Preliminary Technologies

TEACHING & LEARNING SUPPLEMENT

INDEPENDENT SCHOOLS TASMANIA

TASMANIAN CATHOLIC education office

Tasmanian Government

Preliminary Technologies
Teaching and Learning Supplement

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ADVICE TO TEACHERS

This document helps to describe the nature and sequence of teaching and learning necessary for students to demonstrate achievement of course outcomes.

It suggests appropriate learning activities to enable students to develop the knowledge and skills identified in the course outcome statements.

Tasks should provide a variety and the mix of tasks should reflect the fact that different types of tasks suit different knowledge and skills, and different learning styles. Tasks do not have to be lengthy to make a decision about student demonstration of achievement of an outcome.

COURSE SPECIFIC ADVICE

This Teaching and Learning Supplement for *Preliminary Technologies* must be read in conjunction with the *Preliminary Technologies* course document. It contains advice to assist teachers delivering the course and can be modified as required. This Teaching and Learning Supplement is designed to support teachers new to, or returning to, teaching this course.

Terminology and key concepts

When teachers first start to plan learning programs for this course, it is critical that the specialist terminology used is well understood. The Glossary that forms part of the course document should be read thoroughly. In particular, the definitions of the following terms used throughout the course document may be unfamiliar:

- Technologies
- Designed solution

SEQUENCE OF CONTENT

Preliminary Technologies consists of two compulsory units of study and two elective units selected from a choice of four units specific to technology contexts. The term "unit" is used as a content organiser, rather than as a chronologically sequenced period of learning. Some teachers might prefer to sequence the content with modules that draw on content from multiple units.

Compulsory units:

Unit 1: Technology and Society

Unit 2: Digital Technologies

Elective units:

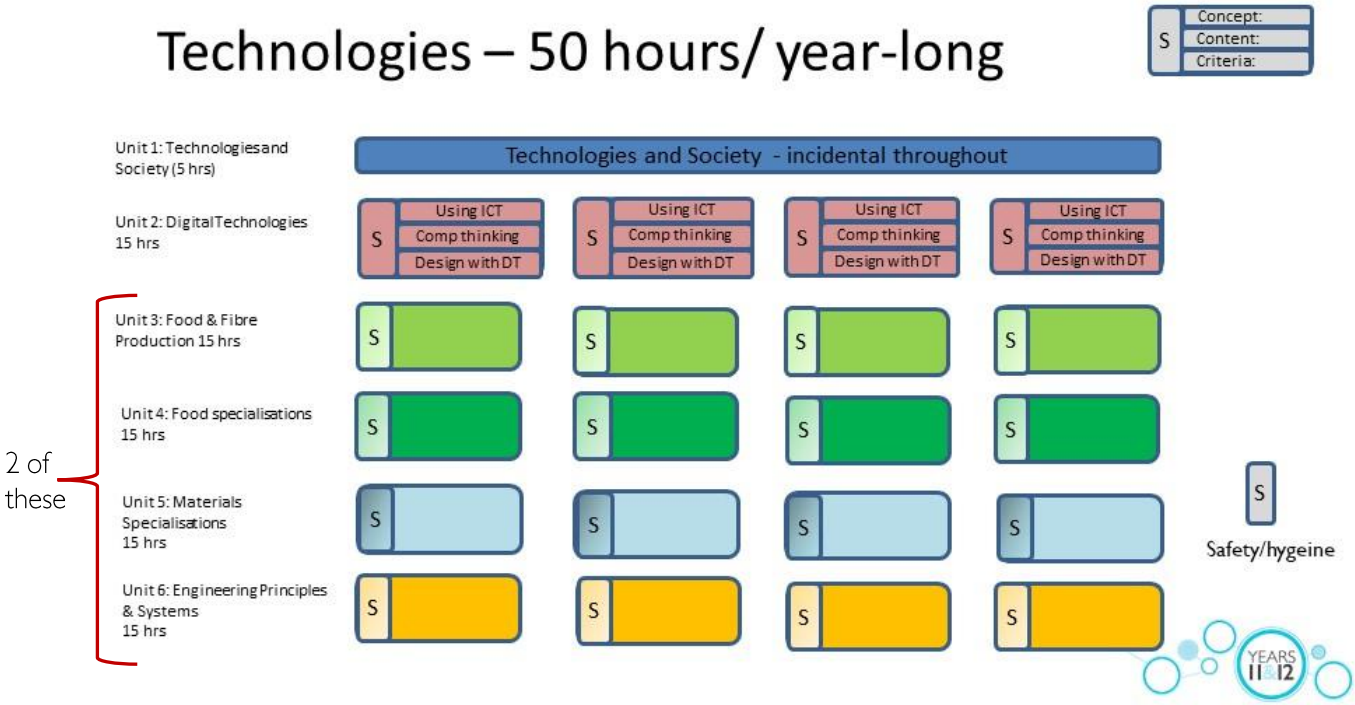
Unit 3: Food Specialisations

Unit 4: Food and Fibre Production

Unit 5: Materials and Technologies Specialisations

Unit 6: Engineering Principles and Systems

One model for sequencing the content is shown in the diagram below:



Features of this model are:

- Unit 1 Technologies and Society is incidental throughout the course, taught by modelling and asking guiding questions as learners experience designed solutions in many contexts.
- Unit 2 Digital Technologies: has three aspects to it:
  - » Using ICT (which can also be considered an aspect of Technologies and Society), where the ICT is a digital system designed for a specific purpose, for example, a digital camera. This aspect could take place in an integrated way throughout the units
  - » Starting to develop computational thinking which is about data, its representation, seeing patterns, understanding the concept of sequences of instructions (much of which can be learned without using digital systems). This thinking also intersects with aspects of the mathematics curriculum. Some time spent on explicit activities to develop this thinking.
  - » Designing to create digital solutions to meet personal needs
- Safety/hygiene is prioritised at all times.
- The rectangular blocks for units 2-6 represent about three and a half hours of time.
  - » Unit 3 Food and Fibre Production could be delivered through a kitchen garden program, which is also used as a primary vehicle for Preliminary Science and a context for Preliminary Access to Work.
  - » Unit 4 Food Specialisations could be delivered through a weekly Dining with Friends program which comprises preparing food for a shared lunch, progressing through to inviting others to join the class.
  - » Unit 5 Materials Specialisations could be delivered through a weekly Maker Space Workshop Program with design challenges forming the context of the learning.
- If the course is offered for 100 or 150 hours, the structure could be repeated. A single cycle can give coverage of the course content and two or three cycles (with changes in focus) can enable coverage in more depth.

Course Delivery

It is not essential, and may not even be desirable, to teach the units as discrete modules of learning. The two compulsory units could be integrated into the context of the two selected elective units, while having some time dedicated to explicit teaching of aspects of the compulsory units.

This course has natural synergies with other Preliminary to Level 1 courses and the content can be delivered through integrated programs such a kitchen and garden program where learners grow food and then cook it. Further, the kitchen and garden environments could operate as simulated workplaces and also be a vehicle for delivering the Preliminary to Level 1 Access to Work course.

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 the 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, and 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 a duty of care is exercised in relation to the health and safety of all students. The Department of Education, Tasmania, School Science Practical Work Procedure includes clear procedures for the use of hazardous materials and animal ethics, as well as templates for risk management.

ANIMAL ETHICS

Any teaching activities that involve caring, using, or interacting with animals must comply with the 'Australian code of practice in the care and use of animals for scientific purposes'.

CURRICULUM CONNECTIONS

Preliminary Technologies has strong connections with a number of other courses in the Preliminary to Level 1 suite of courses, for example, Science and Health and Physical Education.

In Technologies, students learn how to apply knowledge of the characteristics and scientific and sensory principles of food, along with the nutrition principles describe in Preliminary Health and Physical Education, to food selection and preparation. They do this through the design and preparation of food for specific purposes and consumers. They also develop understandings of contemporary technology-related food issues such as convenience foods, highly processed foods, food packaging and food transport.

TEACHING AND LEARNING

Unit 1 – Technologies and Society

EXAMPLES OF LEARNING ACTIVITIES

With co-active assistance, learners at Stage 1:

- Experience how people create familiar designed solutions to meet their needs, in a variety of technologies contexts.

The table below shows a progression in complexity from Stage 1 to Stage 4, for each of the technologies contexts including digital technologies. Regardless of which two elective units are chosen for the course, it is desirable that learners experience most of the technologies contexts. The examples below are illustrative only.

Table 1: Example learning activities for Unit 1: Technologies and Society

Technologies contexts	**Stage 1** (experience how people create familiar designed solutions to meet their needs)	**Stage 2** (explore the characteristics and properties of familiar designed solutions in at least one technologies context)	**Stage 3** (match familiar designed solutions to the personal needs they meet)	**Stage 4** (explore how people create familiar designed solutions and identify their ability to meet personal and local community needs.
Food specialisations	experience designed solutions such as different types of sandwiches	explore and select sandwich fillings based on personal preference	match images of different foods to categories such as savoury and sweet.	make design decisions in everyday activities, for example, what should we prepare for lunch today and why?
Food and fibre production	experience harvesting products from the school garden	select an appropriate tool to meet a need, for example, what tool should we use to harvest this crop?	make a decision from a variety of options to meet a need, for example, matching a garden tool to a specific use	explore what technologies they use in their daily life, for example, what tools and equipment do we need to grow vegetables?
Materials and technologies specialisations	experience people making design decisions based on personal needs, for example, tools and equipment used in the school garden	select an appropriate material for a given purpose, for example, a fabric suitable for a cushion for personal use	select and use products for a specific need, for example, identifying ways to be shaded from the sun/be sun-safe	make a decision from a range of options to meet a need, for example, which material would be most suitable for a purse to store money?

Engineering principles and systems	use voice and body movements to make sounds in a microphone	visit and use designed solutions, for example parks or playgrounds	suggest ideas about the use of a product and what need it meets, for example, what do you use scissors for?	explore how and why their local environment has changed over time, for example, new buildings or recreational equipment
Use of Digital technologies	experience the use and impact of technologies in their life such as their personal assistive technologies	select an appropriate tool to meet a need, for example a digital camera to take a photo	suggest ideas about the use of a familiar software product and the need it meets, for example, a word processor to create a sign	explore what technologies they use in their daily life, for example, how do I set an alarm on my clock app or other digital device?

Unit 2 – Digital Technologies

EXAMPLES OF LEARNING ACTIVITIES:

- Use digital systems (hardware and software components) within everyday life and school programs, for example a digital camera.

  With co-active assistance, learners at Stage 1:

  » Experience the use of digital cameras as others use them.

  » Experience cause and effect components on the camera, for example, the use of buttons or gestures to zoom on an image.

  » Experience changes in a digital system due to the activation/de-activation of a button.

  With co-active assistance, learners at Stage 2:

  » Observe the use of a digital camera and copy the actions to take a photo, for example using a phone or a tablet.

  » Copy the actions modelled to cause a particular effect, for example, activate the camera.

  » Copy how to carry out an instruction, for example, connecting the camera to a computer to download photos.

  With co-active assistance, learners at Stage 3:

  » Develop skills to use a digital camera to take a photo.

  » Develop skills to adjust photo settings (for example zoom, portrait or landscape orientation).

  » Use a digital camera and computer purposefully, to download photos from a camera.

  With co-active assistance, learners at Stage 4:

  » Identify and use different techniques to carry out an instruction, for example a gesture or button to activate a camera, a gesture or button to take a photo.

  » Copy the actions modelled to cause a particular effect, for example, activate the camera.

» Use icons to operate familiar software features such as file management operations to save photos to a nominated location, or access them for viewing.

- Sorting activities – learners sort sets of cards representing the steps of a familiar process, into the correct sequence, for example, washing hands or making a sandwich. The point of this activity is to begin to develop the fundamentals of computational thinking which underpins creating digital solutions – the concept of a sequence of instructions. The cards could be physical, for example, laminated images, or digital, for example, presentation slides made in MS PowerPoint or Keynote and manipulated in "slide sorter mode". Ideally, learners would experience both. In the digital example, a complete lesson sequence using this idea is available on the Digital Technologies Hub using Fairytales as their example which is not age-appropriate for Years 11-12. An adaptation of this is provided in Appendix 1 – Clean Machine Learning Sequence.

  With co-active assistance, learners at Stage 1:

  » Carry out a simple step-by-step procedure such as washing hands.

  » Experience a visual display of the steps involved in the process of washing hands, for example a poster or digital display.

  With co-active assistance, learners at Stage 2:

  » Follow a sequence of simple single step instruction to compete the process of washing hands.

  » Follow a sequence of instructions presented as pictures or images, for washing hands.

  With co-active assistance, learners at Stage 3:

  » Re-sequence the steps needed for washing hands using actual or digital visual prompts, with only the main steps offered.

  » Experiment with a very simple visual procedure to explore completing a task, for example, printing a picture.

  With co-active assistance, learner at Stage 4:

  » Re-sequence the steps needed for washing hands using actual or digital visual prompts, rejecting cards showing irrelevant detail.

  » Copy the actions modelled to cause a particular effect, for example, activate the camera.

  » Take and use photos to represent the sequence of events needed to solve a simple problem, for example placing in order, photos of buildings/rooms that need to be passed when getting from classroom to the front school gate.

Unit 3 – Food Specialisations

LEARNING ACTIVITIES:

- Dining with friends – learners, with co-active support, experience and/or participate in the preparation of a weekly meal to be eaten together, and over time, with invited guests. Menus are repeated for two weeks to enable learners to respond to feedback and develop skills. Note, this learning experience lends itself to being integrated with Preliminary Humanities and Social Sciences, in the development of interpersonal skills.

  With co-active assistance, learners at Stage 1:

  » Experience the characteristics and properties of different foods, by reacting to their sensory properties.

» React to a designed solution that has been created and produced safely to meet their needs, for example:
  – communicate simple choices through accept or reject actions as they experience the preparation of the meal
  – experience the production of the meal, for example, tasting one of the prepared foods.

With co-active assistance, learners at Stage 2:

» Explore the characteristics and properties of different foods, for example:
  – dry or wet, heavy or light, solid or liquid
  – begin to use tools and equipment needed to prepare food.
» Experience and explore how designed solutions are created and produced safely to meet personal needs, for example, communicate a design idea by selecting and indicating ingredients needed for a particular recipe.

With co-active assistance, learners at Stage 3:

» Examine and indicate the characteristics and properties of different foods, for example, identify the sensory properties of food according to its colour, taste, texture or smell, for example, green vegetables or sweet foods.
» Examine and indicate how designed solutions are created and produced safely to meet needs, for example:
  – identify opportunities for creating designed solutions, for example, ways to use leftover food
  – communicate why a piece of equipment was selected or rejected, for example, a mixing bowl was too big or small for the purpose.

With co-active assistance, learners at Stage 4:

» Explore and communicate the characteristics and properties of familiar designed solutions in the context of food specialisations, for example, use tools and equipment safely and hygienically to prepare simple, healthy food.
» Explore and communicate how designed solutions are created and produced safely to meet needs, for example:
  – gather and use ingredient, utensils and equipment to make a designed solution in the context of food specialisations, for example, a batch of muffins
  – use a common testing method and record results, for example, taste-testing comparison of food products being considered for use in the next menu, and recording results.

Unit 4 – Food and Fibre Production

EXAMPLES OF LEARNING ACTIVITIES:

Learners:

- Kitchen garden program: with co-active support, learners experience and/or participate in the process of growing plants from seed or seedlings. They care for the plants as they grow by weeding, watering and mulching. The plants are used in the kitchen and excess produce harvested for sale to staff at pop-up market stalls in the school grounds or elsewhere. Learners, with co-active support, make design decisions about suitable garden stakes and plant labels. Note, this learning experience lends itself to being integrated with Preliminary Science and complements the Preliminary Technologies elective Unit of Food Specialisations.

  With co-active assistance, learners at Stage 1:

» Experience the characteristics and properties of different plants, by reacting to their sensory properties.

» React to a designed solution that has been created and produced safely to meet their needs, for example:
  – communicate simple choices through accept or reject actions as they experience the planting and nurturing of seeds or seedlings
  – experience plant materials characterised by their softness, flexibility, texture

With co-active assistance, learners at Stage 2:

» Explore the characteristics and properties of familiar designed solutions in the food and fibre production context, for example:
  – learn how to harvest plants
  – learn how to complete some processes in the care of a plant.

» Experience and explore how designed solutions are created and produced safely to meet personal needs, for example, work with others by helping hold tools, for example, direct a hose to water plants.

With co-active assistance, learners at Stage 3:

» Examine and indicate the characteristics and properties of different foods, for example, identify the sensory properties of food according to its colour, taste, texture or smell, for example, green vegetables or sweet foods.

» Examine and indicate how designed solutions are created and produced safely to meet needs, for example:
  – identify opportunities for creating designed solutions, for example, ways to use leftover food
  – communicate why a piece of equipment was selected or rejected, for example, a mixing bowl was too big or small for the purpose.

With co-active assistance, learners at Stage 4:

» Explore and communicate the characteristics and properties of familiar designed solutions in the context of food specialisations, for example, use tools and equipment safely and hygienically to prepare simple, healthy food.

» Explore and communicate how designed solutions are created and produced safely to meet needs, for example:
  – gather and use ingredient, utensils and equipment to make a designed solution in the context of food specialisations, for example, a batch of muffins
  – use a common testing method and record results, for example, taste-testing comparison of food products being considered for use in the next menu, and recording results.

Unit 5 – Materials and Technologies Specialisations

EXAMPLES OF LEARNING ACTIVITIES:

- Design challenge: How could we make a garden label that is affordable, easy to install and will last a long time? Learners are shown a variety of garden labels as examples and invited to explore their properties. With co-active support, learners identify that labels need an upright component that can easily be inserted in the soil, and a section above the soil on which the label can be written. They are supported to explore questions of size, shape, material(s) and ways of writing the label. They could experience making labels from some available materials (wood, plastic, laminated paper) and conduct simple experiments to determine suitability (for example, leaving exposed outside for a week). Use of digital technologies could

be incorporated to conduct targeted searches for images (what search terms will we use? how do we search for images) to gather design ideas, and to develop templates for cutting shapes and/or writing labels for laminating.

This challenge could be varied (or repeated), by changing the context to labels for potted plants to be sold at a pop-up stall.

With co-active assistance, learners at Stage 1:

» Experience the characteristics and properties of different plants labels, for example, by indicating a preference based on colour, size, shape, for example, being shown three identical potted plants where the only difference is the label, and indicating a preference.

» React to a designed solution that has been created and produced safely to meet their needs, for example:
  - communicate simple choices through accept or reject actions as they experience the trialling of different types of plant labels in the garden
  - experience potential plant label materials characterised by their flexibility, texture.

With co-active assistance, learners at Stage 2:

» Explore the characteristics and properties of familiar designed solutions in the materials and technologies specialisations context (in this case, plant labels), for example:
  - begin to use tools and equipment needed to make a plant label in a given material
  - discover the characteristics of materials used for plant labels, for example, colour, flexibility, smoothness.

» Experience and explore how designed solutions are created and produced safely to meet personal needs, for example, communicate a design idea by selecting and indicating materials to make a garden label.

With co-active assistance, learners at Stage 3:

» Examine and indicate the characteristics and properties of familiar designed solutions in the materials and technologies specialisations context (in this case, plant labels), for example, begin to identify some familiar tools and equipment used in designing and producing with a given material, for example, one of the materials they have worked with when making trial labels.

» Examine and indicate how designed solutions are created and produced safely to meet needs, for example:
  - identify opportunities for creating designed solutions, for example, materials that could be re-purposed as plant labels
  - communicate why a material was selected or rejected for making plant labels, for example, it was too soft and floppy, or too difficult to cut.

With co-active assistance, learners at Stage 4:

» Explore and communicate the characteristics and properties of familiar designed solutions in the context of materials and technologies specialisations, for example, explore the safe use of tools for making plant labels in a workshop or other environment.

» Explore and communicate how designed solutions are created and produced safely to meet needs, for example:
  - gather and use materials, tools and equipment to make a plant label
  - begin to evaluate designed solutions (plant labels) by asking questions such as 'How does it work?', 'What purpose does it meet?', 'Who will use it?', 'What do I like about it?' or 'How can it be improved?'

Unit 6 – Engineering Principles and Systems

All engineering design challenges need a narrative context, but it is important that the presentation of the context for the problem is done in an age-appropriate way. Learners need to understand what the problem is and why it's important before they figure how to solve the problem. Learners like to solve a problem that's relevant to their lives and/or that allows them to help a friend or the community.

Students learn how to navigate a challenge by trying, failing, and rethinking their designs and then trying some more. The idea that failure is good can be a new experience for students, but it's how engineering works. By experiencing engineering challenges, learners may develop their resilience.

EXAMPLES OF LEARNING ACTIVITIES:

Learning activities can be framed as engineering challenges.

- Marshmallow and toothpick challenge: What is the tallest freestanding structure you can build with 20 mini marshmallows and 25 toothpicks? Tip: slightly stale marshmallows are easier to manipulate.
  - » Learners are encouraged to start with what they know – what shapes can you make with your mini marshmallows and toothpicks? Which are stronger? Test by seeing how wobbly they are. How can you join two or more together?
  - » Relate to real life by showing photos of tall structures, such as many found in major cities such as Dubai and New York City. Some examples are collected on the following website: http://www.learnwithplayathome.com/2015/01/mini-marshmallow-and-toothpick-building.html

  With co-active assistance, learners at Stage 1:

  - » Experience the characteristics and properties of familiar designed solutions in the context of engineering principles and systems, for example, by experiencing marshmallow and toothpick shapes and the use of force to produce movement to demonstrate which shapes are strongest (by testing how wobbly they are).
  - » React to a designed solution that has been created and produced safely to meet their needs, for example, communicate simple choices through accept or reject actions as they experience the construction of the marshmallow and toothpick structures.

  With co-active assistance, learners at Stage 2:

  - » Explore the characteristics and properties of familiar designed solutions in in the context of engineering principles and systems, for example, begin to make structures by joining toothpicks with marshmallows.
  - » Experience and explore how designed solutions are created and produced safely to meet personal needs, for example, collect, give and share toothpicks and marshmallows as part of their role in a team responding to the challenge.

  With co-active assistance, learners at Stage 3:

  - » Indicate the characteristics and properties of familiar designed solutions in the context of engineering principles and systems, for example, begin to group designed solutions based on similar characteristics, for example those structures that use triangles and their main building shape.
  - » Indicate how designed solutions are created and produced safely to meet needs, for example, use images to indicate key steps of the process of building their toothpick and marshmallow structure.

  With co-active assistance, learners at Stage 4:

  - » Explore and communicate the characteristics and properties of familiar designed solutions in the context of engineering principles and systems, for example, experiment with techniques (for example, using squares or triangles or changing the width) to build a tall structure.

» Explore and communicate how designed solutions are created and produced safely to meet needs, for example, begin to evaluate designed solutions (tall structures) by asking questions such as 'How tall is it?', "Why is this one taller than that one?" 'How can it be improved?'

This is one example of many engineering challenges that can be undertaken with toothpicks and marshmallows, or toothpicks and blu-tac. These activities explore how forces can be used to provide control or support in systems or structures. For more ideas related to this aspect of engineering, conduct an Internet image search using the term "marshmallow and toothpick challenge", and you will see many options, many of which lead to useful websites.

- Marble ball run challenge: Design a marble running track that makes the marble take up to a minute (60 seconds) to get from the top to the bottom of the maze. Use any combination of materials available to you. Note the following:
  - » The "maze" could be a square or rectangle marked out on a wall space, or any other vertical 2D or 3D structure to which learners can attach their construction pieces (see DIY Questacon resource in reference list).
  - » Materials could include cardboard, toilet rolls, other cardboard tubes or tube sections of other materials.
  - » Relate to a real world application like moving fruit (which is fragile) large distances but not too quickly.
  - » Refer to the Questacon lesson plan and other resources in the reference list for more details of this activity.

  With co-active assistance, learners at Stage 1:

  - » Experience the characteristics and properties of familiar designed solutions in the context of engineering principles and systems, for example, by experiencing cardboard tubes and strips arranged in ways that slow down the vertical progress of the marble.
  - » React to a designed solution that has been created and produced safely to meet their needs, for example, communicate simple choices through accept or reject actions as they experience the construction of the ball run in small groups.

  With co-active assistance, learners at Stage 2:

  - » Explore the characteristics and properties of familiar designed solutions in in the context of engineering principles and systems, for example, begin to make structures by placing elements of the ball run in place.
  - » Experience and explore how designed solutions are created and produced safely to meet personal needs, for example, collect, give and share components as part of their role in a team responding to the challenge.

  With co-active assistance, learners at Stage 3:

  - » Indicate the characteristics and properties of familiar designed solutions in the context of engineering principles and systems, for example, identify that steeper ramps make the marble run faster; or rough surfaces make the marble run slower.
  - » Indicate how designed solutions are created and produced safely to meet needs, for example, use images or diagrams to indicate key steps of the process of building their ball run.

  With co-active assistance, learners at Stage 4:

  - » Explore and communicate the characteristics and properties of familiar designed solutions in the context of engineering principles and systems, for example, experiment with techniques (for example, different textures of materials, or slopes of ramps) to build a ball run.

» Explore and communicate how designed solutions are created and produced safely to meet needs, for example, begin to evaluate designed solutions (marble ball runs) by asking questions such as 'How long does it take the marble to reach the bottom?', 'How can it be improved?'.

SUPPORTING STUDENT RESPONSES AND ELABORATIONS

Knowing your learners – Key messages

Learning is a social collaborative undertaking that happens in a classroom community.

Developing positive and respectful relationships forms the basis for building strong classroom communities. An integral part of building those relationships lies in getting to know the backgrounds, talents, needs and aspirations of your learners.

This can include an undertaking to:

- Find out their strengths, what they are passionate about and their goals.
- Know about their cultural and language background.
- Know about social disadvantage or trauma that may be part of their background.
- Understand their needs; including medical, personal, physical, communication, sensory and learning needs.
- Create opportunities for learners to get to know one another and appreciate the diverse qualities they bring to the classroom.
- Model and teach about wellbeing, mutual support and respectful interactions.
- Find out where learners are up to in their learning with respect to the curriculum.

Getting to know learners with disability

Sometimes getting to know learners with disability or complex health needs may seem a little daunting. However, getting to know the student as an individual as well as their health and care needs is key to personalising their learning programs. Start with the student and seek information from them in terms of their aspirations, support needs and details on what has worked well for them in the past. If the student is unable to convey this information, then the student's family are a key point of contact.

Note too that information such as existing Individual Education Plans, professional reports and anecdotal summaries may be stored in the Student Support System, providing a good outline of strengths, interests and needs. Check with the support staff in your school to help develop an up-to-date and complete picture of the student that can readily inform their teaching and learning programs.

Keep in mind that learners with disability are heterogeneous, and expressions of any disability are likely to be different in any two learners. Some learners will not have an identified name for their disability other than 'global' or 'developmental' delay. Some learners will have multiple disabilities.

What are the best sources of information?

If the student is not able to convey their needs, strengths and interests, the student's family will have a wealth of knowledge about their child and the disability. They can often direct you to good sources of information. Some schools use parents and their contacts to inform staff, and in some situations the student body about the disability.

Pre-assessment

As well as knowing who their learners are as learners, it is important that teachers know where they are up to in their learning. This allows learning experiences to be planned so that they are challenging, without being so difficult that learners feel overwhelmed.

Pre-assessment is formative assessment done with learners before any teaching occurs. It is used to inform planning and to differentiate according to learners' current level of understanding.

Thus, pre-assessment strategies and techniques allow teachers to gain insight into the background knowledge and skills that learners already have relating to a topic before they teach it.

Carefully designed pre-assessment can ascertain learners' current level of achievement and identify any gaps in essential knowledge or misunderstanding that they might hold.

This information is used by the teacher to inform decisions about:

- where to begin the teaching and learning
- who needs revision and how much
- who needs scaffolding or teaching for missing essential skills
- the pace of learning
- who has already achieved significant aspects of the topic and requires extension/enrichment
- how groupings of learners might be formed for the topic.

The first step in planning for learning is to have an understanding of the curriculum scope and sequence for the learning area and the expected learning outcomes.

Identifying goals for learning

To support learners to achieve greater learning independence, we need to communicate to them:

- what they are going to learn - learning intentions
- why they should learn it in the first place - reasons for learning
- how they will recognise when they have succeeded - success criteria.

Pre-assessment techniques

There is an enormous range of both formal and informal pre-assessment techniques and tools available for teachers to use. The pre-assessment technique or tool a teacher selects will vary depending on:

- the nature of the content to be taught
- whether they need individual, small group or whole group information
- the time available and relative efficiency of different techniques.

Making adjustments to teaching

Using the information collected from pre-assessment tasks will include looking for common, powerful differences in student responses with respect to their current knowledge and skills, interests or preferred way of learning.

This information can be used as the basis for flexible groupings of learners and to inform the design of the tasks that different groups engage with.

Formative assessment

When designing a program of work it is important that teachers find out what learners already know, understand and can do, as well as uncovering any misconceptions they have developed. This will involve using the formative assessment strategies and tools.

Knowing your learners: questions for reflection

- What information can I source from the student data that informs my understanding of my learners; e.g. existing learning plans, curriculum assessment reports, attendance data, specialist reports, communication with parents and wellbeing data?
- What are some creative ways I can use existing school processes to know my learners better?
- How can I make time and create opportunities to get to know my learners?
- Which specialists may have relevant background information about my learners?
- In what ways can I communicate positively and effectively with each student's family?
- What are my learners' current interests and how can I tap into them?
- What are the priority individual's and group's needs?
- What are the dominant attitudes and dispositions that significantly impact on each student's engagement or attention? How might these be improved?
- In what activities do the learners achieve success?
- What information can we gather from listening to student questions and watching their actions in class?

DIFFERENTIATION STRATEGIES FOR PERSONALISING LEARNING

Overview

Differentiated classroom learning recognises that some learners require significant personalisation of their learning programs to be fully engaged and challenged.

Some learners will require adjustments that extend and enrich their learning. Some will require considerable support and others may require targeted support or systematic teaching to overcome barriers such as learning English as an Additional Language or Dialect (EAL/D) to enable their engagement, learning and achievement.

Adjustments include any measure or action to promote access, engagement and optimise student learning outcomes. Adjustments and/or extensions vary according to the needs of the learners. They may be minor or significant. In some instances, such as learners with disability, they may be designed and developed as part of a collaborative planning meeting.

Adjustments can be made to:

- content (what is to be taught)
- process (how learning will occur)
- product (evidence of student learning).

Content differentiation – Key messages

Content can be differentiated through:

- Making adjustments to the content described in course documents.
- Choosing learning resources and stimulus materials that meet a student's preferred mode of learning and stage of development.
- Using technology to locate and provide content at a range of levels and in modes that engage and support learning.

Process differentiation – Key messages

"Note that differentiation relates more to addressing learners' different phases of learning from novice to capable to proficient rather than merely providing different activities to different (groups of learners)." (Hattie 2009)

TEACHING STRATEGIES

Teachers who differentiate select the most appropriate strategy for a task to facilitate each student's engagement and learning. This might happen when planning a lesson, or even in response to a student's needs during a lesson.

Differentiated teaching is often referred to as 'responsive' teaching, reflecting the way in which a teacher moves from using one mode to another as required.

TASK DESIGN

Teachers also design authentic and relevant tasks for learners so they can actively engage with the concepts, information and skills identified in the curriculum.

Tasks that have a number of entry points and directions lend themselves well to differentiation.

Tasks can be differentiated by pre-planning prompts, questions and supports that will enable and support learning for those learners experiencing difficulty, and that increase the degree of challenge and complexity for those learners who need extension.

Effective process differentiation strategies for all learners include:

PEOPLE

- Developing solid partnerships that support the student.
- Taking account of and valuing learner differences.
- Drawing on prior learning and extending background knowledge. For some learners it may be important to supply them with background knowledge they are missing.
- Varying learning activities to promote and support different learning styles and preferences.
- Building opportunities for learners to work in teams, sharing roles and building on from their individual strengths.
- Having fun with learning.

SCAFFOLDS

- Developing language and new vocabulary.
- Supporting learning with the provision of scaffolds.
- Clearly displaying learning intentions and key concepts/skills.
- Removing unnecessary distractions.
- Providing organisational support.
- Allowing time for learners to process information and ask questions.
- Providing opportunities to practise the new skill or knowledge.
- Incorporating student interests and allowing them choice in some aspects of the learning or assessment.

ENVIRONMENTAL SUPPORTS

- Including visual cues in the environment and teaching all learners to use these.
- Providing clear routines for smooth transitions and structured and predictable learning experiences.
- Explicitly teaching positive behaviours and encouraging learners to apply the skills they learn.
- Providing multisensory inputs, actions and expressions.
- Providing models of problem solving, verbalise the thought processes and support with guided practice
- Using concrete models and examples of what success looks like.
- Using human resources effectively at the planning and delivery stages - thinking about peers, teacher assistants, specialist staff, and other classroom teachers.

- Engaging technology to improve access to information, processing information and demonstrations of student understandings and skills.

ONGOING ASSESSMENT

- Encouraging learners to plan, monitor and evaluate their own learning by checking and testing for understanding.
- Giving feedback that is timely, specific, clear and related to the learning intentions (What worked? What's needed? What next?).
- Allowing learners opportunities to put the feedback into action.
- Providing opportunities to celebrate student success, and share work and learning.

Principles and strategies of task design

Designing group tasks ensures that every student can access and learn from a rich and varied curriculum and has to think about and apply essential ideas and skills. Some tasks may need to accommodate opportunities for some learners to work on their personal goals as described in their Personalised Learning Plans.

There are some general principles and strategies that can be applied to task design that include:

- know where learners are up to in their learning
- prerequisite knowledge and skills
- what they understand and misunderstand
- the degree they have mastered or surpassed expectations
- which teaching strategies work well for them
- whether they can connect key ideas to their lives and experiences
- identify appropriate expectations (KUD) informed by the course content and assessment criteria
- plan to stretch learners who are most advanced and scaffold the task for learners requiring additional support to work with the key ideas and skills as identified learning goals (tiered task design)
- address diverse levels of thinking and abilities through the use of tasks that have more than one right answer or way to solve a problem
- draw on a variety of media - ensure that written content is accessible to everyone.

Product differentiation – Key messages

A key principle of differentiation is that it removes barriers and limitations to learning.

This must also apply when it comes to enabling learners to demonstrate what they really know, understand and can do, through the products they create.

A lack of skill with a tool or genre, such as a hand written essay, can mask the true level of understanding a student has developed.

For formative assessment purposes, alternatives may need to be considered to gain accurate insight into their learning progress.

Tasks that are differentiated to take account of each student's needs, strengths and interests may result in a range of different artefacts being produced.

When designing tasks and their associated products teachers can consider:

- a common learning task may be differentiated just in the products created through the learning.

- a student's level of skill with tools used to communicate their learning needs to be taken into account.
- technology tools can be powerful enablers for differentiating the products that result from learning tasks.
- providing choice and flexibility in the tool used to create products of learning allows learners a voice in their learning.

The learning environment can also contribute to differentiation in significant ways.

Adjustments may be made to one of these aspects of learning, or to any combination that makes sense in the context.

Not every aspect of every lesson will be differentiated. Ideally it is targeted to have the most significant impact on a student's learning.

A teacher's skill in differentiating develops with:

- experience in applying a broad repertoire of teaching strategies in flexible ways.
- access to a range of resources for learning.
- capacity to manage a classroom with diverse learning activities happening simultaneously.

Assistive Technologies – An Explanation

WHAT IS MAINSTREAM TECHNOLOGY?

Mainstream technology is described as products used widely in the mainstream such as laptops running Windows or Mac operating systems, iPads and Smart phones.

WHAT IS EDUCATIONAL TECHNOLOGY?

Educational technology aims to support the attainment of student learning goals. Technology tools can be powerful enablers for learners in terms of processing information and showing their understanding or skill. Some examples of educational technology include: Interactive White Boards, digital storytelling, mind mapping and web based learning programs.

WHAT IS ASSISTIVE TECHNOLOGY?

Assistive technology is a term that covers a range of technology aimed at helping learners with disability participate, communicate and achieve in teaching and learning programs. Despite the word 'technology', not all assistive technology is high tech. Assistive technology ranges from simple adaptive tools, such as calculators and pencil grips, to high tech tools like speech to text software.

Assistive technology is adapted to suit the needs of the student and includes tools such as:

- e-books with audio files that can read text or put text from a computer screen into speech
- timers - help learners develop a sense of time for tasks and prepare for activity to activity transitions
- seat cushions to help with sensory processing and attention issues
- calculators
- writing supports such as a pencil grip or a computer for typing
- graphic organisers to help learners plan their writing or capture and sort the main ideas from a reading or information presentation.

High Assistive Technologies include:

Language Acquisition through Motor Planning (LAMP) device, and switch- activated toys

The starting point for planning assistive technology supports for learners is a conversation with the Physical Impairment Coordinator in your Learning Services.

Complete an ICT Information Technology Assessment Profile

Once you have had a conversation with the Physical Impairment Coordinator in your Learning Services you may need to apply for technology supports.

The SETT Framework is another tool used to identify the most effective assistive technology decisions. This framework takes you through several steps that help clarify the student's strengths and needs, the environment/s, tasks required for active participation and the system of tools needed.

Teaching Strategies

- Getting to know your learners
- Integrate to differentiate
- Evidence based teaching strategies:
  - » Clear lesson goals
  - » Show and tell
  - » Questioning to check for understanding
  - » Summarise new learning in a graphic way
  - » Practise
  - » Feedback
  - » Be flexible about how long it takes to learn
  - » Collaborate
  - » Strategies not just content
  - » Nurture metacognition
- Explicit teaching is an instructional strategy used by teachers to meet the needs of their learners and engage them in unambiguous, clearly articulated teaching. Teachers plan for explicit teaching to make clear connections to curriculum content, through a concise focus on the gradual and progressive steps that lead to a student's development and independent application of knowledge, understanding and skills of the course content.
- Information on explicit teaching is found at https://www.teachingacenglish.edu.au/explicit-teaching/overview/explict-overview.html
- Differentiating teaching and learning requires knowledge of each student's background and experiences, interests, readiness and learning needs. Teachers use this knowledge to plan and implement curriculum, teaching strategies, learning experiences and assessments that provide multiple pathways for learning for every student. This ensures all learners have equitable access to curriculum and are able to demonstrate success.
- Knowing your learners is the key to differentiating teaching and learning – what they know and can do, what they need to learn next and how best to teach them and monitor their progress. Information on differentiation and through the Good Teaching Resources: Differentiated Classroom Practice Learning for All.

Work Requirements

There are no specific work requirements outlined in the course.

RESOURCES

Websites

All URLs (website addresses) cited were accessed and checked for accuracy and appropriateness of content on 15 December 2018. However, due to the transient nature of material placed on the web, their continuing accuracy cannot be guaranteed.

Thinking about the design process

http://education.abc.net.au/home#!/media/2128865/thinking-about-the-design-process

Watch as UNSW student and Blusat member William Frohlich talks about the design process. What are some of the important things to consider before you start to make a project?

UNIT 2 – DIGITAL TECHNOLOGIES

Digital Technologies Hub

https://www.digitaltechnologieshub.edu.au/

This Australian Government funded website is the key support for the Australian Curriculum Digital Technologies curriculum. The *Preliminary Technologies* course, in Stage 4, is very close to the first band (F-2) of AC Digital Technologies. Some of the learning activities available in the Digital Hub can be adapted to be age-appropriate. Learning activities include:

Communicating Safely Online

https://www.digitaltechnologieshub.edu.au/teachers/lesson-ideas/communicating-safely-online

This learning sequence from the Digital Technologies Hub website includes a set of MS PowerPoint presentation slides, and an accompanying script, that could be adapted for selected use.

Data detective

https://www.digitaltechnologieshub.edu.au/images/default-source/dt/about-me.pnghttps://www.digitaltechnologieshub.edu.au/teachers/lesson-ideas/data-detective

In this sequence of lessons, students conduct a simple survey to collect, organise and present data. In doing so, they demonstrate their understanding of how to use patterns to represent data symbolically. This learning sequence introduces the idea of data. It includes a set of seven slides explaining what data is. Note these slides are presented as a slideshow and are not editable.

Fairytale Fun

https://www.digitaltechnologieshub.edu.au/teachers/assessment/assessment-ideas/fairytale-fun

This lesson uses MS PowerPoint in slide-sorter mode as a way of learners sorting a sequence into an appropriate order. This idea (using the slide-sorter function) could be adapted to be a repeatable skill adapted to many routine situations (washing hands, preparing for bed) in work and daily life.

About Me (Digital Technologies and HASS Geography)

https://www.digitaltechnologieshub.edu.au/teachers/lesson-ideas/integrating-digital-technologies/about-me

In this learning sequence, students order images to show a sequence of personal events or milestones such as birth, birthdays, starting school, transitioning to high school.

What is Computational Thinking, And Why Should All Kids Learn It?

https://www.primotoys.com/blog/2018/04/what-is-computational-thinking-and-why-care/

This article and embedded video clip is useful as a teacher resource that explains the importance of computational thinking. The basic principles of computational thinking, so important for designing digital solutions, can ironically be developed without computers.

UNIT 5 - MATERIALS AND TECHNOLOGIES SPECIALISATIONS

How to make your own garden labels (video 7:45)

https://www.youtube.com/watch?v=Ro_Y4kSCNNo

This video could be used as teacher reference or stimulus material for the suggested learning activity in Unit 5 Materials and Technologies Specialisations. It is about a very specific solution but there are many aspects of it that are relevant to the design process.

Printable garden markers

https://www.createcraftlove.com/printable-garden-markers/

One example of accessing the internet for resources to support a design idea. While this site provides a downloadable template, its real benefit to learners is as an example of using digital technologies to produce a template that can be printed and then laminated. Laminating paper changes its characteristics.

Sam the Lamb – Properties of wool

https://www.youtube.com/watch?v=jbfTmJ1ldRo&feature=youtu.be (2 :54)

Join Sam the Lamb to discover the amazing properties of wool – a versatile, renewable and biodegradable natural fibre people have been using for thousands of years to make textiles, clothing and insulation. Explore how wool can stretch and return to its natural shape when you are wearing it, can keep you warm when it's cool and keep you cool when it's hot. Discover why wool is safe to wear around campfires and in the sun, and how wool can manage moisture from your body to keep you dry and odour free when you play sport. Wool is even stain resistant, making it an easy care option.

Sam the Lamb – What is wool?

https://www.youtube.com/watch?v=HanHq0auWNU&feature=youtu.be (1:53)

Where does wool come from? Take a trip to the farm with Sam the Lamb to discover how sheep produce wool, just like we grow hair on our head. Find out how wool protects sheep from all kinds of weather. Explore how wool looks and feels and how woolgrowers harvest their sheep's woolly fleece each year…and how it grows back again!

UNIT 6 – ENGINEERING SYSTEMS AND PRINCIPLES

Marshmallow Toothpick Challenges

15 Engineering Challenges Kids Love (STEAM)

https://www.giftofcuriosity.com/engineering-challenges-for-kids-steam/

These challenges appeal to all learners, regardless of age. They encourage thinking, designing, trialling and modifying to improve solutions.

Marshmallow and Toothpick Challenge

http://www.crscience.org/pdf/Marshmallow_toothpick_challenge.pdf

A simple lesson outline, framed in engineering terms, for the challenge of "What is the tallest freestanding structure you can build with 20 marshmallows and 25 toothpicks?".

Shapes, Letters, & Towers: Building with Marshmallows

https://deceptivelyeducational.blogspot.com/2013/04/shapes-letters-towers-building-with.html

A blog post about a home-based version of a marshmallow-toothpick challenge, easily adapted to be age-appropriate.

Toothpick geodesic dome timelapse (video 5:02)

https://www.youtube.com/watch?v=ECu6CH_05p0

How high can we build? (Video 5:23)

http://education.abc.net.au/home#!/media/2840995/how-high-can-we-build-

Many factors need to be considered when building a really tall structure. In this video, Niraj Lal explains the importance of mass, materials and the design of a building, and how they contribute to the stability and integrity of a tall building.

Marble Run Challenge

How to make a marble run

https://tinkerlab.com/toilet-paper-roll-marble-run/

Fun STEM Challenges for Kids: The best marlbel runs to build

https://frugalfun4boys.com/best-marble-runs-for-kids-to-build/

(Questacon) Ball Run Lesson Plan

https://www.questacon.edu.au/sites/default/files/resources/teacher-resources/file/Ball%20Run%20Lesson%20Plan.pdf

This lesson plan can be easily adapted to suit any group of learners, and classroom resources. Importantly, it outlines key design process ideas using an innovation model of "make, try and refine".

(Questacon) Teacher Resources – Ball Run

https://www.questacon.edu.au/sites/default/files/assets/outreach/program/qssi/assets/docs/Teacher%20Resource%20-%20Ball%20Run_0.pdf

(Questacon) Teacher DIY: Build a Ball Run Frame

https://www.questacon.edu.au/sites/default/files/resources/teacher-resources/file/Build%20a%20Ball%20Run%20Frame%20DIY.pdf

This DIY resource will guide you through creating frames to use with the Questacon Ball Run Lesson Plan.

(Questacon) Marbelous Ball Run (and app developed by Questacon)

https://www.questacon.edu.au/discover/apps/marbelous-ball-run

This app enables the user to use classic ball run components like cardboard ramps, wooden rulers, tomato sauce bottles and more to build a track then share it with friends. The advanced physics engine, powered by Unity™, allows accurate tracking and realistic ball motion, with adjustable gravity, ball bounciness and even friction.

(Questacon) Ball Run – home activities

https://www.questacon.edu.au/discover/ball-run

This resource outlines simple activities to demonstrate the basic principles of making a ball run – the ball rolls faster when the track is steeper and slower when it is less steep; when fewer pieces are used, the time taken for the ball to reach the bottom is reduced; gravity is the force that pulls the ball towards the ground.

OTHER

Darts vs Gliders (video 0:36)

http://education.abc.net.au/home#!/media/2239352/darts-vs-gliders

Can you describe the differences between darts and gliders? Why do these paper plane types fly so differently? Choose one type and try making a few different versions of it. Do some experimenting and see which one of your designs either flies the furthest (if you make darts) or stays in the air the longest (if you make gliders). What's different about your winning plane?

Architecture in Sand (video 2:46)

http://education.abc.net.au/home#!/media/2269182/architecture-in-sand

Watch first year architecture students from Curtin University embrace Sanditecture! Through a project to sand sculpt landmark buildings, they transfer computer based skills to the more practical world of sand sculpting. Through this process the students learn about design, volume, form and texture, as well as gaining the practical skills required for sculpting, model making and working as part of a team.

How to fold the Squarosaurus paper plane (video 3:25)

http://education.abc.net.au/home#!/media/2238616/how-to-fold-the-squarosaurus-paper-plane

What makes the Squarosaurus paper plane stay airborne for so long? Consider the size of the wings in comparison to the body - or the fuselage. What do the winglets do? What is the dihedral angle and why is it important? Now go and fold your own Squarosaurus and time how long it stays in the air. Then see if you can improve the design so it will stay airborne even longer. Don't forget to consider how you're actually throwing it!

Recycling shells (video 0:49)

http://education.abc.net.au/home#!/media/2614965/recycling-shells

You probably already know that you can recycle paper, plastic and glass, but did you know there are many other things that can be recycled? A local shell recycling program in Geelong, Victoria uses shells discarded from restaurants to build reef foundations. Find out more about this innovative program in this video. Can you think of other materials that could be re-used or recycled to create something useful?

A Puppy for Christmas! LEGO Building Project

https://frugalfun4boys.com/a-puppy-for-christmas-lego-building-project/

This website is actually for boys and girls, and is developed by a homeschooling parent. It has many useful ideas that can be used in the technologies learning area. This particular project uses a mechanical winding mechanism to make a puppy pop up out of a box.

APPENDIX 1

Clean Machine Learning Sequence

(Adapted from a learning sequence featured on the Digital Technologies Hub https://www.digitaltechnologieshub.edu.au/teachers/lesson-ideas/integrating-digital-technologies/fairytale-fun. The context has been changed to be more age-appropriate.)

SUGGESTED STEPS

1. Learners participate in discussion about hand washing (in contexts of after using the toilet, and before preparing food), and watching a demonstration.
2. Learners are given opportunities to practise the steps.
3. Students are supported to identify significant steps within the process.
4. In small groups students are supported to work collaboratively to agree on a sequence of significant steps. Use one of the following processes to do this, depending on the learners:
    a. Provide learners with a series of slides (MS PowerPoint or Keynote) depicting significant events and details of no significance. Slides may include pictures, words, simple sentences or a combination of these.
    b. Ask students to create their own set of slides to include the most significant steps and discard irrelevant details.
5. Learners choose which details/steps are significant and use the slide-sorter function to arrange these in order, to produce an instructional text. Students are supported to understand the importance of correctly sequencing the steps and identifying the most important details.

WHY IS THIS RELEVANT?

One of the key concepts within the Digital Technologies curriculum is 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 and stage of development. For example, when students are asked how to make toast for breakfast, they do not mention all of the steps explicitly if they assume 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.