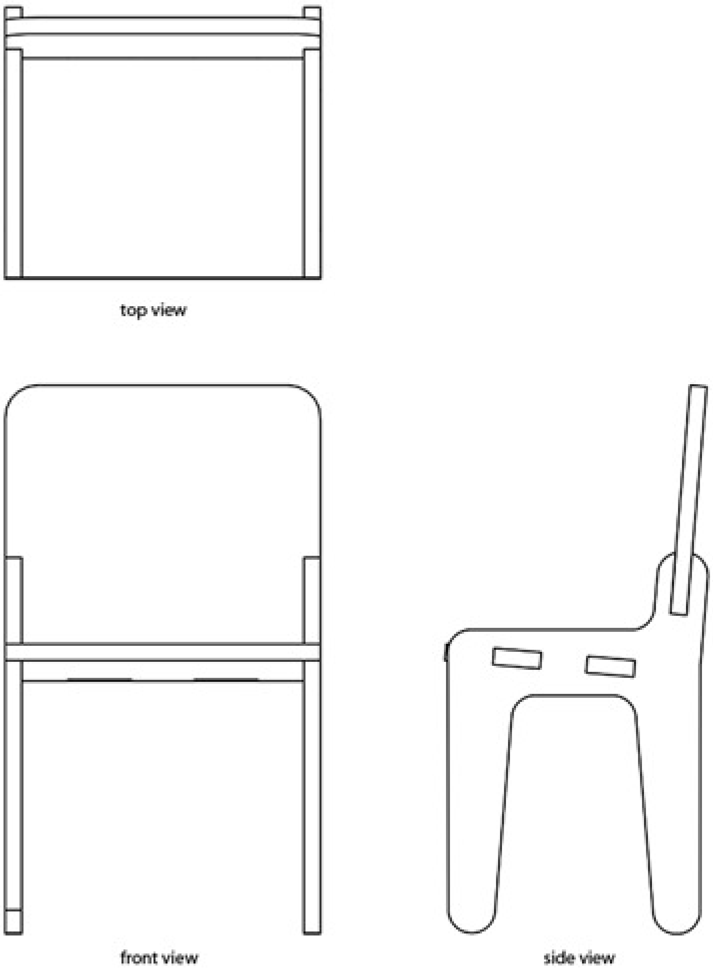
A simple online interface, such as a form on a website, that provides a way for a user to query a specified *dataset*. This could include a catalogue for a local library, or a website that allows searching of Creative Commons images.

organic fertiliser

A mixture of extra nutrients that are derived from sources which are or were living, to be added to crops and pastures. Examples include seaweed, blood and bone, manure and compost.

orthogonal drawing

A scaled multiview drawing of a three-dimensional object to show each view separately, in a series of two-dimensional drawings, for example, top or bottom, front, back and sides. In Australia, *orthogonal drawings* use third-angle projection for layout of the views. Orthogonal drawings may also include measurements on each view and are used to develop lists of material requirements. In these drawings each edge is represented by a connected line, each segment of which is parallel to a coordinate axis. Also see *production drawing*.



orthogonal drawing of a chair

output

A result of something (physical or virtual) such as power, energy, action, *material* or information produced by a person, machine or a system. Also see *engineering principles and systems*.

paddock to plate

All steps in the growing, processing and preparation of food.

palatability

An impression made by foods. The foods may be acceptable or agreeable to the palate or taste.

passive design

A design approach that uses natural elements – often sunlight – to heat, cool or light a building. Systems that employ *passive design* require very little maintenance and reduce a building's energy consumption by minimising or eliminating mechanical systems used to regulate indoor temperature and lighting.

peripheral device

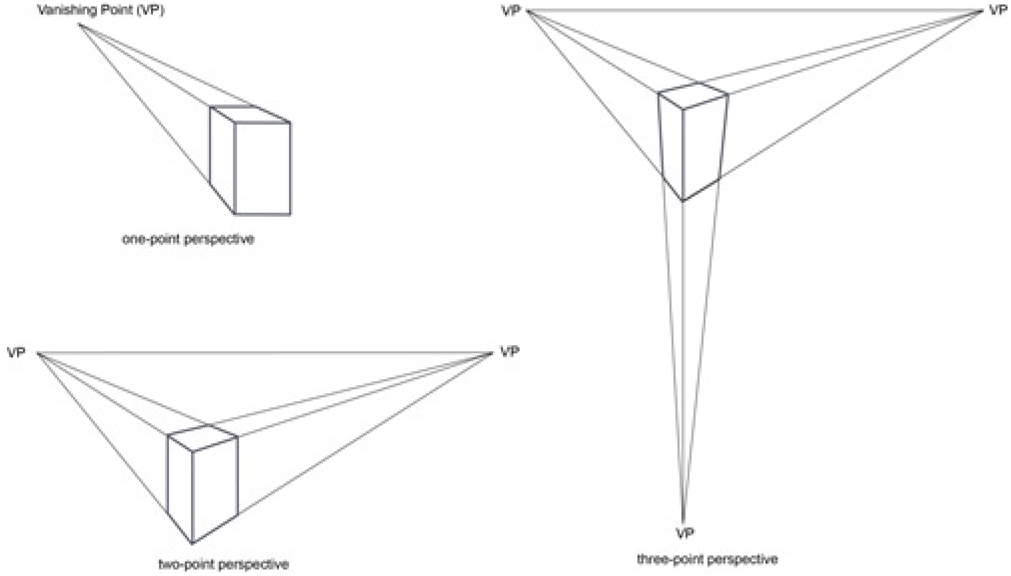
A digital component that can be connected to a digital system but are not essential to the system, for example, printer, scanner, digital camera.

personal protective equipment (PPE)

Equipment used or worn by a person to minimise risk to the person's *health* or safety, for example, goggles, ear muffs, face shield, hard hat, apron, gloves.

perspective drawing

A drawing that represents the way objects appear to be smaller and closer together, the further away they are. *Perspective drawings* may be one-, two- or three-point perspective and have the corresponding number of vanishing points. A one-point perspective drawing has a single vanishing point (VP). Perspective drawings are often used in building, interior and architectural design.



perspective drawings

pictorial map

A map that shows illustrated (rather than technical style) cartography. The area shown may be the representation of a view of a landscape from above on an oblique angle. *Pictorial maps* are not drawn to *scale*.

pictorial map of a landscape

pixel

A physical point in a *bitmap* image or on a display device that corresponds to the smallest amount of information that can be stored and accessed. Also see *bitmap*.

play

An imaginary situation and the exploration of objects and actions for a specific purpose, where meaning and sense of objects, actions and social situation can change for individual and collective needs to create something new.

preferred futures

Preferences for the future identified by a student to inform the creation and evaluation of solutions.

preparing soil

The processes of tillage, addition of organic matter and fertilisers, and drainage prior to establishing a food or *fibre* crop.

producing

Actively realising (making) *designed solutions,* using appropriate *resources* and means of production.

product

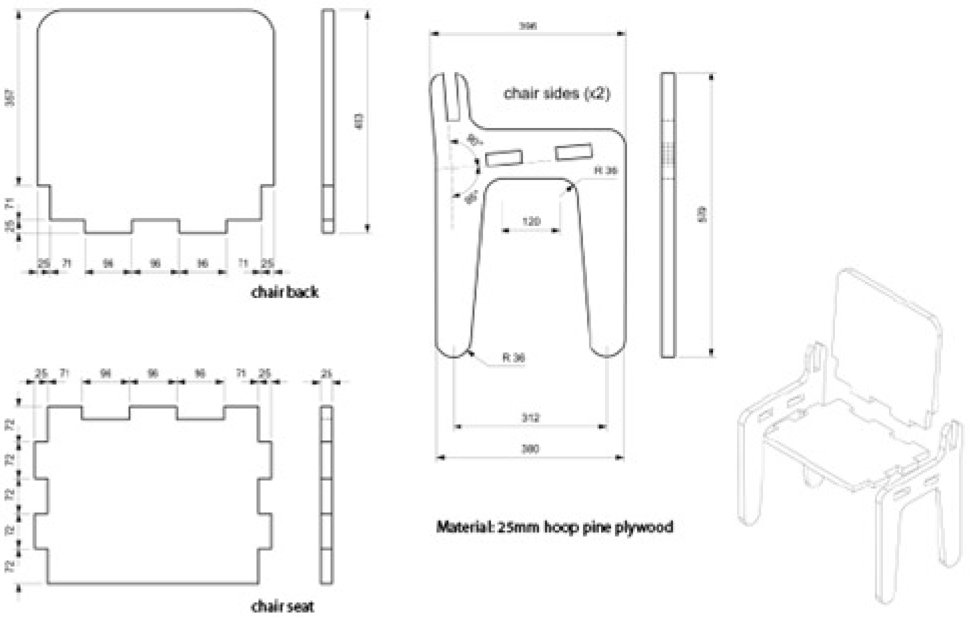
One of the *outputs* of *technologies processes*, the end result of processes and production. *Products* are the tangible end results of natural, human, mechanical, manufacturing, electronic or digital processes to meet a need or want.

product demonstration screencast

A presentation of a product's *features* and interface generated by capturing the screen of a computer while the *product* is in use. Usually recorded using video, then annotated using text or voice to provide explanatory notes about the actions occurring on screen.

production drawing

A working drawing that details requirements for the manufacture and assembly of a product and environment.



production drawings for a chair

production process

In Design and Technologies, a *technologies* context-specific process used to transform *technologies* into a product, service or environment, for example, the steps used for *producing* a *product*.

project

A set of activities undertaken by students to address specified content, involving understanding the nature of a problem, situation or need; creating, *designing* and *producing* a solution to the *project* task; and documenting the process. *Project* work has a benefit, purpose and use; a user or audience, which can provide feedback on the success of the solution; limitations to work within; and a real-world *technologies* context influenced by social, ethical and environmental issues. *Criteria for success* are used to judge a project's success.

project management

A responsibility for planning, organising, controlling *resources*, monitoring timelines and activities, and completing a *project* to achieve a goal that meets identified criteria for judging success.

property

A distinctive quality of a material that can be tested and used to help people select the most suitable one for a particular use.
Mechanical *properties* are determined when a force is applied to a material, for example, to test its *strength*, hardness, wear resistance, machinability/workability, stretch and elasticity.
Thermal properties are determined when varying temperatures (for example, cold or heat) are applied to test whether a material expands, melts, conducts or absorbs heat (warms up), find its boiling point, and whether its colour changes.
Chemical properties relate to the chemicals a material is made of (its composition) and how it may change because of its surrounding environment, for example, how it ages or taints; develops an odour; deteriorates; resists stains, corrosion or cracks due to heat; or is flammable.
Electrical *properties* relate to the way a material responds if a current is passed through it or if it is placed in an electrical field, for example, whether the material conducts or resists electricity or acts as an insulator.
Optical *properties* relate to how light reacts with a material, for example, opaqueness, transparency and reflectiveness.

protocol

A set of generally accepted standards or 'rules' that govern relationships and interactions between and within *information systems*. Also see *file transfer protocol* and *hypertext transfer protocol*.

prototype

A trial *product* or *model* built to test an idea or process to inform further design development. A *prototype* can be developed in the fields of *service*, design, electronics or software programming. Its purpose is to see if and how well the design works and is tested by users and systems analysts. It can be used to provide specifications for a real, working *product* or system rather than a virtual or theoretical one. *Prototype* is derived from Greek terms that, when translated, mean 'primitive form', 'first' and 'impression'. Also see *working models*.

radiofrequency identification device (RFID)

A small electronic device, consisting of a small chip and antenna, used for identifying and tracking products, animals and people.

rapid prototyping

A range of techniques used to quickly fabricate a *scalemodel* of a physical part or assembly using three-dimensional computer-assisted design (CAD). Construction of the part or assembly is usually done using 3D printing or additive layer manufacturing technology.

recirculation technologies

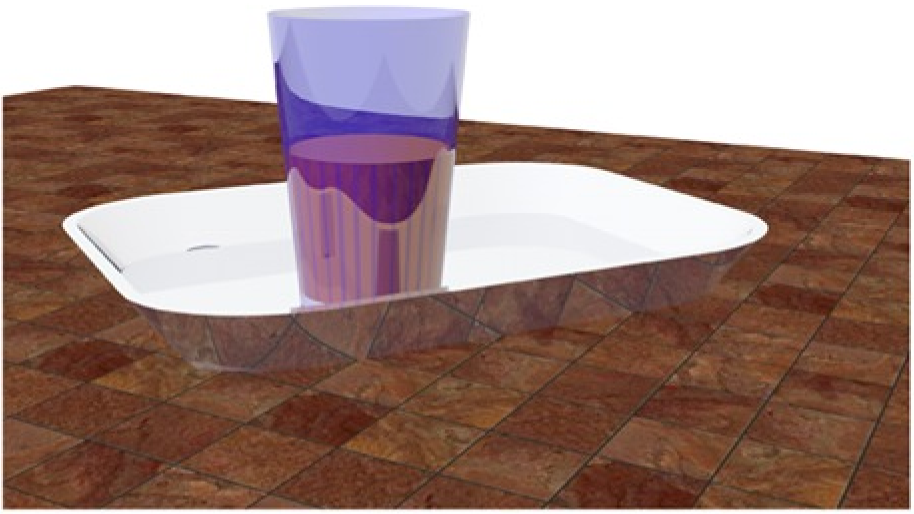
Technologies associated with reusing water or air after it has been treated to remove particles, gases and/or dissolved chemicals.

red, green and blue (RGB) colours

Digital representation of colour, displayed on *pixels*, through the use of varying amounts of red, green and blue light. By combining different amounts of each colour, many of the colours of the visible spectrum can be represented on screen.

rendered drawing

A drawing that shows a relative relationship of elements or a form of objects using texture, colour, light, shade and tone (lightness or darkness of a colour). *Rendered drawings* are used, for example, in architecture to show what a building will look like or to show the form and shape of the body of a proposed car design. Rendering can be done by hand, or using computer software such as computer-aided drawing.



rendered computer-aided drawing

REPEAT statement

A statement used for declaring *iteration* and repetition in programming code. Usually a *REPEAT statement* continues to execute until some specified condition has been met, at which point the repetition ceases. Also known as a loop and implemented in many programming languages by terms such as ‘for’ or ‘while’. An example in Pascal may look like this:

```
repeat
  a := a + 1
until a = 10;
```

where the code will repeatedly print out a number and increase its value by 1 until the number reaches 10.

resistant material

A material such as metals, plastics and timber that is usually firm and not easily bent or curved unless heat, pressure or force is applied.

resources

In Design and Technologies, this includes *technologies*, energy, time, finance and human input.

risk management

A practice of identifying potential risks in advance, analysing them and taking precautionary steps to reduce/curb the risk. *Risk management* involves risk identification, analysis, response planning, monitoring, controlling and reporting.

scale

A relationship between the actual size of an object and its representation on a drawing, map or *model*; proportional ratio (reduction or enlargement) of the actual size of an object so it will fit on a page or be more manageable to draw or represent. For example, a house plan uses *scale*. A scale of 1:20 means that each centimetre on the house plan equals 20 centimetres on the actual floor. So the actual room measurements would be divided by 20 to get the floor plan measurements. Ratios may be, for example, 1:5, 1:10, 1:50, 1:100, 1:200, 1:500, 1:1000.

secret key

A piece of information that determines the output of a *cryptographic cipher* and is kept hidden from unintended recipients. The key is required to decrypt information received to restore it to the original message, thus its secrecy is important for ensuring secure transmission of *data*. Also see *cryptography*.

SELECT statement

A statement in *structured query language* (SQL) that retrieves information from a *database*. The structure of a *SELECT statement* provides for optional clauses that allow for the filtering, grouping and sorting of *data* on retrieval. A simple SELECT statement may look like the following:

```
> SELECT * FROM People;
```

where the resulting set would be all of the records in the People table. Following is an example of a more complicated SELECT statement:

```
> SELECT * FROM People WHERE gender='m';
```

This uses the optional WHERE clause to retrieve only the males (that is, that have a gender of 'm') from the *database* table.

sensory properties

Properties that can be identified by organs of sense. Used to evaluate and describe foods in terms of the senses. The taste (sweet, sour, salty); texture or mouth feel (smooth, moist, lumpy); aroma (spicy, sweet, pungent); appearance (light, dark, golden, glossy); and noise (crunchy, fizzy, crackly) are parts of this analysis.

service

One of the *outputs* of *technologies processes*, the end result of processes and production. *Services* are a less tangible outcome (compared to *product*s) of *technologies processes* to meet a need or want. They may involve development or maintenance of a *system* and include, for example, catering, *cloud computing* (software as a *service*), communication, transportation and *water management*. Services can be communicated by charts, diagrams, models, posters and procedures.

service design

A design of a *service* and *service* concept. A *service* concept aims to meet the needs of an end user, client or customer. A *service design* includes physical, organisational, aesthetic, functional and psychological benefits of a *service* and requires *systems thinking*.

side view

Drawing of an object to show what the object looks like when viewed from its side. Also see *orthogonal drawing*.

smart material

A *material* that has extra functions designed into it, so it has extra *properties* that can be controlled by external stimuli or react to an *environment* all by themselves. These stimuli can include such things as stress, temperature, moisture, pH, electric or magnetic fields. Examples of *smartmaterials* include those that self-heal if scratched or that can detect if the foods they contain are past their 'best by' use date. These materials have been developed following extensive research and development (R&D) and manufactured to include extra 'smart behaviour' functions.

social network

A structure that describes the relationships that exist between individuals and/or organisations. Social networking services and *tools* provide a mechanism for people who share common interests or personal ties to communicate, share and interact using a range of media such as text, images and video.

social protocols

Generally accepted 'rules' or behaviours for when people interact in online environments, for example, using language that is not rude or offensive to particular cultures, and not divulging personal details about people without their permission.

social sustainability

Practices that maintain quality of life for people, societies and cultures in a changing world for a long period of time, ensuring *health* and wellbeing without disproportionate costs or side effects.

softwood

Wood from gymnosperm trees such as conifers. Examples of *softwood* include pine, spruce and cedar.

strength

The state, property or quality of a *material* or object being physically strong and able to withstand or resist a significant amount of force or pressure without breaking. This includes when a material or object is put under compression (compressive *strength*) or under tension (tensile strength). Compressive strength is measured by the material's capacity to withstand loads that are intended to reduce its size (forcing its atoms together) and to see how much it deforms or cracks. Tensile strength is measured by the material's capacity to withstand loads to extend it (forcing its atoms to be pulled apart). Also see *properties*.

structured English

The use of the English language to describe the steps of an *algorithm* in clear, unambiguous statements that can be read from start to finish. The use of keywords such as START, END, IF and UNTIL provides a syntax similar to that of a programming language to assist with identifying logical steps necessary to properly describe the algorithm.
An example of the use of structured language can be demonstrated using the following problem:
Description of the problem: Describing the decision a person makes about how to get to a destination based on the weather and the distance from their current location to their destination.
Structured English example:

```
START
IF it is raining outside THEN
  Catch the bus
ELSE
  IF it is less than 2km to the destination THEN
    Walk
  ELSE IF it is less than 10km to the destination THEN
    Ride a bicycle
  ELSE
    Catch the bus
  ENDIF
ENDIF
END
```

The *Structured English* description can easily be translated into code using a programming language and accurately captures logical elements that must be followed to answer the question posed.

structured query language (SQL)

Specialist programming language used to manage *data* and access *data* in relational *database* management systems.

supplementary feeding

The supply of animal feed by a farmer in addition to what a grazing animal can obtain from pasture.

sustainability factors

Economic, environmental and social sustainability issues that impact on design decisions.

sustainable

Supporting the needs of the present without compromising the ability of future generations to support their needs.

system

A structure, *properties*, behaviour and interactivity of people and components (*inputs*, processes and *outputs*) within and between natural, managed, constructed and digital environments.

systems thinking

A holistic approach to the identification and solving of problems, where parts and *components* of a system, their interactions and interrelationships are analysed individually to see how they influence the functioning of the whole system. This approach enables students to understand systems and work with complexity, uncertainty and risk.

technologies

Materials, *data*, systems, *components*, *tools* and *equipment* used to create solutions for identified needs and opportunities, and the knowledge, understanding and skills used by people involved in the selection and use of these.

technologies contexts

A focus and opportunities for students in Design and Technologies to use processes and production skills to design and produce products, services and environments. The prescribed *technologies contexts* for Foundation – Year 8 are: *engineering principles and systems*; *food and fibre production*; *food specialisations*; and *materials and technologiesspecialisations*.

technologies processes

Processes that allow the creation of a solution for an audience (end user, client or consumer). The processes involve the purposeful use of *technologies* and other *resources* and appropriate consideration of impact when creating and using solutions. The processes typically require critical and creative thinking such as: computational, design or *systems thinking*. The processes involve: investigating and defining; generating and *designing*; *producing* and implementing; *evaluating*; and collaborating and managing (*design processes*) and *technologies*-specific *production processes*.

technologies specialisations

Areas of specialisation that typically involve extensive use of *technologies* (for example, architecture, electronics, *graphics technologies*, fashion).

thumbnail drawing

A small drawing usually done quickly by designers, architects and *engineering* designers to indicate roughly what an object, *system* or *environment* could look like. *Thumbnail drawings* are a method of visualising thinking and show main *features* rather than minor details. They may include annotations.

tool

An implement and machine to carry out specific processes when working with *materials*. For example, a saw is an example of a tool used to cut timber; scissors are used to cut fabric, paper and cardboard; a tape measure is used to measure lengths and widths of wood and fabric; a blender is used to mix and blend food ingredients; secateurs are used to prune plants. Also see *equipment*.

top view

Drawing of an object to show what it looks like when viewed from above. Also see *orthogonaldrawing*.

transmission control protocol / internet protocol (TCP/IP)

A set of rules or standards for organising how messages are transmitted over the internet. Also see *file transfer protocol* and *hypertext transfer protocol*.

Unicode

A standard for consistent encoding and representation of text from most of the world's writing systems. Like *ASCII*, characters are mapped to unique numerical values; however, *Unicode* contains more than 100,000 characters from more than 100 different types of script.

user interface

Characteristics of the boundary between users and a computer system, or the manner in which users interact with computer hardware or software. In software, this usually comprises of fields for text and number entry, mouse pointers, buttons and other graphical elements. In hardware, switches, dials and light-emitting diodes (LEDs) provide information about the interactions between a user and a machine.

vector graphics

Images that are represented and stored on computers using geometric elements such as points, lines, curves and shapes. Unlike *bitmap* images, *vector graphics* can be easily scaled without loss of clarity due to all points used in the reproduction of the graphic having a clearly defined location and shape in two-dimensional space.
For example, if a line is drawn using vector graphics, only the two end points and the fact that it is a straight line need to be stored. To double the length of the line only needs information about one end point changed so that the software can fill in all the dots between. As a *bitmap*, each *pixel* would have to be doubled in size, making a more 'blurry' image. (The software doesn't 'know' it is a line and stores information about all the pixels that made up the line separately.)

bitmap graphic

vector graphic

vertical farming

Cultivation of plants or animals on or in a vertical space associated with a multistorey building or vertical, or near-vertical surfaces.

virtual object

A representation of an object, real or imagined, in a digital form. Examples might include a reproduction of a landmark such as the Eiffel Tower in a virtual world tour, or of a constructed spaceship in an *environment* designed to simulate changes in gravitational force or air density that would not be possible in real-world experiments.

visualisation software tools

Software to help in the recording of ideas as visual representations. Examples in are *computer-aided drawing* (or computer-assisted design – CAD) and computer simulation. *Graphic organisers* are visualisation *tools* as are software that display graphs of *data*.

visual programming

A programming language or *environment* where a program is represented and manipulated graphically rather than as text. A common visual metaphor represents statements and control structures as graphic blocks that can be composed to form programs, allowing programming without having to deal with textual syntax. Examples of *visual programming* languages include: Alice, GameMaker, Kodu, Lego Mindstorms, MIT App Inventor, Scratch (Build Your Own Blocks and Snap).
Note: A *visual programming* language should not be confused with programming languages for creating visualisations or programs with user interfaces, for example, Processing or Visual Basic.

warmth

The sensation of being warm. *Warmth* of a fabric is determined by the arrangement of *fibres*, *fibre* size, shape and structure and thermal conductive *properties* of the fibres. Generally speaking, the smaller and finer the fibres, the more insulating the garment, because more air is trapped between the fibres. Protein-based fibres (wool, fur) and polypropylene and polyester are the least thermally conductive *materials*.

water management

A way water *resources* are monitored and used by humans. This can include the use of dams, irrigation systems, bores, windmills and testing the quality of water and levels of pollution.

web-authoring software

A computer program designed to assist in the creation of web pages. Simple *web-authoring software* may take a form of a basic text editor, or may contain more advanced *features* that allow for editing the content and layout of a web page.

water-efficient irrigation

Systems that supply water in a manner that maximises the plant growth associated with each unit of applied water. Irrigation systems may use targeted delivery into the root zone of plants or may apply water to minimise losses through evaporation or soil infiltration.

while loop

A set of instructions in a loop with a test at the top – a programmatic implementation of *iteration* or *repeat*. The beginning and ending of the loop may be indicated by key words ‘while’ and ‘endwhile’; however, this will vary depending on the syntax of the programming language used. Sometimes it is referred to as a ‘do while’ loop and in some languages a ‘do’ loop is used instead.

wireless device

A device that transmits and receives *data* from other sources, using electromagnetic radiation (for example, radio waves) rather than being connected by electrical conductors such as wires. A common example of a wireless device is a mobile phone, which uses radio waves of a specific frequency to connect to telecommunications towers for the purpose of communication.

wool fibre diameter

The thickness of a wool *fibre* measured in microns (the millionth part of a metre). The smaller the measure, the finer the *fibre*.

working model

Engineering simulation software *product* that, when run, can be used to test how virtual components interact. A program can simulate various interactions of the parts (components) and graph the movement and force on any element in a system. These *working models* are also known as prototypes and can be used to evaluate performance, and make alterations and improvements if necessary.

The Australian Curriculum

Technologies - Design and Technologies

Design and Technologies - How the Subject works

This rationale complements and extends the rationale for the Technologies learning area.

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.

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.

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.

Table 2 outlines the focus of expected knowledge, understanding and skills in Design and Technologies F–10 and Figure 2 illustrates the relationship between the Design and Technologies strands.

Table 2: Design and Technologies content structure

Knowledge and understanding	Processes and production skills
Technologies and society • the use, development and impact of technologies in people's lives Technologies contexts • technologies and design across a range of technologies contexts	Creating designed solutions by: • investigating and defining • generating and designing • producing and implementing • evaluating • collaborating and managing

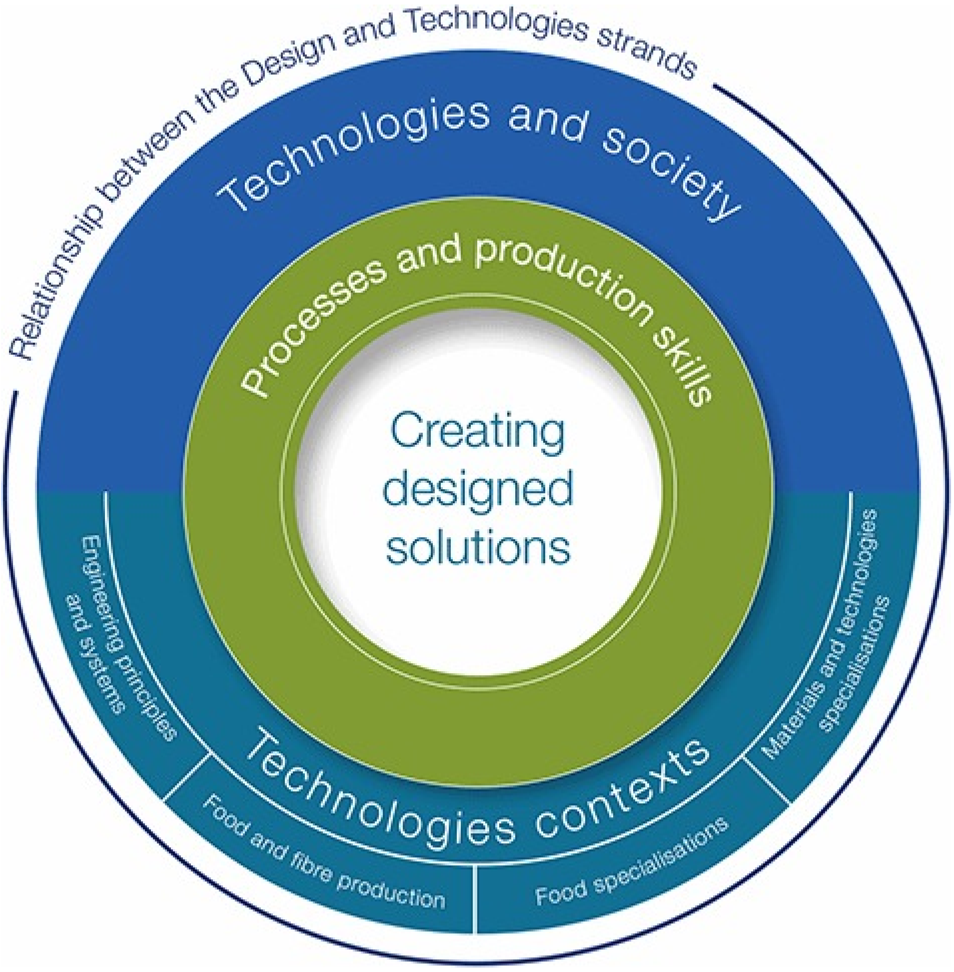


Figure 2: Relationship between the Design and Technologies strands

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 includes 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.

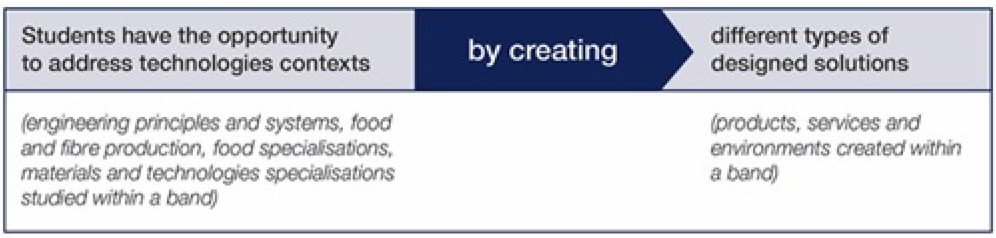


Figure 3 outlines the relationship between technologies contexts and types of designed solutions.

Figure 3: Relationship between technologies contexts and types of designed solutions

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.

The Australian Curriculum

Technologies - Design and Technologies

Curriculum F-10

Years 9 and 10 Level 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 10 students will have had the opportunity to design and produce at least four designed solutions focused on one or more of the five technologies contexts content descriptions. There is one optional content description for each of the following: Engineering principles and systems, Food and fibre production, Food specialisations and Materials and technologies specialisations. There is an additional open content description to provide flexibility and choice. Students should have opportunities to experience creating designed solutions for products, services and environments.

In Year 9 and 10 students use design and technologies knowledge and understanding, processes and production skills and design thinking to produce designed solutions to identified needs or opportunities of relevance to individuals and regional and global communities. Students work independently and collaboratively. Problem-solving activities acknowledge the complexities of contemporary life and make connections to related specialised occupations and further study. Increasingly, study has a global perspective, with opportunities to understand the complex interdependencies involved in the development of technologies and enterprises. Students specifically focus on preferred futures, taking into account ethics; legal issues; social values; economic, environmental and social sustainability factors and using strategies such as life cycle thinking. Students use creativity, innovation and enterprise skills with increasing confidence, independence and collaboration.

Using a range of technologies including a variety of graphical representation techniques to communicate, students generate and represent original ideas and production plans in two and three-dimensional representations using a range of technical drawings including perspective, scale, orthogonal and production drawings with sectional and exploded views. They produce rendered, illustrated views for marketing and use graphic visualisation software to produce dynamic views of virtual products.

Students identify the steps involved in planning the production of designed solutions. They develop detailed project management plans incorporating elements such as sequenced time, cost and action plans to manage a range of design tasks safely. They apply management plans, changing direction when necessary, to successfully complete design tasks. Students identify and establish safety procedures that minimise risk and manage projects with safety and efficiency in mind, maintaining safety standards and management procedures to ensure success. They learn to transfer theoretical knowledge to practical activities across a range of projects.

Years 9 and 10 Content Descriptions

Design and Technologies Knowledge and Understanding

Critically analyse factors, including social, ethical and sustainability considerations, that impact on designed solutions for global preferred futures and the complex design and production processes involved (ACTDEK040 - Scootle)

Elaborations

evaluating design and technology professions and their contributions to society locally, nationally, regionally and globally, for example Aboriginal designers collaborating with international craftspeople for local enterprises

recognising the impact of past designed solutions and possible decisions when creating preferred futures, for example the design of public transport systems that use renewable energy and the design of rural communities to reduce fire risk

considering the factors that influence design and professional designers and technologists, including time, access to skills, knowledge, finance, expertise, for example Australian designers working with rapid prototyping manufacturers in China

explaining how product life cycle thinking can influence decision-making related to design and technologies, for example rethinking products to provide for re-use, selecting a material for a product that has a lower carbon footprint

critiquing mass production systems taking into account ethics and sustainability considerations, for example the mass production of food, clothing and shoes and why manufacturers produce different versions of the same product

Explain how products, services and environments evolve with consideration of preferred futures and the impact of emerging technologies on design decisions (ACTDEK041 - Scootle)

Elaborations

considering how creativity, innovation and enterprise contribute to how products, services and environments evolve, for example how designers use biomimicry, the ways plant and animal adaptations can be copied to solve human challenges, such as the Japanese building Sendai Mediatheque based on seaweed-like tubes

exploring the ways commercial enterprises respond to the challenges and opportunities of technological change, for example e-commerce, and carbon footprint

explaining the consequences of social, ethical and sustainability decisions for products, services and environments, for example a managed public environment such as a theme park

predicting the impact of emerging technologies for preferred futures

constructing scenarios of how the future may unfold (forecasting) and what impacts there may be for society and particular groups, and back casting from preferred futures

recognising real-world problems and understanding basic needs when considering designed solutions, for example Engineers Without Borders High School Outreach Program allows students to design solutions to problems in a country in Asia

Investigate and make judgements on how the characteristics and properties of materials are combined with force, motion and energy to create engineered solutions
(ACTDEK043 - Scootle)

Elaborations

explaining the way common machines combine properties of materials and force, motion and energy in, for example, cranes on building sites

examining and explaining the interaction between material properties and function of a common system, such as car brakes analysing the relationship between materials of properties, forces and safety in engineered systems such as bridges

critiquing the effectiveness of the combinations of materials, forces, energy and motion in an engineered system such as a 3D printer

calculating forces, reactions and loads in structures

Investigate and make judgements on the ethical and sustainable production and marketing of food and fibre
(ACTDEK044 - Scootle)

Elaborations

examining emerging production technologies and methods in terms of productivity, profitability and sustainability, for example vertical farming, recirculation technologies in aquaculture

investigating how digital technologies could be used to enhance food production systems, for example global positioning system (GPS) for managing animals, crop sensors or automated animal feeding or milking

comparing the environmental impacts of intensive and extensive production systems and their contribution to food and fibre production

investigating the interdependence of plants and animals in food and fibre production

examining the marketing chain of a range of agricultural products and outlining the effect of product processing and advertising on demand and price

taking account of animal welfare considerations in food and fibre production enterprises

Investigate and make judgements on how the principles of food safety, preservation, preparation, presentation and sensory perceptions influence the creation of food solutions for healthy eating (ACTDEK045 - Scootle)

Elaborations

experimenting with food preservation methods such as freezing and dehydrating to determine changes to food structure and how these impact on designing healthy food solutions, for example dehydrating fruit for the lunch box

conducting sensory assessment testing of a range of foods to determine how these characteristics might be used to enhance food solutions, for example taste testing a variety of milks, comparing freshly squeezed juice to commercial juices

determining how the causes of food spoilage can be addressed when preparing, cooking, presenting and storing food items, for example developing a comprehensive checklist of considerations for safe and hygienic food storage and preparation including danger zone temperatures for a food service

preparing and presenting foods using a range of techniques to ensure optimum nutrient content, flavour, texture and visual appeal, for example designing and producing a healthy snack for the canteen and using food photography and digital technologies to promote the item in a healthy eating campaign

Investigate and make judgements on how the characteristics and properties of materials, systems, components, tools and equipment can be combined to create designed solutions (ACTDEK046 - Scootle)

Elaborations

critiquing the design of an existing product to identify environmental consequences of material selection

justifying decisions when selecting from a broad range of technologies − materials, systems, components, tools and equipment, for example selecting low-emission paints and locally sourced materials

analysing and explaining the ways in which the properties and characteristics of materials have been considered in the design of a product with specific requirements such as reduced weight to reduce transport costs in rural Australia

investigating emerging materials and their impact on design decisions

Investigate and make judgements, within a range of technologies specialisations, on how technologies can be combined to create designed solutions
(ACTDEK047 - Scootle)

Elaborations

examining factors influencing the design of a product that has an explicit environmental emphasis, for example the low-flush toilet

critiquing product manufacturing processes in relation to society, ethics, and sustainability factors, for example a mechanised entertainment system; an interactive multimedia product to teach a concept to a student in a country in Asia

critiquing the social nature of services, for example a signage system to manage students and community members during a school function (signs may include words, pictures and/or braille); organisational system for an aged-care facility

critiquing environments in relation to preferred futures in relation to society, ethics and sustainability practices, for example the refurbishment of a local playground; the re-design of a local wetland

Design and Technologies Processes and Production Skills

Critique needs or opportunities to develop design briefs and investigate and select an increasingly sophisticated range of materials, systems, components, tools and equipment to develop design ideas
(ACTDEP048 - Scootle)

Elaborations

critiquing the design of new products to identify how well design ideas respond to sustainability issues

critiquing a range of design and technologies ideas, for example assessing those that draw on the intellectual property of others, exploring how well the ideas respond to international and Australian standards

considering the needs of community groups to identify rich design tasks

examining relationships of properties for complementary materials for products, for example examining compressive and tensile strengths of materials

identifying appropriate tools, equipment, techniques and safety procedures for each process and evaluating production processes for accuracy, quality, safety and efficiency

Develop, modify and communicate design ideas by applying design thinking, creativity, innovation and enterprise skills of increasing sophistication (ACTDEP049 - Scootle)

Elaborations

using techniques including combining and modifying ideas and exploring functionality to generate solution concepts

undertaking functional, structural and aesthetic analyses of benefits and constraints of design ideas, for example to different communities and environments including those from the countries of Asia

re-imagining designs to feature emerging technologies

considering competing variables that may hinder or enhance project development, for example weight, strength and price; laws; social protocols and community consultation processes producing drawings, models and prototypes to explore design ideas, for example using technical drawing techniques, digital imaging programs, 3D printers or augmented reality modelling software; producing multiple prototypes that show an understanding of key aesthetic considerations in competing designs

communicating using appropriate technical terms and recording the generation and development of design ideas for an intended audience including justification of decisions, for example developing a digital portfolio with images and text which clearly communicates each step of a design process

Work flexibly to effectively and safely test, select, justify and use appropriate technologies and processes to make designed solutions (ACTDEP050 - Scootle)

Elaborations

refining technical skills and using production skills with independence to produce quality designed solutions and to reduce risks in production

using materials, components, tools, equipment and techniques safely and considering alternatives to maximise sustainability, for example using timber because it stores carbon and offsets the demand for alternative products

experimenting with innovative combinations and ways of manipulating traditional and contemporary materials, components, tools, equipment and techniques, and recording findings in a collaborative space to debate the merits of each with peers

explaining safe working practices required for a specific classroom design project for individual or community use

modifying production processes to respond to unforeseen challenges or opportunities, for example when producing bulk quantities of recipes, lower than average rainfall and impacts on growth, materials with unexpected faults

Evaluate design ideas, processes and solutions against comprehensive criteria for success recognising the need for sustainability (ACTDEP051 - Scootle)

Elaborations

establishing specific criteria for success for evaluating designed solutions

evaluating and justifying the use and best combination of traditional, contemporary and emerging technologies during project development, including consideration of sustainability, for example farming methods in South-East Asia

evaluating choices made at various stages of a design process and modifying plans when needed with consideration of criteria for success

evaluating projects for their long-term application, functionality and impact

reflecting on learning, evaluating processes and transferring new knowledge and skills to future design projects

Develop project plans using digital technologies to plan and manage projects individually and collaboratively taking into consideration time, cost, risk and production processes (ACTDEP052 - Scootle)

Elaborations

producing, explaining and interpreting drawings; and planning production timelines using digital technologies

creating production flowcharts using digital technologies to ensure efficient, safe and sustainable sequences

establishing materials and equipment needs using digital technologies such as spreadsheets

collaborating to develop production plans for equitable distribution of work investigating manufacturing processes to identify strategies to enhance production

Years 9 and 10 Achievement Standards

By the end of Year 10, students explain how people working in design and technologies occupations consider factors that impact on design decisions and the technologies used to produce products, services and environments. They identify the changes necessary to designed solutions to realise preferred futures they have described. When producing designed solutions for identified needs or opportunities, students evaluate the features of technologies and their appropriateness for purpose for one or more of the technologies contexts.

Students create designed solutions for one or more of the technologies contexts based on a critical evaluation of needs or opportunities. They establish detailed criteria for success, including sustainability considerations, and use these to evaluate their ideas and designed solutions and processes. They create and connect design ideas and processes of increasing complexity and justify decisions. Students communicate and document projects, including marketing for a range of audiences. They independently and collaboratively apply sequenced production and management plans when producing designed solutions, making adjustments to plans when necessary. They select and use appropriate technologies skilfully and safely to produce high-quality designed solutions suitable for the intended purpose.

The Australian Curriculum

Technologies - Digital Technologies

Digital Technologies - How the Subject works

This rationale complements and extends the rationale for the Technologies learning area.

In a world that is increasingly digitised and automated, it is critical to the wellbeing and sustainability of the economy, the environment and society, that the benefits of information systems are exploited ethically. This requires deep knowledge and understanding of digital systems (a component of an information system) and how to manage risks. Ubiquitous digital systems such as mobile and desktop devices and networks are transforming learning, recreational activities, home life and work. Digital systems support new ways of collaborating and communicating, and require new skills such as computational and systems thinking. These technologies are an essential problem-solving toolset in our knowledge-based society.

The Australian Curriculum: Digital Technologies empowers students to shape change by influencing how contemporary and emerging information systems and practices are applied to meet current and future needs. A deep knowledge and understanding of information systems enables students to be creative and discerning decision-makers when they select, use and manage data, information, processes and digital systems to meet needs and shape preferred futures.

Digital Technologies provides students with practical opportunities to use design thinking and to be innovative developers of digital solutions and knowledge. The subject helps students to become innovative creators of digital solutions, effective users of digital systems and critical consumers of information conveyed by digital systems.

Digital Technologies provides students with authentic learning challenges that foster curiosity, confidence, persistence, innovation, creativity, respect and cooperation. These are all necessary when using and developing information systems to make sense of complex ideas and relationships in all areas of learning. Digital Technologies helps students to be regional and global citizens capable of actively and ethically communicating and collaborating.

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

- design, create, manage and evaluate sustainable and innovative digital solutions to meet and redefine current and future needs
- use computational thinking and the key concepts of abstraction; data collection, representation and interpretation; specification, algorithms and implementation to create digital solutions
- 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
- apply protocols and legal practices that support safe, ethical and respectful communications and collaboration with known and unknown audiences
- apply systems thinking to monitor, analyse, predict and shape the interactions within and between information systems and the impact of these systems on individuals, societies, economies and environments.

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

- Digital Technologies knowledge and understanding – the information system components of data,

and digital systems (hardware, software and networks)
- Digital Technologies processes and production skills – using digital systems to create ideas and information, and to define, design and implement digital solutions, and evaluate these solutions and existing information systems against specified criteria.

Table 3 outlines the focus of expected knowledge, understanding and skills in Digital Technologies F–10 and Figure 4 illustrates the relationship between the Digital Technologies strands.

Table 3: Digital Technologies content structure

Knowledge and understanding	**Processes and production skills**
Digital systems • the components of digital systems: hardware, software and networks and their use Representation of data • how data are represented and structured symbolically	Collecting, managing and analysing data Creating digital solutions by: • investigating and defining • generating and designing • producing and implementing • evaluating • collaborating and managing

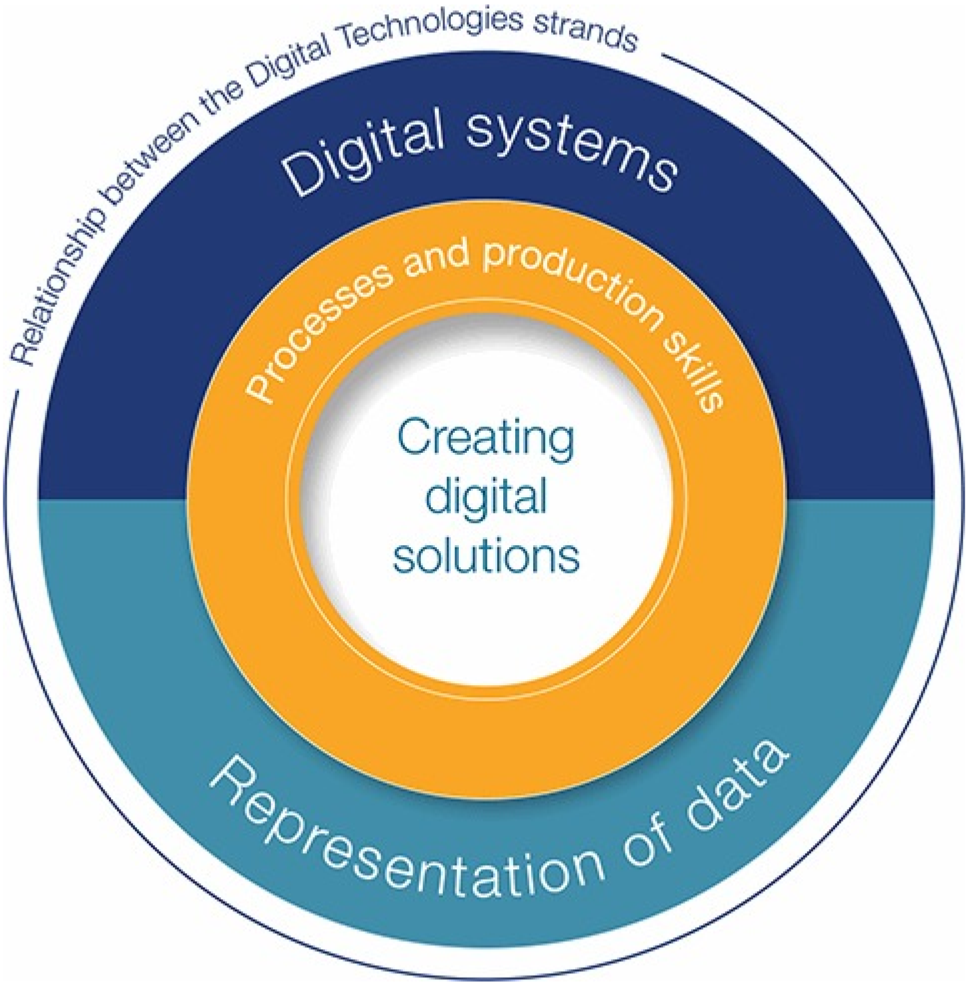


Figure 4: Relationship between the Digital Technologies strands

Relationship between the strands

Together, the two strands provide students with knowledge, understanding and skills through which they can safely and ethically exploit the capacity of information systems (people, data, processes, digital systems and their interactions) to systematically transform data into solutions that respond to the needs of individuals, society, the economy and the environment. Teaching and learning programs will typically integrate these, as content in processes and production skills frequently draws on understanding of concepts in the knowledge and understanding strand.

The strands are based on key concepts that provide a framework for knowledge and practice in Digital Technologies. For more information see Key concepts below.

Digital Technologies knowledge and understanding

This strand focuses on developing the underpinning knowledge and understanding of information systems: digital systems and representation of data.

Digital systems

The digital systems content descriptions focus on the components of digital systems: hardware, software and networks. In the early years, students learn about a range of hardware and software and progress to an understanding of how data are transmitted between components within a system, and how the hardware and software interact to form networks.

Representation of data

The representation of data content descriptions focus on how data are represented and structured symbolically for use by digital systems. Different types of data are studied in the bands including text, numeric, images (still and moving) and sound from Foundation to Year 8 and then categorical and relational data in Year 9 and 10.

Digital Technologies processes and production skills

This strand focuses on developing skills to create digital solutions to problems and opportunities. The Digital Technologies processes and production skills strand focuses on:

- collecting, managing and analysing data, which involves the nature and properties of data, how they are collected and interpreted using a range of digital systems and peripheral devices and interpreting data when creating information
- defining problems and designing digital solutions (Foundation – Year 2), which develops into defining problems and designing, implementing and evaluating solutions that have been developed by students, and evaluating how well existing information systems meet different needs (Year 3–10)
- communicating ideas and information (Foundation – Year 4), which develops into managing, creating and communicating ideas and information (Year 5–6) through to independently and collaboratively managing projects to create interactive solutions (Year 7–10). This involves creating and communicating information, especially online by creating websites, and interacting safely using appropriate technical and social protocols.

These require skills in using digital systems; and critical and creative thinking including systems, design and computational thinking.

Computational thinking

The curriculum is designed so that students will develop and use increasingly sophisticated computational thinking skills, and processes, techniques and digital systems to create solutions to address specific problems, opportunities or needs. Computational thinking is a process of recognising aspects of computation in the world and being able to think logically, algorithmically, recursively and abstractly. Students will also apply procedural techniques and processing skills when creating, communicating and sharing ideas and information, and managing projects.

Key concepts

A number of key concepts underpin the Digital Technologies curriculum. These establish a way of thinking about problems, opportunities and information systems and provide a framework for knowledge and practice. The key concepts are:

- **abstraction**, which underpins all content, particularly the content descriptions relating to the concepts of data representation, and specification, algorithms and implementation
- **data collection** (properties, sources and collection of data), **data representation** (symbolism and separation) and **data interpretation** (patterns and contexts)
- **specification** (descriptions and techniques), **algorithms** (following and describing) and **implementation** (translating and programming)
- **digital systems** (hardware, software, and networks and the internet)
- **Interactions** (people and digital systems, data and processes) and **impacts** (sustainability and empowerment).

The concepts of abstraction, data collection, representation and interpretation, specification, algorithms and implementation correspond to the key elements of computational thinking. Collectively, these concepts span the key ideas about the organisation, representation and automation of digital solutions and information. They can be explored in non-digital or digital contexts and are likely to underpin future digital systems. They provide a language and perspective that students and teachers can use when discussing digital technologies.

Abstraction

Abstraction involves hiding details of an idea, problem or solution that are not relevant, to focus on a manageable number of aspects. Abstraction is a natural part of communication: people rarely communicate every detail, because many details are not relevant in a given context. The idea of abstraction can be acquired from an early age. For example, when students are asked how to make toast for breakfast, they do not mention all steps explicitly, assuming that the listener is an intelligent implementer of the abstract instructions.

Central to managing the complexity of information systems is the ability to ‘temporarily ignore’ the internal details of the subcomponents of larger specifications, algorithms, systems or interactions. In digital systems, everything must be broken down into simple instructions.

Data collection, representation and interpretation

The concepts that are about data focus on the properties of data, how they are collected and represented, and how they are interpreted in context to produce information. These concepts in Digital Technologies build on a corresponding statistics and probability strand in the Mathematics curriculum. The Digital Technologies curriculum provides a deeper understanding of the nature of data and their representation, and computational skills for interpreting data. The data concepts provide rich opportunities for authentic data exploration in other learning areas while developing data processing and visualisation skills.

Data collection describes the numerical, categorical and textual facts measured, collected or calculated as the basis for creating information and its binary representation in digital systems. Data collection is addressed in the processes and production skills strand. Data representation describes how data are represented and structured symbolically for storage and communication, by people and in digital systems, and is addressed in the knowledge and understanding strand. Data interpretation describes the processes of extracting meaning from data and is addressed in the processes and production strand.

Specification, algorithms and implementation

The concepts specification, algorithms and implementation focus on the precise definition and communication of problems and their solutions. This begins with the description of tasks and concludes in the accurate definition of computational problems and their algorithmic solutions. This concept draws from logic, algebra and the language of mathematics, and can be related to the scientific method of recording experiments in science.

Specification describes the process of defining and communicating a problem precisely and clearly. For example, explaining the need to direct a robot to move in a particular way. An algorithm is a precise description of the steps and decisions needed to solve a problem. Algorithms will need to be tested before the final solution can be implemented. Anyone who has followed or given instructions, or navigated using directions, has used an algorithm. These generic skills can be developed without programming. For example, students can follow the steps within a recipe or describe directions to locate items. Implementation describes the automation of an algorithm, typically by using appropriate software or writing a computer program. These concepts are addressed in the processes and production skills strand.

Digital systems

The digital systems concept focuses on the components of digital systems: hardware and software (computer architecture and the operating system), and networks and the internet (wireless, mobile and wired networks and protocols). This concept is addressed in both strands. The broader definition of an information system that includes data, people, processes and digital systems falls under the interactions and impacts concept below.

Interactions and impacts

The interactions and impacts concepts focus on all aspects of human interaction with and through information systems, and the enormous potential for positive and negative economic, environmental and social impacts enabled by these systems. Interactions and impacts are addressed in the processes and production skills strand.

Interactions refers to all human interactions with information systems, especially user interfaces and experiences, and human–human interactions including communication and collaboration facilitated by digital systems. This concept also addresses methods for protecting stored and communicated data and information.

Impacts describes analysing and predicting the extent to which personal, economic, environmental and social needs are met through existing and emerging digital technologies; and appreciating the transformative potential of digital technologies in people’s lives. It also involves consideration of the relationship between information systems and society and in particular the ethical and legal obligations of individuals and organisations regarding ownership and privacy of data and information.

Types of digital solutions

Across each band, students will create digital solutions that will use data, require interactions with users and within systems, and will have impacts on people, the economy and environments. Solutions may be developed using combinations of readily available hardware and software applications, and/or specific instructions provided through programming. Some examples of solutions are instructions for a robot, an adventure game, products featuring interactive multimedia including digital stories, animations and websites.

The Australian Curriculum

Technologies - Digital Technologies

Curriculum F-10

Years 9 and 10 Level Description

Learning in Digital Technologies focuses on further developing understanding and skills in computational thinking such as precisely and accurately describing problems and the use of modular approaches to solutions. It also focuses on engaging students with specialised learning in preparation for vocational training or learning in the senior secondary years.

By the end of Year 10, students will have had opportunities to analyse problems and design, implement and evaluate a range of digital solutions, such as database-driven websites and artificial intelligence engines and simulations.

In Year 9 and 10, students consider how human interaction with networked systems introduces complexities surrounding access to, and the security and privacy of, data of various types. They interrogate security practices and techniques used to compress data, and learn about the importance of separating content, presentation and behavioural elements for data integrity and maintenance purposes.

Students explore how bias can impact the results and value of data collection methods and they use structured data to analyse, visualise, model and evaluate objects and events.

They learn how to develop multilevel abstractions, identify standard elements such as searching and sorting in algorithms, and explore the trade-offs between the simplicity of a model and the faithfulness of its representation.

When defining problems students consider the functional and non-functional requirements of a solution through interacting with clients and regularly reviewing processes. They consolidate their algorithmic design skills to incorporate testing and review, and further develop their understanding of the user experience to incorporate a wider variety of user needs. Students develop modular solutions to complex problems using an object-oriented programming language where appropriate, and evaluate their solutions and existing information systems based on a broad set of criteria including connections to existing policies and their enterprise potential. They consider the privacy and security implications of how data are used and controlled, and suggest how policies and practices can be improved to ensure the sustainability and safety of information systems.

Students progressively become more skilled at identifying the steps involved in planning solutions and developing detailed plans that are mindful of risks and sustainability requirements. When creating solutions, both individually and collaboratively, students comply with legal obligations, particularly with respect to the ownership of information, and when creating interactive solutions for sharing in online environments.

Years 9 and 10 Content Descriptions

Digital Technologies Knowledge and Understanding

Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems (ACTDIK034 - Scootle)

Elaborations

explaining how an operating system manages the relationship between hardware, applications and system software

comparing the similarities and differences of two common operating systems

identifying how changes to the configuration of an operating system change the operation of hardware and software components in a networked digital system

explaining the role of hardware and software components in allowing people to interact with digital systems, for example using a mouse or touch pad or screen, speech, accelerometer

investigating the operation and use of robotic process control systems

explaining encryption of data as a means of protecting data, for example secret keys and 'exclusive or' (XOR) and hashing algorithms to digitally sign data

Analyse simple compression of data and how content data are separated from presentation (ACTDIK035 - Scootle)

Elaborations

explaining how simple compression schemes reduce the size of repetitive data, for example how run length encoding reduces the size of images explaining the difference between lossy and lossless compression, for example the difference between JPEG and PNG images

explaining codecs for audio-visual compression, for example common codecs for video formats

generating a layout or report in a database or applying a style sheet to a web page

Digital Technologies Processes and Production Skills

Develop techniques for acquiring, storing and validating quantitative and qualitative data from a range of sources, considering privacy and security requirements (ACTDIP036 - Scootle)

Elaborations

developing strategies and techniques for capturing accurate and usable qualitative and quantitative data of different formats, for example using text entry for open-ended questions to acquire qualitative data; using radio buttons or checkboxes for closed questions to acquire quantitative data

identifying strengths and weaknesses of collecting data using different methods, for example online surveys, face-to-face interviews, phone interviews, observation, blog entries in response to a posting, phone logs, browser history and online webcam systems

developing strategies to ensure the privacy and security of survey data, for example using numbers rather than names as identifiers; password protecting files to reduce risks of modifying data and using CAPTCHA™ to confirm human responses

extracting specific data from an external source and storing it in a format that is more useful for analysis, for example combining mapping data from multiple electronic data sets to build a composite representation

Analyse and visualise data to create information and address complex problems, and model processes, entities and their relationships using structured data (ACTDIP037 - Scootle)

Elaborations

using visualisation software tools to identify patterns and relationships between sets of data and information, and support abstract reasoning, for example representing data using histograms, network diagrams and maps

summarising data using advanced filtering and grouping techniques, for example pivot tables in spreadsheets and aggregation functions in databases

automating calculations, for example using absolute cell referencing to automatically extend formulas, and automating arithmetic calculations using built-in functions such as trigonometry, compound interest

simulating simple, iterative processes, for example modelling compound interest or ecological models using a spreadsheet

documenting the attributes of complex objects and processes using a data dictionary

interpreting schemas that represent relationships between entities and querying data across tables, for example using foreign keys to represent relationships and joining tables in structured query language (SQL) SELECT statements

Define and decompose real-world problems precisely, taking into account functional and non-functional requirements and including interviewing stakeholders to identify needs (ACTDIP038 - Scootle)

Elaborations

developing a preliminary specification for an opportunity or a need that typically contains a problem statement, a set of solution needs expressed as functional and non-functional requirements, any assumptions or constraints to be considered and the scope or boundaries of the solution investigating different types of functional requirements for solutions, for example increasing the speed of processing, calculating new results, improving the quality of reports

investigating different types of non-functional requirements for solutions, for example considering how the requirements of reliability, user-friendliness, portability and robustness could affect the way people use solutions

identifying the range of stakeholders who are associated with solutions but are not direct users and using techniques such as interviewing and reinterviewing to clarify needs

using software such as graphic organisers to determine a fundamental cause of a problem or to represent related elements of a problem that need to be jointly addressed in the digital solution

testing a range of text and graphical user interface designs with clients who have different needs on the basis of time taken to complete the task and the number of errors made

Design the user experience of a digital system by evaluating alternative designs against criteria including functionality, accessibility, usability, and aesthetics (ACTDIP039 - Scootle)

Elaborations

designing the user interface of a solution using story boards and mock-ups, for example mocking up the product design of an app for people with disability

identifying similar digital systems and existing user interfaces, assessing whether their elements can be reused

evaluating aspects of the total user experience, that is, all aspects of the system as perceived by the users, for example, a user's initial experience of setting up and using a system, or a user's emotional or cultural response to using a digital system

designing documentation, branding, and marketing for a digital solution, for example a product demonstration screencast or 'getting started' user guide

applying the principles and elements of design to a client's requirements and evaluating the success of a solution through an iterative feedback process, for example using customer feedback to refine a user interface to more effectively provide access to important features

Design algorithms represented diagrammatically and in structured English and validate algorithms and programs through tracing and test cases (ACTDIP040 - Scootle)

Elaborations

designing algorithms to solve real-world problems and describing algorithms using flow charts and structured English, for example START, END, IF and UNTIL

recognising that different algorithms can solve a problem with different trade-offs

tracing algorithms to predict results and program state for a given input, for example desk checking or using an interactive debugging tool

using tracing techniques to test algorithms, for example desk checking an algorithm for a given input by stepping through the algorithm while keeping track of contents of the variables

developing test cases that correspond to the requirements of the specifications, for example validating program behaviour on a range of valid and invalid user input

Implement modular programs, applying selected algorithms and data structures including using an object-oriented programming language (ACTDIP041 - Scootle)

Elaborations

coding separate modules that perform discrete functions but collectively meet the needs of the solution defining classes that represent the attributes and behaviour of objects in the real world or in a game

considering different algorithms and selecting the most appropriate based on the type of problem, for example choosing appropriate algorithms for particular problems

selecting different types of data structures such as an array, record and object to model structured data

Evaluate critically how student solutions and existing information systems and policies, take account of future risks and sustainability and provide opportunities for innovation and enterprise (ACTDIP042 - Scootle)

Elaborations

investigating actions, devices and events that are potential risks to information systems, for example losing portable storage devices containing important files, deliberately infecting systems through malware, and power surges

investigating techniques used by people and organisations to shape how information systems are used, for example refusing to use innovations, using social media to advocate behaviours, purchasing devices, withdrawing previous processes that can now only be performed by an information system

investigating the impact and opportunities created through the practice of planned obsolescence, for example discussing the benefits and risks to users, the creators and the environment of information systems having a defined life span, taking into account costs, research and resource extraction

examining the ICT policy for schooling and evaluating the impact on education

reviewing the 'terms of use' policies on social media networks and predicting ways in which these can support advocacy of change and protection of individuals and societies

reviewing state, national and regional policies and analysing the potential impact of each. Examples of policies include: *Australian Government Protective Security Policy Framework*, the *Australian*

Government ICT Sustainability Plan 2010–2015; the *Green Growth Policy* in Korea and the *Korean National Strategy for Sustainable Development*

Create interactive solutions for sharing ideas and information online, taking into account safety, social contexts and legal responsibilities (ACTDIP043 - Scootle)

Elaborations

investigating legal responsibilities of organisations regarding the storage, communication and disposal of personal and organisational data, for example the Australian Privacy Principles as they apply to intellectual property

applying techniques to make ethical decisions when faced with dilemmas about security and ownership of data, for example selecting an action that results in the greatest benefit for the most number of people; avoiding the use of photos of deceased persons from Aboriginal and Torres Strait Islander communities

creating an interactive web-based project that provides enterprising opportunities and complies with accessibility requirements, for example using fragments of a web language to create dynamic content that supports interactivity

creating online interactive solutions for working with others by combining or modifying online software tools to support project work

Plan and manage projects using an iterative and collaborative approach, identifying risks and considering safety and sustainability (ACTDIP044 - Scootle)

Elaborations

managing and modifying the development of a solution, for example using software to record and monitor project tasks, responsibilities and timeframes and to organise continuous opportunities to review progress with collaborative partners and to conduct regular unit testing

developing an evolutionary prototype iteratively and incrementally, for example regularly revising features of an application in response to user feedback and development decisions investigating indicators of economic success, for example the capacity to scale up an innovative solution to meet the demands of a mass market and the savings accrued through sustainable practices

investigating major causes of threats to data, for example human actions such as losing a storage device, disclosing passwords, theft and fraud

Years 9 and 10 Achievement Standards

By the end of Year 10, students explain the control and management of networked digital systems and the security implications of the interaction between hardware, software and users. They explain simple data compression, and why content data are separated from presentation.

Students plan and manage digital projects using an iterative approach. They define and decompose complex problems in terms of functional and non-functional requirements. Students design and evaluate user experiences and algorithms. They design and implement modular programs, including an object-oriented program, using algorithms and data structures involving modular functions that reflect the relationships of real-world data and data entities. They take account of privacy and security requirements when selecting and validating data. Students test and predict results and implement digital solutions. They evaluate information systems and their solutions in terms of risk, sustainability and potential for innovation and enterprise. They share and collaborate online, establishing protocols for the use, transmission and maintenance of data and projects.