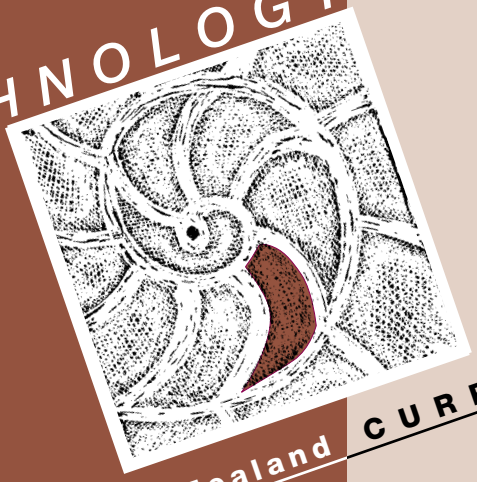
TECHNOLOGY in the New Zealand CURRICULUM



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FOREWORD

This statement represents an exciting new development for New Zealand schooling. It is the first national curriculum statement to be developed for the learning area of technology, identified as one of the essential learning areas in *The New Zealand Curriculum Framework*. It represents a new requirement for schools in that technology education will now be part of the curriculum for all students in New Zealand schools.

This curriculum statement provides the basis for technology programmes in schools from year 1 to year 13; that is, from junior classes to form 2 in primary schools and from form 3 to form 7 in secondary schools.

This curriculum replaces the *Forms 1-4 Workshop Craft Syllabus for Schools* (1986).

The Minister of Education requested the development of the technology curriculum in 1991, as part of a broad initiative aimed at improving student achievement. The development process initially involved a policy development phase which included scrutiny of technology education developments occurring in many other countries. This was followed, in 1993, by the development of a draft statement which was circulated to schools and interested groups for comment and discussion. This final version takes into account the many responses that were received to the draft statement, as well as experience from school trials and pilot teacher development programmes.

The technology curriculum aims to develop technological literacy through three integrated learning strands to enable students to participate fully in the technological society and economy in which they will live and work. This curriculum seeks to enable and empower students with the know-how they will need to make informed choices about technology, and to be the technological innovators of the future.

I am grateful to all who have contributed to this exciting and challenging development, especially Ministry staff, the writers, the members of reference groups, and the members of the Minister's advisory group, all of whom gave freely of their time, experience, and expertise.

Dr Maris O'Rourke
Secretary for Education

INTRODUCING TECHNOLOGY

Technology is a creative, purposeful activity aimed at meeting needs and opportunities through the development of products, systems, or environments. Knowledge, skills, and resources are combined to help solve practical problems. Technological practice takes place within, and is influenced by, social contexts.

Technology is a universal and age-old human activity. People have always adapted resources to meet their needs, from such fundamental, far-reaching innovation and invention as the development of the wheel, to innumerable and equally significant uses of resources such as shaping bone to create a hook for fishing, or pressing wool fibres into felt, or applying heat to make foods more edible.

We live in a technological world. Technological practice affects our environment, our standard of living, and our quality of life. We use technology in the workplace, at home, and in our sporting and leisure activities. Technology plays an increasingly important part in our health care, choices of food, transport, and the very functioning of our society.

The technologies used today have built on the ingenuity, traditions, observation, and knowledge of people who, throughout history, have sought to improve their lives, solve problems, and satisfy their needs and wants. Technology makes use of knowledge developed in many other disciplines and, in turn, these draw on technological innovations and ideas. This process of continuous incremental development and testing is essential for people to meet challenges and fulfill their expectations.

Technology helps people make new connections and leaps of discovery both to create new ideas, products, and services, and to improve the quality and effectiveness of existing systems and products.

New Zealanders today find employment as technicians and technologists in many fields, including aviation, interior design, food, conservation, engineering, clothing, biotechnology, and city planning. In these jobs, they create products, environments, structures, and systems to enhance the quality of life in response to needs and opportunities both locally and overseas.

Men and women working in technological careers add value to traditional products and services and create new ones to improve people's quality of life, and help New Zealand's continuing development as a successful nation. New Zealand is rich in energy resources and primary products which can be processed into higher value products, through ideas and technologies yet to be developed.

The inclusion of technology as an essential learning area in the New Zealand curriculum provides exciting opportunities for all students to develop and extend their ideas and to explore creative solutions to practical problems. Technology is challenging and rewarding, and open to everyone.

TECHNOLOGY EDUCATION

Technology education is a planned process designed to develop students' competence and confidence in understanding and using existing technologies and in creating solutions to technological problems. It contributes to the intellectual and practical development of students, as individuals and as informed members of a technological society.

- **Educationally**, students are motivated to participate in purposeful activities, enabling them to apply and integrate their knowledge and skills from many learning areas in real and practical ways.

  Technology education offers authentic opportunities for community interactions, and for linking school experiences with the wider world of enterprise and the community.

  It fosters intellectual and practical abilities through its open-ended, problem-solving approach, and links theory with practice.
- **Personally**, students become more aware of their responsibilities within their families and society. They gain confidence in their ability to contribute to informed decision making about technological development.

  Students learn to make decisions, take calculated risks, evaluate their own choices, and develop ways of addressing real problems.

  All students are able to participate successfully, individually, and in groups in technological activities at their own levels of ability.
- **Culturally**, students become aware of the diversity of valid ways in which different groups of people respond to technology and to innovation, and appreciate the impacts that technological changes have on different peoples. They develop understanding of the beliefs, values, and traditions of other people and how these influence technological development.
- **Environmentally**, students explore the impact of technology on the world around them and learn how to investigate options. They experience decision making in relation to authentic problems, and are able to take informed roles in debate on technological change. They can appraise the appropriateness of technological solutions to environmental problems.
- **Economically**, students learn to be creative and innovative in generating ideas, and to co-operate in working to translate their ideas into action.

  They gain skills, knowledge, and competencies that equip them to undertake many activities and to contribute to New Zealand's social and economic development.

  They have opportunities for interactions with business and industry that help them to understand and adapt to a rapidly changing world and to take a confident part in shaping the future.

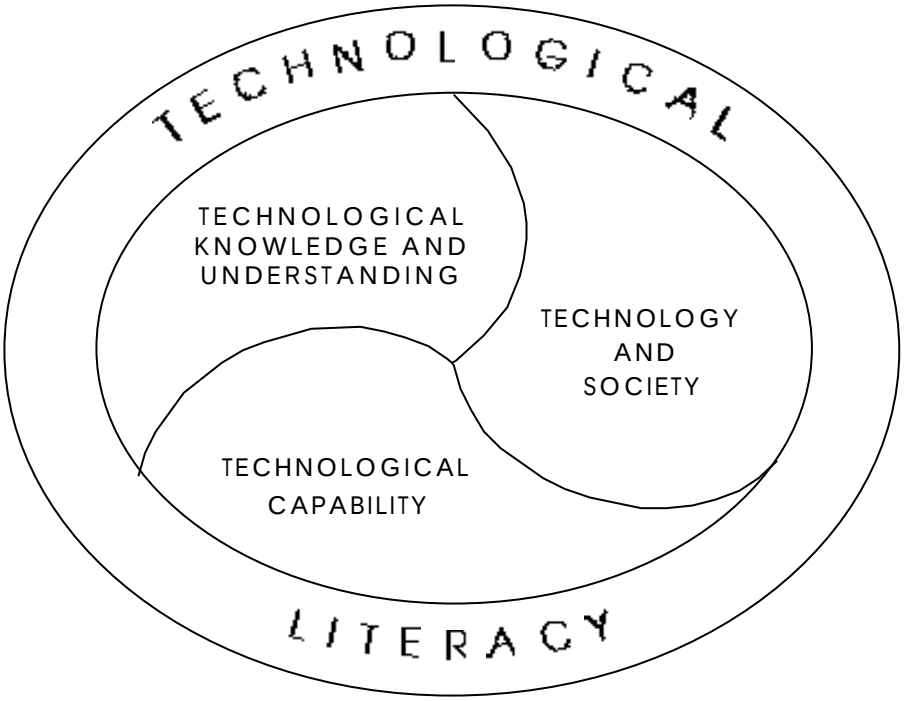
The Aim of Technology Education

Learning in technology implies becoming confident in using a variety of means to address needs and opportunities and solve practical problems within society. It focuses on know-how as well as knowledge itself, gathering information from diverse sources. It encourages risk taking, lateral and divergent thinking, the development of multiple solutions to problems, trial and error, teamwork, and the management of resources effectively and efficiently.

Technology education explores choice and the factors that influence choice, including culture and society, costs and benefits, aesthetics, and fitness for purpose. It seeks to empower students to make informed choices in the use of technology and in their responses to technological change.

The aim of technology education is to enable students to achieve technological literacy through the development of:

- technological knowledge and understanding;
- technological capability;
- understanding and awareness of the relationship between technology and society.



Technology education, therefore, involves students in:

- investigating, using, and understanding the technological products, systems, and environments that have been developed in their society;
- developing knowledge of the principles and processes of technology;
- identifying and exploring needs and opportunities which may be met through technological activity;
- creating and evaluating ideas to improve or modify technology in relation to these identified needs and opportunities;
- choosing and using materials, tools, and equipment skilfully and safely;
- designing their own technological solutions;
- working to agreed specifications and quality standards;
- recognising the inter-relationship of technology and society—now, in the past and in the future;
- feeling empowered to contribute to a technological society.

STRUCTURE OF THE CURRICULUM STATEMENT

The technology curriculum is organised in three inter-related learning strands. Within each strand there are sets of achievement objectives, which are numbered for ease of reference. The numbering does not imply a hierarchy, and the different number of objectives in each strand does not imply weighting of significance or time allocation.

Strands

The strands are:

Strand A: Technological Knowledge and Understanding

1 understanding the use and operation of technologies;
2 understanding technological principles and systems;
3 understanding the nature of technological practice;
4 understanding strategies for the communication, promotion, and evaluation of technological ideas and outcomes.

Strand B: Technological Capability

5 identifying needs and opportunities;
6 with reference to identified needs and opportunities:
a: generating, selecting, developing, and adapting appropriate solutions;
b: managing time, and human and physical resources, to produce technological outcomes—products, systems, and environments;
c: presenting and promoting ideas, strategies, and outcomes;
d: evaluating designs, strategies, and outcomes.

Strand C: Technology and Society

7 understanding the ways the beliefs, values, and ethics of individuals and groups:
- promote or constrain technological development;
- influence attitudes towards technological development;

8 understanding the impacts of technology on society and the environment:
- in the past, present, and possible future;
- in local, national, and international settings.

The achievement objectives provide a basis for planning and enable teachers, students, and parents to be aware of the nature and goals of technological education. Students will be working towards the achievement objectives over a period of time, through activities in a range of technological areas and in different contexts.

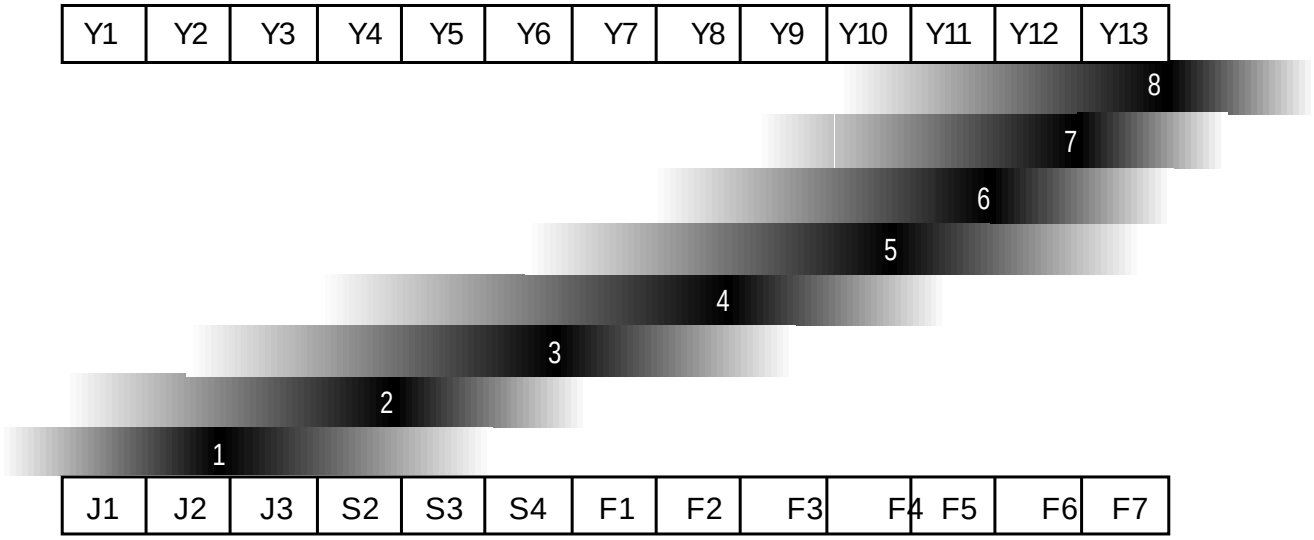
In practice, most units of work in technology will include objectives from all three of these strands.

Achievement Objectives at Eight Levels

Achievement objectives are expressed at eight progressive levels in this curriculum statement, in accordance with *The New Zealand Curriculum Framework*. These level statements describe a clear and structured progression of the technology curriculum from junior primary (J1=Year 1) to senior secondary (F7=Year 13).

The organisation of the expected learning into successive levels provides guidance for learning and teaching, and is intended to assist teachers to identify students' development in the different strands, as a basis for assessment of student achievement and school-based planning.

As outlined in *The New Zealand Curriculum Framework*, individual students will not necessarily be achieving at the same level for all strands. They may operate at different levels and progress at different rates, depending on the context of the technological activity and technological area.



Technological Areas

The technological areas indicate areas in which students will be expected to carry out their technological activities, and suggest the range around which the technology curriculum in schools can be organised and developed. These areas, listed here alphabetically, are not mutually exclusive: **most technological developments and learning experiences encompass more than one area**.

Whichever technological area is selected, **design**, including the processes of specification and development and testing of prototypes, is an essential component of the activity. **Drawing and graphics**, including freehand and technical drawing and the use of computer graphics packages, are also essential in technological practice to depict and clarify ideas and proposed solutions.

Schools and teachers should develop learning approaches and technological activities within the technological areas which will best help their students achieve the objectives of this curriculum.

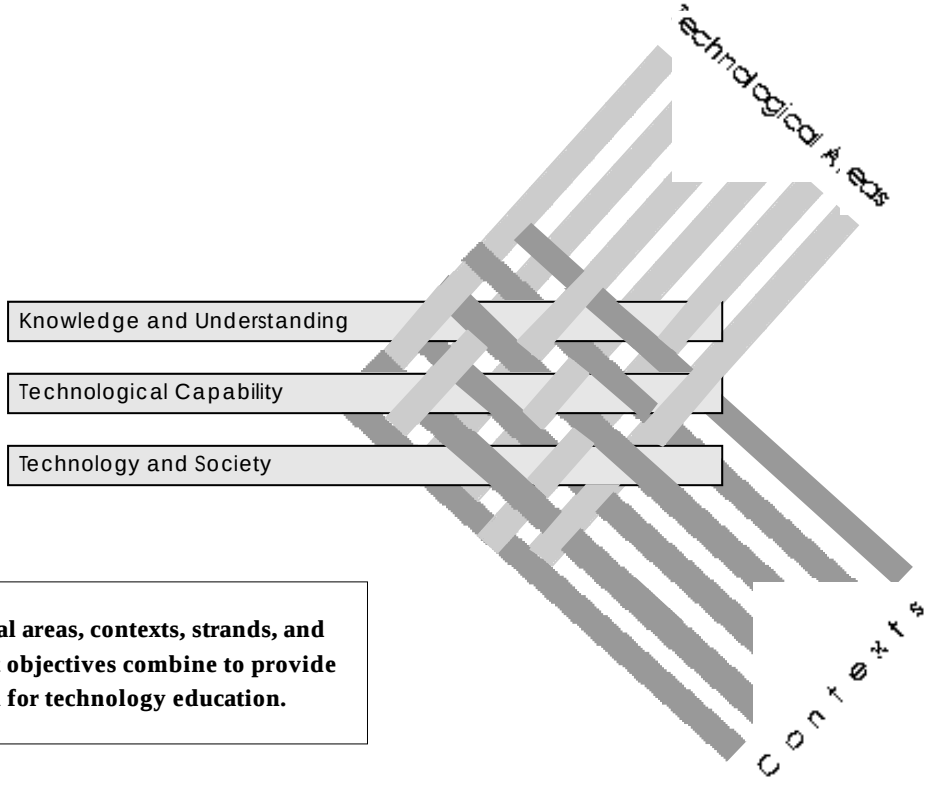
- **Biotechnology** involves the use of living systems, organisms, or parts of organisms to manipulate natural processes in order to develop products, systems, or environments to benefit people. These may be products, such as *foods, pharmaceuticals*, or *compost*; systems, such as *waste management* or *water purification*; or environments, such as *hydroponics*. Biotechnology also includes genetic or biomedical engineering.
- **Electronics and Control technology** includes knowledge and use of electrical and electronic systems and devices, as well as their design, construction, and production. These may be simple electrical circuits or complex integrated electronic circuits, or robotics. Control technologies may be electronic, pneumatic, hydraulic, or mechanical.
- **Food technology** includes understanding and using safe and reliable processes for producing, preparing, presenting, and storing food and the development, packaging, and marketing of foods.
- **Information and Communication technology** includes systems that enable the collection, structuring, manipulation, retrieval, and communication of information in various forms. This includes audio and graphical communications, the use of electronic networks, and interactive multimedia.
- **Materials technology** includes the investigation, use, and development of materials to achieve a desired result. It involves knowledge of the qualities and suitability of different types of materials, including wood, textiles, composites, metals, plastics, and synthetics, and fuels, as well as the processing, preservation, and recycling of materials. Materials technology contributes to many other areas, especially Structures and Mechanisms.
- **Production and Process technology** includes both the manufacture and assembly of products from individual components in, for instance, *a furniture or appliance factory* or *a motor vehicle assembly line*; and the processing of fluid-bulk raw materials—gases, fluids, and fluidised solids—into products such as *paints, fertilisers, and petrochemicals through a continuous process.* This area also includes large-scale primary production of agricultural and forest products.
- **Structures and Mechanisms** includes a wide variety of technologies, from simple structures, such as a *monument*, or mechanical devices, such as a *mousetrap*, to large, complex structures such as a *high-rise office block*, or mechanical devices such as a *motor car*.

Contexts

Technological activities are carried out in a variety of broad overlapping contexts, such as personal life, the home, the school, recreation, the community, the environment, energy production and supply, business, and industry. Each of these can provide further specific contexts for exploration.

Schools may wish to use contexts as an organising principle for some or all of their programmes.

- **Personal** contexts might include clothing; personal health; jewellery.
- **Home** contexts might include preparation of food; interior design; furnishings; home security.
- **School** contexts might include a drama production; school litter and waste management; the school canteen.
- **Recreational** contexts might include water sports, such as sailing; ball games; orienteering; games of chance; playground planning.
- **Community** contexts might include waste management; traffic control; town planning; transportation.
- **Environmental** contexts might include water management; forest regeneration; tourist facilities.
- **Energy** contexts might include solar power; co-generation; the use of fossil fuels; and renewable energy applications such as water and wind turbines.
- **Business** contexts might include desktop publishing; financial reporting; marketing presentation; ergonomics.
- **Industrial** contexts might include workplace safety; woodworking; plastics; production line planning. An industrial context might range from the smallest in scale—based in a home or garage—through to a major industrial plant.



Technological areas, contexts, strands, and achievement objectives combine to provide a framework for technology education.

Suggested Learning and Assessment Examples

The learning and assessment experiences included in this document are examples only. They provide some ideas of technological contexts and areas through which the achievement objectives can be met. Learning experiences should be relevant to objectives from a number of strands. Teachers may use the suggested learning examples as planning starters to develop a balanced technological programme.

The examples are grouped in two-level bands and illustrate an integrated approach: that is, they cover all three strands and a number of objectives. Technological activities related to a particular area or context need not be confined to the levels suggested. They may be enjoyable and useful for a wide range of students, who can be expected to achieve the objectives at different levels of competence.

Learning examples may be repeated at different levels or with different emphases, depending on the needs of the students. Teachers may also wish to refer to the large number of ideas included in the 1993 Ministry of Education document, *Technology in the New Zealand Curriculum (Draft)*, for other starting points.

TECHNOLOGY EDUCATION FOR ALL STUDENTS

All students have the right, and therefore should have the opportunity, to achieve in technology. Technology programmes should *"recognise, respect, and respond to the educational needs, experiences, interests, and values of all students: both female and male students; students of all ethnic groups; students with different abilities and disabilities; and students of different social and religious backgrounds".* [1]

Almost every daily activity involves some aspect of technology, from the soap we wash with, to our cooking appliances, the transport we use, and the paper we write on. Teachers should select or devise content, contexts, and learning approaches that make connections between students' everyday lives and experiences and the world beyond the school gate, and also extend their appreciation of the ways technology impacts on their lives and society.

Technological development is initiated and sustained by people according to the needs and opportunities they perceive. These needs and opportunities reflect the ways in which people view their world and the priorities they establish. Many factors determine how these world views and priorities are developed, including gender, ethnicity, socio-economic and geographic location, and physical and intellectual abilities.

Many people have, historically, been excluded from publicly recognised technological developments; there have even been discriminatory practices, such as past laws which denied some people the right to patent. Historical documents and records often focus on a limited range of major technological developments, emphasising dramatic changes, and thus undervaluing the perspectives and achievements of other important innovations, particularly in personal and domestic spheres.

Language, too, is of primary importance in how people develop and express their ideas and views. Language and contexts in technology education must be inclusive of all students. It is especially important to use gender-inclusive language in all learning and teaching. Technology education for Maori students will be further enhanced through the medium of te reo Maori, and by including technological activities based on Maori developments and applications.

Many such technological activities derived from Maori experience already feature in educational programmes, although they have not always been recognised as technology. Consultation with, and involvement of local iwi, kaumatua, kuia, and advisers is crucial in the recognition of tikanga in technology education.

Teachers should develop programmes which recognise the technological contributions of societies in the past, as well as those of diverse contemporary groups which contribute to our society. In the course of the school programme, all students should be encouraged to explore all areas in a range of contexts, and should not be limited by traditional assumptions or perceptions of what will "interest" girls, boys, or other defined groups.

All resources used should be critically reviewed to ensure that they support gender-inclusive, non-racist, and non-discriminatory programmes.

CHARACTERISTICS OF LEARNING IN TECHNOLOGY

To achieve the best possible learning outcomes in technology, programmes should reflect the following characteristics of technology education.

- Technology education builds on students' existing knowledge and skills, values, interests, and aspirations. All students will be familiar with many technologies, but may not have articulated their understandings, nor recognised their own skills.
- Technology education deals with real, identified needs or problems, and with multiple solutions. There is no single "right answer"—lateral thinking and willingness to test divergent options are to be encouraged—although some solutions will be more successful than others.
- Further learning in technology occurs through failure analysis, recognising the value of alternative and unexpected outcomes.
- Technological activities usually lead to a tangible outcome: a product, a model, a modified environment, or a system. All students should experience the satisfaction of developing a range of outcomes.
- Technological developments are advanced by sharing ideas, presenting concepts, and evaluating possible solutions.
- The teacher's knowledge, experience, and skills provide input to assist in refining ideas, selecting resources, and achieving quality in products, as well as guiding students towards viable solutions.
- The teacher supports, guides, challenges, and learns with the students, interacting with their thinking and helping to clarify ideas.
- Technology education encourages risk taking: students' ideas should be accepted and valued, and students challenged to realise their aspirations. It provides opportunities for students to show initiative, make choices, and take more responsibility for their own work.
- Technological activities often require students to work co-operatively and collaboratively—with each other, their teachers, and other adults.
- Technology education recognises that students have different starting points and will progress at different rates: the teacher's role is to motivate, encourage, support, and provide feedback to students.
- Technology education gives opportunities for a wide range of people in the community to provide specialist input.

COMMUNITY AND ENTERPRISE LINKS

The link between schools and the community, including business and industry, tertiary institutions, and local authorities, is important to a well developed, inclusive technology curriculum. Outside experiences enhance, reinforce, and clarify classroom learning. People involved in technology can provide a stimulus for school-based technological activity as well as assisting as expert resources for further activities.

Exploring technology in the community, whether in the environment, in products, or in systems, such as those relating to public safety, gives students an appreciation of the relationship between technology and society, how decisions are made, and future opportunities for technological development.

Having access to people who can fulfil a mentoring role when students are undertaking technological activities can increase enjoyment, participation, and success.

Approaches should be carefully planned. The mutual benefit to schools and outside organisations will be advanced when all considerations, particularly health and safety, are taken into account. Links may be made between students and enterprise, teachers and enterprise, and school management and enterprise management.

For detailed discussion on school-enterprise links, refer to *Working Together: Building Partnerships between Schools and Enterprises*, Ministry of Education, 1993.

DEVELOPMENT OF THE ESSENTIAL SKILLS THROUGH TECHNOLOGY

Schools need to ensure in their planning that all students have the opportunity to develop the full range of essential skills to the best of their ability.[2] Technological activities provide opportunities for the development of the essential skills, and the reinforcement and application of skills used in other essential learning areas.

Communication skills

Students will be communicating ideas, possible solutions, reflections, and outcomes. They will use a variety of means of communication, including:

- annotated drawings;
- graphical representation;
- construction of demonstration models;
- modern information and communication technologies.

For example, students may make an oral presentation with the aid of overhead transparencies developed using a computer graphics package.

Numeracy skills

Calculating, measuring, and estimating skills can be practised and developed through technological activities, linking technology with mathematics. Graphs, tables, charts, and other visual presentations of data have a role in technological activities.
For example, students may need to calculate the cost of materials used in making a model of their expected result and estimate the materials necessary for full-scale production.

Information skills

As technology involves the integration of information from a wide range of sources, information skills are of special importance in technology. Technological activities provide students with opportunities to develop and apply all of the essential information skills:

- devising questions, and using a range of inquiry techniques;
- identifying, locating, gathering, storing, retrieving, and processing information;
- organising, analysing, synthesising, evaluating, and using information;
- presenting information clearly, logically, concisely, and accurately;
- identifying, describing, and interpreting different points of view;
- using a range of information-retrieval and information-processing technologies confidently and competently.

Problem-solving skills

The technology curriculum offers rich contexts for problem solving. In particular, the aim of developing technological capability is closely linked with problem-solving skills:

- thinking critically, creatively, reflectively, and logically;
- exercising imagination, initiative, and flexibility;

- identifying, describing, and redefining problems, and analysing them from a variety of perspectives;
- making connections and establishing relationships;
- inquiring and researching, and exploring, generating, and developing ideas;
- testing ideas and solutions, and making decisions on the basis of experience and supporting evidence;
- evaluating processes and outcomes.

Self-management and competitive skills

Technology, with its practical focus, provides a significant context for students to develop self-management skills and to compete in an authentic environment by:

- setting and achieving goals;
- managing time and other resources effectively;
- showing initiative, perseverance, commitment, and adaptability;
- developing strategies to deal with challenges, and resolve conflicts;
- dealing with competition, and feelings of success and failure.

Social and co-operative skills

Learning activities in technology provide natural, regular, and authentic opportunities for students to relate to others and work co-operatively. Many problem-solving tasks demand a high level of negotiation, collaboration, and respect for others.

For example, students could negotiate the allocation of tasks and roles within their group, taking account of the views of all its members.

Physical skills

In planning, developing, and carrying out technological tasks, students have systematic, purposeful opportunities to develop manipulative skills and learn to use tools, equipment, and materials correctly, efficiently, and safely. Students also need to understand and apply health and safety skills, in relation both to themselves and to others, especially when using materials and equipment.

Work and study skills

Technological activities can involve students in working co-operatively with community or business groups. They will develop skills to operate independently, in groups, and in the wider community.

LINKS WITH OTHER ESSENTIAL LEARNING AREAS

Throughout technology education, students will be drawing on knowledge and skills developed in other areas of the curriculum, and from other sources. In turn, technological activities contribute to the development of learning in other essential areas by providing practical and authentic contexts in which the knowledge and skills can be used.

Language and Languages

Learning experiences in technology require students to investigate needs, communicate ideas, and present solutions. They will be engaged in using oral, written, and visual language and in responding to the ideas of others. For example, students will use:

- oral language, when interviewing, listening, and responding to the ideas of others, and when expressing their own ideas concisely and accurately;
- visual and written language, when developing and demonstrating technological ideas, interpreting models, and presenting information graphically;
- written language, when preparing briefs, interpreting specifications, and presenting proposals and evaluations.

Mathematics

Technological activities draw on many areas of mathematical concepts and skills, as students undertake investigations, organise and use resources, and plan strategies. For example, students will be:

- surveying, graphing, and describing trends;
- collating and interpreting statistical information;
- estimating, measuring, and calculating quantities, time, and costs.

Science

Science helps people to investigate products and processes systematically, to record and test observations, and to test some of the ideas on which technological solutions may be based. For example, students will be:

- observing and identifying principles, generalising, and providing accurate evidence;
- including scientific knowledge and skills in the design of functional solutions;
- identifying relationships between science and technological innovations.

Teachers should note that *Science in the New Zealand Curriculum*, Ministry of Education, 1993, includes a strand, "Making Sense of Science and its Relationship to Technology".

Social Sciences

Technology education contributes to, and draws on, students' understandings of their own society and those of others in the past, present, and possible future. Students will be challenged to understand many aspects of human behaviour, including the ways decisions

are made in different societies. They will be helped to understand their responsibilities as members of a family and be empowered to take part in society as an informed citizen. Economic and environmental considerations are important in planning technological solutions to needs and opportunities. For example, students will be:

- exploring how technologists work in a variety of settings;
- managing time and resources to achieve an outcome that meets identified needs;
- understanding the cultural factors, values, and social structures that influence decisions;
- researching and analysing past uses and impacts of technology;
- recognising the impact of location, natural resources, and environment on priorities and decision making in different societies.

The Arts

The arts cross the boundaries into technological education in a number of contexts—for example, in recreation—as well as in particular knowledge and skills that are important in developing technological solutions to problems. For example, students will use:

- drawing and modelling in shaping ideas for solutions;
- a range of media in presenting ideas and products;
- aesthetic principles and knowledge in developing and appraising ideas and products.

Health and Physical Well-being

Technology education offers practical opportunities for all students to experience the success that contributes to their self-esteem, as well as opportunities for purposeful social interactions with their peers. It also requires knowledge and skills related to:

- nutrition and food processing;
- handling equipment and materials in a healthy, safe way;
- producing outcomes that promote well-being and are safe for users;
- making choices which enhance health and well-being.

THE LANGUAGE OF TECHNOLOGY

Technologists use particular words and phrases in specific ways to convey information and meaning. It is therefore important that teaching approaches use terms accurately and appropriately, and that students become familiar with particular usages.

Language is integral to learning concepts and principles, so the many opportunities for student explanations, discussions, and presentations in the technology curriculum should provide valuable experiences in using specialised language confidently.

Special care needs to be taken with everyday words, such as “system” or “environment”, when they are used in specialised ways.

Technologists working in different areas may also use the same terms in different ways. For instance, many technologists refer to the “design process”. The term may be interpreted by some groups with an emphasis on specifications, whereas other technologists may interpret it in terms of creativity and a more general brief. Again, typographers may interpret “design” mainly in terms of aesthetics.

The glossary in this document defines some of the terms most frequently used in technology.

HEALTH AND SAFETY IN TECHNOLOGY EDUCATION

When developing technology programmes, schools and teachers need to ensure that the environment, equipment, and the planned learning experiences are all safe, in terms of the age range and levels of competence of the students.

Schools must take account of the mandatory minimum requirements derived from the Health and Safety in Employment Act 1992 and other statutes as set out in the *Ministry of Education Health and Safety Code of Practice for State Primary, Composite, and Secondary Schools,* 1993. This Code has been distributed to all schools and should form the core reference on this issue.

From Level 1, students should be made aware of their responsibility for their own safety and that of others and, therefore, the importance of using equipment and materials correctly.

Equipment should be carefully selected and regularly maintained, and schools should have a programme of risk management built into their property maintenance policy.

Schools may wish to develop a concise Code of Practice, referring to all the school's policies and documentation relating to health and safety, as a reference for teachers involved in technology education.

ASSESSMENT AND EVALUATION IN TECHNOLOGY

The primary purpose of school-based assessment is to improve students' learning, and the quality of learning programmes. [3]

The sample assessment activities included with the learning examples in this document indicate the close relationship between learning, teaching, and assessment. In technology programmes, teachers and students have the opportunity to be involved in a wide range of learning and assessment experiences; those outlined are merely suggestions and are neither exhaustive nor definitive.

With all technological activities, assessment should be integral and systematically planned for, and focus on the ways that students are meeting achievement objectives so that a full picture of their progress can be built up. Assessing technology is more than the assessment of individual components: rather, the whole task or outcome should be evaluated. Emphasis on a narrow component or testing outside the context of learning does not enable reliable judgments to be made. Nor do single-focus standard assessment tasks, designed to rank or assess students in relation to levels, meet the purpose outlined above.

Coverage

The technology programme should provide a balanced coverage of all achievement objectives, but it is not expected or appropriate that all objectives will be assessed in each unit of work. The achievement objectives most relevant for assessment, in relation to the context and learning areas, should be carefully selected and suitable strategies designed. This selective, focused approach not only results in higher-quality assessment, but is more manageable for teachers. In selecting the objectives to assess, teachers should also monitor that their choices reflect a balance of the strands and objectives, not simply ease of assessment.

Both technological processes and outcomes should be assessed. These will often require a qualitative rather than a quantitative approach, especially as students may use a variety of suitable approaches and produce diverse outcomes. In technology, encouraging students to communicate their ideas and strategies as they develop them can assist in assessment of processes. Technology education invites innovation and creativity, but these aspects can present particular challenges in assessment. Teachers need to collate assessments that demonstrate students' achievement over time, such as annotated portfolios, photographs, or video- or tape-recordings of work, both in progress and on completion.

Teachers will need to devise assessment strategies to suit their intended purposes and activities. For instance, students will be involved in group and collaborative technological activities, so ways to assess group and collaborative work will need careful consideration. Peer review and self-evaluation are inherent parts of the technological development, and are suggested in the examples in this document. In selecting situations and strategies for assessment, teachers also need to be responsive to their students and their different communication and learning styles.

A topic or unit of work in technology will almost always involve all of the strands, and can also involve achievement objectives from other essential learning areas. It is, however, important to have a clear focus on a specific technological strand and objective if assessment is to be reliable and valid.

Recording and reporting

Assessment is also carried out by classroom teachers to provide students and others with an indication of students' progress. Teachers should discuss progress with students, as well as record and report on what has been achieved. The use of a variety of strategies, in a range of situations, over a period of time, will enhance the quality of the judgments and decisions that can be made and ensure that information gained from such assessment can enrich subsequent learning and reporting.

The levels of achievement are not intended to provide a rigid framework against which students should be measured, but rather offer assistance to teachers in making professional judgments on the student's overall performance, and to guide schools in planning for curriculum delivery.

Assessment practices must address the variety and scope of the programme as experienced by the students, taking into account the integrated nature of technological education. Because of the breadth and range of the achievement objectives, students are likely to achieve at different levels both within and across strands. It is important that assessment provides feedback which not only rewards excellence and progress but motivates students to develop in each aspect.

Guidance on assessment is available in the handbook, *Assessment: Policy to Practice,* Ministry of Education, 1994.

Learning, teaching, assessment, and evaluation in technology will draw on the professional experiences and understandings of teachers, and be consistent with the school's total assessment policy and programme.

Some Indicators of Progression

Progression in technology education may be broadly described in terms of the increasing scope and sophistication of ideas, skills, and understandings that contribute to a student's technological decisions and activities. As students make progress in technology education, they will be able to identify an increasing range of factors, and bring their knowledge and skills from other areas to bear in technological activities. They will deepen their knowledge, using it to improve their decision making, and also increasingly develop new knowledge from their experiences.

In each strand, therefore, teachers should expect to see an increase in the number, range, and complexity of the factors being considered and used. For example, the evaluation of a product or system might begin with a student simply seeking opinion from peers as to its

usefulness; the student might progress through considering it in terms of negotiated criteria and, by level eight, to evaluation in terms of ethics, aesthetics, client-specific criteria, environmental and legal factors, and so on.

Progression in terms of presenting an outcome might move from simply showing or demonstrating the solution through to presenting it in terms of quality control, health and safety regulations, and the appropriateness of the production processes that were used.

Some possible indicators of progression for each strand are outlined below. Teachers may find these useful as starting points when observing individual students and evaluating the balance and quality of activities within their programmes.

Strand A: Technological Knowledge and Understanding

Students will demonstrate progress in technological knowledge and understanding through their:

- increasing precision and detail in describing and depicting their observations;
- ability to investigate increasingly unfamiliar examples of technology;
- ability to compare and contrast the technologies used, and the work technologists do, in different areas and contexts;
- increasing appreciation of the inter-relationships among different technological areas and processes in particular contexts;
- increasing accuracy in using technological terminology;
- increasing understanding of abstract technological concepts and principles;
- increasing confidence and competence in evaluating technological ideas and outcomes.

Strand B: Technological Capability

Students will demonstrate progress in technological capability through their:

- use of an increasing range of valid and appropriate ways of assessing needs and identifying opportunities;
- sensitivity and accuracy in interpreting information on needs and opportunities;
- increasing ability to relate ideas for solutions to the range of needs they identify, and to justify the selection of preferred solutions;
- increasing understanding, and effective use, of the principles and processes of design;
- increasing ability to develop and work to specified criteria;
- increasing ability to use drawing and graphics to portray ideas effectively;
- ability to plan and use accurately a critical path of increasing complexity, and organise tasks in a team;
- increasing ability to choose and use suitable tools, equipment, and materials correctly, skilfully, and safely;
- increasing efficiency in the use of resources such as time and materials;
- increasing ability to explain, reflect on, and review their plans, intentions, and progress;
- increasing satisfaction in presenting robust, high quality, innovative outcomes;
- flexibility in responding to evaluation and adapting plans and products in the light of review.

Strand C: Technology and Society

Students will demonstrate progress in awareness and understanding of the relationship between technology and society through their:

- increasing knowledge of and respect for different beliefs and values and their influence on technological development;
- growing recognition of their own values, ethics, and the factors that influence them, in relation to technological choices and decisions;
- increasing ability to respond to and accommodate diverse factors and different perspectives in their designs and planning;
- growing ability to take an informed, sensitive role in debate on technological change;
- ability to make informed and imaginative forecasts of possible futures;
- growing confidence that they will be able to take an effective part in the technological shape of the future.

IMPLEMENTING THE TECHNOLOGY CURRICULUM

Technology and the Teacher

Technology involves knowing and doing. Learning and teaching approaches should address both of these areas. Technology is derived from a variety of knowledge bases, values, processes, and skills. These are used both to create and to evaluate designs, products, systems, and environments critically. There should be flexible, open, collaborative approaches to classroom teaching which accommodate all students' perspectives, interests, aspirations, and learning styles.

Students' technological capability will be enhanced through engagement in purposeful and comprehensive activities. An appropriate technological activity will require thoughtful planning and negotiation between students and teachers.

Technological activities often involve students working as a team and undertaking a variety of roles and tasks. The successful management of knowledge, skills, and resources is crucial to group activities in technology.

Teachers, too, will often work collaboratively to plan and deliver the curriculum. In particular, teachers with special knowledge and skills in different and existing disciplines will have important roles in working with their colleagues to achieve the successful implementation of a school's technology curriculum. This technology curriculum will need teachers who can contribute expertise in using a wide range of materials; in food technology and processing; in information and communication, such as keyboarding, computing, and language; in electronic, mechanical and biotechnologies; and in drawing and graphics.

Technology in the School Programme

The achievement objectives set out in this curriculum statement are designed to guide the organisation of the learning and teaching programme and do not reflect an exact balance of time to be spent on any objective. Achievement by students in a particular objective will not necessarily be dependent on undertaking one specific unit or activity: rather, a range of technological activities should be designed which will, together, enable particular achievement objectives to be met and assessed. Different activities will naturally emphasise some objectives more than others. The attainment of the achievement objectives may involve two years of learning at levels 1 to 5 and one year at levels 6, 7, and 8.

Students will work towards all achievement objectives over a period of time (one to two years), through different activities, using different settings, and in different technological areas.

To achieve a balanced approach to technology during this time, students will be required to experience a range of technological areas.

Years 1–3:	four technological areas
Years 4–6:	five technological areas
Years 7 and 8:	six technological areas
Years 9 and 10:	six technological areas

A range of technology courses may be available in the senior secondary school, and at this level students may specialise in technological areas, undertake general courses in technology, or do both.

Each school will need to develop an implementation process which builds on the strengths of its current practice and provides a balanced education in technology. It is essential that technology is taught in substantial sections rather than dissipated across the curriculum.

Four possible options are:

- providing a time-tabled subject called technology, which is taught by teachers with particular knowledge and skills in technology. These teachers may come from a range of disciplines;
- developing a school approach which integrates units of study, or modules, of technology education in a systematic, co-ordinated way across the curriculum, again involving teachers from a range of disciplines;
- a combination of these two options;
- suspending the timetable for a fixed period to focus on technological activities across a year group, or the whole school.

Each option requires a school to select approaches and settings relevant to its students and their communities and to develop programmes accordingly.

A school's decision will take into account the type of school, the preferred organisational pattern, the ages and competencies of the students, particular teaching strengths, and the availability of community resources.

Issues to consider for each option

- **A timetabled subject called technology:**
  - provides coherence, status, and focus, especially for the students;
  - ensures that content and objectives are not confused with those of other learning areas;
  - allows for teachers to work collaboratively in planning and delivery;
  - ensures that the time required for an appropriate programme is protected;
  - ensures effective use of specialist resources and facilities.

- **Implementation across the curriculum**:
  - demands careful planning to ensure that students experience a coherent programme which meets the full range of achievement objectives;
  - needs a monitored programme to ensure that achievement objectives are reliably assessed, and that they are not obscured or confused with objectives from other learning areas;
  - should help to increase the transfer and reinforcement of skills and knowledge across subjects;
  - should increase communication and exchange of ideas among teachers;
  - helps to overcome the distinctions between academic and vocational orientations;
  - recognises the contributions made by all subjects to technological education.
- **A combination of approaches:**
  - retains strength of focus for specialist activities;
  - encourages collaborative planning;
  - enables specific links to be made between specialist activities and other learning;
  - enables teachers to develop specialist skills;
  - makes full use of resources and facilities;
  - enables students to undertake a coherent and balanced programme.
- **Fixed-period focus across a year group or school:**
  - can be convenient for the school organisation;
  - involves the whole teaching team in a major activity;
  - provides a strong focus for community involvement;
  - provides the opportunity for students to research, design, complete, and evaluate substantial projects in a concentrated and satisfying way;
  - provides an integrated set of experiences for students.

The implementation of the technology curriculum requires school-based decisions. Teachers should make full use of their flexibility to develop technology programmes that reflect the particular character of their school.

ACHIEVEMENT OBJECTIVES

Strand A: Technological Knowledge and Understanding

Students' technological experiences should reflect the interlinking nature of the strands: technological knowledge and understanding; technological capability; technology and society. When involved in any technological activity, students should adapt and apply knowledge, strategies, and skills from a variety of sources.

Within a range of technological areas and contexts, students should develop an understanding of:

1 the use and operation of technologies;
2 technological principles and systems;
3 the nature of technological practice;
4 strategies for the communication, promotion, and evaluation of technological ideas and outcomes.

Technological problem solving is often assisted by the analysis of successful applications. When involved in observing, examining, and experiencing applications of technology, both in their immediate environment and in other settings, students are both developing and employing knowledge from a range of sources.

Students will explore how and why technologies are used and how they operate. They will also recognise the principles that underlie technological developments, such as modification, adaptation, user-friendliness, fail-safe features, flexibility of use, reliability, fitness for purpose, efficiency, ergonomics, aesthetics, and optimisation. They will see that many technological solutions arise from incremental changes to existing technologies.

They will identify and understand the components of technological systems, as part of developing technological knowledge. For example, students will learn about inputs, processes, outputs, feedback, sequence, interconnectivity, and how these are affected by a range of factors.

Different methods and codes of practice have arisen in different technological areas, for instance, in food processing, in engineering, in crafts, or in architecture. Students will investigate the distinctive features, as well as the common principles, of how technologists work in a number of fields.

Knowing about the strategies used for the communication, promotion, and evaluation of technological ideas is also important in understanding technology. Students will explore these strategies in order to develop a critical understanding of their purposes and influences. Such understandings help students to incorporate aspects such as explanatory instructions, advertising, packaging, and marketing in their own technological practice.

Technological Knowledge and Understanding: Level 1

Achievement Objectives

Within a range of technological areas and contexts, students should:

1 ask questions and offer ideas about the use and operation of everyday technologies, such as *at the supermarket;*

2 a ask questions and share ideas about modifications in familiar technologies, such as *paper making;*

b ask questions and share ideas about familiar technological systems, such as *inputs, outputs;*

3 share ideas about how a particular group of people carry out technological activities, such as *builders; check-out operators*;

4 share ideas about some ways in which familiar technological developments are communicated, such as *new food products.*

Technological Knowledge and Understanding: Level 2

Achievement Objectives

Within a range of technological areas and contexts, students should:

1 explore and discuss the use and operation of technologies in everyday use;

2 a identify and discuss ideas about modifications and adaptations in familiar technologies, such as *wheeled vehicles*;

b identify, and depict ideas about components of technological systems, such as *connections; sequence;*

3 describe how particular groups of people carry out technological activities, such as *dentists;*

4 identify and discuss ways in which a specific technology is communicated and promoted, such as *motor cars.*

Technological Knowledge and Understanding: Level 3

Achievement Objectives

Within a range of technological areas and contexts, students should:

1 investigate and describe the use and operation of technologies in an everyday setting, such as *a petrol station;*

2 a compare significant features of some technologies, such as *safety features, user-friendliness;*

b explore and describe how components are linked in a technological system;

3 compare how different groups of people carry out technological activities, such as *home cooking compared with a fast-food outlet;*

4 identify and compare the ways particular technological developments are communicated and promoted to specific groups, such as *information on packaging.*

Technological Knowledge and Understanding: Level 4

Achievement Objectives

Within a range of technological areas and contexts, students should:

1 investigate and explain the use and operation of a range of technologies in everyday use, such as *in communications;*

2 a identify underlying technological principles, such as *reliability; practicality;*
  b investigate several technological systems and explain the relationship between inputs, processes, and outputs;

3 explain why people within specific technological areas carry out activities in particular ways, such as *preparing a hangi; planning a local facility;*

4 identify strategies used to communicate and promote a technological idea or development, such as *instruction manuals; explanatory leaflets.*

Technological Knowledge and Understanding: Level 5

Achievement Objectives

Within a range of technological areas and contexts, students should:

1 investigate and discuss the relationship between the use and operation of technologies;

2 a explain underlying technological principles, such as *efficiency;*
  b investigate and report on the factors involved in the control of technological systems, such as *feedback; monitoring;*

3 investigate a specific technological area to identify features of technological practice, such as *health and safety practices in food technology; a design process involved in the construction industry;*

4 compare strategies for the communication of different types of technological innovation, such as *computer systems for different groups of users.*

Technological Knowledge and Understanding: Level 6

Achievement Objectives

Within a range of technological areas and contexts, students should:

1 identify and discuss in detail the relationship between the use and operation of a range of technologies;

2 a explore and explain technological principles, such as *ergonomics;*
  b investigate and describe how systems work together as part of a larger system;

3 identify, compare, and explain distinctive aspects of different technological practices, such as *use of different knowledge bases;*

4 investigate and review strategies for the communication, promotion, and evaluation of technological outcomes, with reference to users, such as *environmental protection; consumer appeal and response.*

Technological Knowledge and Understanding: Level 7

Achievement Objectives

Within a range of technological areas and contexts, students should:

1 investigate and explain the features of a range of technologies and describe the relationship between their use, function, and operation;

2 a analyse a range of technologies and explain underlying principles, such as *optimisation;*

b analyse the structure, organisation and control of systems;

3 experience and report on a particular community of technological practice, such as *a case study of a biotechnological development or a town planning revision;*

4 analyse different strategies and constraints on the communication, promotion, and evaluation of technological ideas and outcomes, such as *a patent application; packaging standards.*

Technological Knowledge and Understanding: Level 8

Achievement Objectives

Within a range of technological areas and contexts, students should:

1 analyse and appraise the relationship between the use, function and operation of specific technologies;

2 a explore and analyse underlying technological principles, such as *modularisation, adaptation;*

b examine and appraise complex systems in terms of interconnectivity within and between systems, such as *control; feedback; stability;*

3 experience, analyse, compare, and appraise the nature of practice in different technological communities, such as *architecture; electrical engineering; pharmaceuticals;*

4 critically analyse and evaluate the strategies used and constraints which apply in the communication, promotion, and evaluation of a specific technological innovation in relation to particular groups of users, such as *ethical or statutory requirements; trade practices.*

Strand B: Technological Capability

Students' technological experiences should reflect the interlinking nature of the strands: technological knowledge and understanding; technological capability; technology and society. When involved in any technological activity, students should adapt and apply knowledge, strategies, and skills from a variety of sources.

Within a range of technological areas and contexts, students should produce technological solutions. They will:

5 identify needs and opportunities to provide information for possible technological practice;

6 with reference to identified needs and opportunities,

- a generate possible options and strategies, and select, develop, and adapt appropriate solutions;
- b produce technological outcomes to agreed quality standards, managing time, and using human and physical resources skilfully, safely, and effectively;
- c present and promote ideas, strategies, and outcomes throughout technological practice;
- d evaluate designs, strategies, and outcomes throughout technological practice in relation to their own activities and those of others.

Technological capability, the practical application of knowledge and ideas to develop technological solutions, is central to technology education.

In the active process of generating, designing, making, communicating, and evaluating technological solutions to meet identified needs, students should be applying their knowledge and understanding of existing technologies, and considering the values, priorities, and possible impacts on society which underlie their proposed solutions.

There are particular links between the fourth objective of Strand A: Technological Knowledge and Understanding, where students investigate the strategies used in communicating and evaluating technological ideas and outcomes, and 6c and 6d of this Technology Capability strand, where students communicate, promote, and evaluate their own solutions.

In developing their solutions, students should be encouraged to show how existing technologies might be adapted or modified, as well as the possibility of generating a new product, system, or environment. A technological solution may be produced as a scale model, a simulation, a representation, or a product—an object, a system, or an environment.

Students will often bring a product to a sophisticated level of production, and should be encouraged to take pride in a high level of aesthetic and craft qualities. On other occasions, the activity may appropriately result in conceptual models or drawings, supported by notes, which generalise and demonstrate a solution rather than bring it to a refined conclusion.

Students need time to analyse decisions and strategies throughout the process, and to evaluate their outcomes, their use of time and resources, and the ways they can communicate their ideas. They should recognise the importance of meeting consumer needs and being responsive to the community. Students should be encouraged to rework and refine outcomes to achieve a solution. The solution may sometimes be accidental and unexpected, resulting in an innovation which offers new possibilities for development.

Technological Capability: Level 1

Achievement Objectives

Within a range of technological areas and contexts, students should produce technological solutions. They will:

5 identify and discuss needs, opportunities, and preferences in their immediate environment;

6 with reference to identified needs and opportunities,

- a share ideas about possible solutions and strategies, and choose a practicable option;
- b identify and gather necessary resources, and model or make their preferred solution;
- c discuss their ideas, intentions, progress, and outcomes with others;
- d describe and discuss how they feel about what they have accomplished.

Technological Capability: Level 2

Achievement Objectives

Within a range of technological areas and contexts, students should produce technological solutions. They will:

5 gather information, and identify and discuss needs, opportunities, and preferences in their local environment;

6 with reference to identified needs and opportunities,

- a discuss possible solutions and strategies, and select and develop a suitable option;
- b identify and gather necessary resources, and model or make their preferred solution;
- c show and describe examples of their intentions, progress, and outcomes to others;
- d describe how satisfied they are with their progress and outcomes, and how well they are achieving the intended solution.

Technological Capability: Level 3

Achievement Objectives

Within a range of technological areas and contexts, students should produce technological solutions. They will:

5 gather and collate information on needs and opportunities in the local environment;

6 with reference to identified needs and opportunities,

- a explore possible solutions and strategies, and select appropriate options, justifying their decisions;
- b prepare a plan of action, identify and collect the required resources, and produce the selected solution to meet agreed or specified criteria;
- c present designs, plans, and outcomes to selected groups, using suitable means of communication;
- d review decisions and progress, assessing how satisfied they are with their strategies and outcomes.

Technological Capability: Level 4

Achievement Objectives

Within a range of technological areas and contexts, students should produce technological solutions. They will:

5 use quantitative and qualitative methods to identify and clarify needs and opportunities;

6 with reference to identified needs and opportunities,

- a identify the nature and details of the issue and explore feasible strategies; select an appropriate solution through testing, adaptation, refinement, and modification;
- b prepare plans of action, identifying the required resources (time, human, material, financial); produce the selected solution to meet agreed or specified criteria;
- c present and explain designs, plans, strategies, and outcomes to specific groups, using a variety of forms of communication;
- d explain their choices, review strategies, and appraise outcomes, taking responses of others into account.

Technological Capability: Level 5

Achievement Objectives

Within a range of technological areas and contexts, students should produce technological solutions. They will:

5 use a range of appropriate techniques to investigate and determine needs, opportunities, and consumer preferences;

6 with reference to identified needs, opportunities, and preferences,

- a consider relevant factors and constraints, including existing solutions; develop and test a solution through modification and adaptation, justifying decisions;
- b develop plans of action which allocate time, equipment, materials, and people efficiently; produce a solution to meet agreed or specified criteria;
- c present and promote designs, plans, strategies, and outcomes, using appropriate forms of communication for their audience;
- d review the ways their chosen strategies and solutions have developed in relation to intentions and agreed criteria, such as *cost-effectiveness; social and environmental implications.*

Technological Capability: Level 6

Achievement Objectives

Within a range of technological areas and contexts, students should produce technological solutions. They will:

5 use a range of appropriate techniques to investigate and review needs and opportunities, analysing information to identify factors such as trends in consumer preferences;

6 with reference to identified needs, opportunities, and preferences,

- a consider existing solutions, and the range of available options, such as materials; propose and test ideas and strategies to select a solution;
- b develop and record plans of action which apply resources efficiently; produce a solution which meets specified criteria, including agreed standards, such as *fitness for purpose;*
- c demonstrate and explain designs, plans, strategies, and outcomes, using communication and promotion methods which meet specific consumer preferences;
- d review the chosen strategies and outcomes, debating their decisions in relation to a range of criteria.

Technological Capability: Level 7

Achievement Objectives

Within a range of technological areas and contexts, students should produce technological solutions. They will:

5 use a range of appropriate techniques to collect, analyse, and appraise data to identify and refine consumer preferences and market needs and opportunities;

6 with reference to identified needs, opportunities, and preferences,

- a specify the tasks, establish constraints and considerations through consultation, analyse possible solutions, and select, test, and modify or adapt a feasible option;
- b develop a critical path, applying resources to ensure efficiency and quality; produce a solution which meets physical and aesthetic criteria, service requirements, and health and safety standards;
- c present, interpret, and promote designs, plans, strategies, and outcomes to a specific audience, using appropriate specialist vocabulary and symbols;
- d critically evaluate strategies and outcomes with reference to factors such as *society, environment, finances, standards, and regulations.*

Technological Capability: Level 8

Achievement Objectives

Within a range of technological areas and contexts, students should produce technological solutions. They will:

5 use a variety of appropriate techniques to identify, clarify, and review needs and opportunities, taking into account consumer and market demands and preferences;

6 with reference to identified needs, opportunities, and preferences,

- a identify task specifications, establish constraints and considerations, apply relevant research to generate viable preliminary solutions and strategies, and test, select, and modify or adapt a viable solution;
- b develop a critical path, managing resources effectively; produce a solution which meets the identified requirements, including production efficiency, quality assurance, commercial standards of performance, and health and safety standards;
- c make informed decisions about and implement strategies for the communication and promotion of ideas, decisions, and outcomes, with reference to community responses;
- d critically analyse and evaluate the strategies and outcomes, appraising the systems used to meet standards and criteria related to performance, aesthetics, and consumer demand.

Strand C: Technology and Society

Students' technological experiences should reflect the interlinking nature of the strands: technological knowledge and understanding; technological capability; technology and society. When involved in any technological activity, students should adapt and apply knowledge, understandings, and skills from a variety of sources.

Within a range of technological areas and contexts, students should:

7 develop awareness and understanding of the ways the beliefs, values, and ethics of individuals and groups:
   - promote or constrain technological development;
   - influence attitudes towards technological development;

8 develop awareness and understanding of the impacts of technology on society and the environment:
   - in the past, present, and possible future;
   - in local, national, and international settings.

Understanding the nature of the relationship between technology and society is vital to technological practice. Technological developments arise from within society. No technology is "value-free": needs arise from a variety of causes and perceptions, and the ways they are addressed depend on a complex set of relationships in society, the resources that are available, the priorities that the society holds, and the culture, beliefs, and values that influence decision making in that society. Decisions about technological innovation are governed by this complex balance of factors, and groups or individuals may have markedly different attitudes towards particular technological practice. While the external impacts of technology are frequently examined, the characteristics of the people and the social and physical environment that gave rise to the developments are sometimes overlooked.

Students should recognise and explore these ideas and factors in considering technological developments and their applications. Examples from history, in our own times, and projecting into a likely or preferred future can be used as contexts for this strand, as should examples from local, national, and international settings. Topical issues which affect technological outcomes and are currently under debate may capture students' interests, be relevant to their own lives and decision making, and provide useful resources.

Technology and Society: Level 1

Achievement Objectives

Within a range of technological areas and contexts, students should:

7 share their reasons for their choice of technological activity;

8 share ideas about the ways in which familiar technologies affect their lives, such as *cooking appliances; play equipment.*

Technology and Society: Level 2

Achievement Objectives

Within a range of technological areas and contexts, students should:

7 identify different views about a specific technological development within the local community, such as *a roading or waste disposal project;*

8 explore and compare the roles of some example of technology in daily life in their own and another time or place, such as *retailing; personal hygiene.*

Technology and Society: Level 3

Achievement Objectives

Within a range of technological areas and contexts, students should:

7 identify and consider different views and feelings of people in relation to some specific technological developments or effects, such as *fitness equipment; noise pollution;*

8 describe and identify the positive and negative effects of some instances of technologies on people's lives and the environment, such as *the introduction of Cook Strait fast ferries.*

Technology and Society: Level 4

Achievement Objectives

Within a range of technological areas and contexts, students should:

7 identify and compare the range of factors and attitudes that promote or constrain a current technological development in the wider community, such as *speed cameras; artificial fibres;*

8 explore and discuss the impacts over time on the local and wider environments and society of some specific technology, as in *the dairy industry; the introduction of wide-bodied jets.*

Technology and Society: Level 5

Achievement Objectives

Within a range of technological areas and contexts, students should:

7 explain the beliefs, values, and ethics that have promoted and constrained some recent technological developments, including instances within their own technological activities, such as *the school production; food preservation;*

8 investigate and describe the present impact, and the possible future effects, of some instances of rapidly changing technologies, such as *plant propagation; entertainment.*

Technology and Society: Level 6

Achievement Objectives

Within a range of technological areas and contexts, students should:

7 identify and assess the factors that affect the ways different groups have responded to, promoted, or inhibited some technological innovation, such as *agricultural exports;*

8 examine and compare the factors that have influenced, and may affect in the future, the development and impact of some major technological innovations, such as *the Internet; data matching.*

Technology and Society: Level 7

Achievement Objectives

Within a range of technological areas and contexts, students should:

7 investigate, assess, and report on the factors that led to changes in attitudes among some identified groups with regard to some technological developments, such as *vaccination; bar-codes; microwaves;*

8 investigate and debate the perceived social and economic impacts of some specific examples of technological development, such as *those associated with military hardware; developments of new drugs.*

Technology and Society: Level 8

Achievement Objectives

Within a range of technological areas and contexts, students should:

7 investigate and analyse how beliefs, values, and ethics of individuals and groups promote and constrain technological developments in specific communities, such as *the 1960s space race; reproductive technologies;*

8 analyse and critically evaluate the social and economic impacts of some significant technological developments in a variety of settings, debating viewpoints, and exploring options for the future.

SUGGESTED LEARNING AND ASSESSMENT EXAMPLES FOR LEVELS 1 AND 2

These learning and assessment examples are suggestions which teachers could develop further into units of work.

Example 1: Letterboxes

Contexts: Home; Business; Environmental
Main Areas: Materials; Structures; Information and Communication

The postal system provides opportunities for a variety of technological observations and activities which relate to all three curriculum strands. The community links can be built from the outset, through discussion with the local post office about the proposed range of activities and the part that staff might take in fostering students' knowledge.

Technological Knowledge and Understanding

- Students list the purposes served by letterboxes.
- They examine a variety of letterboxes to identify similarities, differences, and key features.
- They discuss how different letterboxes operate and are used.
- They prepare and ask questions of the postie, focusing on the types of letterboxes they prefer, and why.
- They identify what they think is the best letterbox in their neighbourhood, giving reasons for their choice.

Technological Capability

- Students collect and present data about letterboxes examined in a particular location.
- They find out about the types of improvements the postie and owners would like to make in relation to letterboxes.
- They brainstorm ideas about the type of letterbox best suited to group members which also meets the needs of the class's postal system and which accounts for constraints identified by the teacher and themselves, such as materials and time.
- They identify needs and possible difficulties associated with the designing and making of their own letterboxes.
- They discuss how their design / product meets identified needs and constraints.

Technology and Society

- Students discuss reasons for their selection of a design and materials for their group's letterbox / their letterbox at home / letterboxes in their neighbourhood.
- They discuss what it would be like if there were no letterboxes, and what other methods of mail delivery might be possible.

Assessment

The main focus in this example could be on the production of the letterbox, and teachers may choose to concentrate assessment on the objectives of the capability strand, mainly in terms of the choices made for a well produced solution, including choice of suitable materials.

Example 2: The Supermarket

Contexts: Home; Community; Personal; Business
Main Areas: Electronics and Control; Food; Information

Technological Knowledge and Understanding

- Groups of students observe, collate information, and share ideas on specific sections of the supermarket in operation for the purpose of recreating the system in the classroom, considering:
  - storage of different types of goods, including controlled temperature environments;
  - the systems in use for receiving stock, stacking shelves, re-ordering goods, packing at point of sale;
  - the layout of different goods within the store;
  - the work done by different staff members—supervisors, check-out operators, shelf fillers, managers of different areas, packers;
  - the electronic and other systems operating for calculating customers' bills—bar-codes, weighing machines, EFTPOS, cheques;
  - the security and control systems in use—exit and entry lanes, mirrors, cameras;
  - promotion and communication strategies, including signs, and labelling, positioning, and packaging of goods.

Technological Capability

- Students identify needs and opportunities by observing and talking to staff about layout and different types of services, such as being personally served.
- They share ideas about how to arrange products and organise services in the supermarket.
- They sketch, model, or role-play some solutions to problems identified and evaluate the quality and usefulness of these.

Technology and Society

- Students talk with family, friends, and supermarket staff about their views on various changes in shopping, such as developments in self-service, different methods of payments, bar-codes, methods of display.
- They look at photographs of shops from other places and times, or visit other kinds of shops, and discuss the similarities and differences to shopping in a supermarket.

Assessment

Teachers could maintain a record of each student's understandings of each aspect, and their competence and quality of planning and participation. For example:

- students could discuss what they have learned, both from their own observations and activities, and from listening to others about different aspects of supermarket operation.

Example 3: Pet Houses

Contexts: Home, School; Environmental
Main Areas: Materials; Structures; Control

Technological Knowledge and Understanding

- The teacher arranges a visit from a veterinarian, zookeeper, or RSPCA representative for the students to ask about important considerations in housing pets at home or school.
- Students depict their understandings about the key features required in a house for a specific pet.
- They share ideas about proportions, materials, location, and other factors that are necessary for animals' comfort and health.

Technological Capability

- Students survey teachers, parents, and friends to identify the needs of particular animals, in terms of hygiene, warmth, and adequacy of food.
- They brainstorm ideas for a suitable cage or feeding device for their chosen animal, and select one, explaining their decision to other groups.
- They plan and produce a prototype of a pet house for a particular pet, learning about the qualities of different materials and the use of a variety of tools.
- They test their product, checking that it meets all the requirements that they identified, and discuss their findings with others, modify their prototype and complete the project.

Technology and Society

- Students discuss why people keep pets.
- They identify the most popular kinds of pets.

Assessment

This example focuses on the objectives of technological capability. Teachers may particularly wish to assess students' ability to record and evaluate their designs and products in terms of how well they match the original brief.

Example 4: Milk Foods

Contexts: Home; Personal; Community
Main Areas: Biotechnology; Food; Materials

Technological Knowledge and Understanding

- Students identify as many milk products as they can. They share ideas about how milk might turn into, for instance, cheese or yoghurt.
- The teacher demonstrates the idea of a culture through a common example.
- The teacher might arrange a visit to a cheese factory or from a dairy technologist.
- The class makes junket and separates curds and whey, identifying the processes involved, problems, and developing improved procedures.
- Students examine the information on the labels and packaging of the milk products they have identified, with a view to incorporating aspects into the packaging of their milk product.
- They collect a range of advertisements relating to milk products, and identify the key features.

Technological Capability

- Groups of students develop a survey to identify preferences among a specific group of users, such as younger children, and share the results.
- Students explore adaptations and modifications of milk products and select one to develop, such as a flavoured yoghurt or cheese with herbs.
- They design and make a packaging that will be suitable for storing or carrying their product.
- They explain the process they have been involved in, try out each other's products, and comment on them.

Technology and Society

- Students identify and investigate a variety of specialised milk products, and discuss why these have been developed.
- They talk to friends and family, or refer to selected resources, to identify why these have been developed.

Assessment

Teachers may wish to focus on the problem-solving aspects of this example, and the ways students express and respond to the ideas of others in relation to their products.

The level of understanding of the way milk is modified through the use of cultures could be assessed through noting students' ability to explain the process and conditions required for success.

Example 5: Electronic Devices

Contexts: Home; School; Personal
Main Areas: Electronics and Control; Information and Communication

Technological Knowledge and Understanding

- Students describe and demonstrate the use and operation of some familiar electrical and electronic devices in the classroom and home, for example, a video recorder, showing understanding of the different controls and systems.
- Groups look at instruction sheets and other informational material about some of the examples, and write operating instructions for one example, such as a tape recorder, presenting it clearly and with diagrams, if necessary.

Technological Capability

- Students survey, collate information, and prepare a report on the electronic devices and systems which school staff and family members find most useful and what might be improved, for example, the instructions for use.
- Students share ideas and, with the teacher's help, select a simple electrical or electronic system or device to make.
- Using simple components, such as cells, tinfoil and wires, students make a prototype or model of a device to meet some aspect of identified needs, and write accurate instructions for its use.
- They answer questions about how they constructed their device or system, and evaluate each other's instructions.

Technology and Society

- Students interview a number of adults about the changes they have observed in electronic devices during their lifetimes, exploring and preparing a report on:
  - how they feel about specific aspects of these changes;
  - the impact of some of these devices on their daily lives.

Assessment

Students could assess how their understanding of familiar items has changed during these activities. For example:

- teachers could listen to students' explanations about how an electronic device works, noting, for example, their description of inputs and outputs;
- teachers could note the level of understanding shown during students' presentations of their work and in their written instructions;
- the Technology and Society strand could be a focus of assessment in terms of students' understandings of the impacts of technology.

Example 6: Recycling and Waste Disposal

Contexts: Home; School; Community; Environmental; Industrial
Main Areas: Biotechnology; Materials; Process

Technological Knowledge and Understanding

- Students investigate and draw a simple diagram, with captions, to show how the current system for disposal and recycling of rubbish operates in their class or home.
- They talk to parents or the school caretaker and others involved in the school environment to find out how they deal with waste.
- They identify and discuss the signs, containers, and information around the school and neighbourhood concerning litter and waste disposal.

Technological Capability

- Students identify and classify items of rubbish, according to the type of material.
- They identify problems with the current systems for the collection and disposal of rubbish at home and school.
- They share ideas about possible improvements to recycling and waste disposal systems, selecting some for development.
- In groups, students design and make models, diagrams, instructions, or prototypes of their solutions.
- They present their solutions and modify them according to the responses.

Technology and Society

- Students discuss why waste disposal systems are necessary.
- They ask people for their views about different systems of waste disposal.

Assessment

Teachers may wish to focus assessment on students' understanding of issues involved in waste disposal, noting how well ideas generated in the Capability strand reflect these understandings. For example:

- after this topic is studied, students could evaluate the changes in their behaviour about dealing with litter and rubbish.

Example 7: Protective Clothing

Contexts: Recreational; Community; Personal
Main Area: Materials

Technological Knowledge and Understanding

- Students identify protective clothing worn for particular activities.
- They describe features of the clothing which offer protection.
- They match examples of protective clothing to specific occupations and write to users to ask about the effectiveness of the clothing.
- The teacher demonstrates, and students practise, ways of joining and fastening different materials.
- The teacher could arrange a visit from a person whose occupation requires special clothing, such as a farmer, nurse, fire fighter.
- Students collect advertisements relating to special clothing, for example, rainwear, and discuss key features.
- They test a range of materials for specific qualities, for example, resistance to water, heat retention, heat deflection.

Technological Capability

- Relating their ideas to information gained from their activities so far, students brainstorm particular situations where they require protective clothing.
- Groups explore ideas for a simple modification to a garment or for a new garment, and select an option to develop.
- They identify suitable materials and equipment, with teacher guidance, and design and produce their chosen solution.
- The garment is modelled and evaluated by other students, according to the need identified in the initial brief.

Technology and Society

- Students refer to books or talk to other people to gather ideas about garments worn for particular occupations and activities in other times and places.
- They suggest how the requirements for protective clothing might change in the future.

Assessment

Teachers may wish to focus on capability in this unit of work, giving students opportunities to explore textiles, and other materials, including flax, to produce hats, aprons, scarves, or similar protective garments. Assessment could be in terms of suitability of design and materials, correct use of tools, quality of the outcome. For example:

- students could peer- and self-evaluate, according to the criteria of the initial brief.

Example 8: Paper and Paper Products

Contexts: Personal; Home; School; Community; Industrial
Main Area: Materials; Communication; Mechanisms

Technological Knowledge and Understanding

- Students examine a wide range of papers, identifying similarities and differences.
- They explore and discuss the process of making paper by hand.
- Groups consider the effectiveness of various papers and card designs for different purposes.
- They discuss how retailers display paper products, and why they are displayed in particular ways.
- They suggest modifications to paper or paper products to meet the needs of a particular user group.

Technological Capability

- Students identify different types of paper and the ways in which they are used to meet the needs of specific communicators and audiences.
- Each group selects an opportunity and explores ways in which the communication could be achieved, giving reasons for their choice.
- They plan, design, and make their preferred product, which may involve making the paper and developing the product using handwriting, stencils, drawings, collage, or a computer.
- They share their progress and outcomes, responding to suggestions for improvement.
- The product is used as planned, and students evaluate their success, in relation to the identified need.

Technology and Society

- Students gather information about past and present paper products and cards from homes, shops, or museums.
- Students consider the materials, texts, and designs in terms of the purposes, and share ideas about how these have changed over time.

Assessment

The focus could be on capability, with the fitness for purpose and quality of outcomes being assessed as students present and use their solutions. For example:

- students could talk about the successes and problems they encountered when undertaking these activities.

Example 9: School Lunches

Contexts: Personal; Home; School
Main Area: Food

Technological Knowledge and Understanding

- The teacher arranges a visit to a lunch bar or by a dietitian or health expert to identify key considerations when preparing and packaging food.
- Students examine and comment on the advertising and packaging of foods commonly selected for lunches, noting the implications for food handling.

Technology Capability

- Students collect and collate data about the school lunches eaten by their peers over several days.
- Students collate information about preferences for sandwich fillings and other lunch ingredients, and about the factors that make a school lunch appetising.
- Groups share their survey results.
- They use this data to identify lunch preferences and develop a plan for a nutritious lunch.
- Each group lists and assembles the ingredients or materials and prepares the selected products.
- Groups present their solutions to others, explaining the reasons for their decisions, responding to questions, and asking for feedback.
- The class could review their products and prepare these in quantities sufficient to test the market elsewhere in the school, with suitable labelling, packaging, and promotion.
- They could create school lunch menus which reflect their findings and meet standards of nutrition.

Technology and Society

- Students identify foods preferred by a variety of cultures, noting similarities and differences.
- They investigate and report on the school lunches that were customary among their parents' and grandparents' generations.

Assessment

The focus for assessment could be capability, evaluating students' skills in selecting, preparing, and presenting suitable foods. For example:

- peer evaluation of the products chosen could be recorded, using appropriate criteria;
- students could evaluate what they have learned and how their new understandings might affect their school lunch decisions.

Example 10: Toys and Games

Contexts: Personal; Community; Home; Recreational
Main Areas: Materials; Structures and Mechanisms

Technological Knowledge and Understanding

- Students observe and analyse a range of toys and games and describe the components of some games, and explain how they operate.
- They collect advertising and promotional material relating to toys and games and discuss which they would buy, and why.
- Students examine the instructions for toys and games and discuss their clarity and usefulness.

Technological Capability

- Students discuss what makes a good toy or game. They chart the responses and make some generalisations.
- From the information they have gathered, groups explore opportunities for modifying or improving an existing product or making a different one.
- Groups select and design their solution, making a list of materials required. With guidance from the teacher on materials and the correct use of tools or equipment, they produce their solution.
- Groups demonstrate their toy or game, explain the reasons for their decisions, and allow others to test the solution, which might then be modified.

Technology in Society

- Students interview an older person to find out about the types of toys and games in that person's childhood, looking at similarities and differences to present-day toys and games.
- They question the person about changes they have observed in toys and games.
- They discuss why people use toys and play games.
- Students visit a museum or use references to identify toys and games from other places and periods, how they were used, and how they worked.

Assessment

Teachers could assess all aspects of technological processes during this series of activities, using student-kept records and teachers' records which note the quality of students' observations, planning, production, self-evaluation, and awareness of social aspects.

SUGGESTED LEARNING AND ASSESSMENT EXAMPLES FOR LEVELS 3 AND 4

These learning and assessment examples are suggestions which teachers could develop further into units of work.

Example 1: A Festive Table

Contexts: Personal; Home; School; Community
Main Areas: Materials; Food; Information and Communication

Preparing for a celebratory meal provides an opportunity for a wide range of technological activities, culminating in a memorable event. The meal might be to celebrate a family event—a child's birthday, grandparents' anniversary, a friend's homecoming; it could be part of a church or community event—the opening of a new facility, a religious festival, a welcome to a team; or the school could welcome a new teacher or overseas guests.

Technological Knowledge and Understanding

- Students compare the settings, choices of foods, and methods of service that are used on different celebratory occasions.
- They investigate and describe the components that need to be considered when organising such an event.
- Depending on their choice of event and the types of products that they will be making, they plan a visit and make a list of relevant questions to ask.
- They examine samples of invitations, notices, and other relevant communications relating to a celebratory occasion.

Technological Capability

- Students identify the needs relating to particular celebratory occasions.
- The class as a whole considers the options, and decides on one event as a focus; or, if family celebrations are preferred, students may work in several groups; or the event may relate to a current theme of study.
- The class, or each group, develops a full plan, identifying all the elements, allocates tasks, and devises a timeline to meet the required deadline.
- The teacher helps to organise resources and monitors progress to support the range of activities.
- A "trial run" is held and tested. Modifications are made as necessary.
- The meal is served.

(A range of appropriate products, including invitations, table napery, candles and candle-holders, barbecue facilities, serving equipment, protective garments for the servers, foods to suit the occasion, menus, and place names could be designed and developed to support the festive table.)

Technology and Society

- Students discuss the central role that food plays on celebratory occasions in a range of cultures.
- They research recipes and menus, and interview others about comparable events in other places and times.
- They discuss preferences and the impact that particular technologies have on the choices available.

Assessment

Teachers could keep a conference log noting group progress in relation to the achievement objectives, noting their particular contributions and assessing, particularly, the processes and products within the Capability strand. For example:

- students could keep a group portfolio containing a record of their progress.

Example 2: A Hangi

Contexts: Home; Community
Main Areas: Food; Materials

Technological Knowledge and Understanding

- The teacher arranges for a kaumatua or other expert to talk to the students about the protocols involved in mahi hangi, before further investigation takes place.
- If possible, students participate in a hangi with other people.
- Students report on the factors that need to be taken into account when preparing food for a hangi.
- They depict the system necessary to ensure a successful result.

Technological Capability

- Students discuss opportunities for providing a hangi and identify a suitable occasion.
- They compile a list of tasks and assign responsibilities for the making of a hangi, and the preparation, cooking, and serving of the food.
- They test their system on a small scale and modify it, as necessary.
- They prepare information to promote the hangi.
- They carry through their plans and serve their guests.

Technology and Society

- Students identify the cultural values and traditions associated with the hangi, and discuss why it is still a favoured technology for serving food on certain occasions.

Assessment

The teacher could assess the way students observe protocols and traditional systems and, with students' help, the success of the hangi. For example:

- students evaluate how well they carried out their tasks and their understandings of the system and principles of earth-oven cookery.

Example 3: Traffic Systems

Contexts: Community; School
Main Areas: Structures and Mechanisms; Control

Technological Knowledge and Understanding

- Students observe and depict (with sketches or photographs) the features of traffic control in their local environment.
- They observe and note the way vehicles and pedestrians behave in relation to these features.
- A traffic officer, AA representative, or other expert is invited to discuss the students' observations with them, and to answer questions.
- Students investigate how information relating to traffic systems is communicated to users.

Technological Capability

- Students use appropriate systems to collect and collate information about local traffic flows, identifying key features and problems, and explore accident statistics, the public transport system, and other data to identify trends and problems in the local traffic flow.
- They develop and select ideas for improvements in the local traffic system.
- They draw, model, or prepare diagrams of their proposed solutions and discuss them with the class or a local traffic officer, modifying them in the light of responses.
- Students communicate their proposals, in writing or in person, to the relevant authorities, explaining and justifying their solutions.

Technology and Society

- Students discuss their observations of people's behaviour in relation to traffic controls, and consider the attitudes that different behaviours suggest.
- Students select a proposal for change in traffic conditions in their neighbourhood, and hold a debate about its likely impacts.

Assessment

The teacher could focus on the quality of knowledge and understanding that students demonstrate in their proposals. For example:

- students could evaluate what they have learned about the nature of traffic and transport planning for a community.

Example 4: Electronic Warning Devices

Contexts: Home; Community; School
Main Area: Electronics and Control

Technological Knowledge and Understanding

- Students identify a range of warning device systems and describe their components and the relationship between them.
- They identify the uses and describe the operation of warning devices in their own environment.
- They collect and examine the information provided for the use of specific warning devices, such as a car alarm, and evaluate its usefulness.

Technological Capability

- Students survey family, teachers, and other adults to identify the desirable features of specific electronic warning devices.
- They collate and report findings of the class survey, identifying desirable features.
- They list ideas about modifications that could improve the performance and appeal of the devices identified, or develop ideas for a new application.
- Groups select their project and design and construct a prototype, following a circuit diagram, if necessary.
- Groups develop and explain their solutions and how they achieved their results, using overhead transparencies or other technology to assist communication.
- They design and develop a promotional package for their electronic warning device.

Technology and Society

- Students discuss why electronic warning devices are necessary.
- They research how a specific device was developed, where it is used, and the impact that it has had.
- They examine advertisements relating to electronic warning devices, and identify the target audience.

Assessment

The teacher could focus on the electronic skills and their understanding of electronic systems as demonstrated by the students in their planning and production. For example:

- students could evaluate their own work and that of their peers in terms of its fitness for purpose.

Example 5: Food Containers and Packaging

Contexts: Home; Business; Personal; Environmental
Main Areas: Materials; Food

Technological Knowledge and Understanding

- Students assemble, describe, and classify a variety of food containers in terms of the materials, design, and disposability.
- They identify the specific purposes for which each is designed.
- Students examine and evaluate the clarity and usefulness of information on packages.

Technological Capability

- Students discuss the merits and weaknesses of the packaging that they have examined and brainstorm ideas for improvements in relation to particular foods.
- Each group selects an option to work on, and plans, designs, and develops a container, taking special account of perishability, hygienic handling, and other safety factors.
- Groups prepare or obtain the food and fill their package, testing it for functionality in terms of their objectives, such as freshness, portability, ease of opening, optimisation of materials, and disposability.
- Students share their solutions. One might be selected as a class project, using process technology to produce a line of packaged foods for a school function.

Technology and Society

- Students research and account for changes in food packaging, using a range of reference sources.
- They consider the resistance to, or enthusiasm for, certain types of packaging, identifying reasons for preferences.

Assessment

The teacher could assess the students' understanding of the special requirements for safety and hygiene in handling and packaging food, and the relationship between the final product and the identified need. For example:

- students and teachers could evaluate the quality of their plan of action, including appropriateness of resources, suitability of design, and allocation of tasks.

Example 6: Yeast Products: Bread/Ginger Beer

Contexts: Home; Personal
Main Areas: Biotechnology; Food

Technological Knowledge and Understanding

- The teacher arranges a visit to a bakery, where students observe and identify stages in the breadmaking process.
- They experiment with growing yeast in different conditions.
- They identify a variety of breads and beverages, and distinguish between yeast-based products and those using other rising or carbonating agents.
- They compare strategies used to promote a variety of yeast-based products.

Technological Capability

- Students survey and collate people's bread and beverage preferences.
- In groups, students consider a range of ways to meet the preferences they have identified, and select a product to develop for an identified group, such as toddlers or grandparents.
- Each group plans and produces a yeast-based product.
- Groups test their products, report on any problems they encountered, and identify critical factors when using yeast.
- On the basis of this information, groups replan and reproduce their products.
- Groups assess the acceptability of their product, develop recommendations for how it should be packaged and stored, write an information leaflet to accompany it, and design a promotional package.

Technology and Society

- Students research the use of different types of bread and the range of beverages available.
- They collect information on staple foods from other cultures and societies and investigate why certain foods become central to particular groups.

Assessment

The teacher could assess the processes used, the suitability of the product for the defined purpose, and the quality control that students demonstrated. For example:

- students assess their work by the response to their tests.

Example 7: Bicycles

Contexts: Personal; Community; Environmental
Main Areas: Materials; Structures and Mechanisms

Technological Knowledge and Understanding

- Students identify and explore the principles of the bicycle, depicting these with annotated diagrams. They identify the significant factors which have influenced the design, such as materials, comfort, and safety.
- They visit a bicycle shop to examine a range of bicycle attachments, such as locks or lights, investigating and describing how these devices work.
- They identify types of bicycles, such as a road bike or mountain bike, noting similarities and differences and explaining reasons for these.
- They read and evaluate information or promotional leaflets about different types of bicycle, indicating which bicycle they would buy, and why.

Technological Capability

- Students interview peers and collate information graphically about preferred features of different kinds of bicycles and of related equipment, such as locks, lights, seats, bottle holders, handlebar grips, gears, and bike computers.
- Groups explore the range of opportunities they have identified and select a viable option to modify, adapt, or generate.
- Each group designs and makes its part or product.
- The prototype is tested with users, and refined or completed.

Technology and Society

- Students research the development of the bicycle, using a range of reference sources, displays, or books.
- They consider the reasons for different styles and shapes.
- They investigate the impact of the bicycle in the past and present in several different societies, such as 1890s New Zealand; modern China.

Assessment

The teacher could evaluate students' progress through ongoing conferences held with groups during the activity. For example:

- students could submit portfolios for assessment.

Example 8: Sports Equipment and Clothing

Contexts: Personal; Recreational
Main Areas: Materials; Mechanisms

Technological Knowledge and Understanding

- Students assemble and examine a range of sports clothing and equipment, identifying and recording features which enable each product to function effectively.
- They investigate and depict the details of how various components are assembled in a piece of sports equipment/clothing.
- They discuss with relevant people the factors they look for in selecting safe, suitable clothing and equipment.
- They collect promotional material on clothing and fitness equipment and analyse how well important features are explained.

Technological Capability

- Students interview people actively involved in sports activities to determine recreational preferences and ideas about different recreational needs, or requirements for equipment and clothing.
- Groups select a relevant task and design and develop a solution—a plan for a fitness centre; a piece of equipment; a product such as a sports bag or item of clothing; a fitness trail.
- Students test their solution with the target audience and modify it in the light of responses.

Technology and Society

- Students research the fitness and recreational opportunities available in their community and interview people from several age groups about:
  - what promotes or constrains their participation in these opportunities;
  - whether their needs have changed over time or are likely to change in the future, and how these needs could be met.

Assessment

The teacher could assess any one or all three of these strands, depending on the nature of the opportunities that are identified. Students should demonstrate understanding of the individual nature of choices made in relation to sport and recreation. For example:

- students could peer-evaluate the promotional package developed for their product.
- teachers could assess the quality of the students' debates about whether technology has brought recreational benefits to people in their community.

Example 9: Animal Environments

Contexts: Environmental; Community
Main Areas: Control; Materials; Structures and Mechanisms

Technological Knowledge and Understanding

- Students investigate and depict examples of environments designed or designated for particular animals, such as an aquarium, a tuatara house, a horsebox, a bird sanctuary, a wetland reserve.
- The teacher arranges a discussion with, for example, a pet shop worker, RSPCA representative, zookeeper, wildlife officer.
- Students visit a protected or specially designed environment, or view video footage of some examples, and depict the operational systems, such as temperature control, they observe in these environments.
- They meet local authority staff or others involved in providing or protecting facilities for animals.

Technological Capability

- Students consider the needs of some specific animals, in terms of temperature controls, protection from predators, access to foods, in order to identify opportunities for technological activities.
- Groups select opportunities for investigation, and gather and collate details of the requirements, such as the construction of an aviary, development of a controlled entry system, feeding device, or refurbished zoo enclosure.
- They plan, design, and produce a model or system, in consultation with the relevant authority.
- They evaluate progress and check ideas against the specialised information available to them.
- They prepare a pamphlet explaining the operational details of their facility.

Technology and Society

- Students research the history and purposes of animal enclosures or special environments for wildlife in their area.
- They survey the attitudes of residents to these facilities and collate responses in terms of the values and beliefs expressed.
- They discuss the likely outcomes for endangered species in New Zealand and other countries and actions that they would support.

Assessment

The focus could be on the Capability strand, in order to encourage students to relate their understandings to practical solutions. For example:

- students could write a report on their activity, including diagrams and specifications for their solution.

Example 10: A Dairy Factory

Contexts: Industrial; Environmental; Community
Main Areas: Production and Process; Biotechnology; Food

Technological Knowledge and Understanding

- Students visit a dairy factory, farm dairy unit, or milk processing plant, and observe and depict the systems that are used, including waste disposal.
- They find out about export standards in the dairy industry, such as hygiene, shelf-life, labelling, quality controls, relating them to their observations.
- They identify the work done by different technologists in the sequence of processing from farmer to consumer.
- They examine promotional material for a recently developed export dairy product, identifying key features.

Technological Capability

- Students survey consumers and workers about needs for new products, containers, or systems, and select opportunities for developments.
- They plan and produce a prototype of their solution, which may be a product, model, diagram, flow-chart of the process, or set of guidelines for workers.
- They share plans and progress, modifying ideas in the light of responses, and test their prototypes before completing the project.

Technology and Society

- Students research the dairy industry in New Zealand over time, to see the impact on land use and changes in export flows.
- They investigate a potential market for a new or existing product, consider the cultural, social, and other factors which a producer or exporter would need to take into account, and develop ideas for a marketing plan.

Assessment

The teacher could focus on the technology and society strand in this topic, in terms of how well students have related their practice to planning for the marketplace. For example:

- students could present their reports, products, and plans and groups could discuss each other's achievements.

Example 11: Jewellery and Personal Ornaments

Contexts: Personal; Recreational; Business
Main Area: Materials

Technological Knowledge and Understanding

- Students bring favourite personal items, such as pieces of jewellery, hair clasps, photograph frames, and identify the materials and techniques that have been used in their production.
- They visit a craftsperson or craft shop to investigate how specific items are produced and displayed for marketing.
- They examine the labelling and assess how well it explains how to use and care for the item.

Technological Capability

- Students conduct a survey among friends and family, and record the data electronically in order to analyse and make generalisations about preferences for products.
- Students research decorative styles and techniques popular at different times, relating these to choice of materials.
- Individuals or groups identify an opportunity, and design and make a product, selecting materials for the purpose and using equipment skilfully.
- The products are displayed with suitable labelling and promotional information.
- The class might hold a sale of work, with individuals permitted to mark their item "NFS".

Technology and Society

- Students research similar types of ornaments which have been produced in other times and places, noting similarities and differences to those selected by individual students.
- They investigate the beliefs and values associated with different types of personal adornments, such as Victorian mourning brooches, huia feathers.
- They discuss which materials might be regarded as valuable in the future and how they could be used.
- They identify factors which contribute to the value of a personal ornament or piece of jewellery.

Assessment

This topic could be assessed mainly in relation to capability objectives, with students encouraged to produce a high level of finish. For example:

- students evaluate their skills in designing and making their product, noting any difficulties they may have had with materials and techniques.

Example 12: Natural and Synthetic Dyes

Contexts: Personal; Home; Industrial
Main Areas: Materials; Structures

Technological Knowledge and Understanding

- Students experiment with small packs of commercial dyes, following the instructions, to dye cotton handkerchiefs, flax fibre, raw wool, natural silk.
- They record the procedures used, and note the special requirements in different processes.
- For different materials, they investigate the results of changing the recommended system, and the effects of laundering on colour.
- They collect a variety of plant materials—such as lichens, fruit skins, onion skins, barks—and develop ways of using them to dye different materials.
- They record their observations about the use of mordants, colour mixes, and particular effects.
- They test for any allergic reactions to different dyes or mordants, and modify their experiments accordingly.
- They evaluate the accuracy and clarity of the information included with small packs of commercial dyes.

Technological Capability

- Students use a computer to record data matching dye types and techniques to different fabrics and purposes.
- They select a range of opportunities for the use of natural dyes.
- Groups design, plan, and produce a colour-fast dyed product, with a leaflet explaining the materials used and the way to care for the fibre or textile.

Technology and Society

- Students research the uses made by Maori weavers of natural materials to achieve the range of colours and effects in their fibres.
- They explore the significance of certain colours and patterns in different societies, and consider why some are valued more highly than others.

Assessment

The teacher could focus on development of knowledge and understanding. For example:

- the students could assess what they have learned about the practical problems of achieving colour-fastness with a chosen colour.

SUGGESTED LEARNING AND ASSESSMENT EXAMPLES FOR LEVELS 5 AND 6

These learning and assessment examples are suggestions which teachers could develop further into units of work.

Example 1: The School Production

Contexts: School; Personal; Community
Main Areas: Materials; Electronics and Control; Information and Communication; Structures and Mechanisms

The school production provides a focus for a wide range of technological activities, which relate well to other learning areas such as language and the arts, and which can involve many students in purposeful, integrated learning.

Technological Knowledge and Understanding

- Students attend a performance of a play or musical, observing and discussing the components of a production, such as sets, lighting, publicity, front-of-house, bookings, music and other sound effects, choreography of dance or haka, costuming, special effects, make-up and props.
- They meet a producer, stage manager, set designer, or sound/lighting technician to hear about the factors that make for a successful production.

Technological Capability

- Students meet the producer of the school's production as soon as the decision to stage one has been made.
- They discuss the components and factors for success that they have observed, and read the script to identify the needs for this particular production.
- The class brainstorms the tasks that need to be undertaken and develops a critical path.
- Groups form to undertake specific tasks, such as set construction.
- The producer, teacher, and class check the critical path and the ideas that are emerging, and refine briefs for each group, allocating a budget if appropriate.
- Each group plans, prepares sketches, designs, models, tests, and completes their part of the system, on time and within budget.

Technology and Society

- Students research other productions of their play or musical, or examples of similar productions, to compare with their own.
- They identify technologies used at other times, such as thunder-sheets, trapdoors.
- They interview friends and family members about productions that they enjoyed, and identify the impacts of the different components on audience appreciation.

Assessment

Teachers and the producer could assess each group's achievement in relation to the task and the innovative use of technology and the critical path. For example:

- students could keep group log-books, sequences of photographs, or videos recording progress, assembling and annotating their drafts, sketches, and decisions. They could report on the contributions of different components to the production as a whole.

Example 2: Computers

Contexts: Personal; School; Business; Industrial
Main Area: Information and Communication

Technological Knowledge and Understanding

- Students use a computer system, including the manuals, to identify and describe the relationship between the internal hardware components, the operating system, and the applications software.
- They investigate how computers use binary numbers to switch electrical devices, such as controlling a model using a computer interface.
- They evaluate the functions and purposes of a range of software to determine suitability for specific tasks.
- They identify the tasks undertaken by people using computers in a school, an office, or a small business, and record how the people and computer systems work together.
- They review computer magazines or newspapers to evaluate the quality of information provided about innovations.
- They investigate the modifications made to different versions of hardware and software.

Technological Capability

- Students investigate, and discuss with users, some applications of computer technology in their school which need improvement, such as the school bell system, attendance checks, career information retrieval, Maori language software, design of the school newspaper, a team logo.
- They explore ideas to meet these requirements and decide on viable options for development.
- Groups write, test, refine, and debug a program, or adapt an existing program, to meet their selected need.
- The class shares progress and outcomes, and selects certain programs to work on to complete projects that meet specifications.
- They publish manuals for new users of the programs.

Technology and Society

- Students use the information systems available to them in libraries to obtain information about technological innovations in personal computing.
- They discuss these innovations with specific groups to assess their usefulness in their own environment, and note attitudes and preferences that are expressed.
- Students debate how computers might be best employed in the school of the future.

Assessment

The teacher could focus on knowledge and capability in selecting objectives for assessment, evaluating how well the students used or adapted specific programs for their needs. For example:

- the students could record their own development in gaining understanding of new computer applications.

Example 3: Ergonomic Furniture and Fittings

Contexts: Home; School; Business
Main Areas: Materials; Structures and Mechanisms

Technological Knowledge and Understanding

- The teacher introduces the concept of ergonomics in terms of workplace safety, personal comfort, productivity, and meeting individual requirements.
- Students analyse the objects in the classroom—chairs, desks, writing instruments, scissors, door and window handles—and undertake a similar exercise at home.
- The teacher arranges a visit to a workplace—office, factory, retailer—and the students observe and depict the flow of work in terms of the interaction of people with furniture, fittings, and equipment.
- The teacher arranges a visit from an occupational safety officer or a physiotherapist to discuss ergonomics.
- Students collect and analyse promotional material about office furniture and other products described as ergonomic or similarly beneficial to workers.

Technological Capability

- Students collect, collate, and analyse data from a range of people to identify advantages and disadvantages of different designs in furniture or objects and establish opportunities for improvement, for example, for people with specific disabilities.
- Groups debate possible solutions and select one for development.
- They design and make a prototype, drawing, or model, possibly using computer-aided design (CAD) and computer-aided modelling (CAM).
- They evaluate their proposed solution with the identified user-group and modify it in the light of responses.
- They complete their projects, and present their solution with appropriate instructions for use.

Technology and Society

- Students collect photographs of homes and workplaces in other times or places, or visit an archive or museum.
- They identify changes in the design of appliances, domestic furniture, and factory layout over time, and consider reasons for these changes.
- They evaluate the different objects and compare lifestyles in terms of personal health and well-being with and without their use.

Assessment

Teachers could focus on objectives of understanding and identifying needs, or place emphasis on evaluation of the solutions in relation to user response. For example:

- students could record what they have learned about different individual preferences and needs that should be met in the design of everyday objects;
- they demonstrate their understanding of ergonomics by showing how it has been incorporated in their design.

Example 4: Harvesting and Storing Food

Contexts: Home; Industrial
Main Areas: Food; Production and Process; Mechanisms

Technological Knowledge and Understanding

- Students identify the range of foods that they have eaten in the past twenty-four hours, and describe where the foods came from, whether home, local, or bulk supplies, fresh, processed, or preserved, and methods used in the preservation, including technologies such as freeze-drying, UHT. They present their observations graphically.
- The teacher arranges visits to two facilities, or visits by people working in facilities such as a food processing plant, a produce market, a market garden, a home garden, a food research institute.
- Students observe, depict and compare the systems that are used and the principles that apply in different cropping, harvesting, and storage settings.
- They record the work that different technologists do in the facilities they have observed or learned about.
- They compare promotional material for foods, noting the qualities that are emphasised in these promotions in relation to storage and preservation.

Technological Capability

- Some students survey a specific group, such as yachties or mountaineers, to determine needs and preferences in relation to the storage of food.
- Other students discuss the systems used in a food processing or research facility.
- They explore ways of modifying existing processes or developing a new piece of technology, or modifying a system, to meet a particular need, and select projects to work on.
- All students take part in a class activity related to food storage or preservation, to establish common understandings of safety, hygiene, nutrition, and production processes.
- Groups work on their own projects, planning, resourcing, and producing a model, design, system, or object to meet the identified needs of a specific group.

Technology and Society

- Students refer to household guides or cookery books from previous generations to collect and evaluate methods of food storage and preservation in other times.
- They research, with the help of iwi, traditional methods of food-gathering, preservation, and storage in Maori society.
- They research the relationship between the systems for gathering and storing food, and the customs, beliefs, and values of different societies and cultures.

Assessment

Teachers could focus on students' knowledge and understanding of the principles of food storage and preservation techniques in developing their own solutions. For example:

- students could assess how well their food storage and preservation solutions meet the identified needs in the light of feedback from users.

Example 5: Hydroponics

Contexts: Business; Environmental; Home
Main Areas: Biotechnology; Control

Technological Knowledge and Understanding

- Students identify the nutrients that are used in hydroponics, and the components and relationships within a hydroponics system.
- They discuss the work of establishing and maintaining a system with a nursery gardener, user, or technician.
- They examine the information materials that are supplied for the systems they have observed, and advertisements from gardening magazines and suppliers of hydroponics equipment.

Technological Capability

- Students identify and compare situations where hydroponics are used, communicating with people through electronic networks, and collate information about the patterns of use and opportunities for product development.
- The class shares data, considering the diversity of applications, and each group selects one opportunity to follow up.
- The group identifies the growth conditions and rates of a variety of plants and designs a compact hydroponics system; or a control mechanism to suit specific plants and conditions.
- The groups explain their progress and findings to each other, test their solution with a possible customer, and evaluate the costs and acceptability of their solution.

Technology and Society

- Students gather information and assess trends about social changes affecting the role of home gardening in people's lives.
- They observe a commercial facility where vegetables are grown under premium conditions, and identify the economic and environmental implications of these developments.

Assessment

Asessment could focus on the Knowledge and Capability strands, in relation to meeting agreed criteria in designing and producing a system, or on the impact on society of producing and marketing new products for specialised markets. For example:

- students assess their work by testing their solution over time, assessing its efficiency, and illustrating their understanding of the control features they have incorporated.

Example 6: Plant Propagation

Contexts: Home; Business
Main Areas: Biotechnology; Production and Process

Technological Knowledge and Understanding

- The teacher arranges for students to visit a nursery, garden centre, local authority botanical garden, or to have a demonstration from a skilled gardener.
- Students observe, investigate, and depict the various methods for producing large numbers of rooted plants for home gardeners or street planting, such as grafting, media aeration, cold frames, hydroponics.
- They record the work that technologists do to produce plants in quantity, including propagation to produce and stabilise hybrids.

Technological Capability

- Students conduct a survey about changing plant preferences in the local community, interviewing nursery workers and other suppliers as well as consumers.
- They collate and analyse data to predict market trends, and develop options for particular plants to market.
- Groups plan a system to produce large numbers of their selected plant, and set out a critical path. If time permits, they could set the propagation in train as a continuing project.
- Groups produce a marketing plan, identifying their market niche and outlets by consulting people in the community, if possible.
- They design suitable packaging to present their plants to the consumer or retailer.
- They produce information materials about their plants for point-of-sale promotion to their selected market.

(Note: this project can be carried through in full if students have the opportunity to begin it in one year, continue maintenance of the stock, and follow up the activities through subsequent school years. As a partial project, it offers worthwhile technological experiences.)

Technology and Society

- Students use archived resources, such as gardening magazines, and draw on recollections of parents or older people, to research and compare current preferences in selection of plants for home gardens with, say, practices fifty years ago.
- They identify differences in choice of vegetable crops, trees, shrubs, flowers, and garden colours, and consider reasons for the variations.

Assessment

The teacher should focus on all three strands, especially if the project is a continuing one, and relate capability to knowledge and understanding and society. For example:

- students keep a record of their marketing plans and evaluate them over the duration of the project;
- they demonstrate their understanding of the principles involved in the production of modified plants.

Example 7: Game for a Specific Group of Children

Contexts: Community; Home; School
Main Areas: Materials; Information and Communication; Process; Structures and Mechanisms

Technological Knowledge and Understanding

- Students visit an early childhood centre, long-stay ward in a children's hospital, or facility for special needs children.
- They observe and record the behaviour of a small number of children using different games, developmental equipment, or play materials.
- The teacher arranges a discussion with an early childhood health and education specialist (possibly an experienced parent or caregiver) to explore aspects of play in terms of children's development of mobility, skills, and responses.
- Students describe a range of games and equipment that are designed for children.
- They investigate and depict how these products are designed, produced, and marketed, and clarify the principles that underlie some of the products.

Technological Capability

- From their observations and investigations, students identify needs and opportunities in relation to specific aspects of child development that they have noted.
- They brainstorm ideas for modification, adaptation, or innovation that could be developed using, for example, recycled materials, and select viable options.
- In groups, they plan, produce, test, and modify a prototype solution.
- They prepare a plan for a production run, considering economic use of resources and costing the final product, and specifying quality standards.
- They prepare a marketing plan, investigating methods of promotion and distribution.
- They evaluate their plans and proceed to a completed project (a small production run, if time is limited).

Technology and Society

- Students research ideas about child development in terms of the developmental and supporting games, equipment, and materials that have been used in different periods for children with special needs.
- They investigate the factors that influenced technological changes in this context and examine reasons for different views.
- They explore the possibilities for future innovation inherent in one or more of the new technologies.

Assessment

One focus of this topic could be on assessing how well the product meets the criteria identified in the needs, and how well those needs reflect the knowledge gained in investigations. For example:

- students could keep a journal recording the development of their ideas and the production of the prototype;
- they could identify the factors that ensure consistent quality in a production run, and assess how well they achieved this with their own products;
- they could identify the ways in which toys have been modified and adapted for particular age-groups.

Example 8: Environments for People

Contexts: Business; School; Home; Community
Main Areas: Structures and Mechanisms; Electronics and Control; Materials; Information and Communication

Technological Knowledge and Understanding

- Students brainstorm and depict the technological features of their own environments—home, shopping mall, park, streetscape, school grounds, classroom—in terms of how they support or enhance the quality of life. Features that could be noted include exterior and interior design, layout, choices and effects of colours, textiles, surface finishes, access, security, seating, and so on.
- Small groups each observe and analyse a range of clearly defined environments, such as a doctor's waiting-room; a public office (perhaps a bank's customer area); a visitors' centre; a housing development; a kitchen; a motorway junction.
- They collate information on the factors that need to be taken into account in planning an environment and consider their importance in relation to the environments they analysed.
- They analyse and evaluate promotional material about some of these environments.

Technological Capability

- From their knowledge and analysis, students identify environments which invite modification to meet user needs, test their ideas with other consumers, and select viable options.
- In groups, and possibly working with mentors or the appropriate authorities, they plan and produce designs and specifications, providing annotated drawings or computer models of proposed solutions.
- They test specific products, such as a paint finish, flooring and paving materials, a security system, to ensure that they meet the requirements.
- They finalise the plans, prepare costings and a critical path, and bring at least one component of the proposed new environment to completion, with an information item setting out the rationale and context for that component.

Technology and Society

- Students research the implications of introducing technological changes to environments, such as changing streetscapes, introduction of different colours and materials, open-plan designs, synthetic fabrics.
- They identify factors that lead to resistance or acceptance of change.
- They clarify issues in a current debate about, for instance, a mall development in a main street, a hypermarket absorbing individual shops, a street planting proposal, a traffic-calming system, and identify the perceptions and other factors that influence participants in the debate.

Assessment

One focus could be on the knowledge and understanding that students demonstrate in their needs analysis, and the extent to which this carries through into their designs and plans. For example:

- students could assess the design specifications in relation to identified needs;
- they could evaluate their ability to take an informed role in a debate on a change to their environment;
- they could illustrate principles, such as aesthetics, modification, and reliability.

Example 9: Group Special Purpose Clothing

Contexts: Home; School
Main Areas: Materials; Production and Process

Technological Knowledge and Understanding

- Students investigate the features that distinguish a variety of clothing used for special occasions, such as clothing for a cultural group, an orchestra, a dance group, a sports team, a workplace (supermarket; bank).
- They visit a clothing factory to investigate and depict a production line system.
- They investigate the principles of designing for a group.
- They test the performance properties of a range of fabrics, including locally produced textiles and recycled materials.
- They examine and evaluate standard patterns for clarity of instructions, explanation of sizing adjustments, and fabric recommendations.

Technological Capability

- Students interview members of groups to identify the factors that are important to them in their choice of clothing for a group occasion.
- They consider options and develop outline proposals for their potential consumers to evaluate, providing design sketches, fabric swatches, and key information on care, durability, and other features identified in the needs analysis.
- They modify ideas in the light of consumer responses and develop the designs and specifications for a production run.
- They cost their solution and establish a critical path.
- They use CAD to develop patterns and cutting plans.
- Students undertake several roles in the production run, gaining experience in more than one part of the operation.
- They package and deliver the group clothing on time, within budget, and to agreed quality standards.

(Note: this topic could lead to the production of a complete outfit, or for one distinguishing component such as a waistcoat, or cover-all.)

Technology and Society

- Students investigate and compile a report about the factors that influence reactions to a group appearance and the concept of corporate identity.
- They compile an illustrated scrapbook or display, showing the ways in which fibre or fabric choice, garment style, and quality of finish can create visual impressions, and identify the messages that are conveyed.

Assessment

The completed clothing could be modelled to an invited audience, who assess its effectiveness, suitability for purpose, and quality. For example:

- the teacher assesses the level of skills and quality control demonstrated by each student in their contributions to the task;
- students evaluate, through group discussion, what they have learned both about production line processes and the impact of group clothing;
- they could report on the ways in which they have accounted for different influences on their designs.

Example 10: Building Design and Modification

Contexts: Home; School; Industrial; Community

Main Areas: Structures and Mechanisms; Electronics and Control; Materials

Technological Knowledge and Understanding

- Students visit a construction site to identify and depict the components and principles of a construction system and observe the work of different users of technology on site.
- They identify, and learn correct terms for, core features of any construction such as loadings, foundation, bracing, scaffolding.
- The teacher arranges for a visit from a builder, architect, or engineer to help students read examples of plans, if possible comparing a routine house plan on a flat site with a structure for a special purpose or on a difficult site.
- Students investigate and describe the special features of a construction in their local area, such as the installation of base isolators, replication of stonework in a restoration project, or incorporation of "smart" technology in a new office building.

Technological Capability

- The teacher arranges with appropriate authorities for students to work through a needs analysis related to a specific proposal, such as the construction of a music room, an addition to the library.
- Students analyse the range of tasks related to the needs, and are allocated responsibilities.
- Students work on their tasks, such as producing the set of working drawings, calculating and specifying load-bearing requirements, preparing a prototype section of bracing, designing entry and security controls (swipe-cards, video surveillance).
- Students could integrate the tasks and produce a scale model of the completed project, incorporating their different elements.
- They evaluate their plans and progress and support each other in modifying and integrating plans and ideas.
- They present plans and models to the authorities or at a public meeting and explain reasons for their decisions.

Technology and Society

- Students research building and construction methods used in New Zealand, relating the choice of materials, techniques, and features of design to the technologies available at different times, local environmental conditions, and changes to building styles.
- They prepare annotated sketches of the building they might expect to construct in fifty years' time.

Assessment

One focus could be on assessing how well students handle materials and equipment, how well their designs meet identified needs, and the quality of their outcomes. For example:

- students could prepare a portfolio, recording their understandings and the processes they used in their tasks, and accounting for how they incorporated specific features in response to particular requirements;
- expert assessors could assist in adjudicating at the public presentation of models and solutions.

Example 11: Renewable and Non-renewable Energy

Contexts: Home; Environmental; Recreational
Main Areas: Structures and Mechanisms; Biotechnology; Information and Communication

Technological Knowledge and Understanding

- Students gather, collate, and analyse information about energy sources that contribute to the power for their homes, school, and to local business or industry.
- They visit the power company to observe and record:
  - the real-time generation and usage information system;
  - issues for the company about sources of supply and forecast needs;
  - the work undertaken by different technologists within the company.
- They analyse the strategic planning documents and annual plans from this and other organisations, in terms of energy resources and conservation measures, including promotional campaigns.

Technological Capability

- Students survey, in groups, a range of power users in different settings to gauge their concerns about stability of supply, costs and benefits of different energy sources, and preferences for future power generation.
- They collate and analyse the information, using computer data management software to present trends graphically.
- They develop ideas for feasibility studies about energy sources, generation technologies, and conservation strategies.
- Each group selects one aspect and produces a feasibility plan for their option—wind farms, wave generation, individual methane generators, solid-fuel energy, decentralised transmission, incentives for economy of use.
- They present their studies in the form of seminars, supported by visual and written material, and evaluate each other's proposals.

Technology and Society

- Students research a specific issue relating to energy, such as nuclear power, the impact of wind farms, sustainable energy houses, household heating systems.
- They prepare a report on the values, beliefs, ethics, and knowledge that influence people's decisions and choices in energy use.
- They draw some inferences about factors that may affect technological innovations in the energy sector in the near future.

Assessment

A focus for this topic could be on the knowledge and understanding that students demonstrate in their feasibility studies and in their seminar presentations. For example:

- students could describe the features of an energy system in terms of its components, process, function, and use;
- they could report on the ways values and beliefs influence decisions about energy systems.

SUGGESTED LEARNING EXAMPLES FOR LEVELS 7 AND 8

These learning and assessment examples are suggestions which teachers could develop further into units of work.

Organising for Technological Experiences at Levels 7 and 8

Students at the upper secondary school levels are likely to have had a wide, and quite varied, range of technological experiences. Individual achievement levels may be diverse, both in general competence and within the objectives of the curriculum. Students may have developed strong interests in some areas or contexts of technology. Schools may have access to particular resources, in terms of people from tertiary institutions, business, agriculture and industry, who could assist in programmes at these levels.

Two organisational patterns are suggested to address these opportunities.

Teachers could establish individual / group technological projects, negotiating agreements with individuals or teams of students to pursue a specific set of tasks related to their interests and the resources available. This structure works especially well if there is an opportunity to arrange authentic technological work placements.

Alternatively, or in addition, teachers could establish some whole-class or year-group studies which explore a context or major area, with a number of projects for individuals or groups contributing to a major, integrated experience.

In planning and negotiating projects, teachers should ensure that they address objectives from all three strands. Teachers should consider the following factors.

- Will workplace experience be part of this project?
- If so, what roles and responsibilities will employers and mentors take in setting up the project?
- What protocols are needed to provide feedback and support among all parties—workplace, student, and school?
- Could the activities involve a number of areas?
- Can experience in drawing, design, and information technology be developed in the project?
- What documentation is necessary to establish the project, without constraining it?
- How will assessment be best undertaken, and by whom?
- Are there suitable Unit Standards available for assessment in relation to the achievement objectives?

Individual Projects

The following are some sample suggestions for individual project topics.

Example 1: Sensor Instrumentation

Students could be:

- investigating and reporting on the range and sensitivity of proximity and remote sensors;
- researching, planning, and developing new uses for them, such as warning devices for children around swimming pools, or a remote-control gate;
- testing reactions to them among different groups;
- investigating ways of recording temperature and light levels in controlled environments, and using virtual-instrumentation software to design a twenty-four hour monitoring system;
- presenting and marketing this innovation.

Example 2: Quality Control Systems in Food Products

Students could be:

- investigating regulatory controls for food manufacturing and the principles behind them;
- analysing quality control mechanisms and systems in a food processing plant;
- planning and documenting management systems to meet required quality standards;
- producing information for staff;
- monitoring efficiency of the system;
- researching understanding of, and attitudes to, regulation of food production and service.

Example 3: Home Security Systems

Students could be:

- investigating different types of security devices and systems, and the reasons for their use;
- planning, specifying, and producing a home security system;
- evaluating the market opportunities;
- preparing an installation and maintenance guide for consumers;
- developing a patent application for their innovation.

Example 4: Protective Coverings and Coatings

Students could be:

- investigating the range, properties, and promotion of protective coverings and finishes currently available—polymers, thermal coatings, silicones;
- identifying unmet needs, for example, in specific climatic conditions;
- designing, developing, testing, producing, and promoting a new product;
- exploring materials used in other times and situations, such as flax for insulation.

Example 5: Biosensors

Students could be:

- investigating uses of biosensors to identify their reliability and versatility;
- researching, planning, and developing a biosensor which uses enzyme action to bioassay its source and concentration or as a monitoring system;
- presenting a seminar on future possibilities for the use of biosensors.

Example 6: Developments in Information and Communications Technology

Students could be:

- preparing a presentation, looking at current developments in information and communications technology, including the development and demonstration of a specific application, such as investigating the possible applications of artificial intelligence and virtual reality;
- analysing the impact of fibre optics on information, transmission, and acquisition systems;
- debating the advantages and disadvantages of voice recognition technology;
- producing a sound poem, incorporating synthetic and processed sound;
- reporting on the impact of information technology and telecommunications on the siting of businesses;
- surveying attitudes to the use of multimedia in education.

Group Projects

The following are some sample suggestions for group projects.

Example 1: Horticultural Exporting

Groups could be:

- surveying the factors influencing suitability of a crop species for development as a product for export to a discriminating market;
- investigating consumer needs and preferences for taste, aesthetics, presentation, organic production, cost-barriers;
- identifying the packaging and micro-environmental requirements for optimal export quality;
- planning and carrying through a production and marketing system for a horticultural export product;
- providing consumer information and point-of-sale information;
- researching changes in tastes for, and attitudes to, products and responding to them.

Example 2: Technology and Health

Groups could be:

- surveying the use of technologies in a range of health delivery systems;
- identifying Maori and other attitudes to these uses;
- analysing a continuum of attitudes to technology in health care, ranging from "low-" to "high-" tech;
- investigating the principles which underlie various approaches to health care, such as holistic healing, natural therapies, microsurgery;
- developing a product based on natural materials, such as seaweeds, to meet a health need;
- planning an information system to monitor health service delivery;
- producing informational material for a specific audience about an important development in health technology.

Example 3: Robotics

Groups could be:

- investigating successful applications of a robotic arm interfaced with a control system;
- analysing new applications for specific users, such as people with disabilities;
- discussing with local kaumatua the concept of using robotics to produce carving patterns or assist in food preparation;
- planning, producing, and testing prototypes for different purposes to investigate the sequencing and ease of control;
- producing an illustrated report to show the articulation and performance of the prototype;
- planning final production;
- analysing the impact on an individual or workplace of introducing a robot to undertake certain tasks.

Example 4: Reproductive Technology

Groups could be:

- investigating, questioning, and describing the uses of technology for fertility, ante-natal monitoring, survival of premature babies, genetic selection of animals, genetic disease diagnosis;
- investigating and developing reports on community views on reproductive technologies;
- planning and producing diagrammatic explanations of these technologies;
- producing information on options for birth control, designed for different cultural groups;
- debating the issues of embryonic technology and the impacts of these on people's life decisions;
- establishing ethical guidelines for recording genetic information.

Example 5: Waste Disposal Systems

Groups could be:

- presenting an analysis of current waste disposal systems in the local authority area, including industrial and integrated home-based systems;
- identifying options for large-scale application of household systems;
- investigating priorities for action;
- preparing feasibility studies for presentation to groups as part of consultation;
- evaluating environmental, health, social, and economic impacts of proposed options;
- producing a report on methods and recommendations for individual and enterprise action;
- promoting information relevant to specific communities and groups.

Example 6: An Information System for an Historical Site

Groups could be:

- designing and developing a progressive information system providing interpretation of an historical site by:
- identifying the areas on the site to be interpreted, in consultation with experts—if the site is of special significance to Maori, then a whare wananga or kaumatua or the rununga of the appropriate iwi should be consulted, taking into consideration the appropriate protocols;
- researching suitable information systems for the site, taking into account local environmental conditions and other constraints;
- determining, in consultation, the appropriate levels of restoration needed or desired on the site;
- developing a suitable system for presenting information about the site that does not require full-time operating or interpreting staff in attendance.

GLOSSARY

adaptation: the process of adjusting or altering to fit new conditions or purposes

aesthetics: concerned with the qualities of appearance; visual appeal; good taste; beauty

biotechnology: the technique of using living materials or systems, including micro-organisms, to perform chemical processing, such as waste recycling, or to produce other materials, such as cheese or antibiotics; *also* the process of using genetic techniques to modify organisms

circuit: a complete route or path through which a current or communication channel can flow; the apparatus through which current passes

context: conditions or situations which precede or follow an event and help fix its meaning and give it coherence

cost-effectiveness: the provision of effective benefit in relation to the cost involved

critical path: sequence of stages, marking transition points, and determining the time needed for a project

design: preliminary conception or plan; development of specifications necessary to execute plans

electronics: the branch of technology concerned with the development and application of circuits or systems using electron devices, including magnetic amplifiers, transistors

efficiency: the ratio of useful work achieved to the amount of effort and resources used

environment: all external conditions and influences affecting the life or development of a person or organism

ergonomics: the study of the relationship between people and their environment, especially the equipment they use

feedback: information gained as a result of tests

graphics: the process or art of drawing in accordance with mathematical rules; design and decoration involving typography

interconnectivity: capacity to connect components or systems; having reciprocal links

model: a representation, often on a small scale, of a proposed structure; simplified description or plan of a system or design to assist calculations and predictions

modification: a partial alteration to a structure or system, usually to make it more efficient, without changing its essential character

modularisation: the development of standardised parts or independent units for assembly especially within construction, manufacturing, or electronic systems

needs: requirements; conditions or circumstances motivating some course of action

opportunities: favourable circumstances for action; good chances for achieving an end or purpose

optimisation: gaining the best or most favourable outcome

process: a series of actions, taking place in a planned manner, that produce a change or development, especially a series of regular operations in manufacture

process industry: an industry based on the processing of fluid or bulk resources into other products. Examples are the chemical and petrochemical industries.

product: an object, plan, or service produced by effort, natural process, manufacture, or operation; a result or consequence

production: a term generally associated with manufacturing, where materials are shaped and assembled according to a systematic plan

promotion: the action taken to communicate with, inform, and gain support from a client or consumer

reflection: reconsideration; the action of turning or fixing thoughts on some subject; an act of concentrated thinking

reliability: probability that a system will not fail

resources: a supply or source of support; stock that can be drawn on; inventiveness; ingenuity

robot: an automated machine that can be programmed to perform a variety of specific mechanical functions

robotics: the technology of designing, building, controlling, and using robots (q.v.)

robust: the ability of a system to work under changing conditions

specification: an organised, detailed description of the criteria for construction, appearance, performance and so on, in relation to some projected work or construction

system: a set of things or parts connected, associated, or interdependent so as to form a complete unity; a whole composed of parts in an orderly arrangement according to some plan

FOOTNOTES

1 *The New Zealand Curriculum Framework*, page 7.

2 *The New Zealand Curriculum Framework*, page 17.

3 *The New Zealand Curriculum Framework*, page 24.