Report to Technology Writing Group: Summary of feedback and recommendations for changes

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Introduction

This report has been developed to support the work to be undertaken by the Technology Writing Group (TWG) on 2 May 2007 as part of the Ministry of Education's curriculum review process. The report is structured into three main parts. Prior to this however, it begins with a discussion of an overarching issue related to the feedback gained on technology as part of the curriculum review process.

Part One provides the TWG with a summary of the feedback received on the Draft 2006 technology curriculum, and a reflective comment on the implications of points raised for technology. At this stage of the curriculum review process, all questionnaires, short submissions (3 pages and under) and long submissions have been collated. Two international reviews have been completed (Le Matais, 2007; Ferguson, 2007), and four reports (Flockton, 2007; Aitken, 2007; Patara, 2007; Doig, 2007) have been commissioned by the Ministry of Education to gain different perspectives and recommendations from the data. The summary presented in this report therefore, draws from all six reports, plus feedback gathered from technologists, teacher educators and teachers as part of the Technological Knowledge and Nature of Technology research (Compton and France, 2007).

Part Two provides recommendations based on this summary as follows:

- Specific recommendations for changes to the Introductory Learning Statement.
- Specific recommendations for changes to the Achievement Objectives.
- General recommendations for points of discussion.
- Indications for second tier implementation support.

Part Three presents the overall recommendations as made by the internal Ministry of Education report (Ministry of Education 2007). This internal report was based on the analysis and synthesis of the above six reports, the Colmar Brunton reports, the LIFT Education reports and the recommendations from the New Zealand Curriculum Reference Group. Part Three also provides a draft response outlining how we have addressed each recommendation and the justification for this.

Issue concerning validity of feedback data for technology

Before summarising the feedback, we feel it is important to outline an issue that has arisen out of the curriculum project's feedback with regards to technology. As you are aware, *The New Zealand Curriculum: Draft for consultation* was released in July 2006 (Ministry of Education, 2006a). This document included an incomplete draft of the Technology Introductory Statement, and provided achievement objectives for the Technological Practice strand only. A revised and complete draft of the Technology Introductory Statement and achievement objectives for all three strands (Technological Practice, Technological Knowledge and the Nature of Technology), was subsequently released on October 9, 2006 (Ministry of Education, 2006b). As many of the reports above are based on the feedback gathered, we felt it was important to attempt to establish the validity of this data for technology in terms of what version of technology the feedback refers to.

A total of 9117 questionnaires appear to have been collected. At this point, it seems of these, 4328 questionnaires refer specifically to the Technology Introductory Statement and 1677 refer specifically to the Technology Achievement Objectives. The initial feedback questionnaire accompanying the July document had space for comment on the Technology Introductory Statement, but not the Technology Achievement Objectives. Due to this, the questionnaire data around the Technology Introductory Statement may or may not be based on the complete October version. The questionnaire data around the Technology Achievement Objectives could be assumed to be based on the October version, but there is no guarantee of this, as people may still have used the July version with the new feedback form. We have been unable to establish which version of the questionnaire (the July or October) the 4328 questionnaires were. However, it seems logical to surmise that if they were the October questionnaires, there would be a response included around the Technology Achievement Objectives. We therefore suspect that of the 4328 comments on the Technology Introductory Statement, only 1677 may be based on the October version. It is probable therefore that 2651 of the questionnaires reflect comments on the incomplete July version of the Technology Introductory Statement. Technology has been reported as having the lowest level of agreement (at 74%) to question 9 focused on each learning area's introductory statement. We suggest the possibility that as over 60% of questionnaire responses may have been in response to the incomplete July version of this statement, this may have impacted negatively on the level of agreement that technology's introductory statement clearly captures and communicates its 'essence'.

A total of 52 short submissions including some reference to technology were received. No mechanism was put in place to determine whether these submissions referred to the incomplete July or the complete October version. We have re-analysed these submissions; however it is difficult to ascertain what version they are referring to, as many were not dated and their comments were not specific enough to determine the version being focused on. However, at least one of these submissions was clearly based on the incomplete July version as a negative comment was made about its incomplete nature and the lack of achievement objectives for the two new strands. Written comments included in the Colmar Brunton report from the short submissions therefore, may not reflect accurate feedback on technology as it is presented in the complete October version.

In total 174 long submissions were received. Thirty one long submissions with sections related to the Technology Introductory Statement and 12 long submissions with sections related to the Technology Achievement Objectives have been collated. Again, no mechanism was put in place to determine whether these referred to the incomplete July or the complete October version. We have also re-analysed these submissions in an attempt to determine from a combination of the date received and the nature of the comments which version they are referring to. Three long submissions appear to be based on the incomplete July version as based on date of receipt and/or specific comments related to incompletion. The 12 submissions that specifically refer to all three strand's achievement objectives are clearly based on the complete October version. However, it is difficult to clearly determine which version the remaining 16 submissions are based on. The majority of these were dated, and received after 9 October so it is at least possible they were responding to the complete October version. Written comments included in the LIFT Education report from the long submissions would appear to be more likely to be based on the complete October version.

This query regarding the questionnaire and short submission feedback in particular, has implications for the impact this may have had on comments regarding technology in reports such as Flockton's, (2007) and the internal Ministry of Education synthesis report.

In addition to this, three of the six commissioned reports written to date have commented specifically on the incomplete *July* version of technology only. These reports are the two international reports by Le Matais (2007) and Ferguson (2007), and the report written by Doig (2007). The recommendations directed towards technology in these reports are therefore reflective of the incompleteness of the July version, and do not provide an accurate commentary for technology for the next round of development.

Part One: Summary of the Feedback

Each of the six reports mentioned above are now summarised, and implications for technology are discussed. This section also presents a summary of feedback from the TKNoT research as presented in the final milestone report.

The Flockton Report

This report identifies five key considerations as based on the questionnaire and short submission responses. These are presented and any implications for technology discussed.

1. *Direction for Learning:* No specific implications for technology apart from affirming the stance taken that it is critical that the final New Zealand Curriculum should make clear the purpose of a national curriculum as a framework (including outcomes) for teachers and not a prescription for what students should do. This allows for a clear differentiation between curriculum issues and pedagogical issues.
2. *Designing School Curriculum:* No specific implications for technology, apart from again affirming the stance taken that this section be strengthened to better allow schools to see how the principles, values, key competencies and learning areas work together, alongside student and local community needs in the development of school and ultimately classroom curricula. This will provide opportunity for technology to develop specific second tier guidance in this area. Key to this is the reiteration of the role of achievement/unit standards as assessment tools within programme design. In technology this also has significant implications in terms of ensuring alignment of technology achievement standards to the new curriculum as soon as possible. Once again, this will allow for a clear differentiation between curriculum issues and pedagogical issues. Some comments related to technology that focused on the lack of explicit reference to practical activity could be linked to this confusion.

3. *Learning Area Descriptions:* As indicated above, of all the learning areas technology has the lowest percentage agreement (at 74%) that the description of learning (Technology Introductory Statement) captures its essence and structure. As with all areas, secondary teachers are less likely than primary teachers to agree, but a greater difference was noted for technology. Notwithstanding that some of the responses may be based on the incomplete July version, we suggest this may reflect the diversity of teachers currently teaching technology, their current programme foci, and the extent of the change suggested in the draft. Little data was available to clearly identify why respondents agreed or disagreed.

   The recommendation from Flockton is to take no action with regard to these levels of agreement. However, we thought it would be worth attempting to more clearly ascertain the reasoning behind any agreement or disagreement.

Having re-analysed the short submissions, it would appear the reasoning behind agreement was focused on two strengths:

- Firstly, an overall perception that the 2006 technology draft provided a more coherent and better explained picture of technology than the 1995 document.
- Secondly a high level of support for the three related, but now separate strands as underpinning technological literacy and allowing for programme flexibility.

The reasoning behind disagreement appeared to focus primarily on the following three key concerns:

- Firstly and most commonly, the perception that practical skills were not being acknowledged as important, and alongside this a concern that technology education was being presented as overly theoretical and lacking in opportunity for students to undertake practical activities.
- Secondly, there were a number of comments concerning the role of graphics and design/creativity in technology.
- Thirdly there were many comments around issues associated with the environment and the need to increase a focus on sustainability.

In addition to these strengths and concerns, many of the short submissions identified a clear need for professional development and implementation support.

Specific suggestions provided in the submissions for how some of the concerns may be addressed have been noted and are captured in the recommendations presented in Part Two of this report as either for changes to the Technology Introductory Statement, or for 'second tier' support material.

4. *Achievement Objectives:* Technology again has the lowest percentage agreement of all learning areas (at 53%) that its achievement objectives state student outcomes that teachers and students are likely to find useful. Again little data is available to clearly identify why respondents agree or disagree.

The recommendation from Flockton is that achievement objectives are audited across levels and evaluated in terms of usefulness. For technology this has significant implications due to the two new strands – and inherent issues associated with a lack of teacher familiarity of the ideas contained therein. In order to audit usefulness for helping teachers make judgments on students' level of achievement, teachers would be required to have a robust understanding of the underlying concepts. Therefore, this becomes an issue of teacher professional development and second tier support material. Technology is therefore not in a position to carry out this audit at this stage as exploring the underpinning ideas in classroom-based research is a pre-requisite for such an audit.

In addition to this, Flockton makes the point that the achievement objectives should stand alone in their ability to communicate a standard. Technology Achievement Objectives are arguable more complex than other learning areas due to their generic nature that must allow for a vast array of underpinning knowledge and skills – from both within technology and across other disciplines and therefore rely heavily on indicators of a standard and illustrative examples from different contexts to support teacher professional judgment of levels.

Flockton also makes the point that many other learning areas exhibit semantic incrementalism. We argue that while not robust in terms of clearly defining a level, such a progression often finds support from teachers it is easier to identify the point of difference between levels. Technology Achievement Objectives attempt to guard against such language based progressions and therefore rely more heavily on teacher understanding of the concepts/practice to 'see' the progression. Given the point made above regarding the two new strands – it is not unexpected that Technology Achievement Objectives were perceived as less useful.

Finally – in keeping with consideration one above regarding direction for learning above, it should be noted that technology upholds the stance that achievement objectives are written for *teachers* as a framework from which to develop specific learning intentions. They are neither a prescription for teachers, or guidelines for students to interpret without mediation.

Again, in an attempt to determine the reasoning behind agreement or disagreement with regards to the usefulness of the Technology Achievement Objectives, the short submissions were re-analysed. This provided an interesting insight into two distinct views which were held in relatively equal percentages across these submissions. It would appear the reasoning behind agreement was focused on a perception that the Technology Achievement Objectives were written in a way that supported flexible programmes and had clearly identified progressions. This was in direct contrast with the reasoning behind those in disagreement regarding their usefulness. In this case the perception provided was that the achievement objectives included far too much 'jargon' and did not communicate clearly what was expected.

Few specific suggestions for how the concerns might be addressed were provided. Recommendations presented in Part Two of this report have attempted to address concerns raised however through changes to the Technology Introductory Statement, the Technology Achievement Objectives or for 'second tier' support material.

5. *Achievement Objectives* – Secondary Teachers: There is a noticeable difference between primary and secondary teachers in their response to the usefulness of all learning area's achievement objectives. This is particularly so for technology with 66% of responses stating they were not useful.

   Flockton's recommendation in terms of this difference is to reiterate the need for the document as a whole to explain the purpose and function of the national curriculum (that it is not a course prescription) and its relationship to senior secondary curricula – particularly with reference to NCEA. Once again technology would support this stance.

Twelve additional considerations from the long submissions were also identified by Flockton, and he made twelve recommendations based on these. Only two of these have direct relevance to technology, although we would agree with the other ten general recommendations in the Flockton paper, seeing them as supporting all other learning areas including technology.

The two recommendations specific to technology were as follow:

> *Recommendation 9 – consider including sustainability in relevant learning area descriptions and achievement objectives (e.g. science, technology, social sciences).*
>
> *Recommendation 14 – make the development of practical skills in technology more explicit within the Technological Practice strand.*

We suggest Technology could make sustainability links more explicit in the Technology Introductory Statement and Technology Achievement Objectives. Technology could also look at providing further explanation of the underpinning knowledge and skills for all three strands as part of the Technology Introductory Statement, and provide second tier support material to further emphasise this. We could also revisit the description of technological practice and modify this to make practical skills more explicit.

We have also re-anlaysed the 31 long submissions including comments regarding Technology in an attempt to gain further insight into the thinking behind the levels of agreement and disagreement. As with the short submissions, there was a clear polarisation of views with relatively equal numbers of submissions being supportive overall or highly critical. The supportive long submissions focused on the view that technology is more coherent and better explained now, and that the strands allow for more interesting and flexible programmes of work. In these submissions, the Technology Achievement Objectives were described as showing a clear and helpful progression for teachers to identify the level of student achievement and the next step needed in their learning in technology.

In contrast, the long submissions that were critical of technology focused on the apparent lack of practical skills, design, and creativity, and the use of jargon that rendered the achievement objectives in particular difficult to understand. Specific suggestions regarding how these could be improved included increasing an emphasis on design, sustainability and a reduction in jargon.

In keeping with the short submissions, the need for extensive professional development and implementation support material was identified in both supportive and critical long submissions.

Recommendations presented in Part Two of this report have attempted to address Flockton's recommendations above, and the specific suggestions provided in the long submissions, through suggested changes and additions to the Technology Introductory Statement, the Technology Achievement Objectives and suggestions for 'second tier' support material.

The Aitken Report

This report makes no specific recommendations for technology. However, some points raised by Aitken generally are discussed below in terms of their implications for technology.

Technology needs to ensure the relationship between its strands, and that the importance of underpinning knowledge and skills, is made explicit. This reinforces our earlier suggestion that the Technology Introductory Statement could include a section on the importance of context specific knowledge and skills, and possibly a diagram, to help clarify this. Second tier explanatory papers around each of the new components could further show these links.

Further second tier material could also be developed to enhance overall coherency discussing the relationship between technological literacy and the overall literacy aimed for by the national curriculum as a whole, and its direct relationship to the principles, values, key competencies and other learning areas.

Aitken warns against relying too extensively on professional development to ensure the curriculum is understandable for teachers. However, given the two new strands within the technology curriculum, and the diverse range of teachers we have currently teaching technology, we would argue that along with working to make the Technology Introductory Statement and Achievement Objectives more explanatory in nature, we must provide extensive professional development and second tier support material if we are to ensure the revised technology curriculum will result in a shared understanding of the area.

The Patara Report

Recommendations of relevance to technology in this report include the need to increase links to Maori (along with all learning areas), and to make specific links between technology and sustainability. A suggestion was also made that a general revisiting of the Technology Introductory Statement could be undertaken as based on the secondary response.

Recommendations presented in Part Two of this report have attempted to address Patara's recommendations through suggested changes and additions to the Technology Introductory Statement, the Technology Achievement Objectives and suggestions for 'second tier' support material. How we address the links to Maori are indicated as a point for discussion.

The Doig, Le Matais and Ferguson Reports

All these reports are based on the incomplete July version of technology, therefore specific recommendations made are not relevant (for example, recommendations that technology must complete its achievement objectives). Specific comment was made in these reports questioning the linking of technology with 'enterprising and innovative employment opportunities'. We suggest this be revisited and possibly removed in the Technology Introductory Statement.

The more generic comments provided in these reports that have relevance to technology, are those around increasing links to Maori and sustainability, and a greater link between key competencies and learning areas. As indicated above, technology could work to show links to Maori and sustainability. We would argue the need for all learning areas (including technology) to explain their alignment to the principles and values, as well the key competencies.

Recommendations from the TKNoT research

The TKNoT research was a two year research project which sought to provide a sound basis from which to revise the technology curriculum and in particular establish and develop the two new strands of technological knowledge and the nature of technology. To this end, the researchers worked with 35 leading technologists (both practising industry technologists and/or academic technologists), and international experts in the area of the philosophy of technology. As well as providing input into the initial identification and ongoing development of the key components of technological knowledge generic to all technological communities, the technologists also provided a critical review of the complete October draft of the technology curriculum. This research project also provided opportunity for ongoing interaction with and feedback from the Technology Beacon Practice Teachers (44), teacher educators (both pre-service and in-service approx 40), and Head of Department Technology (approx 80).

The feedback on the complete October draft of the Technology Introductory Statement and the Technology Achievement Objectives from the technologists, teacher educators and teachers was very supportive. An overview of their evaluative feedback is provided below.

Technology Introductory Statement

It was noted by all three groups that design is no longer mentioned in this statement, and notions of creativity and critical reflection were not emphasised as much as they should be.

The technologists in particular expressed concern regarding the inclusion of examples of 'technologies', although no consensus was reached on this point. They also suggested that some comment could be made around the weighting of the strands as levels increase, but again no consensus view was reached. They suggested that *'requires'* be changed to *'includes'* in technological practice description, and suggested *'how things work'* was a key concept not captured in technological knowledge descriptor.

Teachers commented that the use of the term *'balanced'* was not a useful clarification. The also queried the retention of products, systems *and environments* and suggested this should just read *products and systems* to ensure consistency.

Technology Achievement Objectives

The technologists queried the use of the term *research* in levels 1-4 of the achievement objectives, suggesting *investigating* may be more appropriate. They also suggested materials *testing* be changed to materials *evaluation* at higher levels, and that *ultimate* disposal would be appropriate at level 8. All technologists agreed that it should be made clear that senior programmes need to ensure a level of specialisation that allows appropriate depth of knowledge related to technology programmes to be developed. That is, the importance of knowledge and skills from other disciplines and specific technological knowledge and skills should be made clearer at higher levels.

Some concern was raised by the teachers about the nature of the progression in 'technological product' from levels 4-6.

Specific suggestions provided in the TKNoT final milestone have been noted and are captured in the recommendations presented in Part Two of this report as either for changes to the Technology Introductory Statement and Achievement Objectives, and/or for second tier support material.

Part Two: Recommendations to the TWG

The following recommendations are made to the TWG for consideration at the meeting on 2 May 2007.

Changes to the Introductory Learning Statement

WHAT IS TECHNOLOGY ABOUT?

People use technology to expand their possibilities, intervening in the world through the design and development of technological products and systems. To do this, they apply available intellectual and practical resources in an informed creative and critically reflective manner. Technology is continually changing and contemporary developments clearly reflect the need to prioritise factors associated with sustainability. Technology is influenced by and in turn impacts upon the cultural, ethical, environmental, political, and economic factors of the day, both local and global. Technology values technological skills and 'know how' alongside knowledge and skills from other disciplines as it seeks to address the needs and desires of people through adaptation and innovation.

WHY STUDY TECHNOLOGY?

The aim is for students to develop a broad technological literacy that will equip them to participate in society as informed citizens. To develop such literacy, students need to experience and explore a wide range of technologies in a variety of contexts. These include, but are not limited to, control, food, communications, structural, dynamic, and bio-related technologies, along with creative design processes and materials.

Technology provides opportunities for students to apply knowledge and skills from other disciplines, as well as from specific technological contexts in an authentic setting. For students to develop the generic knowledge and practices around which the curriculum is structured, the development and application of specific knowledge and skills within a particular context is required. The importance of specific knowledge and skill development for learning in all strands in technology is captured in Diagram 1.

As student technological practice becomes more sophisticated (levels 6, 7 and 8), it is important that links are encouraged to other curriculum areas that are appropriate to the particular nature of their programme in order that they can develop further in technology. At this stage of learning in technology, providing students with the opportunity to work in-depth in contexts is more important than providing them with a wide range of contexts.

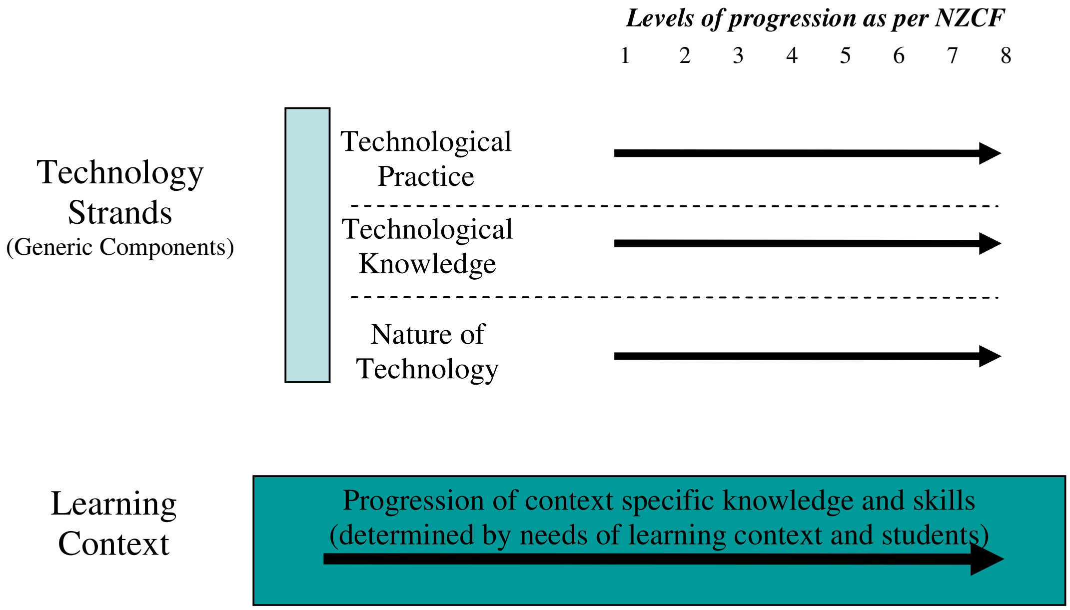

Diagram 1: The relationship between context-specific skills and knowledge and generic components.

HOW IS THE LEARNING AREA STRUCTURED?

Students develop their technological literacy by learning in three interrelated strands: technological practice, technological knowledge , and nature of technology. Teaching and learning programmes will integrate all three strands, although specific units of work may focus on one or two strands at a time to increase manageability for teachers and ensure students are provided with learning experiences that progress their context specific knowledge, skills and knowledge and practice.

The **Technological Practice** strand provides opportunity for students to examine the practice of others and undertake their own technological practice to design and develop outcomes. Technological practice includes identifying and investigating issues and existing outcomes to ensure their own practice is informed by that of the past and from different cultural and ideological perspectives. It also includes consideration of ethics, legal requirements, protocols, codes of practice, and the needs of and potential impacts on stakeholders and the environment. Through technological practice, students may design, develop and communicate a range of outcomes, including concepts, plans, briefs, technological models and fully implemented technological outcomes.

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

The **Technological Knowledge** strand provides opportunity for students to develop understandings of '*how things work'* and develop technological knowledge specific to technological endeavours and environments. Key ideas that cross all technological contexts included in this strand are: technological modelling; product development including material use and development; and the components of technological systems and how they interact.

Changes to the Achievement Objectives

	Level One	Level Two	Level Three	Level Four
Technological Practice	**Planning for practice** • Outline a general plan to support the design and development of an outcome, identifying appropriate steps and resources. **Brief development** • Describe the outcome they are developing and identify the attributes it should have, taking account of the need/opportunity and the resources available. **Outcome development and evaluation** • investigate in order to present potential outcomes. Evaluate these in order to select and develop an outcome in keeping with the identified attributes.	**Planning for practice** • Develop a plan that identifies the key stages and the resources required to design and develop an outcome. **Brief development** • Explain the outcome they are developing and describe the attributes it should have, taking account of the need/opportunity and the resources available. **Outcome development and evaluation** • investigate to develop ideas for potential outcomes, trial and evaluate these against the identified attributes, select and develop an outcome.	**Planning for practice** • Undertake planning to identify the key stages and resources required to design and develop an outcome. This planning will include reviews of progress and identification of implications for subsequent decision making. **Brief development** • Describe the nature of an intended outcome, explaining how it addresses the need/opportunity. Describe the key attributes that enable development and evaluation of an outcome. **Outcome development and evaluation** • investigate to develop ideas for potential outcomes. Trial and evaluate these in order to select and develop an outcome that addresses the key attributes.	**Planning for practice** • Undertake planning that includes reviewing the effectiveness of past actions and resourcing, exploring implications for future actions and accessing of resources, and accessing stakeholder feedback, in order to ensure the design and completion of the development of an outcome. **Brief development** • Justify the nature of an intended outcome in relation to the need/opportunity. Describe the key attributes identified in stakeholder feedback, which will inform the development of an outcome and its evaluation. **Outcome development and evaluation** • investigate to develop ideas for feasible outcomes. Undertake trialling and evaluation that takes account of stakeholder feedback in order to select and develop the outcome that best addresses the key attributes.

	Technological modelling • Understand that functional models are used to represent reality and test design concepts, and that prototypes are used to test technological outcomes.	**Technological modelling** • Understand that functional models are used to explore, test and evaluate design concepts for potential technological outcomes and that prototyping is used to test a technological outcome for fitness of purpose.	**Technological modelling** • Understand that different forms of functional modelling are used to inform decision making in the development of technological possibilities and that prototypes can be used to evaluate the fitness of technological outcomes for further development.	**Technological modelling** • Understand how different forms of functional modelling are used to explore possibilities and to justify decision making, and how prototyping can be used to justify refinement of technological outcomes.
	Technological products • Understand that technological products have material and performance properties.	**Technological products** • Understand that there is a relationship between the material and performance properties of technological products.	**Technological products** • Understand the relationship between the material and performance properties of technological products.	**Technological products** • Understand that materials can be formed, manipulated and/or transformed to enhance the fitness for purpose of a technological product.
Technological Knowledge	**Technological systems** • Understand that technological systems have inputs, controlled transformations and outputs.	**Technological systems** • Understand that there are relationships between inputs, controlled transformations and outputs occurring within simple technological systems.	**Technological systems** • Understand that technological systems are represented by symbolic language tools and understand the role played by the 'black box' in technological systems.	**Technological systems** • Understand how technological systems employ control to allow for the transformation of inputs to outputs.

Nature of Technology	**Characteristics of technology** • Understand that technology is purposeful intervention through design.	**Characteristics of technology** • Understand that technology both reflects and changes society and the environment, and increases people's capability.	**Characteristics of technology** • Understand how society and environments impacts on and is influenced by technology in historical and contemporary contexts, and that technological knowledge is validated by successful function.	**Characteristics of technology** • Understand how technological development expands human possibilities and how technology draws on knowledge from a wide range of disciplines.
	Characteristics of technological outcomes • Understand that technological outcomes are products/systems developed by people and have a physical nature and a functional nature.	**Characteristics of technological outcomes** • Understand that technological outcomes are developed through technological practice and have related physical and functional natures.	**Characteristics of technological outcomes** • Understand that technological outcomes are recognisable as fit for purpose by the relationship between their physical and functional natures.	**Characteristics of technological outcomes** • Understand that technological outcomes can be interpreted in terms of how they might be used and by whom, and that each has a proper function as well as possible alternative functions.

	Level Five	Level Six	Level Seven	Level Eight
Technological Practice	**Planning for practice** • Analyse their own and others' planning practices to inform the selection and use of planning tools. Use these to support and justify planning decisions (including those relating to the management of resources) that will see the design and development of an outcome through to completion. **Brief development** • Justify the nature of an intended outcome in relation to the need/opportunity. Describe specifications that reflect key stakeholder feedback and which will inform the development of an outcome and its evaluation **Outcome development and evaluation** • Analyse their own and others' outcomes to inform the development of ideas for feasible outcomes. Undertake ongoing experimentation and evaluation that takes account of key stakeholder feedback and trialling in the physical and social environments. Use the information gained to select and develop the outcome that best addresses the specifications.	**Planning for practice** • Critically analyse their own and others' past and current planning practices in order to make informed selection and effective use of planning tools. Use these to support and justify ongoing planning that will see the design and development of an outcome through to completion. **Brief development** • Justify the nature of an intended outcome in relation to the need/opportunity and justify specifications in terms of key stakeholder feedback and wider community considerations. Specifications inform the development of an outcome and its evaluation. **Outcome development and evaluation** • Critically analyse their own and others' outcomes to inform the development of ideas for feasible outcomes. Undertake ongoing experimentation and evaluation, taking account of key and wider community stakeholder feedback and trialling in the physical and social environments. Use the information gained to select, develop, and justify the outcome that best addresses the specifications.	**Planning for practice** • Critically analyse their own and others' past and current planning and management practices in order to develop and employ project management practices that will ensure the effective design and development of an outcome to completion. **Brief development** • Justify the nature of an intended outcome in relation to the issue to be resolved and justify specifications in terms of key stakeholder feedback and wider community considerations. Specifications inform the development of an outcome and its evaluation. **Outcome development and evaluation** • Critically analyse their own and others' outcomes and evaluative practices to inform the development of ideas for feasible outcomes. Establish and conduct experimentation and critical evaluation, taking account of key and wider community stakeholder feedback and trialling in the physical and social environments. Use the information gained to select, develop, and justify the outcome that best addresses the specifications.	**Planning for practice** • Critically analyse their own and others' past and current planning and management practices in order to develop and employ project management practices that will ensure the efficient design and development of an outcome to completion. **Brief development** • Justify the nature of an intended outcome in relation to the context and the issue to be resolved. Justify specifications in terms of key stakeholder feedback and wider community considerations. Specifications inform the development of an outcome and its evaluation. **Outcome development and evaluation** • Critically analyse their own and others' outcomes and their determination of fitness for purpose in order to inform the development of ideas for feasible outcomes. Establish and conduct experimentation and critical evaluation, taking account of key and wider community stakeholder feedback and trialling in the physical and social environments. Use the information gained to select, develop, and justify the outcome that best fits the purpose as determined by all dimensions of the context.

	Technological modelling • Understand how evidence, reasoning and decision making in functional modelling contribute to the development of design concepts and how prototyping can be used to justify ongoing refinement of technological outcomes.	**Technological modelling** • Understand the role and nature of evidence and reasoning when understanding and managing risk through technological modelling.	**Technological modelling** • Understand how the 'should' and 'could' decisions in technological modelling rely on an understanding of how evidence can change in value across contexts, and how different tools are used to ascertain and mitigate risk.	**Technological modelling** • Understand the role of technological modelling as a key part of technological development, justifying its importance on moral, ethical, sustainable, cultural, political, economic, and historical grounds.
	Technological products • Understand how materials are selected, based on desired performance criteria.	**Technological products** • Understand how materials are formed, manipulated and transformed in different ways, depending on their properties, and understand the role of material evaluation in determining suitability for use in product development.	**Technological products** • Understand the concepts and processes employed in materials evaluation and the implications of these for design, development, maintenance, and disposal of technological products.	**Technological products** • Understand the concepts and processes employed in materials development and evaluation and the implications of these for design, development, maintenance, and ultimate disposal of technological products.
Technological Knowledge	**Technological systems** • Understand the properties of subsystems within technological systems.	**Technological systems** • Understand the implications of subsystems for the design, development, and maintenance of technological systems.	**Technological systems** • Understand the concepts of redundancy and reliability and their implications for the design, development, and maintenance of technological systems.	**Technological systems** • Understand operational parameters and their role in the design, development, and maintenance of technological systems.

Nature of Technology	**Characteristics of technology** • Understand how people's perceptions and acceptance of technology impact on technological developments and how and why technological knowledge becomes codified.	**Characteristics of technology** • Understand the interdisciplinary nature of technology and the implications of this for maximising possibilities through collaborative practice.	**Characteristics of technology** • Understand the implications of ongoing contestation and competing priorities for complex and innovative decision making in technological development.	**Characteristics of technology** • Understand the implications of technology-as-intervention-by-design and how interventions have consequences, known and unknown, intended and unintended.
	Characteristics of technological outcomes • Understand that technological outcomes are fit for purpose in terms of time and context, and understand the concept of malfunction.	**Characteristics of technological outcomes** • Understand that some technological outcomes can be perceived as both product and system and understand how technological outcomes impact on other technological outcomes and technological practices and on people's views of themselves and possible futures.	**Characteristics of technological outcomes** • Understand that technological outcomes are a resolution of form and function priorities and that malfunction impacts on people's views of and acceptance of technological outcomes	**Characteristics of technological outcomes** • Understand how technological outcomes can be interpreted and justified as fit for purpose in their historical, cultural, social and geographical locations.

Points for discussion

Introductory Statement

- "These include control, food, communications, structural, dynamic, and bio-related technologies, along with creative design processes and materials."

Need to debate the inclusion of this list – and if included look at modifying to reduce confusion. *Dynamic* causing problems as is lack of specific reference to ICT. Discuss suggestion above that this may be better dealt with in following paragraph in Introductory Statement.

- Debate worth of diagram showing relationships between context-specific knowledge and skills and generic AOs.

- Progression in technological products 4-6 caused some concern.

- Jump from level 5 to 6 seen as large and 8 linked to scholarship viewed as a problem to some.

- Discuss advantage of adding an example in the introductory statement around the need to link to other curriculum areas… ie if undertaking a programme focused on food technology in upper secondary – students should be taking chemistry/ maths. If focused on creative design – should be taking art/art history/graphics etc??

- We could insert reference in statement to the role of graphics/visual communication ās a key explorative and communicative tool (enhancing quality of presentation) in technology… where would this best fit?

- If the overall direction is to add reference specifically to Maori – we could insert a further reference in this statement?

Achievement Objectives

- Have we communicated by adding *design and development* in planning for practice we are expecting a build/construct element to be present as central to practice??
-
- Can/should we make more links to sustainability/Maori/enterprise in Achievement Objectives?

Second tier implementation support

A lot of thought is needed with regards to second tier support. Many comments provided in the submissions showed a clear need and desire for professional development support. These comments were from all sectors and from both those commenting positively and negatively on Technology.

Current initiatives under way to provide this support include:
Discussion papers released to support release of the October technology draft.
Indicators of progression developed for all components with guidance for learning environments.
Teacher friendly explanatory papers around all generic components of the three strands.
Beacon Practice and growing number of case studies on Techlink
HOD/Lead teacher support

Future initiatives to provide support include:
State of nation research
Classroom research on TKNoT
Teacher print/web-based resourses
Database of NZ research in technology

Part Three: Overall recommendations and justification of how these have been addressed

The following recommendations are from the Ministry of Education's overall synthesis of recommendations for technology as per the 18 March report.

Recommendation	Addressed	Justification
Strongly consider introducing absolute requirement to make/build/produce something.	To be completed by Technology Writing Group and the senior advisor technology	To be completed by Technology Writing Group and the senior advisor technology
Consider comprehensive support materials and PD (implementation) for specific direction (for understanding of teaching required).		
AOs: Need for specific details, goals, outcomes.		
Stress sustainability of new technologies.		
Reduce large leaps in learning between levels 5-8.		

Bridging between levels 4 and 5.		
Re-order AOs – ie experimentation and critical analysis before planning.		
Emphasise exploration, critical thinking, creativity, innovation and adaptation within the concept and definition of technology rather than it being a structured process with defined outcomes.		
Emphasise fundamental depth of knowledge, concepts and principles of technology, so that teachers see where the concepts and principles that generic and specific technologies fit.		
Emphasise 'design' within TP strand.		
Emphasise links to community engagement.		

Consider introducing ICT/Food technology		
In TK strand emphasise specific knowledge, I.e. ‘opportunities for students to develop technological knowledge specific to particular endeavours.’		
Re-order strands Nature of Tech, tech practice, tech know.		
Simplify the explanation of expected AO outcomes for students.		
Consider reviewing all the achievement objectives (“back to the drawing board”).		
That the writing group be expanded to include a wider range of views including tertiary and industry.		

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