



## **New Zealand Council of Engineering Deans**

Shelley Pope  
Policy Advisor  
PO Box 12 241  
Wellington  
policy@ipenz.org.nz  
[www.ipenz.org.nz](http://www.ipenz.org.nz)

# **SCHOOLS PLUS**

**SUBMISSION TO THE MINISTRY OF EDUCATION  
31 MAY 2008**

---

### **BACKGROUND TO IPENZ**

The Institution of Professional Engineers New Zealand (IPENZ) is the lead national professional body representing the engineering profession in New Zealand. It has approximately 10,500 Members, including a cross-section from engineering students to practising engineers to 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.

### **BACKGROUND TO NZCED**

The New Zealand Council of Engineering Deans (NZCED) consists of eight representatives, one from each of the institutions in New Zealand that offer four-year internationally accredited professional engineering degrees. They are co-operating in the delivery of engineering education and research.

## **EXECUTIVE SUMMARY**

This joint submission was prepared by Members of IPENZ, NZIFST, TENZ and NZCED, 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.

The above organisations thank the Ministry for the opportunity to comment on the development of *Schools Plus*.

Our organisations support the government’s intention to lift achievements for all students, as we agree that there is a problem in our education system in that it is inadvertently disenfranchising many students.

We consider that this is largely due to a breakdown of “learning by doing” in secondary school education and a lack of contemporary relevance in curriculum delivery, particularly in mathematics and science.

We consider that the current issues can largely be overcome by adopting a “learning by doing” approach to the *Schools Plus* initiative, and moving away from the focus on examination success, which has led to an environment where students strive purely to pass assessments.

As such, consideration should be given to restructuring assessments in science and mathematics. We also strongly recommend that technology is split into three separate subjects at senior high school level.

We also note that success of educational initiatives, such as Futureintech, Techlink and the industry training organisation (ITO) programmes, is due to the fact that they motivate students by bringing real-life experiences into the school environment, and that they are also “learning by doing”.

We are concerned that the proposed *Schools Plus* policy may have some negative outcomes. These include too early subject specialisation by students, restricted future career paths and uninformed long-term decision making by students. Overspecialisation due to ITO programmes also needs to be avoided. We recommend that consideration be given to developing appropriate support mechanisms for students, who are required to make important, high-level decisions at an early age. Support and mentoring of students in the classroom environment has already proven to be successful.

We note that the successful implementation of *Schools Plus* will require a redevelopment of teacher education and professional development for secondary teachers, and also career advisors.

## **SUBMISSION**

We agree that there is a problem in our education system in that it is inadvertently disenfranchising many students.

In this submission we identify the specific issues that are contributing to the problem, and set out, in general terms, what we consider to be the necessary elements of an appropriate response based on our combined knowledge and experiences. In the following section are our responses to the specific questions in the *Schools Plus* discussion document.

## **LEARNING BY DOING**

There are many excellent aspects of the New Zealand education system, and those best aspects are characterised by the simple phrase: “learning by doing”.

Learning by doing is the essential method of our primary education system. This is evident in the primary classroom, which is full of student project work, the furniture set-up in the room itself is group-based and informal, and where the teacher acts as a facilitator. Diversity of learning methods is the norm, and development of independent learning skills is encouraged. In this style of education, children can take work home, involve their family, and the whole experience is highly participatory. In this environment strong relationships are formed between the teacher and individual students which lead to mentoring bonds that allow each child to be understood and supported.

Nevertheless we would not claim that every student is well-served by the primary education system. For example, those who experience a dysfunctional relationship (for whatever reason) with a teacher can drop behind, sometimes irreversibly so. We would also argue that sometimes cultural clash can impede learning. Learning the caucasian way is dominant, and there can be problems if the different learning styles and needs of Māori, Pasifika and Asian students are not understood and accepted by the teacher.

## **ISSUES WITH THE CURRENT SYSTEM**

As students progress through intermediate and high school and into tertiary study there is a withdrawal of learning by doing, and in our view this lies at the heart of the problem.

New Zealand’s secondary learning system is still based on the “British” system which was first implemented last century. The dominant feature of this is the timetable, by which students trip between rooms, and subject specialist teachers deliver from the front of the room, generally assuming synchronous learning behaviour by the students.

The focus is on examination success (and where the British system is still most dominant there is even resentment about having to assess for NCEA rather than just mark examination papers). This focus has led to an environment where students strive purely to pass assessments. There is a loss of focus on developing independent learning capability, technological literacy (t-literacy) and personal resilience to learn when unsupported.

Many curricula are still delivered in a dry manner that fails to use contemporary examples from commerce, industry and the day-to-day world outside the learning environment.

This style of teaching changes only towards the end of tertiary education, especially in postgraduate study, which reverts to the concept of learning by doing. Only at this belated stage does there appear to be acceptance of asynchronous learning, with diverse learning styles and modes of learning, and the classroom delivery no longer being dominant.

The physical classroom has not changed in decades in the secondary system, nor in the undergraduate part of the tertiary system. Learning is intended to be synchronous (all students get the same material in the same way at the same time), with the teacher as a dominant personality. Students move from one subject specialist to another, and lose the supportive mentoring environment of primary school as a result.

We also note that there are academically able students with learning difficulties who are currently placed in the everyday classroom – these students can become high achievers but need additional support to do so.

In addition, the teaching workforce, particularly in science, technology and mathematics, is ageing. The current workforce largely constitutes the same educators as two decades ago, and it has not responded well to the change in the learning styles of young people, or to increasingly diverse learning styles, not just between ethnicities, but the wide spread of independent learning skills from those who are e-literate to those who are less so.

## **IMPACTS OF EXISTING INTERVENTIONS**

Futureintech, a government-funded initiative of IPENZ, was set up to increase students' participation in science, engineering and technology education. In developing the delivery of this project, and considering international research and New Zealand experiences, it is apparent that the most important aspect is student motivation.

This motivation is lost by failure in assessments which are not accompanied by a support mechanism to overcome the poor learning experience. This motivation can be rekindled by bringing ambassadors (working young scientists, engineers and technologists) into the classroom to work alongside teachers in delivering the curricula. Those ambassadors work with students and show how their learning at school can be applied in the real world. This in itself can be enough to create or rekindle student motivation. Furthermore, the experience might be taken home and discussed with family, who then see the real world relevance, and are likely to be more encouraging of their children's education.

IPENZ also runs the Techlink project, which involves preparing curriculum support material, most often case studies for technology teachers. In our experience, the real world case studies work really well – we try to include a diversity that will appeal to a range of cultures. A teacher picking our case studies can then create a learning by doing experience in the classroom. Unfortunately this material is not widely used by the traditional "technical" teachers.

We note the entry of many ITOs into senior secondary schools. They claim success for their programmes, which are intended to give the students real-life motivating experiences. However, we question whether these programmes target the children most at need. We also question whether the ITO specialist programmes actually achieve much good, other than motivational value, as even trades employers say that the ability to problem solve, reason logically, be numerate, and communicate effectively are more important than any specialist skills that students pick up.

We also note that the TEC Gateway programme turns on the light for a number of young people. However, we note that these programmes only reach a small number of children who are likely to already have the motivation to learn, albeit at a lower achievement level. It should also be noted that such programmes are resource intensive.

The shared success of Futureintech, Techlink and the ITO programmes is that they motivate students by bringing real-life experiences into the school environment – they are all learning by doing. The difference between Futureintech and Techlink compared to the ITO programmes is that the former try to reinforce the curriculum, whereas the latter operates outside it. As such, the ITO programmes have the potential to be counterproductive because they are overly specific too early in a young person's education.

Māori and Pasifika students are no less bright than other ethnicities but are over-represented in the underachieving category. We note that their style of learning is currently insufficiently catered for, particularly the need for participation and understanding by family, and also the wider support of their communities. There is

evidence from the University of Auckland Engineering School, and also the activities of the South Pacific Indigenous Engineering Students, that when Māori and Pasifika students enrol in engineering tertiary study, provided they get support to help them transition to the style of learning that dominates universities, they can and do succeed. That support needs to only last a year or so – enough to help them find a way to learn in spite of the environment not being their most favoured mode of learning.

## **ELEMENTS NECESSARY FOR SUCCESSFUL TEACHING**

As outlined above, we consider that the withdrawal of learning by doing with a supportive mentoring system is the biggest single issue that has led to a disenfranchised low-achieving student group.

In our view, the following changes (in the parts of the school system for which we are sufficiently knowledgeable to comment) are required if these problems are to be addressed:

- Moving focus away from the content of the curricula (which in our view have been sufficiently researched and worked over), and instead focusing on assessment, resource materials, modes of delivery and teaching workforce development. We would also recommend against too much local diversity – that makes things worse not better.
- Revising the NCEA Levels 1-3 achievement standards in science and maths to remove the “marking paradigm” and replace it by assessing competence (the ability to do things) with a clear need to relate the learning to practical experiences. This most affects calculus and physics. Biology and statistics are probably the most worldly.
- Rethinking the way technology is streamed and assessed in senior secondary school. This should include the deliberate creation of three subjects in Years 12 and 13: “ICT and electronics”; “manufacturing and construction”; and “processing” (food and biotechnology). The present internal standards for technological practice need to be retained but registered in all three subjects.

When well-delivered in senior school, technological practice is learning by doing. However, if there is a weakness in technological practice delivery it is that less able students might be discouraged if the “doing” stage comes well after planning. For this reason, we support the need to also have “skill” based achievement standards (based on a combination of quantitative problem solving and demonstration of manual dexterities to implement the problem result) and knowledge-based external standards in the three subjects. This will create learning experiences that are relevant and motivating, but not overly specialised, for young people whose probable career destination is in a trade or technical employment.

- Substantial investment in workforce education and re-education to support these changes. The traditional “technical” teachers need to be made comfortable to deliver the new technology subjects. Maths and science teachers need to be comfortable to move away from the present abstract methods of delivery towards real-life examples, and integration of commercial examples in their teaching programmes.
- Active recruitment of engineers (ideally holding a three-year degree such as BEngTech plus some practical experience), and technologists (holding an applied degree) as physics, maths and technology teachers.
- Rethinking the physical structure of classrooms and the timetable to better support student learning in secondary schools. At-risk students may need more flexible time to undertake learning by doing studies in the technology curriculum, with access to

the three standard workrooms (electronics/ICT lab, dry lab for manufacturing/construction, and wet lab for processing).

- Overlay of a student mentoring system with delivery by specialist subject teachers in school – schools need to be resourced for this.
- Developing nationally consistent entry requirements for tertiary study – small and relatively unimportant differences in entry requirements between providers confuse and limit students unnecessarily. This is a major concern, and if it was resolved the plethora of literature found in every careers adviser’s room could be vastly reduced.

We do not support active participation by local businesses in setting educational objectives and programme requirements in schools. In our view, although well-intended, the people involved are unlikely to be qualified to take a sufficiently long-term view or to place students’ interests first. We acknowledge that these people are frustrated and lack confidence in what schools are delivering. However, the answer is to get the overall New Zealand schooling system functioning effectively by the means above. Business will then have confidence.

Whilst our organisations generally support the government’s intentions to lift achievements for all students, we are concerned that the measures put in place do not lead to too early subject specialisation by students, restricting future career paths, or uninformed long-term decision-making by students.

Research has demonstrated the importance of ensuring that students receive a broader, general education. Such an education is essential to:

- avoid channelling students too early
- encourage continued learning
- allow future comprehensive and balanced multidisciplinary training

For similar reasons we believe it is important to offer different *levels* within subjects in post-compulsory education in secondary school, as well as specialised subjects within curriculum areas.

## **SPECIFIC COMMENTS ON THE DISCUSSION DOCUMENT**

Following are our responses to some of the specific questions in the discussion document.

### **1. *What key factors have the greatest impact on students’ participation, engagement and achievement in school?***

The anecdotal and other evidence suggests to us that the concept of learning by doing which has been enshrined in our primary education system for many years has been successful. Disengagement by students occurs when the students find subjects difficult, the subject matter is presented in uninteresting ways, or when linkages to their own previous learning experiences or potential applications are not demonstrated. Disengagement also occurs when bad results in assessments are achieved and not followed up with what the student would regard as do-able remedial learning pathways. Showing the benefits of learning to students with reinforcement to their caregivers assists engagement and continued participation.

The role of good teachers cannot be underestimated. It is vital that teachers have the necessary competence and confidence to successfully teach. The value of the teaching profession also needs to be recognised, possibly through public education.

3. *How can the school system be made more responsive to Maori students and increase participation and achievement?*

As outlined previously, relationships between teachers and students are important for Māori students and consideration should be given to ways of facilitating the development of such relationships. In technology subjects, experience in the tertiary sector suggests that when entering a higher educational sector Māori students respond to mentoring that develops their own confidence in their ability. Once they can demonstrate sufficient success to themselves they tend to carry on succeeding. The same may be true at other transitions in the education system.

We note that some secondary schools are involved with the Te Kotahitanga project which focuses on raising Māori achievement, including through relationship building. Consideration should be given to evaluating the success of this project, and if favourable, extending such a project to all schools.

4. *How can the sector increase engagement and achievement for Pasifika students?*

Our best information is that the type of mentoring that assists Māori students is also successful for Pasifika students.

10. *How can tertiary education organisations and schools work together to offer high quality and relevant learning opportunities for senior secondary students?*

Employers most value young people who are independent learners, with technological literacy (t-literacy), the ability to reason, to communicate and be sufficiently numerate. Specialised knowledge related to employment is less important to them. The importance of exposing students to specialised knowledge whilst at school is for its motivational value to keep students inspired and interested. Therefore the senior secondary school system and the tertiary system need to work together to create clear pathways into broad career disciplines whereby students with particular vocational interests get a taste of a specialism, but are motivated to continue and succeed in an agreed suite of more generalist subjects. It is important to make these pathways simple and clear, and avoid over-splintering the senior secondary school offering.

In addition, the tertiary sector can assist the secondary sector by acting as a resource. Tertiary Education Organisations (TEOs) can, and to some extent already do, work with high schools in the following areas:

- training, retraining, educating and informing teachers
- providing extension opportunities, both equipment and curriculum related, for whole classes as well as individual students
- improving flexibility in terms of entry requirements, pathways and part-time enrolments
- Providing bridging programmes for students without university entry qualification
- providing relevance to students through industry connections and career promotions

We also note that academics are engaging with school students through programmes such as CREST, neighbourhood engineers, Futureintech and engineering challenges.

11. *How can tertiary education organisations and schools work together and best support young people in making good decisions about their options in education? How will they jointly monitor student outcomes?*

We note that TEOs already organise open days, engage with science and technology teachers, and stage careers advisors days. However, we need to eliminate small regional differences in entry requirements for particular disciplines so that students are not disadvantaged for minor technical reasons. Each major discipline should agree on a suite of school subjects it recommends, thereby simplifying subject choices for students and making it easier for schools. With clearer definition of pathways, the focus can then be on career choice rather than on tertiary course of study.

We also note that some programmes can improve working relationships, for example *Smales Farms 21st Century Careers Pathway programme* or *USFIRST* (For Inspiration and Recognition of Science and Technology), a United States programme that is coming to New Zealand.

We consider that a personal education plan for students entering secondary schools may be helpful. Monitoring such plans should provide feedback on the lasting results of certain initiatives. We also note that purpose-designed questionnaires issued at regular intervals are always useful for monitoring purposes.

12. *From the tertiary perspective, what are the critical factors in establishing and strengthening partnerships with schools, families, whanau and community organisations?*

We consider that the two most critical factors are recognition of the validity of these activities and funding. Recognition, in terms of considering these activities as evidence for promoting individual academics and for appropriate inclusion in the PBRF process, even as a part-time involvement. Funding is important because these activities need resources.

The critical factor is time and hence cost. The core business is delivering tertiary education and research, and if there is no funding specifically for working with secondary schools the TEOs may choose not to.

From the perspective of universities, a major motivation for interacting with schools (and other organisations) is essentially marketing to ensure enough students with the right backgrounds are available to enter university.

13. *How can families, whanau, iwi and communities best support young people to participate and achieve in education?*

Public education campaigns aimed at parents and caregivers may dispel any misconceptions relating to specific careers and the current job market. Such a campaign might also restore value in education and the role of teachers.

14. *What types of social services do young people need to overcome barriers to participation in education?*

As set out earlier, we consider that mentoring and the development of strong relationships between teachers and students is important to students, particularly Māori students.

15. *What services and assistance would help families, whanau, iwi and communities support their young people to continue in education and training?*

As above.

16. *Which students are likely to need additional support to remain in education, skills or structured learning? What support should they get, and from whom?*

Additional support should be targeted at students who are not achieving, or who are achieving but are demotivated,

We would also like to see research undertaken to determine which teaching initiatives or other programmes are the most successful in reaching potentially low-achieving students.

17. *What are some good examples of schools and non-government organisations working together for young people?*

As set out above, Futureintech has been very successful in this area, as Techlink has been in supporting teachers (we also note that the Techlink website has increased in popularity in recent times).

- *Other comments*

We note that some high achieving individuals may successfully complete their secondary education at age 17 and want a gap year before tertiary study – it seems inappropriate to penalise them. Consideration should be given to waiving the age requirement if a certain level of achievement was reached at an earlier age.