

RATIONALE FOR DRAFT MATRIX

Overview

Technology is a learning area defined in the New Zealand Curriculum (Ministry of Education, 2007a). In senior secondary school, technology is taught as *subjects within the technology learning area*¹. These subjects are traditionally resourced with specialist classrooms in New Zealand secondary schools and presently focus on food, materials (hard and textiles), structures and mechanisms, and information and communications technology/digital technologies (ICT/DT), control technology and biotechnology. Graphics is also a subject within the learning area of technology, which places a focus on the development and communication of design ideas. The current suite of achievement and unit standards registered of the National Qualifications Framework (NQF) provide assessment tools that enable students to be credentialed with specific knowledge and skills in the *subjects of technology* taught at senior secondary school. The *subjects of technology* currently taught in senior secondary under the umbrella of the Learning Area of Technology are shown in Figure 1.



Figure 1.

The Ministry of Education is considering the development of teaching and learning guides for the subjects within the technology learning area.

The Learning Area of Technology is structured around three inter-related but distinct learning strands - understanding the *Nature of Technology*, developing *Technological Knowledge* and understanding and undertaking *Technological Practice* (Ministry of Education, 2007a). The intent of these strands is to allow students to develop a broad technological literacy that enables them to “participate in society as informed citizens and give them (better) access to technology-related careers” (Ministry of Education, 2007, p.32). The components of the strands are as follow:

- Technological Practice: *planning for practice, brief development and outcome development and evaluation.*
- Nature of Technology: *characteristics of technology and characteristics of technological outcomes*
- Technological Knowledge: *technological systems, technological modelling and technological products.*

The technology strands and their components are considered to be generic to all *subjects of technology*. The achievement objectives, that describe the nature of expected student learning within the component, provide a focus for progressing student competencies and understandings within a

¹ *subjects within the technology learning area* will from now on be referred to as ‘*subjects of technology*’

technology programme. As such they are also considered to be applicable across all *subjects of technology*. Within the **subjects of technology** it is essential that students also develop subject and context specific knowledge and skills if they are to develop technological outcomes that are fit for purpose (Ministry of Education, 2007b), in conjunction with **generic technological** understandings and practices. The relationship between the generic understandings and practices and subjects of technology is illustrated in Figure 2.

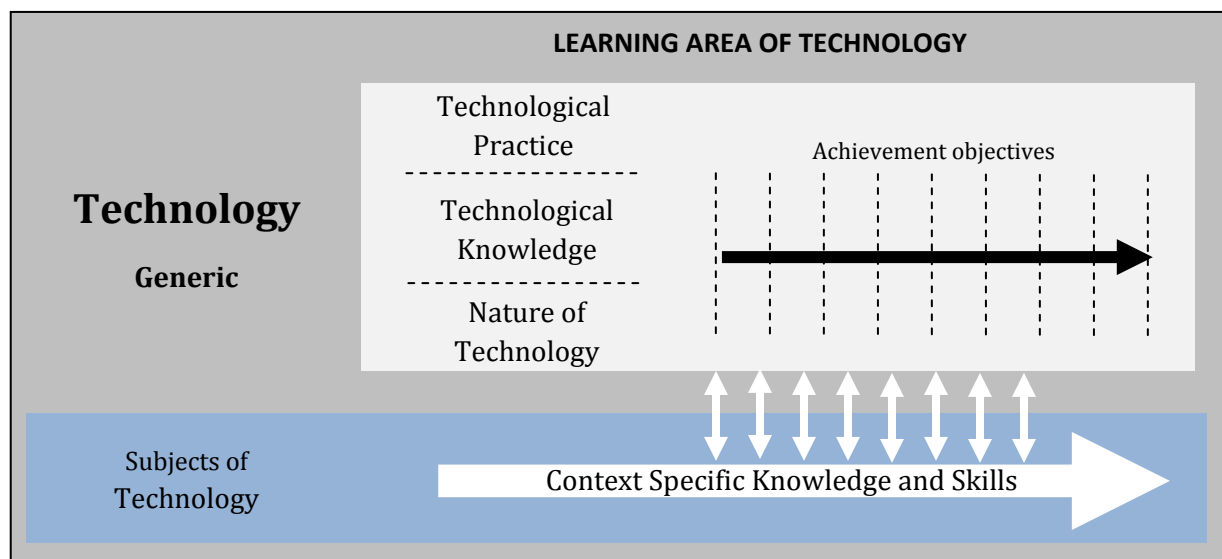


Figure 2.

In keeping with the overall aim of the Learning Area of Technology, learning programmes within subjects of technology should aim to develop students' technological literacy (Ministry of Education, 2007a; 2007). These programmes are traditionally made up of a series of interlinking units of work that provide students opportunity to progress their learning in all three strands. Student experiences gained within a technology programme should provide the competencies and understandings required to allow assessment for qualifications (i.e. NCEA). Whilst ideally, assessment for qualifications should be a collection of assessment standards that together provide opportunity for students to illustrate their overall technological literacy, this is not able to be mandated. Reasons for this include:

- assessment for qualifications credentials individual and specific student understandings
- the need for teachers to be able to select assessment tools to credential students which are appropriate to their particular learning pathway and contextual interests.

The assumption behind these reasons is that teachers are responsible for engaging students in a rich learning programme, and employing assessment tools that validly assess student achievement. The school assessment coordination plan will be a key element to managing the complexities of assessment (standards) selection for students undertaking two or more courses of technology.

Opportunity to incorporate *The New Zealand Curriculum* (Ministry of Education, 2007a) key competencies (and principles and values) should also be provided within a learning programme. The technology standards offered for assessment under the NCEA should therefore also have these additional aspects embedded in them, and teachers should ensure that they are inherent in teaching and learning programmes in senior secondary programmes.

Matrix design

1. In writing the draft matrix the writers were guided by the expectations prescribed in the *Principles for the Standards Review* section found in the document *Background Material Standards Review* (Ministry of Education, 2008). Consideration was also given to the following:
 - the current suite of the existing technology and unit standards developed for the 1995 technology curriculum (Ministry of Education, 1995) and the requirements of the revised technology learning area statement, its achievement objectives (Ministry of Education, 2007a) and supporting Ministry of Education materials (Ministry of Education, 2007b)
 - the opportunity for teachers to recognise similarities between the current registered achievement standards and the proposed technological practice achievement standards. It is anticipated that this will allow them to have confidence that the proposed standards are an evolution of the current standards
 - the need for the proposed achievement standards to provide a range of appropriate assessment tools for teachers to assess student competencies in technology, the evidence that is assessed comes from student work developed within a technology programme of learning
 - that the generic component standards cannot be subject endorsed as they assess the same competency (*i.e. the competencies required to develop a brief (brief development) in a food context is the same as that required in a materials context*)
 - that the matrix provides the opportunity for **all** of the generic strand components of the Learning Area of Technology as well as *subjects of technology* specific knowledge and skills
 - standards 1.1, 2.1 & 3.1 acknowledge the importance of design within technology and its importance in being able to develop a brief with specifications that address the issue. This has been acknowledged in the proposed achievement standard credit value.
 - standards 1.4, 2.4 & 3.4 use the term 'prototype'. This is used to replace the term 'one-off solution' used in the registered achievement standards written for the 1995 curriculum (Ministry of Education, 2007a)
 - the specific knowledge and skills standards across the subjects of technology are given equal credit value to maintain consistency between subjects
 - including achievement standards which focus on the generic learning area components as well as subject specific achievement standards, opportunity is provided to reinforce the status of *subjects of technology* under the Learning Area of Technology.
2. The draft matrix provides assessment opportunities (achievement standards) for the three strands of the Learning Area of Technology and provision for *subjects of technology* specific endorsed knowledge and skill standards (1.11, 1.12; 2.11, 2.12; 3.11, 3.12).

The Ministry of Education plans to develop teaching and learning guidelines for the subjects within technology (materials technology, information and communications technology, electronics and control technology, structures and mechanisms, biotechnology and food technology). These will help describe the specific knowledge and skill for these subjects. These standards can then be drafted in detail.

The intention of the proposed matrix levels 1-3 is to reflect the progression from curriculum levels 6-8 within the components of each of the three strands.

3. The names of the draft achievement standards for the *technological knowledge* and *nature of technology* strands will be further refined when the classroom based TKNoT: Imps research findings² are made available.
4. The credit values of the draft standards have been linked to the estimated time required in a programme of learning for the understandings and/or competencies to be demonstrated. One credit is considered equivalent to approximately 10 hours of learning.
5. The draft matrix at each level provides sufficient standards for a student undertaking two (or possibly more) technology related subjects to be assessed. An example of a potential assessment plan for one student using proposed generic standards and existing registered subject specific knowledge and skills standards is provided in Table 1 below.

Course A	1.1 Develop a brief to address a given issue. <i>(4 credits Internal)</i>	1.2 Select and use planning tools to enable the development of an outcome. <i>(4 credits Internal)</i>	1.4 Develop a prototype to address a given issue. <i>(6 credits Internal)</i>	1.10 Demonstrate understanding of technological endeavour. <i>(4 credits Internal)</i>	<i>Total</i> <i>18 credits</i>
Course B	1.3 Develop a conceptual design to address a given issue. <i>(6 credits Internal)</i>	1.8 Demonstrate understanding of the purpose of subsystems within technological systems. <i>(4 credits Internal)</i>	1.12a Demonstrate skills in <subject of technology>. <i>(4 credits Internal)</i>	1.9 Demonstrate understanding of the characteristics of technology. <i>(4 credits External)</i>	<i>18credits</i>

Table 1: Example of a potential assessment plan

6. *Key Competencies and Values*

A technology programme, based on rich learning experiences will allow the *key competencies*³ (Ministry of Education, 2007a) to be developed in an inter-related manner (Techlink, 2007a). A rich technology programme challenges students and provides them with opportunity to interact with others across a range of social contexts. The proposed standards provide opportunity to recognise the development of key competencies seen in Table 2.

² The TKNoT: Imps research is currently being conducted in New Zealand classrooms to further refine the indicators of progression for the Technological Knowledge and Nature of Technology strands of technology in the New Zealand Curriculum (Ministry of Education, 2007a)

³ The 'key competencies' identified in *The New Zealand Curriculum* (2007) are: thinking; using language, symbols, and text; managing self; relating to others; participating and contributing.

Key Competency	Proposed Achievement Standards
Thinking	all
Using language, symbols, and texts	all
Managing self	1.1 -1.5; 2.1-2.5; 3.1-3.5 (particularly 1.2, 2.2, 3.2)
Relating to others	1.1 -1.5; 2.1-2.5; 3.1-3.5
Participating and contributing	1.1 -1.5; 2.1-2.5; 3.1-3.5

Table 2: Alignment of proposed achievement standards with the key competencies

The *values* identified in *The New Zealand Curriculum* (2007)⁴ are described as ‘deeply held beliefs about what is important or desirable. They are expressed in the ways that people think and act’ (p.10). Technology programmes of learning provide opportunity for students to learn about values and develop value-related capabilities (Techlink, 2007b). Evidence presented for assessment against the proposed technology achievement standards will therefore allow students to evidence dispositions and understandings aligned with the identified curriculum values.

7. *Internal/external justification*

The following is suggested:

- Technological practice related standards (i.e. 1.1-1.5; 2.1-2.5; 3.1-3.5) remain as internally assessed standards with evidence presented using portfolio submission, teacher observations and through evidence obtained through teacher interactions with students. This evidence will continue to be moderated under NZQA current systems
- Nature of technology standards for the characteristics of technology (1.10, 2.10, 3.10) are assessed internally due to the breadth of the understandings that these standards assess. These understandings are philosophical in nature and taught through a wide range of classroom contexts. As such, it is considered learning related to this component would be best evidenced through students demonstrating understanding within the context of the classroom learning environment. This will allow teachers to make informed judgements on the competencies expected by these standards, through their ongoing interaction with students. These judgements will be able to focus on both students’ conceptual understandings as well as how they integrate such understandings into their practice. Internal assessment of these proposed standards under this strand will therefore be more valid with greater reliability
- Nature of technology standards for characteristics of technological outcomes (1.9, 2.9, 3.9) are assessed externally due to the specific focus of these standards. The understandings required by this standard can be captured in a way that would allow, a range of contexts to

⁴ The ‘values’ identified in *The New Zealand Curriculum* (2007) are: excellence; innovation, enquiry and curiosity; diversity; equity; community and participation for the common good; ecological sustainability including care for the environment; integrity; respect for themselves, others and human rights

be brought to a scenario based example and therefore are considered to be more validly assessed using external assessment

- Generic technological knowledge standards for technological products and technological systems (1.7-1.8; 2.7-2.8; 3.7-3.8) are assessed internally. Student conceptual understandings which demonstrate competency against these standards have the potential to be evidenced through teacher's ongoing interaction with students, case studies and/or portfolio evidence. These understandings can also be evidenced within the practice students undertake to develop a technological outcome.
- Generic technological knowledge standards for technological modelling (1.6, 2.6, 3.6) are assessed externally. Student conceptual understandings which demonstrate competency against these standards have the potential to be evidenced through case studies and/or portfolio evidence. These understandings can also be evidenced within the practice students undertake to develop a technological outcome.
- *Subjects of technology* endorsed knowledge standards⁵ are assessed externally. Student knowledge which demonstrates competency against these standards has the potential to be evidenced through portfolio evidence.
- *Subjects of technology* endorsed skill standards⁶ are internally assessed. Student skills which demonstrates competency against these standards have the potential to be evidenced through portfolio evidence and through teacher observation of students' practice.

It is proposed that the externally assessed technology standards be assessed using portfolio submissions. Students should be provided with the opportunity to evidence their learning through undertaking a range of rich linked learning experiences as part of their technology programme. Opportunity to display the competencies expected for award of the proposed achievement standards assessed internally and externally may be evidenced across a range of learning experiences within the programme and/or from a discrete unit of learning.

10. Client

The term 'client' is not used in the proposed matrix to differentiate progression between levels. However teachers are still encouraged to provide opportunity for students to use authentic clients in their technological practice.

References

- Ministry of Education (1995). *Technology in the New Zealand Curriculum*. Learning Media Wellington, 1995.
- Ministry of Education (2007a). *The New Zealand Curriculum*, Learning Media Wellington, 2007.
- Ministry of Education (2007b). *Technology Curriculum Support Material*. Retrieved from <http://www.techlink.org.nz/curriculum-support/pdfs/technology-curriculum-support.pdf>, October, 2007.

⁵ These standards will be developed in Phase 2 of the *Curriculum Alignment Project*

⁶ *ibid*

Ministry of Education (2008) *Background Material Standards Review*. Paper provided by the New Zealand Ministry of Education to standards writers for the Curriculum Alignment Project.

Techlink, (2007a) *Technology and Key Competencies*. Retrieved from: <http://techlink.org.nz/curriculum-support/tech-values/index.htm>, 9 December, 2008.

Techlink, (2007b) *Technology and Values*. Retrieved from: <http://techlink.org.nz/curriculum-support/tech-values/index.htm>, 9 December, 2008.

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