Information for parents about Technology Education

Almost every aspect of our daily life – food, health care, transport, communications, entertainment, our environment – uses technology. This technology is constantly evolving and is changing the way we look at things and how we do things.

New Zealanders have an impressive history for being innovative and creative in technology areas. From Burt Munro (real-life protagonist of *The World's Fastest Indian*), John Britten (a motorcycle designer), Peter Witehira (an award winning technologist, battery creator) to more recent examples, such as *Orca*, *Canterbury*, and *Icebreaker* (performance sports wear), Alan Gibbs (of the Aquada aqua car), and *Weta Workshop* and *Weta Digital* (creating film and television effects, sets and props), New Zealanders can be proud of our country's contribution to technological advancements.

Technological literacy is becoming increasingly important to our everyday lives. Specialised technological knowledge and skills are vital to the current and future well-being of New Zealand – we need an increasingly wide range of technology professionals in many different fields to remain competitive and to contribute globally.

These pages explain what the subject Technology is and how it is being taught in New Zealand schools, and the new and exciting possibilities this presents for your child.

"Globalisation and technological change are the two key features that are changing and shaping our lives. The technology curriculum has now developed to a level that I strongly recommend it as a subject, both to students who have an interest in making a career in engineering, technology or science, and generally as a means of better understanding the modern world."

Professor Bob Hodgson, Former Director, School of Engineering, Massey University

Technology in schools

The importance of technology to all New Zealanders was acknowledged with the introduction of a Years 1-13 curriculum in Technology in 1995. In June 2006, Technology was added to the 'approved subjects' list for university entrance, in recognition of the academic strength of the new subject at senior levels in schools, and the fact that technology is a growing focus of university study.

Study in Technology at school develops a broad technological literacy through the experience and exploration of a wide range of technologies in a variety of contexts.

Technology challenges students in a way unlike any other subject. Within areas such as control, food, communications, structural, dynamic, and bio-related technologies, creative design processes and materials, students work creatively and analytically to identify, trial and evaluate potential solutions, and eventually put their ideas into practice.

Technology has natural inter-relationships with other subjects such as the sciences, social sciences, languages, the arts and health and physical well-being.

Why is it important for students to take Technology Education?

As the world develops it is increasingly important for students to understand how technological developments impact on society, the economy, and the environment. Whether or not they plan to engage in a career in technology, all students can benefit from knowledge gained in Technology Education.

Technology education presents students with rich and varied experiences. It teaches a broad technological literacy through interactions with hard, soft, food and bio-related materials, electronics, and information and communication technology. It provides an opportunity to develop a level of technological understanding that will enable them to participate as an informed participant in an ever-changing society.

Students learn skills that can effect changes in their own lives and community, and perhaps even nationally or globally. Through Technology Education, they are helped to develop a critical eye with which to assess the implications of new technologies – issues such as the dwindling supplies of fossil fuels, alternative fuels, and the impacts of both on the environment, or the health impacts of our increasing production and consumption of processed foods, their production. Technology allows for students to look at the world differently.

A growing number of classroom projects work with real-life 'clients' within and outside the school. These provide genuine experiences and opportunities for students and teachers to interact in a mutually beneficial way with the wider community. These interactions enhance and focus learning and give students experience of and confidence in situations outside the classroom, and an invaluable appreciation of working environments and opportunities and the broader impact of technology on society. Many technology teachers also take advantage of the extensive support network that is in place in which volunteer industry professionals work with classes on projects and mentor individuals.

In Technology classes students most importantly gain knowledge and skills essential to all kinds of work, university study and a successful life. They are encouraged to show initiative, be innovative and creative, learn independently, and to take responsibility. They learn teamwork and communication skills and the importance of contributing to the community both socially and economically.

Three learning strands

Students develop technological literacy by learning in three interrelated strands: Technological Practice, technological knowledge, and the Nature of Technology.

Technological Practice provides opportunity for students to undertake Technological Practice and examine the practice of others. Technological practice includes identifying and investigating issues and existing outcomes. This requires consideration of such things as: ethics; legal requirements; protocols; codes of practice; and the needs of, and potential impacts on, stakeholders. Through Technological Practice students may develop and communicate concepts, plans, briefs, technological models and Technological Outcomes. Some projects may be done with other stakeholders, even working with real-life clients outside of school.

Technological Knowledge provides opportunity for students to develop technological knowledge generic to all technological endeavours. Key ideas include: functional modelling and prototyping; material use and development; and components of technological systems and how they interact.

Nature of Technology provides opportunity for students to develop a philosophical understanding of technology, including how it is differentiated from other domains of human activity. This strand supports the development of a critical understanding of technology and allows for informed debate of historical and contemporary issues and future scenarios.

Technology: Levels 3-8

Intermediate School

At this age, most children are working at **level 2 or 3** of the curriculum.

Level 3

Students describe an intended outcome, explaining how it addresses a need or opportunity they recognise. They describe the key attributes that will be important in the development and evaluation of their project. They develop a plan identifying the key stages and resources required by the project and use this plan to assess its progress. The outcome is assessed as to how well it addresses the problem.

Example: Bush Primary School Technology Centre Year 7, Value Added Noodles

Students in this class replaced the instant noodle flavouring pack with one of their own creation. They studied a deconstruction of a packet of noodles, discussed how several ingredients can combine to make different flavours, and the use of additives. The class then did the same to a packet of dehydrated instant soup.

With a greater understanding of alternatives, students then looked at different forms of flavouring, using foods that could be dehydrated and freeze-dried. This was an essential consideration for packaging. The effect of dehydration on the flavour of food was tested by rehydrating with both hot and cold water and then taste tested.

Finally the class evaluated their completed noodle project against the brief specifications and their personal goals.

Junior Secondary School

At this age, most children are working at **level 3 or 4** of the curriculum.

Level 4

Students must justify their decisions. They have to identify and describe the key attributes required by their project's stakeholder. They have to learn the social skills of working with people outside of the classroom. Students create models based on feedback from their stakeholders, and use these models to create a solution. Students are then asked to consider how well their product fulfils the needs of the project and what could they do better.

Example: Havelock North High School Year 10, Remote-controlled Electronic Robot

In this unit students were introduced to electronics through the construction and programming of a remote-controlled robot. Students started the unit by learning the knowledge and skills that would need for the project, including use of demonstration kits, process and output boards, electronic circuits, and PICAXE microcontrollers.

The class was then presented with their project– develop an electronic moving toy that will entertain young children, suitable for use with the supervision of a babysitter. Students wrote their initial brief and investigated and developed a range of concepts. On-going stakeholder evaluation led into the final development phase with the production of a working drawing and flowchart showing the sequence for

manufacture, with quality control checks structured into the process. Students then completed their project with a final evaluation of both their solution and the practice they followed.

Senior Secondary School

At this age, many students' work is based on **levels 5 to 8** of the curriculum. In years 11–13, students work with fewer contexts in greater depth.

Level 5

Students must justify an intended outcome in relation to the need or opportunity. They research ideas for feasible outcomes and use the information gained to develop the outcome that best addresses the specifications. Finally, they evaluate the final outcome's fitness for purpose.

Level 6

Students must justify an intended outcome in relation to the need or opportunity in relation to key stakeholder feedback and wider community considerations. They must undertake critical analysis, ongoing experimentation and functional modelling, and trialling to develop feasible outcomes.

Finally, they will evaluate this outcome's fitness for purpose using feedback from stakeholders.

Level 7

Students must justify an intended outcome in relation to the issue to be resolved and justify specifications in terms of key stakeholder feedback and wider community considerations.

They must critically analyse their own and others' outcomes to develop ideas for feasible outcomes. They will undertake critical evaluation of on-going experimentation and functional modelling, stakeholder feedback, and trialling. They will use the information gained to select, justify, and develop an outcome.

Finally, they will evaluate this outcome's fitness for purpose using feedback from stakeholders and demonstrating a critical understanding of the issue.

Level 8

Students must justify the nature of an intended outcome and the issue to be resolved. They will outline specifications in terms of key stakeholder feedback and wider community considerations.

They must critically analyse their own and others' outcomes to develop ideas for feasible outcomes. They will undertake critical evaluation of on-going experimentation and functional modelling, stakeholder feedback, and trialling. They will use the information gained to select, justify, and develop an outcome.

Finally, they will evaluate this outcome's fitness for purpose and justify the evaluation using feedback from stakeholders and demonstrating a critical understanding of the issue.

Choosing Technology

The Technology curriculum provides students with the opportunity to develop a broad technological literacy within local and global cultural, ethical, environmental, political, and economic contexts. This learning is important to all students and equips them to participate in society as informed citizens.

Technology is one of the eight essential learning areas that are compulsory for all students to study in Years 1-10.

In Years 11-13 most schools offer Technology as an option. This may be in the context of areas such as materials, information and communication technologies (ICT) and/or food technologies, but increasingly these boundaries are dissolving due to the multidisciplinary nature of technology – for example, an important aspect of Food Technology is its packaging (materials) and marketing (ICT).

Senior technology classes provide a unique learning experience that is challenging and rewarding for every student.

For those going on to tertiary study, Technology is an ideal foundation subject, particularly for further study in science, engineering, medicine, agriculture, architecture, design and the creative arts.

For those considering a career in Technology, Fashion, Biotechnology, Information Technology or Food Technology, studying Technology at senior school level is strongly recommended.

Skills employers look for in employees

Many students, particularly those in senior secondary school, are thinking about their professional future. Whether or not they have a career in mind, most are curious to know what qualities employers are looking for.

Apart from relevant tertiary qualifications, employers in any field look for certain generic skills in their prospective employees.

The New Zealand Curriculum (2007) identifies five key competencies, describing them as 'the capabilities people need in order to live, learn, work and contribute as active members of their communities'. These are:

- thinking
- using language, symbols, and texts
- managing self
- relating to others
- participating and contributing

These competencies form the basis of the learning of Technology in schools, and translate into the essential skills identified by employers, as exemplified in quotes from a variety of industries. The text in italics explains with the way in which these qualities are developed and fostered in Technology Education.

Excellent written and verbal communication skills

Possibly the most requested skill employers look for is the ability to communicate articulately in both written and verbal forms, and whether you have the ability to organise thoughts and ideas effectively. Craig Price, Regional Manager for Beca Carter Hollings & Ferner Ltd says: "The ability to communicate ideas and concepts effectively in conversation, presentations, correspondence or reports is fundamental to growing a career in an organisation."

Good communication skills are essential to good Technological Practice. Students are required to keep comprehensive workbooks throughout each project, and these account for a substantial portion of their final marks. Students are also required to set up and maintain a relationship with their clients throughout their projects, and to consult stakeholders, peers and, of course, the teacher in a continual process of

research, consultation and evaluation. The specialised language of technology provides significant opportunities for enhancing students' competency in using language, symbols and text.

Self-motivation and a keenness to learn

Most employers look for employees who are self-motivated and able to work independently, with as little supervision as possible. Coupled with self-motivation is a keenness to learn – the technology industry is constantly changing and more and more employers are looking for staff with aspirations to improve their skills on the job.

"Attitude is the main thing," says David McKay from Kitchen Contours. "If you've got the right sort of attitude you can pretty much do anything – just the ability to listen and take instructions without being a know-it-all. It's not so much coming in and being able to do a perfect dovetail joint, but more being willing and able to learn on the job. I don't know how many apprentices I have had over the years – 10 or 15 at least – and all now very good tradesmen. So if they want to learn on the job and they have good computer skills, that's a bonus."

Sound Technological Practice demands the learning of new skills both before and during a project, and relies of creating a culture of self-motivation in the learning process. Technology students have a personal stake in their project. Balancing creative freedom with responsibility to clients and/or stakeholders, students are strongly encouraged to take ownership of their projects, including identifying required skills and investigating ways to attain them.

Flexibility to manage multiple tasks

Employees may need to be able to manage several tasks at the same time. Multitasking skills are desirable as it can mean less micromanaging for an employer. A potential employee who can effectively juggle more than one task at a time is attractive to organisations.

"Our technologists are generally working on two or three different projects at any one time," says Sandra Chambers, Product Development Manager at Heinz Wattie's. "They are involved with all aspects of the development of new products. This means they need to be very good at multi-tasking." Ken Herd of Wanganui Incorporated agrees: "Specialised skills are important and in demand in modern business, however people with the abilities and aptitude to broaden their skill base into a multi-tasking role have strong credentials in the current competitive job market."

Scott Abernethy, Software Engineer at Harris Stratex, has this to say: "Engineers can be assigned new work on a daily basis and often have to manage their work across multiple tasks and multiple projects. To be efficient and successful in their job engineers need to be able to prioritize work, to focus on the task at hand, and to be flexible and adaptable to change."

Technology students are often multitasking as they cope with completing tasks in order to meet deadlines. They may be developing a prototype, collecting client feedback, and finishing sections of their workbooks – all in consideration to a projects deadline.

Computer literacy

In an ever-changing technological environment many employers require employees to have good computer literacy. "new employees are always surprised at how computerised things are and how quickly we can do things," says David Mackay, Managing Director of Kitchen Contours. "They still think of kitchen

manufacture as hammer and chisel stuff and the good old sandpaper block. They quickly realise that you need a sophisticated set up if you're going to compete."

Information Communication Technology (ICT) teaches students to use essential computers programmes useful in the modern age, including Microsoft Word, Excel, and PowerPoint. Other technology classes allow students to use modelling software such as Google Sketch Up and Pro Desktop.

Ability to work in a team

Most employees will need to work as part of a team and this ability could be crucial when applying for some positions. "Every project produced by engineers is a team effort," notes Craig Price, Regional Manager for Beca Carter Hollings & Ferner Ltd. "Working collaboratively towards a common goal is hugely satisfying and the ability to work in a team is an important personal characteristic to possess."

Students in Technology classes are often required to work in groups to complete a task, particularly in younger classes where they are more often working on collaborative projects and having to learn a range of new skills. Some classes may have a single client whose time may need to be shared and students required to work together efficiently. Technology programmes provide opportunities to develop ongoing and mutually beneficial community relationships critical for developing student competency in relating to others and participating and contributing to the benefit of others.

Analytical problem solving and the ability to plan, organise, and reflect

Technological industries are continually searching for innovative solutions. They place emphasis on employees being able to think analytically, organise and plan effectively, and reflect on outcomes. The ability to find solutions to problems using creativity, reasoning, and past experiences are often very valuable. "That's the key to any trade," says Rob O'Keeffe from Rob O'Keeffe Joinery. What you're really getting taught in your trade is how to organise a job."

"It's not an old fashioned workshop any more," says Peter Botting, Director of RML Automation, "there's much more depth to it and many more opportunities for bright students to get involved." Sandra Chambers, Product Development Manager at Heinz Wattie's concurs: "Good problem solving skills are vital to resolving product and process related issues. One aspect of a Food Technologist's role is troubleshooting in the manufacturing environment."

"Engineers need to know how to approach and solve complex problems," says Scott Abernethy of Software Engineer at Harris Stratex. "Complexity can easily overwhelm – but a skillful engineer is able to deal with complexity by breaking down the problem into manageable elements, which can be solved and then combined in a total solution."

Critical and creative thinking, planning, organisation, and reflection are key competencies in Technology Education Being able to step back from a situation and answer questions such as 'what is happening?', 'why is it happening?', 'should it be happening?' and 'how could it be done differently?' rely on sophisticated thinking skills. In the technology classroom, students are encouraged to be innovative in finding solutions for their projects. Technology is a unique subject that encourages students to use creativity to design innovative solutions to opportunities.When undertaking their own Technological Practice, whether individually or as part of a group, students are required to develop self management skills in order to effectively plan ahead and manage resources efficiently.

Honesty, integrity and reliability

Employers want trustworthy employees who will act responsibly and with integrity, both individually and as part of a team. "The old fashioned principles of honesty, integrity and reliability remain the

cornerstones of modern business," says Ken Herd of Wanganui Incorporated, "and the prime reasons behind a successful and trusting relationship between employers and employees".

Technology projects often involve stakeholders and clients, requiring students to take personal responsibility to provide a solution on time and that meets the requirements not only of the client, but demonstrates consideration of needs, welfare, health and safety of all stakeholders – the user, the community and society – and of environmental considerations.

Careers in technology

There's a huge range of careers in technology, at all levels of endeavour. The main areas in New Zealand include agricultural & horticulture, biotechnology, chemical products and processing, civil engineering, electrical & electronic engineering, environmental engineering, fashion, Food Technology, forensics, information & communication technology, mechanical engineering, medicine and product design.

A range of different technology courses are offered at tertiary level, ranging from two to four years for most qualifications.

New Zealand has a serious shortage of technology graduates, and the Government has acknowledged this by offering a large number of scholarships for school-leavers to do technology-related study at university. Some students are also offered scholarships and jobs before they've even graduated.

In employment, remuneration is good, and graduates often have a wide choice of work opportunities and locations. This shortage is worldwide, and is forecast to get worse, so the opportunities for technology graduates are excellent in the long-term.

To find out more, visit the Futureintech website.