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NEW ZEALAND INSTITUTE OF FOOD SCIENCE AND TECHNOLOGY (INC)

Technology Education New Zealand

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NZ Curriculum

Submission to the Ministry of Education
30 November 2006

Background to IPENZ

The Institution of Professional Engineers New Zealand (IPENZ) is the leading national professional body that represents the engineering profession in New Zealand. It has approximately 10,000 Members, including engineering students, practicing engineers and senior Members in positions of responsibility in business. IPENZ is non-aligned and seeks to contribute to the community in matters of national interest, giving a learned view on important issues, independent of any commercial interest.

Background to NZIFST

The New Zealand Institute of Food Science and Technology (NZIFST) is the professional link uniting people in the food industry who apply science and technology to the processing and distribution of foods. Formed in 1965, the Institute is a nationwide not-for-profit incorporated society with a current membership of more than 1,000. NZIFST is the trusted and independent voice of food science and technology in New Zealand.

Background to TENZ

Technology Education New Zealand Council (TENZ) is a group of educational professionals elected by their peers to lead technology education into the future. TENZ has a strong history of running successful technology conferences in New Zealand. There are regional cluster groups that meet regularly around the country and all members are linked by *t-news* – an electronically generated newsletter.

Executive Summary

We are broadly supportive of the proposed curriculum, although we note that some issues will need to be addressed to ensure success. These include:

- Broaden generic skills to include independent learning, e- and t-literacy.
- Prevent schools from opting out within under-resourced curriculum areas.
- Recognise and address the specific needs of technology – particularly those posed by the new and still-evolving nature of the learning area.
- Remove confusing claims about the links between science and technology.
- Introduce domains into technology, and guidelines for associated specialization.

We outline these issues in detail below, and suggest some minor wording changes.

Submission

Section A

This joint submission has been prepared by Members of IPENZ, NZIFST and TENZ, and made available for peer review to the membership of these organisations. It therefore represents widely held views from major practising communities – the engineering profession, food scientists and technologists and the technology teaching community.

Section B

In addition to answering the specific questions in the questionnaire we wish to make some wider, overarching comments in relation to technology – our primary interest.

Overall, whilst we are generally supportive, there are concerns in our communities of practice that technology as a curriculum area may suffer in a different manner to other curriculum areas because of the continuing lack of detailed reference or resource material to support teachers developing learning programmes for students. Curricula such as science, mathematics, social sciences have evolved for the past 100 years. They have matured and have a well-defined history with a knowledge base of theories and principles that are often centuries old. The fundamental physical and natural laws are well established. There is a wealth of teaching resources to support the delivery of these curricula, and most teachers learnt things that are still essential parts of the curriculum during their own tertiary study.

In contrast, the technology learning area was first introduced to schools in 1995, and has been evolving since with a developing research base. The teachers from this area mostly came from a craft background rather than a technological practice history. A massive paradigm shift was required that is evolving slowly. The language was new, as was the incorporation of technological practice.

The new draft curriculum introduces two new strands – *Nature of Technology* and *Technological Knowledge*. The brief curriculum document is still potentially inaccessible to the teaching community, largely due to the absence of a sufficient knowledge base and teaching materials. Unless the two newer standards are now strongly supported, they may not be implemented effectively.

- ***Question 3 and related issues***

In our view, the reduction of the curriculum to relatively brief guidance documents will have a profound effect on the way schools operate, and whilst the flexibility appears to offer potential benefit, in our view it will also create considerable potential for undesirable behaviour across all curricula.

We fully support the notion of directing the compulsory years of schooling to develop a young person who can leave school with sufficient basic skills to live a constructive life in wider society. They should also be able to retain both their personal dignity and capability to participate in the work force through re-educating themselves as their life progresses. The curriculum's proposition that this goal is both literacy and numeracy, and the acquisition of generic skills is too narrow in our view. The skills needed to equip a citizen for 21st century society are:

- numeracy
- literacy (reading, writing and comprehension)
- e-literacy (ability to use ICT in a dignified and constructive manner)
- t-literacy (including the ability to confidently interact with, benefit from, and contribute to the development of a wide range of contemporary technologies in a dignified and constructive manner)
- independent learning skills.

The so-called generic skills in the curriculum are a sub-set of independent learning skills. Unless these wider aspects are recognised, there is a considerable risk that primary and intermediate schools will overly concentrate on "basics" like numeracy and literacy. We also question whether the teaching methods likely to apply to basics are as conducive to development of independent learning skills as the teaching methods in wider areas of the curriculum. We particularly emphasise the value of the technology curriculum with respect to developing independent learning skills, including the generic skills list. Hence, our first concern is that the attention to numeracy, literacy and generic skills could lead to schools opting out of teaching programmes that support the wider needs of its students as set out in the list above.

The second undesirable behaviour that could result from the curriculum is that schools may opt out of important curriculum areas when they lack particular staff skills. For example, this is already evident in Years 7–10 where many schools give only token recognition to the technology curriculum. In our view, it is not appropriate to make opting out easier, rather than making schools address the skill mix of their teaching work force.

The contexts and examples used in a teaching course should be rich in local content and emphasis, but we question whether the learning outcomes should differ significantly between schools up to Year 10 (Level 5 of the curriculum). Hence, we question whether much programme design flexibility is really needed. Specialisation at senior secondary level is a different issue and we support flexibility above Level 6.

The change in direction that this document presents will only lead to improvement and avoid undesirable effects if it is quickly mandated, strongly supported, and appropriately resourced by the Minstry of Education. The Ministry must act quickly to address undesirable behaviour, and establish good practice guidelines for how schools should interpret the curricula.

We are also aware that John Daker from Glasgow University has conducted research that looks at the skills necessary to move a teacher's capability from craft to technical to technological practice. This research shows that a major skill change is required and that teachers must actively support the change. We consider that professional development may go some way to overcoming this problem.

- ***Question 4 and related issues***

Readability has clearly been addressed in the structure of the sections. However, this should not restrict the inclusion of specific technical language which is appropriate and necessary in the curriculum sections. Technology as a curriculum area has its own terminology that is common within the industry. In this respect, it is no different from the other curricula.

As a specific example, the term "black box" mentioned in *Level Three achievement objective Technological Knowledge – Systems* may be unfamiliar. This term is not unique to technology. Black and William (1998) and Black et al (2002) have produced significant research on formative assessment referring to the black box. This work is used by the Support Services Assessment advisors when working with schools in "formative assessment". Black box is also a term widely used by technologists who work with systems technology. Success of the curriculum is more likely if teachers are encouraged to learn and use the language of practising communities, thereby using the curriculum to link schools with the outside world.

- ***Question 5 and related issues***

As already outlined, in technology, the impact will in part be dependent on the priority given to implementation and resources allocated by the Ministry.

It is important to remember that primary teachers teaching technology in Years 1–6 are not specialist teachers and do not necessarily have a comprehensive understanding of technology , technological practice or the language associated with either. We welcome the addition of key components of practice, which will facilitate a more focused approach to teaching technology. However, the reality of the current curriculum means that primary teachers are probably teaching two technology units of work per year (at most). This is typically done in "topic time" and unfortunately competes with social studies, science and health. In our experience, technology is an excellent vehicle for the authentic application of literacy and numeracy programmes. We therefore advocate an approach to professional development that encourages teachers to design learning experiences within curricula such as technology to facilitate literacy and numeracy improvement.

- ***Question 6 and related issues***

In the technology curriculum, schools will face huge challenges getting teachers to buy into the nature of the change and the necessity for change in the first place. This may be alleviated by such things as the timely publication of a matrix of indicators of progression for the nature and knowledge of technology and as well as examples of classroom practice at various levels.

Turning to a specific example, there are new terms in the achievement objectives: *black box*; *controlled transformations*; *concept of malfunction*; *codified*; *known; an unknown*. Technology has moved from a subject that was defined by technology type to one based on generic principles, in which students need to experience and explore a wide range of technologies in a variety of environments. Teachers must have had some first-hand experiences to be able to manage the learning and progress of their pupils effectively. This means that they must have some professional development to help build their own experiences and knowledge, assist their understanding and allow them to facilitate a programme as intended in the document. Even older terms such as "attributes" and the meaning of "experimentation" need to be rethought, redeveloped and expanded in terms of technological literacy. Reading a paper alone does not always provide the intended meaning.

If these special needs of technology are not recognised through the allocation of greater levels of professional development than for other subject areas, then the quality of implementation in technology will potentially be poor. A budget that allows teachers delivering technology to leave the classroom and develop shared understandings will be critical to successful implementation. Technology is now in the List A canon and we need to up-skill those teachers to increase the percentage of students undertaking Level 3 and scholarship.

Science and mathematics teachers generally hold tertiary education (university) background qualifications. Technology teachers have historically come from a craft background, although this has evolved to a technical and, more recently, technological background. All three backgrounds have quite different pedagogy and training requirements, and someone with just a craft background is unlikely to be appropriately skilled to teach technology. It is vital that professional development for technology teachers is much more focussed and carried out at a much greater intensity (relative to learning areas that are well developed) to ensure the implementation of the curriculum occurs as intended, providing students with both academic and vocational pathways to build New Zealand into a strong 21st century economy.

- ***Question 7 and related issues***

Key terms and ideas are all articulated within *Vision, Principles Values* and *Key Competencies*. However, a smooth flow of these terms through the document into the *Learning Areas* has not been created. See earlier comments on the skills needed to equip a citizen for 21st century society.

- ***Question 8 and related issues***

Usefulness will be directly related to the nature and level of resource support that schools receive as we have indicated above.

Section C

- ***Question 9 and related issues***

Science – we are particularly concerned about some parts of the description of science, especially with respect to the physical and chemical worlds. The statement "By understanding physics, people are able to design technological solutions in response to a wide range of contemporary issues and changes" is simply not true. More correctly, one might say "By understanding physics, students gain knowledge and skills that will assist them in solving a wide variety of practical problems".

Similarly, for chemistry it is inappropriate to say "By using their knowledge of chemistry, people can predict and control changes in matter, leading to technological advances and the possibility of a sustainable future". This is also a huge stretch from the reality of the skills and knowledge school leavers possess. It would be more appropriate to say "By understanding chemistry, students will be better able to understand how to bring about desirable transformations of materials and limit the extent and rate of their undesirable transformations."

Technology – We are concerned that the curriculum does not adequately address the context in which technology is conducted. In the previous curriculum, seven "areas" were stated as *Technological Areas* important to New Zealand, within which students should study technology concepts. However, these were often inappropriately regarded as "subjects" in practice. In our view, it should be made clear that at levels 1–5 students are expected to study technology in a range of contexts, but at Levels 6–8 there can be some specialisation. We propose the definition of "domains" which are somewhat akin to the "worlds" in science. The domains would be defined according to the types of materials and transformations occurring:

- transformations predominantly using chemical and biological agents (perhaps called the processing domain)
- transformation predominantly using physical agents (perhaps called the artefacts/structures and devices domain)
- transformations predominantly involving electronically stored data or knowledge (perhaps called the digital or ICT domain)

Of the old "areas", there is a loose mapping of food technology, biotechnology and production and processing to the first definition, materials technology, production and process, electronics and control, structures and mechanisms to the second definition, and electronics and control plus ICT to the third definition.

We support some structure and compulsion to the coverage of a range of domains within primary schools. Current research into formative assessment (Clarke, S. 2004 & 2005, Formative Assessment in Action) discusses techniques to write learning intentions or objectives that are context-free, allowing the learning to focus on the aspects of the curriculum being taught. These are generic skills, but the notion of t-literacy suggests that these skills should be demonstrated in a range of contexts. In our view, the curriculum should state that at Levels 1–6 students are expected to work within and across all three domains, and even when studying in the context of one, should draw on knowledge and skills derived from the others. At Levels 6–8 the curriculum might say that the course of study for a particular student should concentrate on one domain, but still draw knowledge and skills from the others as is appropriate to the needs of their own study.

We also consider it important that the relationship between the processing domain to the health and physical education curriculum is clearly delineated. Developing technological literacy in the processing domain develops students' experience in food and biotechnology. They learn that business and industry have social responsibility, and this responsibility is increasingly becoming an outcome in their business practice. However, the learning outcomes are quite different to those achieved when students study "food" in the Health and Physical Education Curriculum than through the subject Home Economics where they develop an understanding of the factors that influence the well-being of individuals and families within the home and wider communities. Further, whilst the concept of nutrition arises in the technology context of Food and Biotechnology the purpose is different to that in health Home Economics where the nutritional knowledge base (eg G.I. nutrient) and more recently health promotion is taught. In technology, the food and health interface is a consideration, and not a learning outcome in itself. This is no different to the integrated learning that also comes from using knowledge from the science and mathematic fields in technological practice. Knowledge from social sciences, language, art and design are used by the technologist as well.

We consider that the concept of evaluation in technology must be explicitly rather than implicitly broad-based. Technological outcomes must be evaluated technically, socially, environmentally and economically. The later link to commerce and enterprise should be recognised explicitly. The technical evaluation needs to include both fitness for purpose of the outcome and the demonstration of skills in the process.

- ***Question 10 and related issues***

Technology – under *"Outcome development and evaluation"* at Levels 1–4 the term "research" might be better replaced by "investigations" (although not all our constituencies agreed on this matter). At Levels 5 and 6 the terminology "experimentation and evaluation" is used. To suggest that research is a lower level activity is not appropriate, particularly when research is normally seen as a higher-level activity.

Under "*Technological products*" at Levels 6 and 7 replace "materials testing" with "materials evaluation". Testing is seen as a lower-level activity. At Level 8, replace "materials development" with "materials development and evaluation" for similar reasons. Also at Level 8, insert the word "ultimate" before "disposal" to indicate a higher level of requirement than at Level 7.

We note that some of the terminology used will be alien to some teachers and they will require a significant level of support to come to terms with the meaning and intent of the achievement objectives – particularly in terms of the newly defined *"Nature of Technology"* and *"Technological Knowledge"* strands.

Conclusion

We are broadly supportive of the shorter principle-based school curriculum, but have some specific concerns that we consider need to be addressed if the new curriculum is to succeed:

- Broaden the generic skills to ensure that literacy and numeracy are not over-emphasised at the cost of development of independent learning, e- and t-literacy.

- The flexibility must not allow schools to opt out of curriculum areas where they are poorly equipped to deliver learning.
- The specific needs of technology, the newest and still-evolving learning area must be recognised and addressed through commitment of resources to assist schools and teachers to improve their capability to deliver high quality learning.
- Remove some confusing claims about the links between science and technology.
- Introduce domains into technology (akin to worlds in science), with clear guidance that specialisation into domains should only occur at levels 6–8.

We have also suggested some minor wording changes.

References

Black, P. & Wiliam, D. (1998). *Inside the black box*, London, King's College

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Clarke, S. (2005). *Formative assessment in action – weaving the elements together*, London, Hodder Murray

Clarke, S. (2004). *Enriching Feedback in the Primary Classroom,* London, Hodder Murray

Hilary Low

From: Christina Ward [christinaward@xtra.co.nz]
Sent: Monday, 4 December 2006 10:18 a.m.
To: Hilary Low
Subject: FW: Updated: NZ Curriculum Submission
Importance: High

------ Forwarded Message
From: "Elizabeth Craker" <elizabeth.craker@cwa.co.nz>
Organization: CWA New Media
Date: Fri, 1 Dec 2006 09:12:04 +1300
To: "'Christina Ward'" <christinaward@xtra.co.nz>
Subject: FW: Updated: NZ Curriculum Submission

fyi

From: Shelley Pope [mailto:SPope@ipenz.org.nz]
Sent: Thursday, 30 November 2006 5:19 p.m.
To: projectfeedback@tki.org.nz
Subject: Updated: NZ Curriculum Submission
Importance: High

Hello,

Please find attached a joint submission from the Institution of Professional Engineers New Zealand, the New Zealand Institute of Food, and Science and Technology and Technology Education New Zealand. If you have any problems opening the attachment please contact me as below.

Kind regards,
Shelley

Shelley Pope

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