Years 3 and 4

Rationale
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 (as a component of an information system) and how to manage risks. Ubiquitous digital systems such as mobile and desktop devices and networks are transforming the way we communicate, conduct recreational activities, home 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 tool 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 understanding and awareness of information systems enables students to create and discern decision-makers when they select, use and manage data, information, processes and digital systems to meet their 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.

Aims
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 and 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
- understand that digital systems are a means 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.

Key Ideas

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 interdependencies are monitored and managed so that they influence the functioning of the entire system.

In Design and Technologies, the success of designed solutions depends on the understanding of ideas and decisions made throughout design processes. It requires students to understand systems and work with consensus not just to perform tasks. 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.

Computational thinking
Computational thinking involves the use of strategies for understanding design needs and opportunities, visualisation and generating creative concepts, ideas, planning 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 design ideas and concepts, and evaluate products and processes. Consideration of economic, environmental and social impacts that result from design 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 effective computer instructions for the robot to travel 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 used in learning environments to develop computational thinking. 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 modeling 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.

In the Australian Curriculum: Digital Technologies curriculum and the ICT general capability it is the capability that helps students to become effective users of digital technologies while the Digital Technologies curriculum helps students to become confident designers 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 curriculum, the safety implications of using, developing or creating digital technologies. Students will use critical and creative thinking to weigh up possible short- and long-term impacts.

Overarching idea: Creating preferred futures

Rationale
By the end of Year 4, students describe how a range of digital systems (hardware and software) and their peripheral devices can be used for different purposes. They explain how the same data sets can be represented in different ways.

Students define simple problems, design and implement digital solutions using algorithms that involve decision-making and user input. They explain how the solutions meet their purposes. They collect and manipulate data, using digital technologies to select and use data to provide evidence for their preferred future.

Through the Australian Curriculum, students are encouraged 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.

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

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 use and care of digital technologies.
Subject structure

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) with the use of digital technologies processes and production skills – using digital systems to create ideas and information, and to design, develop and implement digital solutions, and evaluate these solutions and existing information systems against specified criteria.

Relationship between strands

Together, the two strands provide students with the knowledge, understanding and skills through which they can safely and ethically exploit the capability 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.

### Key concepts

- **Digital Technologies knowledge and understanding**
  - This strand focuses on developing the underlying 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, numerals, 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 includes communicating, interpreting and evaluating data, including 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 recognizing 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.

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) which intersect with all of the 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 systems 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 form of communication: people rarely talk about every detail, because many details are not relevant. The concept 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 abstraction 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 systems. 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 specific 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 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 concepts also develop with年纪, and students can follow the steps within a recipe or describe directions to locate items. Implementation describes the automation of an algorithm, typically 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 concept focus on all aspects of human interaction with and through information systems, and the enormous potential for positive and negative 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 involving communication 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, environmental, economic and social impacts 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.

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### Years 3 and Content Descriptions

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<thead>
<tr>
<th>Digital Technologies Knowledge and Understanding</th>
<th>Digital Technologies Processes and Production Skills</th>
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<tbody>
<tr>
<td>Identify and explore a range of digital systems with peripheral devices for different purposes, and transmit different types of data.</td>
<td>Collect, access and present different types of data using simple software to create information and solve problems.</td>
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<tr>
<td>Recognise different types of data and explore how the same data can be represented in different ways.</td>
<td>Define simple problems, and describe and follow a sequence of steps and decisions (algorithms) needed to solve them.</td>
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<tr>
<td>Implement simple digital solutions as visual programs with algorithms involving branching (decisions) and user input.</td>
<td>Explain how student solutions and existing information systems meet common personal, school or community needs.</td>
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<tr>
<td>Plan, create and communicate ideas and information independently and with others, applying agreed ethical and social protocols.</td>
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