TECHNOLOGY

Years 1 to 10 Syllabus

This syllabus should be read in conjunction with the following Queensland Studies Authority materials:

Technology Initial In-service Materials

Years 1 to 10 Technology Sourcebook Guidelines

Years 1 to 10 Technology Sourcebook Modules

Years 1 to 10 Technology CD-ROM

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Note to teachers

The purposes of the Technology key learning area

The Technology key learning area has a strong foundation in primary school education. It draws on traditions in early childhood education and builds on programs and approaches that emphasise 'thinking skills' and 'problem solving'. Learning in the Technology key learning area is valued for its practical approach.

The Years 1 to 10 Technology key learning area embraces some learnings that traditionally have been included in lower secondary subjects such as Agricultural Science, Business Studies, Home Economics, Information Technology and Industrial Technology and Design. It also includes learnings in other subjects such as Environmental Studies, Graphics and Marine Studies. Courses of study in these subjects may include Technology core learning outcomes. Different sets of learning outcomes can be selected depending on the connection of the subject to particular strands of the Technology syllabus. It is possible that some lower secondary students will choose different combinations of subjects.

It may be necessary to 'map' core learning outcomes from these different subject combinations to ensure students have opportunities to demonstrate all core learning outcomes in all strands of the Technology key learning area.

In addition to the key learning area syllabuses, five subject area syllabuses and guidelines have been developed for:

- Agriculture Education
- Business Education
- Home Economics Education
- Industrial Technology and Design Education
- Information and Communication Technology Education.

These syllabuses and guidelines combine learning outcomes from various key learning area syllabuses with more specific subject area learnings and may be used when developing specialised courses of study for lower secondary school students.

Contents

Rationale

Nature of the key learning area

Technology

Technology arises from a desire to extend individual and collective human capabilities. People everywhere have always used their ingenuity to create new or improved technology that meets their needs and wants and enhances their physical, emotional and social wellbeing.

There is a relationship between people's values and beliefs and the technology they create and use. Their values and beliefs influence, and are influenced by, technology and its impacts on individuals, societies and environments.

The term 'technology' has come to describe such things as:

- the creative processes used to develop products
- the products created through these processes
- the 'know-how' related to these processes and products
- the tools and equipment used.

Sometimes the term 'technology' is used to mean 'computers' or 'information technology'. In this syllabus, however, it is used in a broader sense, as described here:

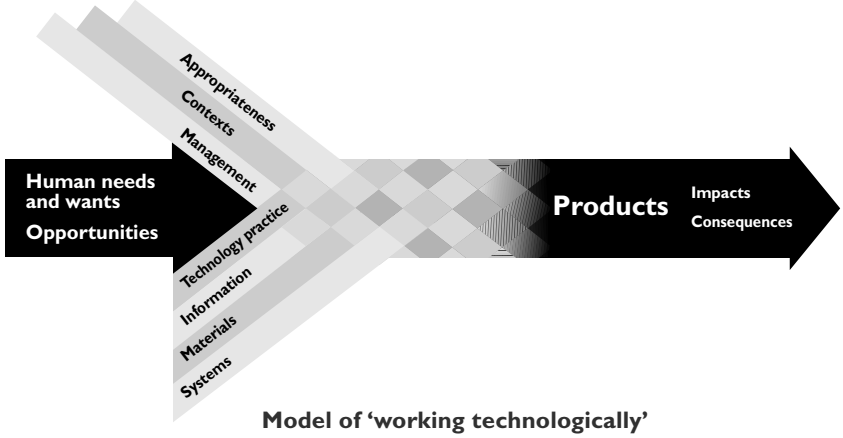
Technology involves envisioning and developing products to meet human needs and wants, capitalise on opportunities and extend human capabilities. Products of technology include artefacts, processes, systems, services and environments. These products make up the designed world. Products of technology have impacts and consequences on individuals, local and global communities, and environments.

Working technologically

'Working technologically' is the term used in this syllabus to describe a way of working that interweaves technology practice, information, materials and systems with considerations of appropriateness, contexts and management. The implicit purpose of 'working technologically' is the design and development of products that enable people to meet their needs and wants and to capitalise on opportunities.

All products of technology have impacts and consequences. When 'working technologically', people make choices and value judgments about the relative merits and impacts of the processes and products of technology.

The following diagram illustrates the interwoven nature of all the elements of 'working technologically'.



Model of 'working technologically'

Technology education

The Years 1 to 10 Technology key learning area reflects the dynamic and innovative nature of technology. It provides opportunities for students to respond to design challenges in a diverse range of contexts by 'working technologically'. Design challenges are situations, problems or tasks that have a technology demand — that is, they are challenges requiring students to make cognitive and practical responses that draw on their technology knowledge, practices and dispositions.

Students are challenged to:

- design and develop products in response to needs, wants or opportunities
- apply technology practice and use information, materials and systems
- consider appropriateness, contexts and management as they initiate, design, use, modify, and reflect on products of technology.

Through the experiences and challenges of 'working technologically', students develop a range of associated knowledge, practices and dispositions. They draw on and expand their understandings of technology — its characteristics, diversity, and role in changing and influencing society. They also enhance their capabilities with technology, particularly in creating and using products to meet real-life and lifelike challenges. In so doing, students become confident, critical designers and users of technology.

In addition, students understand that people must consider issues related to appropriateness, contexts and management if they are to develop products that not only meet people's needs and wants but are also socially just and economically and environmentally sustainable.

Appropriateness

Students consider many perspectives before making judgments about the appropriateness of:

- design ideas
- processes and products
- the possible impacts of these on users or environments.

In particular, they consider, and make judgments about, **aesthetic**, **cultural**, **economic**, **environmental**, **ethical**, **functional** and **social** appropriateness.

Contexts
Students initiate, design, use, modify, and reflect on products in a variety of broad, overlapping contexts for real-life and lifelike purposes. Working in a variety of contexts allows students to make decisions regarding potential users while creating products. As they are 'working technologically', students use knowledge acquired in one context and apply it in another.

Students may work in several contexts simultaneously. These could include **personal** and **global** contexts, as well as contexts of **agriculture**, **business**, **communities**, **home and family**, **industry**, **leisure and recreation**, and **school**.

Management
Students manage **people**, **resources**, **opportunities** and **constraints** when designing and creating products:

- Managing people involves managing oneself and others; working collaboratively in teams (which often include people with specific or 'expert' knowledge) to design products; managing risk, health and safety.
- Managing resources involves managing information, materials and systems; and assuring quality products.
- Managing opportunities involves engaging in enterprise and marketing.
- Managing constraints involves setting and meeting timelines; budgeting; and taking account of specific requirements.

These four aspects of management are interrelated. Students exercise management decisions when 'working technologically'. Management allows people to extend their capabilities effectively and efficiently by drawing together ideas, resources, knowledge and skills to create products that might otherwise appear to be beyond the scope of an individual to develop.

Contribution of the key learning area to lifelong learning

The Queensland school curriculum is designed to assist students to become lifelong learners. The overall learning outcomes of the curriculum contain elements common to all key learning areas and collectively describe the valued attributes of a lifelong learner.

A lifelong learner in Technology is:

- a knowledgeable person with deep understanding
- a complex thinker
- an active investigator
- a responsive creator
- an effective communicator
- a participant in an interdependent world
- a reflective and self-directed learner.

The Years 1 to 10 Technology key learning area provides many opportunities for students to develop the valued attributes of lifelong learners.

Knowledgeable person with deep understanding

Learners understand that technology is used by humans to meet needs and wants, utilise opportunities and extend capabilities. They understand that developments in technology influence, and are influenced by, social, cultural and environmental factors. They recognise that developing new technology often requires combining knowledge from a range of areas and challenging existing knowledge and practice.

Learners have opportunities to:

- examine technology from the past and from other cultures
- recognise and anticipate changes in technology within societies
- draw together knowledge from a range of areas (including mathematics, science, history and the arts) to design and develop creative solutions
- explore issues behind challenges and predict the impacts of the products of technology on people and environments
- understand principles used to design and develop products
- understand that particular fields of technology may have characteristic symbol, language and notational systems
- develop understandings about investigation, ideation, production and evaluation
- understand the nature of information, materials and systems and use appropriate techniques to manipulate them.

Complex thinker

Learners identify challenges and use critical and complex reasoning, intuition and lateral thinking as they are 'working technologically'.

Learners have opportunities to:

- use inductive and deductive thinking to make predictions about the impacts of the processes and products of technology
- compare and critically evaluate the appropriateness of past and present technologies and the impacts of future technologies
- appreciate the value and potential of participating in product development
- predict and identify possible sources of error and bias in research and test results
- judge the relevance, reliability and validity of data and information
- evaluate the suitability of materials for particular purposes based on understandings of their characteristics
- recognise cause-and-effect and part-to-whole relationships in systems
- determine how system components work together to achieve specified goals
- make decisions and justify choices in realising their designs.

Active investigator

Learners use natural curiosity and enthusiasm to identify challenges with a technology demand, investigate the underlying issues and explore a range of alternatives.

Learners have opportunities to:

- identify, question and define challenges and inequities
- explore aesthetic, cultural, economic, environmental, ethical, functional and social implications
- generate and access information from a variety of sources

- test the suitability of materials for specific purposes and experiment with techniques for manipulating and processing materials
- examine cause-and-effect relationships within systems, and refine systems by finding and rectifying faults or design flaws
- monitor the impact of technological development.

Responsive creator

Learners invent, generate and explore new ways of viewing or resolving challenges with a technology demand.

Learners have opportunities to:

- use imagination, originality, intuition, enterprise and aesthetic judgment when meeting design challenges
- identify and conceptualise new ways to solve problems
- use creative strategies to examine needs, wants, opportunities and associated issues from a range of perspectives
- envision and generate a range of potential solutions
- transfer knowledge across contexts to develop innovative applications of that knowledge in order to capitalise on change
- explore techniques to create new effects
- realise and refine innovative designs.

Effective communicator

Learners interpret and communicate design ideas and proposals using appropriate language, symbol systems, and representations.

Learners have opportunities to:

- use a variety of methods to communicate design ideas effectively to a range of audiences
- comprehend information presented in various forms, including sketches and formal drawings, three-dimensional models, photographs, multimedia, diagrams, specifications, tables and graphs
- compose design specifications, design proposals, test reports and product evaluations
- use accepted standards and forms for measurement, calculation and written and visual representations
- explore ideas critically and articulate feelings and values in debating issues related to technology.

Participant in an interdependent world

Learners work cooperatively and consider issues of appropriateness and management as they are 'working technologically' in various contexts to meet real-life and lifelike challenges.

Learners have opportunities to:

- develop dispositions of confidence and critical thinking as they design, develop and use technology
- become creative, self-motivated and capable of transferring skills to many different contexts

- work individually and collaboratively on a variety of design challenges with confidence and initiative
- negotiate with others and resolve conflict in appropriate ways as they work towards common goals and share equipment and resources
- confront inequities and advocate for and contribute to the socially just use of technology.

Reflective and self-directed learner

Learners critically evaluate, and reflect on, their ideas, assumptions, values, processes and products while 'working technologically'.

Learners have opportunities to:

- critically evaluate processes and products of technology and search for improvement and further opportunities
- reflect on their role as decision makers and respond to challenges by directing their learning to meet their needs
- identify their strengths, limitations and preferred learning styles and use this information to improve learning
- reflect on their own practices to better manage time and resources when 'working technologically'
- display self-motivation and perseverance in seeing projects through to completion
- predict possible obstacles and ways to handle them when working on design challenges
- use a variety of strategies to clarify and refine ideas related to technology
- look for and recognise ways of 'working technologically' in everyday life.

Cross-curricular priorities

The Years 1 to 10 Technology key learning area incorporates and promotes the cross-curricular priorities of literacy, numeracy, lifeskills and a futures perspective.

Literacy

Literacy is a social practice that uses language for thinking and making meaning in cultures. It includes reading and writing, speaking and listening, viewing and shaping, often in combination in multimodal texts within a range of contexts. Critical thinking is also involved in these practices. Students seek and critically appraise information, make choices and use their literacy skills to become independent learners. They develop critical literacy by questioning the cultural and social practices embedded in various kinds of texts. Students learn about relationships between the contexts and audiences of those texts. They understand that literacy influences how people view themselves, their identities and their environments as well as providing ways to represent these views.

In the Technology key learning area, students interpret, critically appraise, and communicate information in different forms, including design briefs, instructions, plans, diagrams, illustrations, sketches, flowcharts, blueprints and

pattern markings. They use electronic and print media to locate, interpret and store information, and recognise and use terminology and symbols associated with design and technology in a range of contexts. They understand that the meanings of words in the context of technology may differ from meanings in everyday use. Students also understand that information needs to be presented in a way that is inclusive of all individuals and groups.

As they meet design challenges, students express ideas — in written, spoken and visual forms — about the appropriateness of processes and products of technology. They also read, listen to, view and exchange information about the impacts and consequences of technology.

Numeracy

Numeracy is the demonstration of practices and dispositions that accurately, efficiently and appropriately meet the demands of typical everyday situations involving number, space, measurement and data.

In the Technology key learning area, students design and develop products in real-life and lifelike contexts. In meeting design challenges, students may:

- estimate, count, collect, collate, graph, map and critique technological data and statistics
- apply numerical terms and concepts in practical situations
- identify and use patterns and employ spatial concepts
- visualise and construct three-dimensional structures from two-dimensional plans
- approximate, measure and calculate time, length and mass
- use mathematical symbol systems.

Lifeskills

'Lifeskills' is a term used to describe the knowledge, practices and dispositions considered necessary for people to function adequately in their contemporary and changing life roles and situations. Demonstration of lifeskills takes place in two overlapping dimensions: practical performance of, and critical reflection on, those skills.

It is possible to identify at least four sets of lifeskills that enable students to participate in four life roles. The lifeskills, and related life roles, are:

- personal development skills — growing and developing as an individual
- social skills — living with and relating to other people
- self-management skills — managing personal capacities, goods and services
- citizenship skills — receiving from and contributing to local, state, national and global communities.

The Technology key learning area helps to prepare students for a variety of life roles by providing opportunities for them to develop and demonstrate:

- understandings of the designed world
- skills in communicating technological information and ideas
- interpersonal skills in cooperative learning situations
- practices and dispositions related to evaluating the impacts of technology on individuals, societies and environments
- knowledge and skills in managing people, resources, opportunities and constraints.

Students explore and critically appraise a range of historical and contemporary approaches to meeting needs and wants and capitalising on opportunities. They accept responsibility for their own ideas from inception to realisation, within a range of contexts. They are encouraged to experiment, to take reasonable risks and to view options and opportunities in imaginative and enterprising ways. Students also consider the appropriateness of their own choices and actions and appreciate the importance of equity in decision making.

Futures perspective

A futures perspective involves knowledge, practices and dispositions that enable students to identify individual and shared futures. A futures perspective leads to insights and understandings about thinking ahead and the roles of individuals and groups in envisioning and enacting preferred futures.

Students with insights and knowledge about the past and present consider the consequences of past and future actions. They take responsibility for their actions and decisions and are empowered to participate optimistically in processes of social innovation, recovery and renewal.

In the Technology key learning area, students consider the effects of technological development on individuals, communities and environments. They envision and work towards preferred futures by using the knowledge, practices and dispositions of 'working technologically'. In doing so, they explore their roles and responsibilities in relation to technological change.

Students model, forecast, prepare scenarios, conduct environmental scans and analyse trends. They also communicate ideas and feelings about technology and debate possible, probable and preferred future developments.

Other curricular considerations

The Years 1 to 10 Technology key learning area also incorporates work education.

Work education

Work involves both the paid employment that people undertake and the unpaid work they perform within the groups, communities and societies to which they belong. It occurs with different types and groupings of people in different settings and is performed under many different conditions.

Work education involves **learning for work**, **learning about work** and **understanding the nature of work:**

- Learning for work involves developing work-related knowledge, practices and dispositions.
- Learning about work emphasises student understandings about work and the settings and conditions that characterise workplaces. It highlights the benefits of work to individuals and communities.
- Understanding the nature of work involves critically reflecting on and analysing the sociocultural, economic and political forces that influence the ways society values different kinds of work.

While work education includes providing opportunities for students to explore options for future education, training and paid employment, this is not its sole purpose; nor is it intended to focus exclusively on the development of vocationally oriented skills. Work education has a much broader role — that of preparing students for work in all the forms and contexts in which it occurs. This includes preparing students to participate effectively in both paid and unpaid work, to understand the issues involved in balancing these different kinds of work (including family responsibilities) and to recognise the benefits to society of assisting workers to achieve this balance.

In the Technology key learning area, students learn for work as they are 'working technologically'. They gather and apply information, handle materials, operate equipment and work with systems. They develop understandings of the designed world and how people operate in various contexts. They also focus on ways of meeting people's needs and wants and recognise the importance of considering the appropriateness, contexts and management of technology processes and products. Their actions, decisions and experiences help them develop knowledge, practices and dispositions that can provide a foundation for further development in specific work environments.

Students learn about work as they mirror, in a broad sense, workplace practices such as working cooperatively in teams and sharing knowledge. They develop understandings about workplace practices and attitudes, including the breaking down of stereotypical roles and behaviours.

Students develop understandings about the nature of work as they consider the influences technology has on work and workers, and the ways in which technology shapes, and is itself shaped by, society. Through the Technology key learning area students become capable people, creating innovative solutions for community needs, valuing enterprising and entrepreneurial behaviour and critically responding to technological changes in the workplace and wider community.

Understandings about learners and learning

The following assumptions about learners and learning underpin the Years 1 to 10 Technology key learning area.

Learners

- Learners are unique individuals and thinkers with divergent views about the world.
- Learners have a broad range of knowledge, attitudes, values and experience shaped by their gender, socioeconomic status and geographical location, and by other aspects of their background, all of which form part of their learning environment. Their prior knowledge and experience influence the meaning they make of any new learning experience.
- Learners grow, develop and learn in different ways, in different settings and at different rates. By engaging in design challenges that match their needs, interests, understandings and individual learning styles, learners have opportunities to develop and extend their capabilities with technology.

- Learners have a need to understand the designed world and to comprehend, manipulate and control technological objects within their daily lives.
- Learners learn through designing and creating products in response to design challenges.

Learning

- Learning is a lifelong process.
- Learning occurs within particular social and cultural contexts.
- Learning is most effective when it involves active partnerships with students, parents/carers, peers, teachers and school and community members.
- Learning contexts should acknowledge equity principles by being inclusive and supportive and by celebrating diversity.
- Learning requires active construction of meaning and is most effective when it is developed in meaningful contexts and accommodates, acknowledges, and builds on prior knowledge.
- Investigative and learner-centred strategies are most effective in enabling learners to make informed choices and to take actions that support their own and others' wellbeing.
- Learning is enhanced by the use of a range of technologies.
- Learning occurs when learners have opportunities to reflect on their own thinking and learning.
- Learning is most effective when the learning environment is safe, supportive, enjoyable, collaborative, challenging and empowering.

Learner-centred approach

A learner-centred approach to learning and teaching views learning as the active construction of meaning, and teaching as the act of guiding and facilitating learning. This approach considers knowledge as being ever-changing and built on prior experience.

In the Technology key learning area, a learner-centred approach provides opportunities for students to practise critical and creative thinking, problem solving and decision making when meeting design challenges. This involves recall, application, analysis, synthesis, prediction and evaluation, all of which contribute to the development and enhancement of conceptual understandings. A learner-centred approach also encourages students to demonstrate ownership of their ideas and to reflect on and monitor their thinking as they make decisions and take action. 'Working technologically' in a learner-centred environment offers students many opportunities to draw on and develop their understandings of, and capabilities with, technology.

Equity in the curriculum

The Queensland school curriculum is designed to challenge inequities by:

- acknowledging and minimising unequal outcomes of schooling for different groups
- identifying and minimising barriers to access, participation, active engagement, construction of knowledge and demonstration of learning outcomes
- using the knowledge, practices and dispositions of all students as a basis for their learning and for enhancing the learning of others in the community
- developing understanding of, and respect for, diversity within and among groups
- making explicit the fact that knowledge is historically, socially and culturally constructed
- making explicit the relationship between valued knowledge and power relations
- identifying and promoting the capacity of each key learning area to develop knowledge, practices and dispositions that challenge injustice and empower students.

An equitable curriculum caters for the needs of individuals and groups so that all students have opportunities for learning and for demonstrating learning outcomes. For this to occur, students must have access to the curriculum and be able to participate successfully in learning activities and assessment tasks.

An equitable curriculum also provides opportunities for students to learn about equity and equity issues in the context of the key learning area.

Student access and participation

To plan learning activities and assessment tasks that support student access and participation, teachers must take account of:

- the cumulative and interrelated impacts that students' cultures, languages, locations, abilities, gender and socioeconomic circumstances have on their perspectives and experiences
- the life experiences of students and the diverse range of knowledge, practices and dispositions they bring to the classroom.

The Technology syllabus provides a framework for such planning. One of its focuses is on providing students with opportunities to design, develop and use products of technology to meet real-life and lifelike design challenges. These design challenges, and the associated demonstrations of learning outcomes, may occur in a variety of contexts, depending on students' needs, interests, abilities, circumstances, learning styles and prior experiences. This choice of contexts, together with the emphasis on 'real-life' and 'lifelike' situations, provides the flexibility and scope needed to plan activities and assessment that are both accessible and meaningful to students.

Learning about equity

In the Technology key learning area, all students have opportunities to develop and enhance their capabilities with many different processes and products of technology. Students also consider people's diverse needs and wants, examine

issues related to the appropriateness, contexts and management of technological developments, and explore and describe the impacts and consequences of technology. Through these activities, students explore equity issues and identify and challenge personal, group and societal values that reinforce and perpetuate inequities.

Students examine historical, social, cultural, spiritual, political and economic constructions of technology and the varying perspectives of different people. They also learn about interrelationships between processes and products of technology and the contexts in which these are created.

In so doing, students develop repertoires of knowledge, practices and dispositions that promote equity and equity issues. They broaden their understandings about the diversity of practices, beliefs and values within and across cultural groups and respect people's cultures and environments. They analyse social, political and economic structures created through technological developments (along with the power relations inherent in these structures) and explore ways such structures can work for or against individuals or groups. Ultimately, students gain the insights and understandings they need to recognise and challenge stereotypes and misrepresentations that contribute to inequities.

Outcomes

Framework

The Years 1 to 10 Technology syllabus provides a framework for planning learning activities and assessment tasks through which students have opportunities to demonstrate what they know, and can do with what they know, in the Years 1 to 10 Technology key learning area.

Key learning area outcomes

The key learning area outcomes highlight the uniqueness of the Technology key learning area and its particular contribution to lifelong learning. During the compulsory years of schooling in this key learning area, students develop knowledge, practices and dispositions necessary to:

- envision and create innovative products
- understand and follow production procedures and manage processes and resources
- understand the nature of information, materials and systems
- develop and apply techniques for working with information, for manipulating and processing materials, and for assembling, managing and controlling systems
- reflect on, critically evaluate and respond to relationships between technology and society
- use understandings about resources, processes and products to participate effectively in society and envision their preferred futures
- recognise, and respond to, beneficial and non-beneficial impacts and consequences associated with the design and use of products
- consider appropriateness, contexts and management as they participate in decision-making processes related to designing, developing and applying new technologies
- use forms and conventions of technological language to communicate effectively with others
- demonstrate ways of 'working technologically' in various contexts.

Strands of the key learning area

The key concepts, level statements and learning outcomes of the Technology key learning area are organised into four strands:

- Technology Practice
- Information
- Materials
- Systems.

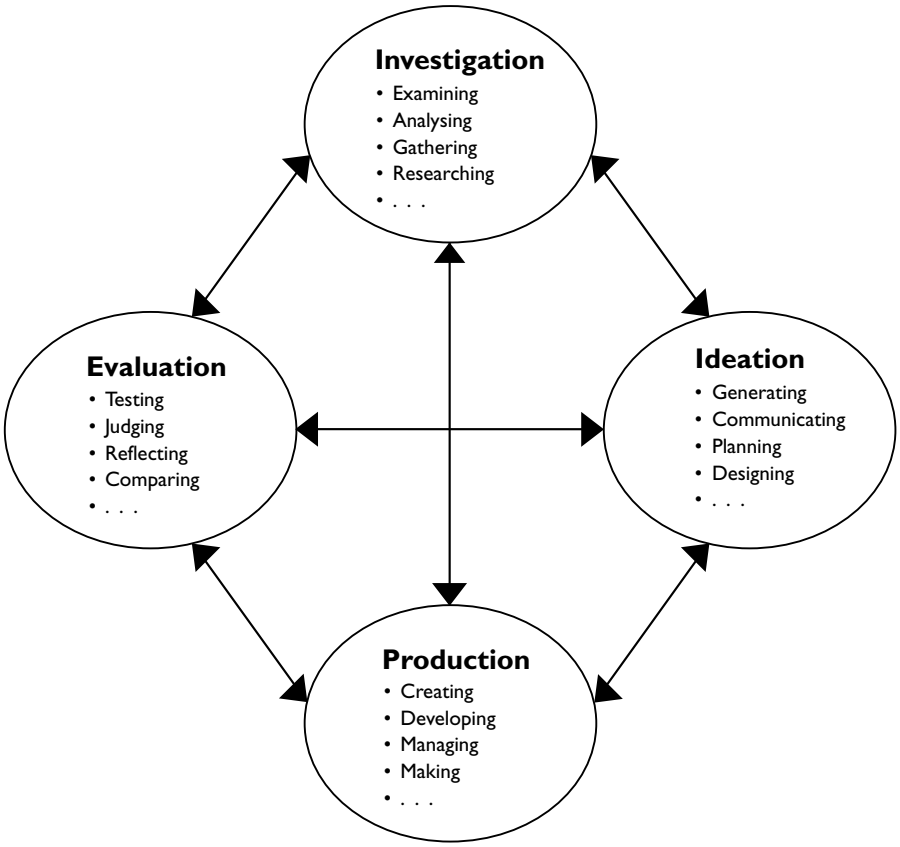
Consistent with 'working technologically', the strands are interrelated and should not be considered in isolation from each other. Each of the strands makes an equivalent contribution to the key learning area. Typically, activities in the Technology key learning area provide opportunities for students to develop and demonstrate learning outcomes in more than one strand. When planning for the demonstration of multiple core learning outcomes, teachers should consider ways of associating outcomes from the Technology Practice strand with outcomes in one or more of the other strands.

Integral to each of the strands are:

- considerations of appropriateness (aesthetic, cultural, economic, environmental, ethical, functional and social), contexts and management
- awareness of possible impacts and consequences of the processes and products of technology.

Technology Practice

Technology Practice is the design element of 'working technologically'. It refers to the actions of investigation, ideation, production and evaluation that people engage in when they design and develop products. As the following diagram shows, these actions may be undertaken in iterative, cyclical and recursive ways.



Technology Practice — actions and interactions

The Technology Practice strand has four key concepts:

- *Investigation is carried out to gather knowledge, ideas and data for use in meeting design challenges.*

  Investigation involves identifying and analysing needs, wants, opportunities, possibilities and challenges. As they investigate, students may:

  – examine how others have solved similar design challenges
  – gather and interpret knowledge, ideas and data from a range of sources through research and consultation
  – explore the use and selection of appropriate tools
  – examine issues and values when meeting design challenges.

- *Ideation is undertaken to generate and communicate ideas that meet design challenges, and to justify the selection of these ideas.*

  Ideation involves:

  – considering problems in new and creative ways
  – generating possible ideas or solutions
  – selecting ideas with the view of developing products
  – communicating ideas in design proposals.

- *Production procedures can be identified, described and managed when making products that meet design challenges.*

  Production involves managing procedures and resources to develop products that reflect design ideas. It requires actions leading to alternative prototypes, models and products that meet design challenges.

- *Evaluation is undertaken to make judgments about the appropriateness of design ideas, processes and products when meeting design challenges.*

  Evaluation involves appraising investigation methods, design ideas, production procedures, and products to determine how effectively they meet design challenges. It also includes reflection on appropriateness, possible impacts and consequences, and individual or group management.

Information

Information is the purposeful organisation and communication of data. It can be stored, retrieved and communicated in a variety of media and formats. There are many different sources from which information originates and is gathered.

The Information strand has two key concepts related to the nature of information, and techniques for working with it:

- *Information originates from different sources, exists in various forms and can be used for different purposes.*

  Understanding the nature of information involves developing knowledge about information products and recognising reliable, relevant and valid sources of information.

- *Information can be manipulated, presented and managed in different ways for different purposes.*

  There are various techniques for working with information. These include techniques for accessing, organising, generating, manipulating, storing, presenting, transmitting and retrieving information in various forms for a variety of audiences and purposes.

Materials
Materials are the resources used to create products.

The Materials strand has two key concepts related to the nature of materials and techniques for manipulating them:

- *Materials have characteristics that affect their selection and use in products.*

  Understanding the nature of materials involves locating and selecting materials based on:

  – understandings of their characteristics
  – knowledge of their sources
  – tests devised and used to determine their characteristics
  – evaluation of the suitability of materials for specific purposes.

- *Materials can be manipulated and processed by using suitable equipment and techniques.*

There are various techniques for working with materials. These include techniques for joining, combining, transforming, shaping and separating materials for a variety of design purposes.

Systems
A system is a combination of components that work together to achieve a specific purpose or goal. Systems consist of inputs, processes and outputs. System components may function in simple or complex ways.

Systems have structures, or purposeful organisation and functions that can be described and represented by such things as flowcharts, models and schematic diagrams. Systems and subsystems are products of technology, as well as being important in the development and modification of technologies.

The Systems strand has two key concepts related to the nature of systems and techniques for assembling, managing and controlling them:

- *Systems comprise interactive components and have inputs, processes and outputs that can be controlled in logical ways based on certain principles.*

  Understanding the nature of systems involves recognising systems and subsystems, identifying their components and how they function together, and understanding the interrelationships of these components.

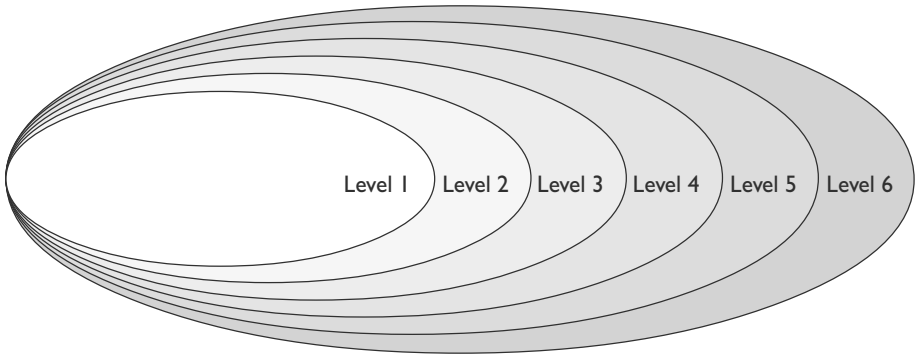
- *Systems can be developed, refined and optimised by organising their components.*

  There are various techniques for working with systems. These include techniques for assembling, disassembling, maintaining, and optimising systems and subsystems for a variety of purposes. Testing for efficiency and effectiveness is also an aspect of working with systems and subsystems.

Levels

The levels outlined on pages 20–35 indicate progressions of increasing sophistication and complexity in learning outcomes. The sequencing of the learning outcomes, based on each key concept, is such that each level is 'nested' within the following level. Learning outcomes for successive levels are conceptually related to each other, forming a continuum rather than existing simply as a number of discrete entities.

This continuum is illustrated in the following diagram.



Progression of conceptual development of outcomes

A level statement is included for each level of each strand of the syllabus. The level statement summarises learning outcomes at each level and provides the conceptual framework for developing the learning outcomes.

The level statements at Foundation Level have been developed for students with disabilities demonstrating a level of understanding before that of Level 1. These statements provide a framework for schools to develop learning outcomes that meet the individual needs of specific students with disabilities. Sample learning outcomes have been provided. Learning outcomes selected or developed at Foundation Level should relate to the students' individualised curriculum programs.

Learning outcomes

Core learning outcomes describe learnings that are considered essential for all students. They describe what students know, and can do with what they know, as a result of planned learning activities.

The core learning outcomes are presented in order of increasing complexity from Levels 1 to 6. All students must be provided with opportunities to demonstrate the core learning outcomes during the compulsory years of schooling.

The learning outcomes at Beyond Level 6 are discretionary. They describe what students know, and can do with what they know, beyond what is considered essential at Level 6.

This syllabus does not include specific discretionary learning outcomes for each level. There is a variety of possible contexts in which students may demonstrate the core learning outcomes in the Technology key learning area. Students who

have already demonstrated a particular learning outcome in one context can broaden their understandings by being given opportunities to demonstrate that outcome in other contexts. Possible contexts are listed on page 3.

Relationship of outcome levels to year levels
For the purposes of planning learning activities and assessment tasks, outcome levels typically relate to year levels as follows:

- students demonstrating Level 2 outcomes are at the end of Year 3
- students demonstrating Level 3 outcomes are at the end of Year 5
- students demonstrating Level 4 outcomes are at the end of Year 7
- students demonstrating Level 6 outcomes are at the end of Year 10.

Some students will demonstrate core learning outcomes beyond the typical levels described above. Some students will require more time to demonstrate the core learning outcomes.

Foundation Level
Learning outcomes at Foundation Level may be developed in accordance with the individual needs of students with disabilities. The learning outcomes presented at Foundation Level of each strand are examples of the kinds of outcomes that students at this level might demonstrate. There are no core learning outcomes at this level.

The examples of Foundation Level learning outcomes are much more specific than core learning outcomes. They are tailored to meet the needs of individual students with disabilities. Additional information about these outcomes is provided in the sourcebook guidelines.

Indicative time allocations
Indicative time allocations are based on an estimate of the minimum time needed to provide students with opportunities to demonstrate the core learning outcomes.

The following have been used to guide the design and development of the syllabus for the Years 1 to 10 Technology key learning area:

- **Years 1 to 3**
  180 hours across the three years
- **Years 4 to 7**
  240 hours across the four years
- **Years 8 to 10**
  180 hours across the three years.

Codes

The core, discretionary (Beyond Level 6) and foundation learning outcomes for the strands of the Technology key learning area are presented on the following pages. Codes have been used to identify outcomes in each of the strands where applicable:

TP Technology Practice

INF Information

MAT Materials

SYS Systems

For example:

TP 3.1 indicates Technology Practice, Level 3

SYS 5.2 indicates Systems, Level 5

*L*earning outcomes

Technology Practice

Investigation is carried out to gather knowledge, ideas and data for use in meeting design challenges.

Ideation is undertaken to generate and communicate ideas that meet design challenges, and to justify the selection of these ideas.

Production procedures can be identified, described and managed when making products that meet design challenges.

Evaluation is undertaken to make judgments about the appropriateness of design ideas, processes and products when meeting design challenges.

Foundation Level	Level 1
Level statement *Students are developing an awareness of the products of technology they use in familiar situations to meet their own needs and wants. They are beginning to generate and communicate ideas for products that can be used for real-life and lifelike purposes. They are developing an understanding of some safety procedures and practices related to the development of products and the use of technological devices. They express their views about various aspects of familiar products and their purposes.*	**Level statement** *Students gather information from familiar environments, generate design ideas and communicate these through experimentation, play and pictures. They make products and describe the production procedures used. Students express opinions about their own and others' design ideas and products.*
The following are **examples** of learning outcomes for students with disabilities demonstrating a level of understanding before that of Level 1. Learning outcomes that meet the individual needs of specific students with disabilities can be developed from the level statement. Such learning outcomes should relate to the individualised curriculum programs of those students. • Students observe and identify the purpose of a specific product or device. • Students indicate a preference from a range of options to meet a need or want. • Students follow directions safely for specific purposes. • Students express their likes or dislikes about products they have helped to make.	**Core learning outcomes** TP 1.1 Students gather knowledge, ideas and data from familiar environments and consider how they will use this information to meet design challenges. TP 1.2 Students generate design ideas and communicate these through experimentation, play and pictures. TP 1.3 Students make products that are meaningful to them, and describe their production procedures. TP 1.4 Students express thoughts and opinions to evaluate their own and others' design ideas and products.

*L*earning outcomes

Technology Practice

Investigation is carried out to gather knowledge, ideas and data for use in meeting design challenges.

Ideation is undertaken to generate and communicate ideas that meet design challenges, and to justify the selection of these ideas.

Production procedures can be identified, described and managed when making products that meet design challenges.

Evaluation is undertaken to make judgments about the appropriateness of design ideas, processes and products when meeting design challenges.

Level 2	Level 3
Level statement *Students organise information gathered to meet a design challenge and use annotated drawings to communicate their design ideas. They identify, sequence and follow production procedures to design and make products. Students compare their design ideas with the final products.*	**Level statement** *Students examine information gathered to meet design challenges. They collaboratively generate design ideas, communicate these in a variety of ways, and develop and follow production procedures to make products. Students evaluate the effectiveness of their own and others' processes and products.*
Core learning outcomes	**Core learning outcomes**
TP 2.1 Students organise knowledge, ideas and data about how needs and wants might be met and use this information when meeting design challenges.	TP 3.1 Students examine knowledge, ideas and data from a range of sources and establish the relevance of this information when meeting design challenges.
TP 2.2 Students generate design ideas, acknowledge the design ideas of others and communicate their design ideas using annotated drawings that identify basic design features.	TP 3.2 Students collaboratively generate design ideas and communicate these using presentations, models and technical terms.
TP 2.3 Students identify, sequence and follow production procedures to make products of their own design.	TP 3.3 Students cooperatively develop and follow production procedures to make products that reflect their design ideas.
TP 2.4 Students consider initial design ideas with final products and give reasons for similarities and differences.	TP 3.4 Students test and judge how effectively their own and others' processes and products meet the design challenge.

*L*earning outcomes

Technology Practice

Investigation is carried out to gather knowledge, ideas and data for use in meeting design challenges.

Ideation is undertaken to generate and communicate ideas that meet design challenges, and to justify the selection of these ideas.

Production procedures can be identified, described and managed when making products that meet design challenges.

Evaluation is undertaken to make judgments about the appropriateness of design ideas, processes and products when meeting design challenges.

Level 4	Level 5
Level statement *Students consult others when gathering information, generating design ideas and developing detailed design proposals. They make use of the practical expertise of others when following production procedures to make products. Students gather feedback to evaluate their ideas, processes and products.*	**Level statement** *Students analyse the links that exist between information gathered and the design and development of products. They develop design proposals that show an understanding of factors influencing the production of their products. Students use predetermined criteria to evaluate their processes and products.*
Core learning outcomes	**Core learning outcomes**
TP 4.1 Students use consultative methods to gather knowledge, ideas and data when researching alternatives within design challenges.	TP 5.1 Students analyse links between the knowledge, ideas and data gathered to meet design challenges and the design and development of new and improved products.
TP 4.2 Students generate design ideas through consultation and communicate these in detailed design proposals.	TP 5.2 Students generate design ideas and communicate these in design proposals that indicate an understanding of factors influencing production of the option(s) they have selected.
TP 4.3 Students identify and make use of the practical expertise of others when following production procedures to make products for specific users.	TP 5.3 Students meet predetermined standards as they follow production procedures to make quality products.
TP 4.4 Students gather feedback to gauge how well their design ideas and processes meet design challenges and how effectively products meet the needs of specific users.	TP 5.4 Students use predetermined criteria to judge how well processes and products meet the needs of specific users, and recommend modifications or improvements.

*L*earning outcomes

Technology Practice

Investigation is carried out to gather knowledge, ideas and data for use in meeting design challenges.

Ideation is undertaken to generate and communicate ideas that meet design challenges, and to justify the selection of these ideas.

Production procedures can be identified, described and managed when making products that meet design challenges.

Evaluation is undertaken to make judgments about the appropriateness of design ideas, processes and products when meeting design challenges.

Level 6	Beyond Level 6
Level statement *Students prepare detailed plans for gathering information and validate their sources and methods. They develop various design proposals that incorporate strategies for managing resources and make quality products that meet detailed specifications. Students use methods that reflect commercial and industrial standards to evaluate their processes and products.*	**Level statement** *Students analyse information in detail and develop understandings and ideas that can lead to innovative and enterprising ways of meeting design challenges. They develop detailed proposals, manage production procedures that reflect industrial and commercial standards and make innovative products. Students use a range of methods to make judgments about the feasibility and community acceptance of their processes and products.*
Core learning outcomes	**Learning outcomes**
TP 6.1 Students formulate detailed plans for gathering knowledge, ideas and data and validate choices of information, sources and methods.	TP B6.1 Students develop formal analyses of knowledge, ideas and data to meet design challenges in innovative and enterprising ways.
TP 6.2 Students generate design ideas and communicate these in design proposals that indicate various options and incorporate management strategies.	TP B6.2 Students generate design ideas and communicate these in detailed design proposals that show evidence of innovation and include in-depth analysis of appropriateness.
TP 6.3 Students negotiate and refine production procedures in making quality products that meet detailed specifications.	TP B6.3 Students manage production procedures that reflect commercial or industrial standards in order to make innovative products.
TP 6.4 Students identify methods for evaluating commercial or industrial products and processes and use these to judge the appropriateness of their own processes and products.	TP B6.4 Students use a range of methods to judge whether their design ideas, production procedures and products are commercially or industrially feasible, and acceptable to the community.

*L*earning outcomes

Information

Information originates from different sources, exists in various forms and can be used for different purposes.

Information can be manipulated, presented and managed in different ways for different purposes.

Foundation Level	Level 1
Level statement *Students are developing an understanding of information by exploring familiar sources and forms of information and different ways of accessing it. They frequently make meaning of the information they receive. They experiment with a variety of ways of communicating information.*	**Level statement** *Students identify and describe different forms of information and use simple techniques to present it.*
The following are **examples** of learning outcomes for students with disabilities demonstrating a level of understanding before that of Level 1. Learning outcomes that meet the individual needs of specific students with disabilities can be developed from the level statement. Such learning outcomes should relate to the individualised curriculum programs of those students. • Students react to stimuli in their environment in various ways. • Students use sound, visual or concrete representations to present information.	**Core learning outcomes** INF 1.1 Students identify and describe different forms of information. INF 1.2 Students use simple techniques for presenting information for their own purposes.

*L*earning outcomes

Information

Information originates from different sources, exists in various forms and can be used for different purposes.

Information can be manipulated, presented and managed in different ways for different purposes.

Level 2	Level 3
Level statement *Students explain the purposes of various forms of information used in everyday life. They use simple techniques for accessing and presenting information.*	**Level statement** *Students describe the advantages and disadvantages of different forms and sources of information. They generate, modify and present information for different purposes.*
Core learning outcomes INF 2.1 Students explain the purposes of different forms of information and describe how these are used in everyday life. INF 2.2 Students use simple techniques for accessing and presenting information for themselves and others.	**Core learning outcomes** INF 3.1 Students describe advantages and disadvantages of different sources and forms of information. INF 3.2 Students select and use techniques for generating, modifying and presenting information for different purposes.

*L*earning outcomes

Information

Information originates from different sources, exists in various forms and can be used for different purposes.

Information can be manipulated, presented and managed in different ways for different purposes.

Level 4	Level 5
Level statement *Students analyse sources and forms of information and match them to requirements. They transform and transmit information for different audiences.*	**Level statement** *Students explain how ongoing changes in sources, forms and management of information affect design and production decisions. They compare and select techniques for processing, managing and presenting information for specific users.*
Core learning outcomes	**Core learning outcomes**
INF 4.1 Students analyse sources and forms of information and match these to the requirements of design challenges.	INF 5.1 Students explain how changes to sources, forms and management of information affect design and production decisions.
INF 4.2 Students apply techniques for transforming and transmitting information for different audiences.	INF 5.2 Students compare and select techniques for processing, managing and presenting information for specific users.

*L*earning outcomes

Information

Information originates from different sources, exists in various forms and can be used for different purposes.

Information can be manipulated, presented and managed in different ways for different purposes.

Level 6	Beyond Level 6
Level statement *Students analyse the implications of information ownership and control. They use specialised techniques for managing and organising the presentation of information to meet detailed specifications.*	**Level statement** *Students identify changes in the ways information is presented and used and describe how to capitalise on these changes to meet people's particular needs. They develop and use specialised techniques to present information in innovative ways.*
Core learning outcomes	**Learning outcomes**
INF 6.1 Students analyse issues related to the ownership and control of information in societies.	INF B6.1 Students identify changes in the ways information is presented and used in societies and describe how to capitalise on these changes to meet the needs of specific communities and groups.
INF 6.2 Students use specialised techniques for managing and organising the presentation of information to meet detailed specifications.	INF B6.2 Students develop and use specialised techniques to present information in innovative ways.

*L*earning outcomes

Materials

Materials have characteristics that affect their selection and use in products.

Materials can be manipulated and processed by using suitable equipment and techniques.

Foundation Level	Level 1
Level statement *Students are developing understandings of the basic characteristics of familiar materials through exploration. They may be facilitated to choose materials from a range of options. They may also be facilitated to select materials for simple tasks, and suitable tools and equipment for manipulating and processing the materials.*	**Level statement** *Students identify characteristics of materials. They also identify materials used in everyday products and explain reasons for their use. Students explore equipment and techniques for working with materials by experimenting and playing with a range of objects.*
The following are **examples** of learning outcomes for students with disabilities demonstrating a level of understanding before that of Level 1. Learning outcomes that meet the individual needs of specific students with disabilities can be developed from the level statement. Such learning outcomes should relate to the individualised curriculum programs of those students. • Students sort materials, with or without facilitation, according to differences in characteristics. • Students choose suitable materials and equipment for a familiar task, with or without facilitation.	**Core learning outcomes** MAT 1.1 Students identify characteristics of materials and explain how materials are used in everyday products. MAT 1.2 Students explore equipment and techniques when joining and combining materials for meaningful purposes.

*L*earning outcomes

Materials

Materials have characteristics that affect their selection and use in products.

Materials can be manipulated and processed by using suitable equipment and techniques.

Level 2	Level 3
Level statement *Students match the characteristics of materials to the design requirements of products. They select and use suitable equipment and techniques for manipulating and processing materials.*	**Level statement** *Students choose materials that have characteristics most suited to the product and to user needs. They select and use suitable equipment and techniques to combine materials accurately.*
Core learning outcomes MAT 2.1 Students match the characteristics of materials to design requirements. MAT 2.2 Students select and use suitable equipment and techniques for manipulating and processing materials.	**Core learning outcomes** MAT 3.1 Students choose materials according to various characteristics that best suit the product and user. MAT 3.2 Students select and use suitable equipment and techniques to combine materials accurately in order to meet design requirements.

*L*earning outcomes

Materials

Materials have characteristics that affect their selection and use in products.

Materials can be manipulated and processed by using suitable equipment and techniques.

Level 4	Level 5
Level statement *Students explain how materials are manipulated in different ways depending on their characteristics. They use practical knowledge about manipulating and processing materials to enhance their products.*	**Level statement** *Students compare and contrast characteristics of materials to ascertain how well materials meet predetermined standards for products being designed and developed. They meet predetermined standards as they operate equipment and apply techniques for manipulating and processing materials.*
Core learning outcomes	**Core learning outcomes**
MAT 4.1 Students explain how characteristics of materials affect ways they can be manipulated.	MAT 5.1 Students compare and contrast materials according to their characteristics to determine how effectively the materials meet predetermined standards.
MAT 4.2 Students employ their own and others' practical knowledge about equipment and techniques for manipulating and processing materials in order to enhance their products.	MAT 5.2 Students operate equipment and apply techniques for manipulating and processing materials to meet predetermined standards.

*L*earning outcomes

Materials

Materials have characteristics that affect their selection and use in products.

Materials can be manipulated and processed by using suitable equipment and techniques.

Level 6	Beyond Level 6
Level statement *Students explain their ideas about the impacts of materials in the design proposals they develop for making products. They use specialised equipment and refined techniques for manipulating and processing materials, and follow detailed specifications to make quality products.*	**Level statement** *Students challenge traditional uses of materials as they combine and modify materials to create innovative products. They use a variety of equipment and techniques to approximate commercial or industrial standards.*
Core learning outcomes MAT 6.1 Students incorporate in their design proposals ideas about the impacts of particular materials used in products. MAT 6.2 Students use specialised equipment and refined techniques to make quality products to detailed specifications.	**Learning outcomes** MAT B6.1 Students challenge traditional uses of materials by applying their understandings about the characteristics of materials in the creation of innovative products. MAT B6.2 Students use a variety of equipment and techniques to approximate commercial or industrial standards when combining or modifying materials.

*L*earning outcomes

Systems

Systems are comprised of interactive components and have inputs, processes and outputs that can be controlled in logical ways based on certain principles.

Systems can be developed, refined and optimised by organising their components.

Foundation Level	Level 1
Level statement *Students are developing an understanding of simple routines and familiar tasks and are participating in activities that involve familiar, simple systems. They identify cause–effect relationships within these systems.*	**Level statement** *Students identify and describe familiar systems used in everyday life. They sequence steps to develop simple systems for familiar tasks.*
The following are **examples** of learning outcomes for students with disabilities demonstrating a level of understanding before that of Level 1. Learning outcomes that meet the individual needs of specific students with disabilities can be developed from the level statement. Such learning outcomes should relate to the individualised curriculum programs of those students. • Students use simple routines for familiar purposes. • Students indicate their understanding of cause–effect relationships through use of simple routines.	**Core learning outcomes** SYS 1.1 Students identify familiar systems and describe how these are used in everyday life. SYS 1.2 Students sequence steps to develop simple systems to carry out familiar tasks.

*L*earning outcomes

Systems

Systems are comprised of interactive components and have inputs, processes and outputs that can be controlled in logical ways based on certain principles.

Systems can be developed, refined and optimised by organising their components.

Level 2	Level 3
Level statement *Students identify and describe the order of components in familiar systems. They combine components to assemble systems to satisfy needs.*	**Level statement** *Students identify and describe relationships between inputs, processes and outputs in systems. They assemble and trial systems.*
Core learning outcomes SYS 2.1 Students identify and describe the order of components in familiar systems. SYS 2.2 Students combine components to assemble systems in order to meet their needs and the needs of others.	**Core learning outcomes** SYS 3.1 Students identify and describe relationships between inputs, processes and outputs in systems. SYS 3.2 Students assemble and trial systems they design by considering inputs, processes and outputs.

*L*earning outcomes

Systems

Systems are comprised of interactive components and have inputs, processes and outputs that can be controlled in logical ways based on certain principles.

Systems can be developed, refined and optimised by organising their components.

Level 4	Level 5
Level statement *Students identify and explain the logic of systems and subsystems. They refine and modify systems and/or subsystems, based on feedback gathered.*	**Level statement** *Students explain the structures, controls and management of systems and subsystems. They incorporate control and management mechanisms in systems that include subsystems.*
Core learning outcomes SYS 4.1 Students identify and explain the logic of systems and subsystems. SYS 4.2 Students incorporate feedback to refine and modify systems and/or subsystems.	**Core learning outcomes** SYS 5.1 Students explain the structures, controls and management of systems and subsystems. SYS 5.2 Students incorporate control and management mechanisms in systems that include subsystems.

*L*earning outcomes

Systems

Systems are comprised of interactive components and have inputs, processes and outputs that can be controlled in logical ways based on certain principles.

Systems can be developed, refined and optimised by organising their components.

Level 6	Beyond Level 6
Level statement *Students explain the principles of complex systems, in terms of structures, control and management. They devise methods of managing and monitoring the operation of complex systems.*	**Level statement** *Students identify relationships within systems, and relationships between systems and external entities, to determine ways of optimising and enhancing beneficial impacts. They use specialised techniques to develop and optimise complex systems and subsystems.*
Core learning outcomes SYS 6.1 Students explain principles underlying complex systems in terms of structures, control and management. SYS 6.2 Students devise ways to manage and monitor the operation of complex systems.	**Learning outcomes** SYS B6.1 Students identify internal and external relationships of systems in order to optimise and enhance beneficial impacts. SYS B6.2 Students develop and optimise complex systems and subsystems by selecting and using specialised techniques.

Using learning outcomes to plan for learning and assessment

Learning outcomes provide a framework for planning learning activities and assessment tasks by describing what it is that students should know and be able to do with what they know. Using learning outcomes for planning involves:

- adopting a learner-centred approach to learning and teaching
- planning learning activities and assessment at the same time
- assisting students to work towards demonstrating the learning outcomes
- establishing clear expectations of student demonstrations as a basis for monitoring the progress of student learning.

The core learning outcomes are sequenced conceptually in six progressive levels. This conceptual development is represented in the level statements for each strand. Learning outcomes at each level are qualitatively different from the corresponding learning outcomes at the levels before and after. This sequencing across levels assists teachers in planning learning activities to cater for the range of developmental differences between students.

When planning units of work, teachers could select learning outcomes from within a strand, across strands within a key learning area, or across key learning areas. The learning outcomes of the Technology Practice strand must be associated with learning outcomes in one or more of the other strands. Assessment tasks may allow students to demonstrate more than one learning outcome.

Planning should make provision for students to demonstrate learning outcomes in more than one context and on more than one occasion. Activities incorporating a variety of content and contexts should be organised to provide these opportunities. Planning for learning and planning for assessment are concurrent processes. Learning activities can be opportunities for teachers to gather evidence about students' demonstrations of learning outcomes.

Planning at Foundation Level may involve learning outcomes that teachers have identified using an interpretation of the level statements specific to the student's needs.

Core content

The core learning outcomes are the focus for planning learning activities and assessment tasks. Students will engage with core content when they are provided with opportunities to demonstrate core learning outcomes.

While the content is listed in strands for organisational convenience, no one part of that content is to be viewed as discretely associated with a single strand. The organisation of content within a strand should not be considered hierarchical. Any of the content can be addressed at any appropriate level; not all of the content need be addressed at every level. Core content should be selected to suit students' needs, interests and abilities and to take account of their prior knowledge and experiences.

The core content should be studied in a range of contexts. These could include personal and global contexts, as well as contexts of agriculture, business, communities, home and family, industry, leisure and recreation, and school.

The core content of each strand is identified on the following pages.

Core content

Technology Practice

Investigation — gathering knowledge, ideas and data to meet design challenges

- analysis of design challenges
  - identifying needs, wants and opportunities (observing, consulting, conducting needs analyses or environmental scans)
  - identifying design requirements (user requirements, safety requirements, requirements under relevant legislation, regulation or conventions)
  - identifying design constraints
- sources of knowledge, ideas and data (familiar and unfamiliar):
  - environments
  - products of technology
  - Internet (websites and online communities)
  - people (potential users, clients, specialists and experts)
  - libraries
- methods of gathering knowledge, ideas and data:
  - consulting (questioning, questionnaires, surveys, interviews)
  - exploring, examining
  - researching
  - observing, scanning
  - experimenting, testing
- methods of organising and analysing of knowledge, ideas and data:
  - recording
  - selecting, sorting and comparing
  - interpreting, inferring and concluding
  - identifying alternatives
  - validating choices
  - challenging ideas
  - verifying accuracy
  - establishing relevance

Ideation — generating and communicating ideas that meet design challenges

- generation of ideas to meet design challenges
  - generating new ideas
  - modifying and refining designs
  - selecting and justifying design options
  - identifying materials, information and systems to meet design requirements
  - identifying equipment and techniques
- communication of ideas that meet design challenges
  - pictures, sketches, annotated drawings
  - play, roleplay
  - drawings of different views
  - scale drawings
  - computer-aided design (CAD)
  - models
  - technical terms
  - design proposals and specifications
  - detailed plans
  - oral, written and multimedia presentations

Production — making products to meet design challenges

- production procedures
  - developed (independently and cooperatively)
  - informed by practical experience
  - described, negotiated, refined
  - specify standards specified
  - identified, sequenced, followed
  - managed
- products (artefacts, processes, systems, services and environments)
  - meet human needs or wants
  - capitalise on opportunities
  - extend human capabilities
  - make models and prototypes
  - produced to meet standards (predetermined criteria, commercial or industrial standards)

Evaluation — judging the appropriateness of design ideas, processes and products when meeting design challenges

- evaluation of design ideas, processes and products
  - expressing thoughts and opinions
  - gaining feedback from others (clients, specific users)
  - testing and judging effectiveness in real-life or lifelike contexts
  - comparing initial design ideas and final products
  - applying standards (predetermined criteria, commercial or industrial standards)
  - evaluating management decisions

Impacts and consequences

- historical, current and future developments
- impacts and consequences related to aesthetic, cultural, economic, environmental, ethical, functional and social appropriateness
- effects of management decisions

Core content

Information

Sources and forms of information

- recognition of different sources and forms
- advantages and disadvantages of different sources and forms
- identification and location of relevant information
- methods of accessing information
- evaluation of quality (accuracy, relevance, reliability and currency)
- identification of bias

Purposes and presentation

- purposes of information products — communication of knowledge, data and ideas (to inform, report, persuade, convey a message, simplify, instruct, entertain)
- creation of information products
- presentation of information for different audiences and contexts

Manipulation

- techniques for manipulating information
  - access
  - search
  - retrieve
  - generate
  - select
  - organise
  - lay out
  - store
  - modify
  - transform
  - present
  - transmit

Management

- organisation of information for different purposes
- analysis, synthesis, monitoring
- maintenance of accuracy and currency
- maintenance of privacy and security
- intellectual property
  - applying for copyright, patents, trademarks
  - seeking permission for using copyrighted material
  - acknowledging sources of information
- control of information
  - standards and conventions
  - global trends in generation, use and management of information

Impacts and consequences

- historical, current, and future developments
- impacts and consequences of information products and the ways information is presented — aesthetic, cultural, economic, environmental, ethical, functional, and social appropriateness

Core content

Materials

Characteristics of materials (including their types, attributes and properties and other attributes)

- types of materials (solid, liquid and gas)
  - natural materials (organic and inorganic)
  - processed materials (alloys, brick, metals, paper, plastics, synthetic fibres)
- properties (absorbency, density, hardness, magnetic properties, reactivity to other substances, sensory properties, solubility, strength, transparency)
- attributes of materials that can change without affecting their properties (mass, size, shape and volume)
- testing materials to determine characteristics
- relationship of characteristics to performance (conductivity, durability, flammability, flexibility)
- relationship between characteristics and their selection and use in products

Suitability of materials for specific purposes

- traditional and non-traditional uses of materials
- commercial and consumer considerations
- methods for judging the suitability of materials

Manipulation and processing

- techniques for manipulating materials (cutting, shaping, joining, combining, bending)
- techniques for processing materials (melting, baking, boiling, cooling, moulding, pulping, separating)
- the use of tools and equipment
- the use of standards when manipulating and processing materials

Management

- workplace health and safety issues — risk assessment
- storage and maintenance of materials, tools and equipment
- functional and economic requirements

Impacts and consequences

- historical, current and future developments
- impacts and consequences of using, manipulating and processing materials — aesthetic, cultural, economic, environmental, ethical, functional and social appropriateness

Core content **Systems**
Characteristics of systems • identifiable components — physical and human • simple and complex systems • logic of systems • inputs, processes and outputs • subsystems • structures, purposeful organisation and functions
Function of systems • types of systems — electronic, human, hydraulic, pneumatic, mechanical, chemical, physical • application and operation of various systems • cause-and-effect relationships • relationships between inputs, processes and outputs • relationships between people and systems • reliability
Manipulation • techniques for manipulating systems – selecting and sequencing of components – assembling and/or combining components – producing – programming – disassembling, dismantling – access to and availability of resources – improving, refining, modifying, fine tuning – adding subsystems
Management • management processes – monitoring – maintaining – analysing and evaluating – controlling – gathering and using feedback – testing and trialling – diagnosing and fault finding – analysing and correcting system failure • control mechanisms – mechanisms to control inputs (remote controls switches, sensors, taps) – mechanisms to control outputs (volume, speed, light, heat) – mechanisms to control processes (quality system procedures, backup procedures, security procedures)
Impacts and consequences • historical, current and future developments • impacts and consequences of developing, using and maintaining systems — aesthetic, cultural, economic, environmental, ethical, functional and social appropriateness

Assessment

Assessment is the purposeful, systematic and ongoing collection of evidence for use in making judgments about students' demonstrations of learning outcomes. In this syllabus, core learning outcomes are presented in levels of increasing sophistication and complexity to form a continuum of learning. The monitoring of demonstrations of these learning outcomes provides evidence about student progress in the Technology key learning area.

Purposes of assessment

Information obtained from assessment is primarily used to:

- provide feedback on student progress
- inform decision making about student learning.

Providing feedback

Assessment provides:

- ongoing feedback on the progress of individual students and groups of students in relation to learning outcomes throughout the learning and teaching process
- information to students, teachers, parents/carers, others in the community and/or school authorities about students' demonstrations of learning outcomes.

Informing decision making

Assessment information helps teachers to:

- make decisions about student needs, the learning and teaching process, and resource requirements
- plan learning and teaching programs for individuals, classes and the whole school
- discuss future learning pathways with students and parents/carers
- make decisions about providing learning support to particular groups of students
- develop learning resources and curriculum materials.

Principles of assessment

For assessment to be effective, it should:

- focus on students' demonstrations of learning outcomes
- be comprehensive
- be valid and reliable
- take account of individual learners
- reflect equity principles
- be an integral part of the learning and teaching process
- provide opportunities for students to take responsibility for their own learning and to monitor their own progress.

Demonstrations of learning outcomes

Within an outcomes approach, assessment focuses on students' demonstrations of learning outcomes. When assessment is focused on learning outcomes, students are aware of what is being assessed and the evidence that will be used to make judgments about their demonstrations of learning outcomes. Teachers may then use information from assessment to plan further learning.

Comprehensive range of evidence

Judgments about students' demonstrations of learning outcomes should be based on a comprehensive range of evidence gathered and recorded over time. To collect such evidence, teachers need to provide numerous opportunities and contexts for students to demonstrate learning outcomes, and to use a variety of assessment techniques and recording instruments. Because students have different learning styles, evidence should be gathered from various sources. (Examples of assessment techniques, recording instruments and sources are provided on p. 45.)

Valid and reliable evidence

Assessment should provide valid, reliable evidence that relates directly to specific learning outcomes. It is essential that assessment tasks assess what they are intended to assess and that judgments about students' demonstrations of learning outcomes are based on a broad range of evidence gathered and recorded over time.

Individual learners

At any one time in their schooling, students could demonstrate learning outcomes in different ways and at different levels. When planning assessment, teachers need to take account of the fact that each student will progress at a different rate across and within the key learning areas. They also need to take account of factors that influence students' learning — in particular, their prior knowledge and experience, and their social, emotional, physical, intellectual and linguistic development.

Equity principles

Assessment based on principles of equity enables students to demonstrate learning outcomes in ways that are sensitive to, and inclusive of, their circumstances. When planning and conducting assessment, teachers therefore need to take account of students' learning styles, abilities, disabilities, gender, sexual identity, socioeconomic circumstances, cultural and linguistic backgrounds and geographical locations.

This includes:

- providing assessment opportunities that assist students or groups of students to overcome barriers that might limit their demonstrations of learning outcomes
- negotiating assessment with students so that they maximise their opportunities to demonstrate learning outcomes.

Integral part of learning and teaching process

Assessment is an integral part of the learning and teaching process. As teachers plan learning activities, they should also plan how they will monitor student progress. Authentic assessment tasks should match the learning activities and teaching methods students have experienced. Assessment tasks should reflect real-life and lifelike situations when appropriate.

Responsibility for own learning and self-monitoring

Assessment should provide feedback and support to assist students to take responsibility for their own learning. This involves giving students opportunities to set their own learning goals, to monitor their progress in relation to the learning outcomes and to gather information that they and others can use to make decisions about future learning. Opportunities also need to be provided for students and teachers to develop shared understandings about how learning outcomes might be demonstrated and for students to explain how they might demonstrate the learning outcomes in their own terms.

Process of assessment

The process of assessment involves:

- providing students with opportunities to demonstrate what they know, and can do with what they know, in terms of identified learning outcomes
- gathering and recording evidence of students' demonstrations of learning outcomes
- making judgments about students' demonstrations of learning outcomes.

Opportunities to demonstrate learning outcomes

Students should have numerous opportunities to demonstrate learning outcomes that have been the focus of planned activities. Assessment opportunities must be provided over time and in a range of contexts. As well as using learning activities as assessment opportunities, teachers can design specific tasks that give students opportunities for demonstrating learning outcomes.

Gathering and recording evidence

Evidence about students' demonstrations of learning outcomes should come from several different sources and be gathered and recorded over time using a variety of assessment techniques and recording instruments. This evidence should be relevant to the learning outcomes being assessed and be collected in a focused and systematic way.

Sources of evidence
Using evidence from a variety of sources caters for different learning styles, different types of learning outcomes, the different ways in which students may demonstrate learning outcomes, and learning that has taken place in different contexts. Examples of activities, tasks, products or processes that could be used as sources of evidence are shown in the table on page 45.

Assessment techniques
Assessment techniques include observation, consultation, focused analysis and peer- and self-assessment. Descriptions of these techniques are provided on page 45.

Assessment techniques should be selected to suit the context in which the learning outcome is being demonstrated and the type of evidence required. Teachers need to familiarise students with these techniques through modelling and practice.

Record keeping
Record keeping must support planning and be manageable and easily maintained. It must also provide accurate evidence drawn from a range of contexts about student learning related to the demonstrations of learning outcomes.

Teachers need to keep records on observation, consultation, focused analysis and peer- and self-assessment. Several examples of records are listed on page 45.

A **student folio** is a useful way of collating and storing evidence about a student's demonstrations of learning outcomes. Student folios are collections of current work in progress, responses, and descriptions of processes undertaken during learning activities over a period of time — for example, annotated samples of a student's work, anecdotal records, checklists, multimedia samples including photographs or videos, and products. This collection of work provides a fair, valid and informative picture of a student's accomplishments. Materials for the folio may be selected by the student or the teacher, or by negotiation between the two. The use of the folio will determine which materials are included.

Another type of record is a **Technology project folio**. This is a working folio that the student compiles when responding to a design brief or design challenge. It is a collection of ongoing or completed work and may include journal entries, notes, sketches, drawings, designs, plans, multimedia presentations, models or products. This type of folio is formative, providing a basis for effective collaboration between the student and teacher leading to ongoing teaching and feedback.

Suggested ways of gathering and recording evidence		
Sources of evidence	**Assessment techniques**	**Recording instruments**
• writing tasks such as – design briefs and plans – design proposals – specifications and modifications – lists of information sources used with justifications for their selection – sketches and drawings of design ideas and products – investigative reports – summaries of tests carried out and processes used – evaluative reports • oral tasks such as – descriptions and explanations of design ideas – reports on the effectiveness of designs and products – descriptions and analyses of techniques used – descriptions of design processes undertaken • Technology project folios — designs, ideas, plans, ongoing and completed work, recordings of interviews and on-the-job conversations • photographic and video records of activities and outcomes • working models and devices • individual and group tasks and projects and practical performances • diaries/journals/scrapbooks	**Observation:** Teachers observe students as they participate in planned activities. Teacher observation occurs continually as a natural part of the learning and teaching process and can be used to gather a broad range of information about students' demonstrations of learning outcomes. Teacher observations can also be structured to gather particular kinds of information in relation to learning outcomes. **Consultation:** Teachers discuss student work with students, colleagues, parents/carers or other paraprofessionals. The varying perspectives of the participants in consultations can help enrich the evidence gathered about students' demonstrations of learning outcomes. Consultation can be used to verify the evidence gathered using other techniques. Some consultations may reveal a need for more detailed assessment. **Focused analysis:** Teachers examine in detail student responses to tasks or activities (e.g. group discussions, tests, projects, presentations, role-plays, debates, research tasks, video presentations, responses to stimulus). This technique provides detailed evidence about students' demonstrations of learning outcomes. **Peer- and self-assessment:** Students use the above techniques to assess their own work and the work of their peers. Peer- and self-assessment allow teachers to take account of students' perceptions when gathering evidence.	• anecdotal records • annotated work samples • anticipated evidence statements or criteria sheets • audio and visual (including photographic and video or multimedia) recordings • graphs • checklists • conference logs • feedback sheets • learning logs • observation notes • peer- and self-assessment sheets • photographic records • profiles • progress charts • reflection sheets • student folios • test results over time • worksheets

Making judgments about demonstrations of learning outcomes

Core learning outcomes are conceptually linked to each other across levels to form a continuum. Following Level 1, each subsequent level of outcomes requires more complex conceptual understanding. This means that students who are not demonstrating a core learning outcome at one level may be demonstrating the related outcome at the preceding level. The sequencing also means that students who are demonstrating an outcome at one level are continually reinforcing the understandings of outcomes at preceding levels.

Some students may be able to demonstrate a learning outcome the first time they have an opportunity to do so. When they have additional opportunities that result in further demonstrations of the outcome, they are deemed to have demonstrated it consistently. Other students may need more opportunities to demonstrate a learning outcome before the same decision can be made. A judgment can be made when a consistent pattern of demonstrations has been established.

Teachers, therefore, make judgments about students' demonstrated learning outcomes when satisfied that they have sufficient evidence. In making these judgments, teachers need to:

- analyse what it is that students are expected to know and be able to do with what they know
- consider the outcomes at the levels before and after the focus learning outcomes
- use a range of evidence
- make a judgment about which learning outcomes the student has demonstrated.

Judgments about a student's demonstrations of learning outcomes should be made without reference to the performance of other students.

Consistency of teacher judgments

Strategies for ensuring consistency of teacher judgments include:

- *sharing of understandings about the learning outcomes*: Teachers discuss the meaning of learning outcomes and what students have to know and do to demonstrate these outcomes.
- *collaborative planning*: Teachers work together to plan for learning and assessment and to reach shared understandings about what is required for demonstrations of learning outcomes. Collaborative planning in primary or middle schools may involve teachers of the same year level, teachers of consecutive year levels or bands of schooling, or specialist and generalist classroom teachers. It may also involve whole-school planning. Collaborative planning in middle or secondary schools may involve teachers of the same year level, teachers of consecutive year levels, or teachers with subject expertise in two or more areas. Primary and secondary teachers might also plan collaboratively, especially for the transition from Year 7 to Year 8.
- *common assessment tasks*: Teachers cooperatively plan and/or moderate assessment tasks focusing on identified learning outcomes. A common assessment task that provides students with opportunities to demonstrate learning outcomes at a range of levels allows teachers to develop shared understandings about the demonstrations of learning outcomes at different levels.

- *statements of anticipated evidence, or criteria sheets*: Teachers identify the properties, components or dimensions by which students' demonstrations of learning outcomes will be judged. In developing a common statement of anticipated evidence, or criteria sheet, teachers collaboratively analyse the learning outcomes to identify and record the anticipated evidence or criteria that will be used as the basis for judgments. Anticipated evidence could be identified in a design brief, criteria sheet, assessment task or verbal description.
- *moderation processes (formal and informal)*: Teachers discuss and compare judgments made about students' work and associated demonstrations of learning outcomes. Formal moderation processes occur when school authorities require teachers from within or among schools to discuss the consistency of judgments about demonstrations of learning outcomes. Informal moderation occurs any time that teachers discuss and compare their judgments of students' work.
- *samples of typical responses*: Teachers compile, and refer to, samples of student work that show how learning outcomes may be demonstrated. The samples could be annotated samples of student responses to selected assessment tasks.

Reporting

Reporting is the process of communicating timely, accurate information about students' demonstrations of learning outcomes. Its main purpose is to acknowledge and support student learning. Reporting may be formal or informal.

Reporting to students and parents/carers

Teachers need to provide regular feedback to students and parents/carers about student learning and progress in relation to learning outcomes. This kind of reporting is an important and ongoing part of the learning and teaching process and can occur incidentally as well as in planned ways.

Students and parents/carers also need to be provided with information about student progress at certain points in time as identified by schools in their overall plans for learning, assessment and reporting.

Reporting on student progress in relation to learning outcomes

Information reported to students and parents/carers as part of the ongoing learning and teaching process includes:

- explanations of particular assessment opportunities
- evidence about demonstrations of learning outcomes
- judgments about demonstrations of particular learning outcomes
- clarification of learning outcomes and how they could be demonstrated
- identification of future assessment opportunities and anticipated evidence.

Information reported to students and parents/carers at particular points in time may include:

- records of the learning outcomes previously demonstrated by the student
- descriptions of learning outcomes that students have had opportunities to demonstrate since reporting last occurred
- statements about what students were expected to know and do to demonstrate the learning outcomes
- descriptions of the contexts in which learning and assessment has occurred
- records of the learning outcomes demonstrated by the student since the previous report
- records of the learning outcomes that the student is currently working towards
- information about the relationship between levels of learning outcomes and year levels
- information that is specific to individual students, such as the student's self-assessment or future learning plans and goals.

Language, formats and modes of reporting

The language, formats and modes used for reporting must be meaningful and relevant to the proposed audience.

Modes of reporting may include:

- written reports (print or electronic)
- student–teacher conferences
- parent–teacher interviews
- culminating presentations
- portfolios (print or electronic).

Copyright notice

Guidance in connection with the Copyright Amendment (Digital Agenda) Act

Libraries, educational institutions, and institutions helping people with a disability may have the right to:

- supply another library with digital copies of a work, or parts of a work that they hold, if the other library cannot get the work in a reasonable time at an ordinary price
- display digital works within their premises (e.g. on an intranet)
- make a digital copy for research or study
- for administrative purposes, make a digital copy of a work held in printed format
- make a copy of an artistic work to display on their premises if the original is lost or in danger.

To comply with subsection 49(5A) of the *Copyright Amendment (Digital Agenda) Act 2000*, anything that a library makes available on their computer system must be so arranged that it can be accessed only through a computer that cannot itself make a copy, or print out the copy displayed. This is made clear in subsection 49(5).

Direct quotation of subsection 49(5A), Copyright Amendment (Digital Agenda) Act

> If an article contained in a periodical publication, or a published work (other than an article contained in a periodical publication) is acquired, in electronic form, as part of a library or archives collection, the officer in charge of the library or archives may make it available online within the premises of the library or archives in such a manner that users cannot, by using any equipment supplied by the library or archives:
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