

## **ALIGNMENT OF LEVEL ONE NCEA TECHNOLOGY STANDARDS WITH THE NEW ZEALAND CURRICULUM**

**Submission to the Ministry of Education**

May 2010

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### **1. INTRODUCTION**

This submission is made by the Institution of Professional Engineers New Zealand (IPENZ) on behalf of stakeholders in the design, engineering and technology sectors. These stakeholders consist of:

- the New Zealand Council of Engineering Deans (NZCED) representing tertiary institutions that deliver four-year professional engineering degree programmes
- the Council of Engineering Technicians and Technologists New Zealand (CETTENZ) representing tertiary institutions that deliver two-year engineering diplomas for technicians and three-year engineering degrees for technologists
- engineering-related industry training organisations (ITOs) such as BITO, ETITO, Competenz, Infratrains, NZITO
- academics teaching design in tertiary institutions
- industry bodies in the design, engineering and technology sectors.

Collectively, these organisations represent the largest end-user communities of technology education in New Zealand, both in terms of tertiary study that follows on, and in terms of career opportunities. The relevant economic sectors such as construction and infrastructure, manufacturing and food processing contribute very substantially to the New Zealand economy. Domestic construction alone is about 6% of GDP, and technological exports comprise the bulk of our export earnings. Ensuring that the pathway from technology education and achievement in senior secondary school to these industries is operating effectively is vitally important.

Representatives of all of these stakeholders attended a consultation meeting with the Ministry of Education on 30 September 2009 to discuss the specialist categories in the Technology Curriculum. Representatives from NZCED, CETTENZ, ITOs, industry bodies and academics teaching design in tertiary institutions were subsequently involved in writing the Level One Technology Standards.

This submission sets out higher-level feedback which collates the view of the various stakeholders. It does not comment on the wording detail within specific standards as stakeholders have been asked to comment directly through the electronic feedback system.

### **2. OVERALL DRAFT TECHNOLOGY MATRIX**

Overall, the stakeholders consider the proposed matrix comprising generic standards and four category areas makes sense as a practical way of providing a coherent and sensible approach to specialisation but retention of generic skills. Many of our stakeholders believe that this is the first time that they can be supportive **of a matrix in its entirety**.

That is not to say that there are no concerns, but the conceptual design is supported. In saying this, it is assumed that progression to Levels 2 and 3 standards in the Construction and Mechanical Technologies and Processing Technologies categories will

be managed by keeping the achievement standards in the same broad pattern, but progressing from “basic” at Level 1 to “advanced” at Level 2, to “complex” at Level 3 (and perhaps even “leading edge” at Level 4).

Having a mix of examined and internal achievement standards is considered appropriate for the stakeholders representing the academic institutions, although some stakeholders from industry would like to see the balance moved towards greater credit for practical “doing” skills rather than acquired knowledge.

Industry stakeholders would like to see the language used in the standards revised to be more user-friendly for industry so employers see terminology they can understand and it has consistent meaning in the unit and achievement standards.

Safety is seen as a core component in all work in all of these specialist categories. Industry has very robust systems of evaluating and endorsing safe practices, and therefore safety has to be embedded as a clear expectation in any of these achievement standards.

### **3. NAMING OF THE SPECIALIST CATEGORIES**

The stakeholders support the three titles:

- Digital Technologies
- Processing Technologies
- Construction and Mechanical Technologies

However, some stakeholders are concerned with the naming of the fourth category. For example, the following feedback was received on the naming of the specialist category Design and Visual Communication.

*Design and Visual Communication is incorrectly used in the Matrix. The term "Visual Communication" is an internationally known term. It is an EQUAL category to Technology - it is NOT a subset of Technology. Visual Communication internationally refers Graphic Design, Packaging, Digital Media visual design, Illustration, Social media, ... all subjects that have belonged to Art Schools and Design Schools for many years. Visual Communication in Universities usually sits under a Humanities faculty. Very rarely under technology. Why would it? To use Visual Communication as a subset of Technology is a gross mistake that will perpetuate the confusion that has already been created by the misuse of the term "Graphics".*

*Graphics: The term Graphics internationally refers to "Graphic Design". For some reason, in NZ Secondary Schools (only), it refers to what used to be known as technical drawing. This is a mistake that students, universities and industries in NZ have been dealing with for several years.*

*Furthermore, the Matrix refers to graphics as a subset of Design and Visual Communication. Graphics, as is currently practiced in NZ schools, is NOT a subset of Design and Visual Communication. It IS a subset of Technology, belonging rightly in Engineering and Industrial Design.*

*A more accurate name for Graphics would "Technical Rendering", or "Technical Communication".*

*Furthermore, to place Visual Communication under "Human Factors" does not make sense, and again, is changing internationally accepted terminology.*

*Summary: there appears to be a tendency to misuse internationally known terminology. This creates more problems than solutions, as career advising is confused, students are confused, and Universities are required to "undo" student perceptions.*

#### *Suggestions*

*Rename "Design and Visual Communication" to "Design for Technology".*

*Rename "Graphics" to "Technical Rendering".*

The stakeholders in this submission have no specific overall view on the name of the fourth category – they simply want it to be the best possible name that most represents the overall bodies of knowledge covered in the category. Many would accept “Design and Visual Communication”. We suspect that “Design for Technology” might also receive support if consulted.

## **4. GENERIC STANDARDS**

The stakeholders recognise that no changes are being made to the generic standards as a result of this consultation. We support the two design and manufacturing generic standards. However, one of the stakeholders provided the following comments on the generic standards.

### **1.1-1.9:**

*These have been devolved from the current 90xxx series of generic achievement standards on the Framework. They appear to be much more useable than their predecessors and ETITO has heard much positive comment from teachers to this effect. **As it is certain that the assessment of Electronics courses will universally involve a mix of generic as well as specialised standards, it would have been good to have been able to comment on these new draft standards, not only the ones at Level 1, but at Level 2 and Level 3 as well.***

### **1.5-1.7:**

*These standards will be of particular interest to those designing an assessment programme in an Electronics programme context, partly because course endorsement criteria include an external assessment requirement and these standards are to be externally assessed. It is not completely clear from reading standards 1.5 and 1.6 (1.7 is straightforward) whether these can be adapted to an electronics context. Electronics ‘materials’ might be taken to mean ‘semiconductor materials’ and ‘products’, ‘components’. ‘Modelling’ could be interpreted as simulation (for software) and prototyping (for hardware). No doubt this will be expounded in the Teaching and Learning Guides. This clarification will determine to how useful these standards will be in Electronics.*

*It is unlikely that the other generic standards will be useful in an Electronics-based programme.*

## **5. STANDARDS WITHIN CONSTRUCTION AND MECHANICAL TECHNOLOGIES**

We note that some of the standards have been replicated in the context of “building materials” and “textiles”. We accept this, although some would have preferred to have avoided this duplication.

Having standards on structures and machines (1.16 and 1.18), and a standard on implementation (1.14) is supported. However, there is concern that the practical knowledge and skills leading to vocational careers represented by standard 1.14 is undervalued due to their low credit value. At four credits (or 40 hours of learning) the level and range of skills that students and industry require and the learning that must take place for students to acquire the range of skills required to implement such

procedures is underestimated. In contrast, the successful Tools4Work programme allocates 12 credits to the gaining of appropriate skills and 10 credits to the development of an appropriate product. We recommend that the credit value of standard 1.14 be increased to at least six. (See Appendix One for a more detailed submission on this recommendation.)

As previously indicated, the area of understanding materials properties is probably of sufficient importance to justify a separate standard on understanding building materials properties, to sit alongside the standard on understanding construction techniques. If these two aspects are to be included in standard 1.16 then it should be increased to six credits. If they were split into two standards, each should be of three credits.

In terms of detail within the standards, comments from the Boating Industry Training Organisation (BITO) are set out in Appendix Two.

## **6. STANDARDS WITHIN DESIGN AND VISUAL COMMUNICATON**

There are no overall comments – any specific comments on standards have been made by individual stakeholders through the electronic submission process.

## **7. STANDARDS WITHIN DIGITAL TECHNOLOGIES**

The ITO for the Electrotechnology and Telecommunications sectors (ETITO) is very supportive of the draft achievement standards in the Digital Technologies specialist category. ETITO welcomes the formal recognition given in a mainstream curriculum area to the knowledge and skills required for hi-tech industries which will encourage more students into careers in this sector.

ETITO has made a number of comments on the standards in this category which are detailed in their submission in Appendix Three.

## **8. STANDARDS WITHIN PROCESSING TECHNOLOGIES**

There is general support for having standards on:

- implementing procedures
- concepts of preservation, packaging and storage.

As previously indicated, the area of understanding of materials properties to be processed is probably of sufficient importance to justify a separate standard on understanding ingredients/materials properties, to sit alongside the standard on understanding processing techniques. If these two aspects are to be included in standard 1.41 then it should be increased to six credits. If they were split into two standards, each should be of three credits.

We note the replication of standards to two contexts “ingredients” and “living organisms”. Because the division is artificial it does not work perfectly. The reference to “living organisms” in 1.38 and 1.40 is awkward as it refers to both living organisms as agents of change during processing (e.g. microorganism) and living organisms as the raw materials (e.g. plants and animals).

Similarly, to above, standards 1.38 and 1.40 combine both production (growing) of living organisms (to become raw materials from further processing) and further processing of these raw materials. The production (growing) stage is not processing.

One stakeholder suggested that it may be better to separate the production (growing) which is a primary industry activity from the subsequent processing (secondary industry).

This stakeholder suggested that an alternative to 1.38 could be *implementation of procedures* and an alternative for 1.40 could be *understanding concepts*.

We therefore question whether the replication is achieving the desired outcomes. It may be better to remove the duplication of standards and reword the notes to make it clear that living organisms as agents of change are part of processing (i.e. these living organisms are simply a means to process ingredients). It should then be made clear that the growing process of biological materials that will be processed after harvesting is not part of the standard.

Finally, one stakeholder would like to see automated process control, optimization and also robotics as areas of relevancy in the standards.

## **9. FOLLOW-UP**

The stakeholders thank the Ministry of Education for the opportunity to comment on the Alignment of the NCEA Level One Technology Standards with the New Zealand Curriculum.

Contact:

Dr Andrew Cleland

Chief Executive

The Institution of Professional Engineers New Zealand

Phone: 04 473 9444

## Appendix One

### Competenz / Apprentice Training New Zealand (ATNZ) Trust response to the draft Technology Matrix and draft Level 1 Technology Standards

Competenz is the New Zealand Engineering, Food and Manufacturing Industry Training Organisation (ITO), with gazetted coverage for a wide range of industries including mechanical engineering and food, beverage and general manufacturing. As such, we actively represent the education and training needs of approximately 2000 employers that collectively generate a significant proportion of New Zealand's current and future economic output. The ATNZ Trust employs nearly 400 engineering apprentices throughout New Zealand.

We have reviewed the consultation documents relating to the alignment of technology standards with the New Zealand Curriculum (2007) and discussed the implications with representatives from the above industries.

We are very supportive of the moves to provide some context to the achievement standards by introducing the four Specialist Categories of Technological Knowledge and Skills, and are comfortable with the naming of these four categories.

With regard to the scope of the new achievement standards, however, we are greatly concerned by the continued undervaluing of practical vocational skills within the technology curriculum. We also believe the standards fail to appropriately cater to the kinesthetic learners who make up a significant proportion of the secondary school population. We acknowledge that new achievement standards such as *1.14 Implement basic procedures using building materials to construct a specified product* are a step in the right direction; however, this is a very small step that still leaves vocational skills drowned out within what remains a largely academic curriculum.

Within the Construction and Mechanical Technologies specialist category, only achievement standard 1.14 explicitly recognizes the carrying out of practical activities. At 4 credits (or 40 hours of learning) we believe the standard writers have grossly underestimated and undervalued the level and range of skills that students and industry require and have fundamentally failed to acknowledge the learning that must take place in order for students to acquire the range of skills required to implement such procedures. In stark contrast, the successful Tools4Work programme allocates 12 credits to the gaining of appropriate skills and 10 credits to the development of an appropriate product.

Given this fundamental undervaluing of practical skills and knowledge, we are firmly of the opinion that there is insufficient practical content to construct a credible vocational pathway within the technology curriculum. Rather, the vocational pathway continues to be sidelined and drowned out at the expense of more fashionable concepts, many of which are duplicated elsewhere within the New Zealand Curriculum. This is evident in the range of standards and credits available within the Digital Technologies category.

- 1) Whilst we are supportive of the Specialist Categories of Technological Knowledge and Skills and of the overall shape of the matrix, we believe significantly greater credit value must be awarded to achievement standard 1.14 and /or additional achievement standards relating to the acquisition and application of basic practical skills must be written. We are willing to work with the Ministry of Education to develop appropriate content.

We are also concerned at the language used within the achievement standards. Whilst we acknowledge that standards must by necessity be written to accommodate a wide range of skills and contexts and not with a particular industry in mind, the standards are written in such a way that employers will not be able to recognize the language and therefore will find it very difficult to identify the Technology curriculum as an appropriate pathway to employment.

- 2) We strongly advise the Ministry to reconsider the language within the achievement standards and to more explicitly reference the intended context (i.e. the acquiring of practical skills and knowledge that provide a pathway to employment within industry).

## Appendix Two

### Submission from the Boating Industry Organisation

#### Design and Visual Communication

The standards that comprise the seven L1 Graphics standards that were developed in 2009.

We would agree with the Title “Design and Visual Communication” as proposed as an appropriate /meaningful category name to be included in the matrix.

#### Construction and Mechanical Technologies

Skills and knowledge in construction are examples associated with procedures which involve a combination of techniques: dovetail jointing in wood, (measure, mark, saw, chisel); safe edging in metal, (measure, scribe or snip, fold). Approaching assessment through scrutiny of procedures will accommodate combinations of techniques but not preclude individual techniques.

The volume of material-specific techniques involved in construction programmes Should not only encompass all existing disciplines but should accommodate future trends i.e. composites and all of their derivatives. The following four groupings are representative of the essential components of any construction practice:

- Measuring/pattern making. This encompasses drawing interpretation through to setting out in readiness for the next element
- Sizing/shaping/forming. The preparation of components or pieces in readiness for assembly or joining
- Joining/assembly. The procedures in bringing components or parts together
- Finishing. Preparation of surfaces or finished products for aesthetic or functional performance.

It is envisaged that capability in each of these four elements is a requirement of the standards. This will maintain high standards of knowledge and skill while allowing flexibility in application. The requirement for robust specifications in the skill standard should provide a mechanism for national benchmarking while accommodating local flexibility. The direct connection between working drawings, patterns, specifications and a constructed item are seen as critical by those providing future learning opportunities to school leavers. Requiring a standard of specifications sets a benchmark for the quality of the item and the range of procedures to be undertaken.

#### Safety

Safety is seen as a core component in all work in of these subjects. Industry has very robust systems of evaluating and endorsing safe practices, and therefore safety has to be embedded as a clear expectation in any of these achievement standards.

#### Testing and trialling

The nature of testing as it relates to skills and knowledge of constructing. Our concern is students would be distracted into testing methods or unrelated processes to construction knowledge. This should be limited to quality programmes in Technology, through higher level future development.

## Appendix Three



# Submission on the Alignment of NCEA Standards- Technology Level 1 Consultation

ETITO May 2010

ETITO is the industry training organisation responsible for setting skills standards for the Electrotechnology and Telecommunications industry sectors in NZ. One of our statutory responsibilities is to provide skills leadership for this industry. This includes appropriate and timely provision for the promotion of career pathways in the sector to secondary schools, so that students may be encouraged to enter careers in these nationally important sectors of our economy and are properly equipped with information to make decisions around suitable study paths.

ETITO's strategy here is called 'ETITO in Schools' and includes the effective Bright Sparks Programme, as well as the National Certificate in Electronics Technology (NCET), Level 2 and Level 3, programmes based on which involve over 2000 students annually. The NCET has been available as a timetabled subject in schools for over a decade and students who have benefited from this foundational course have study have been shown to successfully enter a wide range of tertiary study programmes in electrotechnology at Certificate, Diploma and Degree Level.

ETITO has a clear interest in the secondary school space in this respect. With the full implementation of the new NZ Curriculum in February of this year, the dynamic of this space is changing rapidly. Endorsement of NCEA (and from 2011, 'course endorsement'), the re-introduction of Scholarship and the Alignment of Standards project has highlighted the need for clear structures to be in place so that all students have the opportunity to enter the tertiary pathways that lead to hi-tech industry careers. Academically inclined students should not be disadvantaged in this regard and forced to avoid courses at school because they do not offer, for example, the option of endorsement.

It has therefore been of great significance that the Ministry have developed new draft Achievement Standards under Specialist Categories of Technology to recognise the knowledge and skills present in practically-oriented areas of learning relevant to the industries that ITOs represent. This will, for the first time, permit the specialist skills critical to our hi-tech companies to be formally recognised within a mainstream Curriculum area and courses designed that will be accessible to all students. ETITO applauds this initiative and is keen to work alongside the Ministry in the school space to advise on teaching and learning, as well as the design of assessment programmes for Electronics. In the new Curriculum environment, where courses (rather than subjects with national prescriptions) are recognised, it is encouraging to note that assessment standards, whether they be industry unit standards, or Curriculum based achievement standards, are afforded equal status.

**For school-industry (with tertiary study the usual intermediate step between the two) transition pathways to be viable, it is critical that industry standards have that status and retain their independence in the secondary space.**

ETITO's communities of interest are varied, from Science to Technology to Digital Technologies based teachers and students. We have formed strong relationships within each of these communities, whose needs differ considerably. Generally, we applaud the new draft achievement standards, which have the

potential to form a strong glue between these communities. There is the possibility of not only greater coherency in the way Electronics is managed, delivered and assessed in schools, and greater regard for it, but also a real chance for growth of the area to schools which have until now not offered courses. ETITO intends to maintain and extend its industry leadership role in this new environment and support other ITOs' and Ministry initiatives in this area.

We offer some directed comments below.

#### Comments on the Matrix

The **matrix** is a useful tool in understanding the relationship of the generic to the subject specific (the 'specialist') standards. The layout of the matrix is clear and the structure is logical. It appears to be a useful tool for helping teachers design assessment programmes around their teaching and learning programmes, especially those programmes developed with course endorsement in mind. The detail behind the titles is necessarily sketchy- this has to be determined by looking at the standards themselves.

#### Comments on the Standards

##### 1. The generic standards-

- **1.1-1.9:**

These have been devolved from the current 90xxx series of generic achievement standards on the Framework. They appear to be much more useable than their predecessors and ETITO has heard much positive comment from teachers to this effect. **As it is certain that the assessment of Electronics courses will universally involve a mix of generic as well as specialised standards, it would have been good to have been able to comment on these new draft standards**, not only the ones at Level 1, but at Level 2 and Level 3 as well.

- **1.5-1.7:**

These standards will be of particular interest to those designing an assessment programme in an Electronics programme context, partly because course endorsement criteria include an external assessment requirement and these standards are to be externally assessed. It is not completely clear from reading standards 1.5 and 1.6 (1.7 is straightforward) whether these can be adapted to an electronics context. Electronics 'materials' might be taken to mean 'semiconductor materials' and 'products', 'components'. 'Modelling' could be interpreted as simulation (for software) and prototyping (for hardware). No doubt this will be expounded in the Teaching and Learning Guides. This clarification will determine to how useful these standards will be in Electronics.

It is unlikely that the other generic standards (1.10-1.13) will be useful in an Electronics-based programme.

##### 2. The specialist standards-

These standards have been developed from defined Bodies of Knowledge, which are the foundation documents for the disciplines they represent. The development of these standards represents a huge leap forward for the status and future uptake of areas such as Electronics. ETITO applauds the development of specialist standards as a timely and very welcome initiative.

Here it is worth mentioning that we have detected some concern in our discussions with teachers around the **specialised, but not always intuitive or consistent** terminology used by the draft achievement standards, which is often quite different to that used in unit standards. This may be a consequence of the separate development of the NQF and NCEA frameworks, but it is potentially confusing to those who are not familiar with the 'lingo'- we

refer here in particular to industry stakeholders. ETITO fully support the option of including both unit and achievement standards in an assessment programme and it is important that the terminology used has consistent meaning across the board. NZQA will and should have a key role here in ensuring consistency of language.

**This is something all SSBs need to be aware of, if they are developing industry standards that are likely also to have usage in the secondary school space.**

The information and definitions provided in the new draft achievement standards represent a great improvement in clarity over previous versions. The examples given that illustrate what is expected at each grade level are helpful.

The differentiation between grade levels is generally consistent across each type ('understanding', 'planning' and 'doing' types) of standard. However, **for achievement standard 1.33, having the descriptors 'advanced' and 'sophisticated' allied to the term 'basic' is confusing and possibly inappropriate.**

In the same standard the bullet-point **'obtains and uses input from a user' potentially rules out an electronics context here**, particularly when the input may come, not from a human 'user', but from the environment. We would suggest that an improvement might either be in the form of dropping the phrase altogether, or of defining 'user' to include the environment. As this is a standard that would be a natural fit with an electronics programme and therefore of great interest to the computing community in this respect, we would urge a rethink on the wording.

Comments on the Electronics standards

#### **Achievement standard 1.34**

Title- include the word 'basic', to be consistent with other Digital Technologies standard titles.

Definition 1- replace 'describing'/'analysing' in the first bullet point for each grade discriminator with 'applying'.

Definition 4- last bullet point. This needs rewording to clarify the meaning.

#### **Achievement standard 1.35**

This is an important standard for Electronics, as interfacing is a theme that permeates and is often unique to the discipline.

Definition 1-

Replace 'constructing a working model of the system' in the first two sections with 'testing a model of the system'.

Replace 'choosing appropriate interface hardware' in the Merit descriptor with 'choosing appropriate interface hardware from a selection'.

The Excellence criteria need a rethink. There is a lack of clarity and flow-on from the Achieved and Merit criteria.

#### **Achievement standard 1.36**

Explanatory Note 4 (from 'Contexts include' to 'Contexts may include') and Note 6 ('system' to 'systems').

Explanatory Note 5- delete 'using basic CAD software'. This is inappropriate at this level, students should be able to use freehand pen and etch.

There is a single Digital Infrastructure standard (1.37) at present and we understand another is being written – which will not be included in the consultation. We would be interested in this and in commenting on any further standards that may be developed for the matrix.

It would also seem appropriate once these new standards are bedded in at all Levels and the Teaching and Learning Guides are complete and have been tested, that the Bodies of Knowledge themselves be reviewed and aligned if necessary.

Thank you for the opportunity to comment on this ground-breaking development in the history of technology education, a development which has the potential to align industry objectives with those of the school curriculum in a way that has never been possible before.