Technology (2003)

Years 1 to 10
Sourcebook Guidelines
(Part 1 of 7)

Note: The PDF version of this document has been split into sections for easier download. This file is Part 1 of 7.

Queensland Government
Queensland Studies Authority
Partnership and Innovation

These sourcebook guidelines should be read in conjunction with the following Queensland Studies Authority materials:

Years 1 to 10 Technology Syllabus

Initial In-service Materials

Years 1 to 10 Technology Sourcebook Modules

Years 1 to 10 Technology CD-ROM

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Introduction

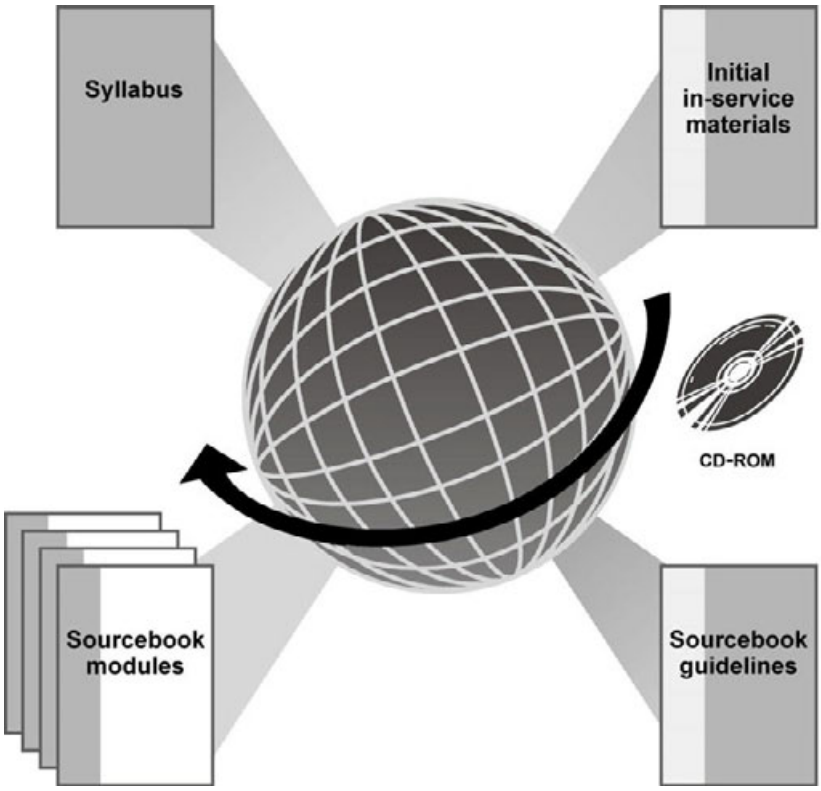
Purpose of the sourcebook guidelines

The *Years 1 to 10 Technology Sourcebook Guidelines* have been developed to assist teachers to implement the Queensland *Years 1 to 10 Technology Syllabus*.

The sourcebook guidelines provide information about:

- the nature of the Technology key learning area
- learners and learning in Technology
- the scope and sequence of learning outcomes
- planning for learning and assessment
- curriculum evaluation.

The sourcebook guidelines are part of a multimedia resource that includes the syllabus, sourcebook modules and initial in-service materials. These materials are published in printed and electronic formats and are supported by the Technology CD-ROM and website (www.qsa.qld.edu.au).



Suite of Technology curriculum materials

Syllabus

The syllabus outlines the rationale of the key learning area and its contribution to the Years 1 to 10 curriculum. It describes key learning area outcomes, core learning outcomes and examples of foundation learning outcomes for the Technology key learning area. The syllabus also provides a framework for planning and assessment.

Sourcebook modules

The sourcebook modules provide teachers with a range of planning, learning, teaching and assessment ideas to assist students to demonstrate core learning outcomes. Modules focus on activities that provide opportunities for students to demonstrate core learning outcomes from the four strands of the Technology key learning area, as well as develop important knowledge, practices and dispositions related to the Technology key learning area.

A number of case studies have been included to provide insights into ways teachers could implement the Technology key learning area. These case studies focus on curriculum decisions that teachers made as they planned for, and assessed, learning outcomes in their own classrooms. They provide valuable insights into how teachers developed their own understandings about technology.

While the full set of Technology modules addresses core learning outcomes from the *Years 1 to 10 Technology Syllabus*, the modules do not cover all situations and contexts through which students could learn about technology. Each module demonstrates one way of planning and assessing learning outcomes in a given context. Teachers may use or modify these modules, or develop their own, to meet the specific needs and interests of individual students or groups of students.

Initial in-service materials

The initial in-service materials assist teachers to develop an understanding of the 1 to 10 curriculum and the Technology key learning area, as well as to develop curriculum programs consistent with the syllabus and effective teaching practice. The initial in-service materials support teachers to develop understandings of the Technology key learning area by:

- allowing teachers to investigate areas of interest in relation to the syllabus and associated curriculum materials
- providing templates, resources and strategies for planning and assessment at individual, class and school levels
- exemplifying planning for learning and assessment in Technology
- providing examples of learning experiences that will assist teachers to understand the syllabus and associated curriculum materials and ways of adapting them to local needs and resources
- providing opportunities for teachers to consider their ideas and understandings about Technology.

Contemporary national and international models of technology education inform the Technology key learning area curriculum materials. The curriculum materials are also informed by advice gathered from teachers, school administrators and school authorities during the trial and pilot of the draft *Years 1 to 10 Technology Syllabus*. In addition, the following references were drawn on during the Technology Curriculum Development Project:

Approaches to Enterprise Education 1995, Curriculum Corporation, Carlton, Vic.
P–10 Curriculum Framework 1999, unpublished, Queensland School Curriculum Council, Brisbane.
A Statement on Technology for Australian Schools 1994, Curriculum Corporation, Carlton, Vic.
Taking on Technology: A Resource Kit for Teachers 1996, EQ, Brisbane.
Teaching Technology: A Resource Kit for Teachers 1997, EQ, Brisbane.
Technology: A Curriculum Profile for Australian Schools 1994, Curriculum Corporation, Carlton, Vic.
Technology Education for Early Learners 1997, Department for Education and Children's Services, Adelaide.
Using the Technology Profile 1995, Curriculum Corporation, Carlton, Vic.

Nature of the Technology key learning area

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 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.

Active nature of learning in technology education

Technology education makes important links between student learning and the many ways in which people, as part of their daily lives, design and develop, access and use technology. Students are actively engaged in learning in real-life and lifelike contexts in technology when they take on roles as designers, decision makers, managers, producers and consumers.

As designers, students can generate and critique design ideas and processes and communicate their thinking by using language, notational and symbol systems appropriate to technology. They may source and synthesise knowledge, ideas and data in order to meet design challenges and reflect upon the impacts of past, current and future products of technology. The examination of diverse solutions to design challenges provides opportunities for students to consider the use of materials, information and systems used to meet needs and wants or to capitalise on opportunities.

As decision makers, students collaborate with others to select preferred options towards appropriate technological futures. The importance of considering different viewpoints is reinforced as students make decisions by balancing possible alternatives against potential impacts and consequences of technology. Students consider impacts and consequences in terms of their aesthetic, cultural, economic, environmental, ethical, functional or social appropriateness.

As managers, students plan for the responsible and efficient use of technology. Through cooperation and communication, they learn different approaches to meeting design challenges. Students are required to meet design challenges, plan and undertake production processes within set budgets and time constraints, and use equipment safely.

As producers and consumers, students become well informed about past, contemporary and emerging technology. They develop critical understandings about the processes used to design and develop products by responding to needs, wants and opportunities. As producers and consumers students recognise the limitations of technological solutions to some situations, problems or tasks. They develop their own understandings about the effectiveness and

efficiency of products and processes and consider the roles of technology in enhancing the likelihood of socially just and ecologically sustainable futures.

The practical and multi-dimensional nature of technology education caters for a range of interests and learning styles. The key learning area encourages students to become actively involved in initiating, designing, creating and using technology. It provides a framework for the development of students' decision-making abilities by allowing them to take reasonable risks in the search for ideas and solutions to design challenges. It provides opportunities for students to develop technology-related knowledge, practices and dispositions as they build, create and contribute to the world around them in tangible ways.

'Working technologically'

The *Years 1 to 10 Technology Syllabus* describes what students do to develop products[1] in response to needs, wants or opportunities as 'working technologically'. 'Working technologically' is the term used in the syllabus, and related curriculum materials, to describe a way of working that interweaves technology practice, information, materials and systems with considerations of appropriateness, contexts and management. When 'working technologically' students have the opportunities to learn in authentic contexts as they consider issues related to real-life and lifelike situations.

By 'working technologically' students develop knowledge, practices and dispositions that enable them to identify and capitalise on opportunities in innovative, creative or practical ways. They create products in response to needs, wants or opportunities, and evaluate their products and those of others. They also consider the impacts or consequences of such products on individuals, communities and environments.

The diagram below has been used in the *Years 1 to 10 Technology Syllabus* to illustrate the process of 'working technologically'. It shows how a human need, want or opportunity may have a technology demand to which students can respond. They do this by drawing on their technology-related knowledge, practices and dispositions. The diagram indicates that the process of 'working technologically' may be ongoing and that the design and development of products have consequences or impacts that may, in turn, lead to new needs, wants or opportunities.

Model of 'working technologically'

[1] Products may include artefacts, processes, systems, services and environments.

Strategies that teachers can use to promote 'working technologically' include encouraging students to:

- consider different aspects of design challenges in terms of appropriateness, contexts and management
- make decisions about the use of technology practice, information, materials and systems in meeting a need, want or opportunity
- make choices and value judgments about the impacts and consequences of the processes and products of technology.

When 'working technologically' students need to consider the interrelationships that exist between technology practice, information, materials and systems.

Technology Practice

Technology Practice can be seen as the design element of 'working technologically'. It refers to the actions and interactions of investigation, ideation, production and evaluation that people engage in when they design and develop products. These actions and interactions may be undertaken in iterative, cyclical and recursive ways which means that any one action may be visited any number of times and in any order. It also means that the order of the interactions between investigation, ideation, production and evaluation may be different every time an individual or group is involved in 'working technologically'.

The diagram that follows has been used in the syllabus to explain the dynamic relationships between investigation, ideation, production and evaluation. It shows that a pathway can be followed from any one action to any other action or series of actions.

Technology Practice: Actions and interactions

Information

Information is the purposeful organisation and communication of data. It can be stored, retrieved and communicated in printed, pictorial, numerical, graphical and electronic forms. There are many different sources from which information originates and is gathered.

Materials

Materials are the resources used to create products. They have a range of characteristics that determine their suitability for certain purposes. Students require understandings about the nature of materials and ways they can be manipulated.

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.

Students consider *appropriateness*, *contexts* and *management* when 'working technologically'.

Appropriateness

The development of products to meet needs, wants or opportunities is a human activity and as such is influenced by the values of people and societies. These values may lead to the development and uses of products that have favourable, neutral or adverse effects on different individuals, communities and environments. When developing or using technology, students need to be aware of the possible effects that their ideas, actions and products may have and should use this awareness to inform their decision making.

When 'working technologically' students are provided with opportunities to consider the aesthetic, cultural, economic, environmental, ethical, functional and social appropriateness of products. As a result of considering appropriateness over time, students develop knowledge, practices and dispositions about technology and the impacts it can have on individuals, societies and environments.

Strategies that teachers can use to promote considerations of appropriateness include encouraging students to:

- question the influences technology has on societies and question the values that underpin the development of technological solutions
- make decisions based on consultative and collaborative processes aimed at gathering relevant information
- recognise the influences technology has on change by reflecting on the history of technology in different societies, and envisioning and evaluating preferred futures when 'working technologically'
- identify advantages and disadvantages that technology can bring to individuals, societies and environments
- balance impacts and consequences to make decisions about processes and products when 'working technologically'.

When students design and develop products, or critique the impacts and consequences of technology on individuals, societies or environments, they make use of the seven aspects of appropriateness as identified in the *Years 1 to 10 Technology Syllabus*.

Aspect of appropriateness	Description
Aesthetic	An understanding of aesthetic appropriateness allows students to make judgments about products and their uses in terms of touch, taste, sound, sight, smell and use of space. Such an understanding assists students to develop an appreciation of the needs and wants of others.
Cultural	An understanding of cultural appropriateness allows students to make judgments about the dynamic relationships between beliefs, nuances and practices of different cultural and ethnic groups, and the effects that a product or a process may have on those groups.
Economic	An understanding of economic appropriateness allows students to make judgments about immediate and long-term costs to individuals and environments resulting from the application of technology and the impacts of those costs over time. Students can evaluate the financial and resource implications that the process of developing products may have on people and places.
Environmental	An understanding of environmental appropriateness allows students to make judgments about the beneficial and non-beneficial environmental consequences resulting from the development of products. They develop responsible attitudes towards sustainable ecological development within a futures perspective.
Ethical	An understanding of ethical appropriateness allows students to make judgments about how personal and shared beliefs affect the application of technology. Such an understanding allows students to develop and use ethically appropriate processes and products.
Functional	An understanding of functional appropriateness allows students to make judgments about how well products fulfil their intended purposes. An understanding of functional appropriateness over time may also involve students in making decisions about the safety and efficiency of technology.
Social	An understanding of social appropriateness allows students to make judgments about the needs and conventions of societies, and their sub-groups, and the effects that the application of technology has on these groups. Students come to understand the mutual relationships that exist between technology and communities and they explore issues related to community, heritage, intellectual property, security, privacy, personal ability and gender.

Contexts

Products of technology are designed, created, modified or used in all aspects of human endeavour. Students should be given opportunities to identify and respond to real-life or lifelike design challenges in a variety of broad, overlapping contexts. This provides an authentic background in which students can construct understandings about technology and the effects that contexts may have on their decisions.

Some students may work in several contexts simultaneously. These may include personal and global contexts, as well as contexts of agriculture, business, community, home and family, industry, leisure and recreation, and school. The activities students are involved in as they ‘work technologically’ are often derived from different topics, which in turn are framed by a context or number of contexts. The following table highlights units that could relate to one or more contexts. However, certain activities and units could be grouped differently as they may relate to more than a single context.

Context	Sample unit	Sample activities
Personal	health and wellbeing	diet, clothing, personal appearance
	family occasions	food preparation, celebrations
Global	environments	online communities, global warming, alternative energy, Landcare
	development	stock market, Young Achievers Australia, CREST (Creativity in Science and Technology — CSIRO initiative)
	partnerships	global economies, space exploration, future studies
	systems	communication, Internet and web development, resource management
	design	architecture, web design, interior design, energy use and solar design, clothing
Agriculture	hydroponics	growing lettuce
	horticulture	market garden, tomatoes for school fete, orchids, home gardening
	animal management	school cattle stud, holding yards, beekeeping, domestic animal care
	farming	equipment and maintenance, irrigation, crop production
	native plant production	rainforest garden, riverbank regeneration
Business	marketing	multimedia presentations, advertising, personal résumés
	money management	budgeting, financial planning
	management	financial reports, business plans, human resource management
	information management	filing and storage, databases, programming, communication systems
Community	community	fundraising, newsletter, radio station, small business ventures, school partnerships, school canteen
	town planning	waste management, transport and traffic control, parks and gardens, skate parks
	management	budgeting, community systems and services, youth issues
	services	clubs and societies, childcare, online communities
Home and family	safety	home maintenance, home security
Industry	manufacturing and engineering	furnishings, production lines
	production and fabrication	fabrics and textiles, woodworking, plastics, metal work, production-line planning, catering
	biotechnology	plant propagation, yoghurt making, ginger-beer making
Leisure and recreation	sports and games	water sports such as sailing, rules for ball games, playground planning, board games, design theme parks
	recreation activities	kite construction, model cars, interior design, hobbies, electronic games, film making, gardening
School	occasions and celebrations	graduation ceremonies, drama productions, special days, rock eisteddfod, open days
	environments	school litter, landscaping, class restaurant, camps, classroom layout and design
	publishing/desktop publishing	school newspaper, magazines, books, multimedia resources

Management

In Technology, students manage the drawing together of ideas, resources, knowledge and skills. As students progress from Level 1 to Beyond Level 6, they take on increasing responsibility for the management of projects. Technology education offers students unique opportunities to explore and develop their organisational skills as they manage people, resources, opportunities and constraints.

Managing people involves:	
Managing oneself and others	Technology often requires people to work in collaboration and cooperative partnerships and teams. Students work individually or as a team member to extend their capabilities to design and develop products. Interpersonal management skills are developed in a practical manner as students manage their own projects to completion.
Working collaboratively in teams to design products	To work effectively as members of teams, students must be able to: • work collaboratively • share equipment and working space • manage the work area safely • take responsibility for themselves and others • negotiate steps for the completion of tasks that establish systems to facilitate desired outcomes and measure success.
Managing risk, health and safety	The practical nature of Technology requires that students use a wide variety of equipment and resources. Technology projects and activities may require simple equipment or materials such as scissors, tape or paint, through to hand and power equipment including saws, sewing machines and computers, and large machinery such as tractors. *Student responsibilities* The requirement for students to work safely and develop an awareness of health and safety issues should be inherent in all design challenges. Students need to identify and minimise potential hazards for themselves, their peers and end users. Students need to consider these issues, and adopt safe procedures as a matter of course when designing products. While undertaking Technology activities, students should be able to explain how they have considered and addressed health and safety issues related to design challenges. *Teacher responsibilities* Teachers have obligations under workplace health and safety regulations to ensure that, with all activities undertaken, potential hazards are identified and strategies are implemented to minimise risk to students and others. Risk analysis should be done in reference to relevant school authority policies.

Managing resources involves:	
Managing materials, information and systems	Students identify and use a range of resources to develop products. The planned and informed use of resources results in minimisation of waste, efficiency of processes and effectiveness of products. As students progress from Foundation Level to Beyond Level 6 they should take responsibility for selecting resources and evaluating their use in meeting needs, wants or opportunities.
Assuring quality products	Students evaluate their own and others' design ideas and products based on criteria defined by themselves or others. As students progress from Foundation Level to Beyond Level 6, they become more aware of industry standards and how these assist in maintaining standards and protecting consumers. This information may be derived from professional associations and trade bodies.

Managing opportunities involves:	
Enterprise	Enterprise is regarded as a set of qualities and competencies that enable individuals, organisations, communities and cultures to be flexible, creative and adaptable to change. Enterprise in technology involves the following in a wide range of living and working contexts: • using imagination • identifying ideas and putting them into practice • using initiative and drive • being creative and innovative • taking a risk and learning from the experience • taking responsibilities • being positive and flexible • making decisions and solving problems • planning, managing and organising action • communicating and negotiating with others • managing resources, people and time • working cooperatively • reviewing and assessing.
Marketing	Students develop ideas and strategies for gaining maximum impact of their design ideas and products. Opportunities should be provided for ideas and products to be tested in the marketplace. This may involve investigating a business opportunity, devising a business plan, producing a product or service, devising a marketing plan, participating in product or service delivery, recording and reporting on profit and loss, and reflecting on and evaluating achievements and successes.

Managing constraints involves:	
Time	Students need to be aware of the time implications that may be involved in completing a project. Timelines, sequencing of stages and setting goals should be considered an important part of project management. Students and teachers need to recognise the creative opportunities and limitations that may exist in schools.
Budget	Students should develop a growing awareness of financial implications involved in completing projects, and be encouraged to develop knowledge, practices and dispositions related to budgeting. These understandings should be used to make decisions about appropriate courses of action that could include selection of resources, acceptance or rejection of a particular idea or assessing the viability of a project.
Audience needs and requirements	Students need to be aware of the needs and wants that can be met as well as opportunities on which they can capitalise. Students must take into consideration how well they have met audience needs and requirements when evaluating products and processes.

Contribution of the key learning area to lifelong learning

The Technology key learning area contributes to general education by providing students with opportunities to learn in, through and about technology. Students engage in activities through which they may develop the valued attributes of a lifelong learner identified in the syllabus.

A lifelong learner is described as:

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

The sourcebook modules support students' development of the valued attributes of a lifelong learner by actively engaging them in problem-solving and decision-making strategies. The activities in the modules assist students to develop technology-related knowledge, practices and dispositions as they work in a range of contexts that have technology demands.

Cross-curricular priorities

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

Literacy

Learning in the Technology key learning area provides opportunities for students to develop literacy practices in practical situations. These practices involve speaking and listening, viewing and shaping, writing and reading, and are developed when students are 'working technologically'.

Students will develop literacy practices by:

- negotiating tasks, ideas and individual and team roles by offering and responding to written and spoken advice
- reporting on the development and evaluation of ideas, plans, processes and products informally or formally using strategies such as design proposals, Technology project folios, journals, brochures of multimedia presentations
- persuading audiences by targeting information to particular groups
- shaping information to affect how people view themselves and others
- representing and communicating design ideas using models, drawings, flowcharts and plans
- responding critically to the generation, presentation and use of information and suggesting alternative ways of presenting information for different audiences
- communicating their ideas using the language and symbol systems related to appropriate fields of technology
- questioning the cultural and social practices embedded in various kinds of texts.

Teachers provide opportunities for the acquisition of these practices by:

- modelling the language and symbol systems related to different fields of technology
- planning activities for students to express their understanding of literacy in contexts that may not be seen as overtly literacy based
- modelling and teaching aspects of literacy used in technology such as negotiating design challenges, developing production procedures, communicating ideas using appropriate terms and conventions
- assisting students to reflect upon products of technology in relation to the cultural and social contexts in which they are made
- encouraging students to structure ideas and communicate meaning in, through and about technology
- encouraging students to make informed interpretations and judgments about their products and processes.

Numeracy

Engaging in real-life and lifelike experiences enables students to develop numeracy-related knowledge, practices and dispositions in practical situations. The knowledge, practices and dispositions involve the use of number, space, measurement and data.

Students develop and enhance numeracy as they:

- access and analyse information needed to undertake design challenges or to define needs and wants

- accurately collect, record and collate data and statistics to trial, modify or refine products
- use measurements, views, scales, graphs or patterns to present information for themselves and others
- assemble three-dimensional models and draw two- and three-dimensional plans to communicate design ideas
- estimate, measure or calculate quantities to efficiently and accurately manage resources
- compare and combine materials or resources to match particular needs or to enhance desirable characteristics
- communicate ideas using the standards and conventions of numerical language and symbol systems related to fields of technology.

Teachers provide opportunities for the acquisition of these practices by:

- modelling the numerical language and symbol systems related to different fields of technology
- helping students to recognise when numeracy practices can be applied
- planning activities for students to express their understandings of numeracy in contexts that may not be seen as overtly numeracy based
- modelling and teaching aspects of numeracy used in technology such as techniques for gathering data, calculating amounts including estimation and measurement, and accurately representing ideas including scaling and making models.

Lifeskills

The Technology key learning area provides students with opportunities for the development of lifeskills in real-life and lifelike contexts. Lifeskills describe the knowledge, practices and dispositions considered necessary for people to function adequately in their contemporary and changing life roles and situations. Knowledge, practices and dispositions involve personal development skills, social skills, self-management skills and citizenship skills.

- Students develop and enhance their *personal development skills* as they reflect on, and critically evaluate and respond to, the relationships between themselves, societies and new products.
- They develop and enhance their *social skills* through teamwork, which encourages cooperative learning, effective communication and conflict resolution strategies to solve problems.
- They develop and enhance their *self-management skills* when they recognise that time and budgetary constraints affect how and which resources are selected and used.
- They develop and enhance their *citizenship skills* when they:
  - make decisions about the impacts and appropriateness of technology on individuals, societies and environments
  - build partnerships through consultation with peers, community members and interest groups.

Teachers provide opportunities for the acquisition of lifeskills by:

- encouraging students to make decisions about the products of technology by promoting identification of and reflection on alternative viewpoints
- creating stimulating environments for students to meet needs, wants or opportunities across a range of contexts
- planning real-life and lifelike activities that require students to communicate ideas, manage resources and interact with others
- modelling strategies that promote risk taking, creativity, flexibility, negotiation and effective decision making about the impacts of technology
- planning activities that develop students' capabilities in the use of tools and equipment.

Futures perspective

The Technology key learning area provides opportunities for students to develop knowledge, practices and dispositions related to making decisions about their own preferred futures. A futures perspective involves using knowledge, practices and dispositions for the identification of possible, probable and preferred individual and shared futures. Students are challenged to think ahead about their futures, make decisions about their preferred futures, and put into action strategies that help them work towards these futures.

Students have opportunities to develop a futures perspective as they:

- examine the values underlying decisions made about technology and the roles they have in making these decisions
- develop products and accept responsibilities for consequences arising from technological change that may arise from these products
- analyse interrelationships between technology and societies and consider how past products of technology have impacted on and influenced societies
- reflect on their own use of processes and resources to develop products and describe how these products impact on their own futures
- discuss short-term and long-term effects of contemporary technological solutions and how they relate to the major dilemmas of our present period of history.

Teachers provide opportunities for the development of a futures perspective by:

- planning activities that encourage students to consider values which underpin the development of products
- assisting students to make connections between their design ideas and past and present futures
- providing students with a variety of contexts in which to make decisions about their own preferred futures
- modelling decision-making processes and planning strategies that consider short-term and long-term impacts and consequences of products and processes.