

IN THIS ISSUE ...

... we look at *Engineering Barriers and Responses* a research report which explores the barriers to the uptake of engineering tertiary programmes in ITPs, and some possible responses.

This research was commissioned by the regional and metro ITPs involved in the Engineering E2E programme, and particular thanks is due to the Wintec team who liaised with Research First.

Neville Jordan  
Chair, Engineering E2E Steering Group

UPCOMING ACTIVITIES ...

ALTERNATIVE ENGINEERING PATHWAYS PROFESSIONAL FORUM

This forum, run by Ako Aotearoa for engineering educators, will be held at the Amora Hotel in Wellington on Monday 24 November (9am-4:30pm) and Tuesday 25 November (9am-1:45pm, followed by lunch).

Topics for discussion include:

- Current entry requirements and processes for students planning to take an engineering qualification
- Barriers and enablers to implementing change
- Supporting implementation

NATIONAL EDUCATION PLAN REVIEW

In 2010, IPENZ published the National Engineering Education Plan, which highlighted likely future demand for engineers. The engineering numbers were generated as a result of analysis of OECD data, DOL and Ministry of Education statistics and, importantly, feedback from the industry and tertiary sectors.

TEC and IPENZ plan to review this data and are convening a reference group of industry and tertiary representatives which will contribute to updating these numbers so that they can be used to inform engineering education funding decisions going forward.

# Research sheds light on barriers to choosing engineering as a career

In October, Research First’s *Engineering Barriers and Responses* was published and shows some of the significant challenges that exist in encouraging more students to study engineering at institutes of technology and polytechnics (ITPs).

The research was based on a review of the literature, a series of informal scoping interviews, and meetings with 14 focus groups in Auckland, Hamilton, Nelson and Blenheim. The challenges identified in the report are both systemic and deep-seated. For engineering in general, they include a lack of understanding of what a career in engineering means and barriers to studying engineering through school. For ITPs, the challenges are particularly significant. The report shows that students interested in studying engineering at the tertiary level show a clear preference for studying at a university, and also that the BEngTech may not be meeting current market demand.

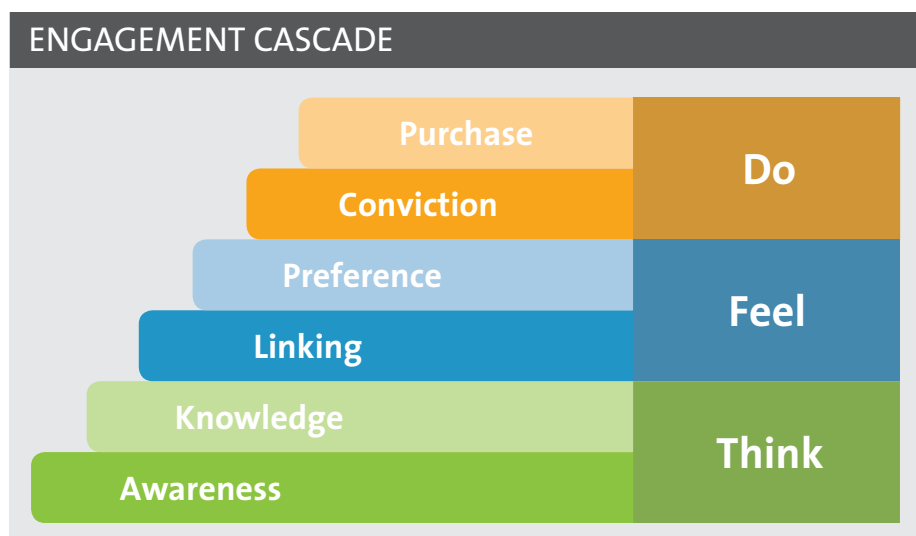
## DEVELOPING A MARKETING RESPONSE

The marketing response required to address these challenges includes:

- Engagement – generating greater interest in engineering as a career.
- Product Development – converting this interest into study intentions and positioning ITPs as a preference within these study intentions.

### Engagement

For engagement, the research indicates the marketing response needs to follow the classic engagement cascade:



## Product development

The second part of the response focuses on product development and examines whether or not BEngTech as it is currently offered is what the market seeks. The research tests assumptions about both supply and demand and proposes a Graduate Diploma in Engineering Technology could offer an alternative for both industry and students.

### THE 'LEAKY PIPELINE'

The research suggests that the metaphor of a 'leaky pipeline' can be applied to the loss of children from the potential engineering student market (Figure 3.1). There are a number of leaks in this pipeline; starting in primary school and continuing at secondary school.

Students looking to study engineering at a tertiary level need to have NCEA in Physics and Calculus at Level 3. But there are a number of leak points which reduce this market considerably. Students were clear that teachers have a key role to play in nurturing or stifling interest in STEM subjects.

Students' perceptions of their ability can also lead them to narrow curriculum choices. Again, teachers and learning experiences can influence students toward seeing themselves as being good or not good in a particular area.

A key 'leak' occurs in secondary school, when teenagers select which subjects to study through NCEA. All those who discard physics or mathematics automatically disqualify themselves from bachelor-level engineering study.

Similarly, maths teaching is seen to lack real world relevance, making it seem more esoteric and complex than it is – again acting as a leak point for students.

## HOW IS ENGINEERING PERCEIVED?

The focus groups reconfirmed that engineering is not well understood amongst many employers. Not only is there confusion about what engineers do, but there's also a lack of understanding about how wide the range of opportunities available in the field is.

The findings also suggest that engineering needs better promotion as a study option. Even among students who studied STEM subjects throughout secondary school, many talked about how other career pathways were "better lit". As students noted, pathways into medicine or science research, for example, were easy to understand and visualise.

Students and parents also thought this meant STEM courses do not enable independent enquiry, or nurture curiosity about STEM subjects.

This and a lack of knowledge about what makes a good engineer, is creating another leak point.

The research also shows that parents, students and teachers believe in the need for good NCEA marks in science and mathematics to study engineering.

University-level engineering study is seen as difficult by both potential students, teachers, and parents – they are clear that study requires hard work, discipline and commitment. Engineering programmes have high entry requirements, limited admission, and involve a large amount of work.

The culmination of these leaks is that the market for tertiary engineering study is much reduced.

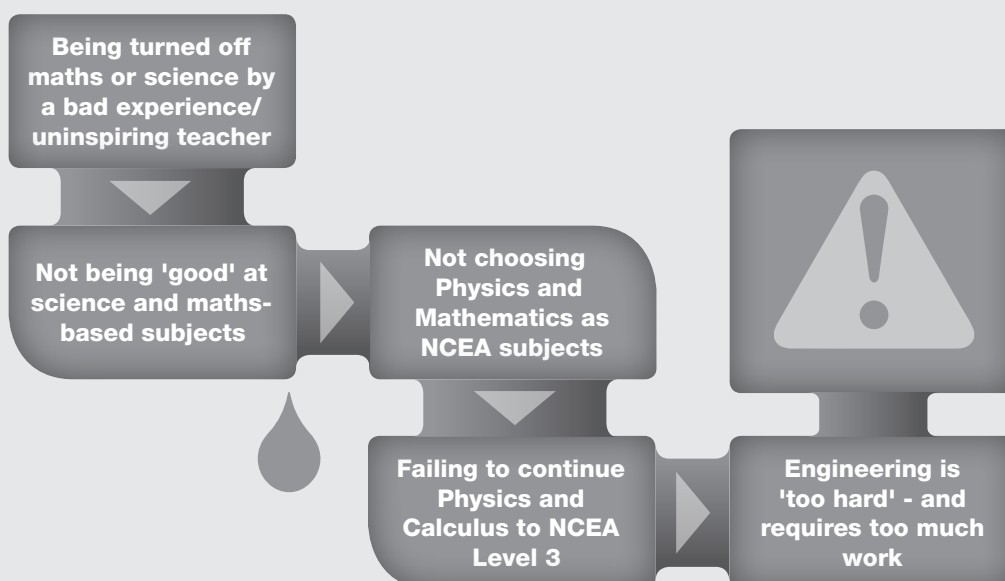
### NCEA Technology is another barrier to entry

While technology classes at secondary school seem like a natural part of the engineering pipeline, in reality it creates more barriers to tertiary engineering study.

While the class may be intended for those interested in degree-level engineering, it is not necessarily seen this way by students or parents.

Additionally, if assessment is by unit standards, the class is even more unattractive as university preparation.

## 3.1 The 'Leaky Pipeline' to Engineering



## THE UNIQUE CHALLENGES TO ITPS

There seemed a general lack of clarity, even within the engineering industry, about the various engineering disciplines and their possible vocational outcomes, and of the roles of a technologist. Researchers found, for example, that students who study engineering are often influenced by their family or family friends who are engineers themselves, who tend to present their view of engineering and in general are unaware of pathways into engineering beyond their own experience – and for many that means a Bachelor of Engineering programme.

The research also notes that many parents also do not understand what ITPs offer in terms of engineering pathways, and therefore may not encourage more academically-able children toward ITP degrees.

The study found that employers acknowledged that ITPs are doing a good job of training. A number of employers interviewed for this research were enthusiastic about ITP graduates and felt that an ITP qualification was good training for a wide range of positions in engineering.

The challenge for ITPs will be to improve understanding and raise awareness of the programmes they offer. One suggestion is through celebrating the success of students who have gone through their programmes.

## COLLABORATION KEY TO SUCCESS

The research highlighted the need for a system-wide approach to encourage more students into engineering, built on collaboration. The current system, it found, is built on competition and is based on the needs of an institution instead of the needs of the industry. For instance, students who fail to complete their first year of engineering, who might be interested in BEngTech, are instead channelled by universities into science or ICT programmes.

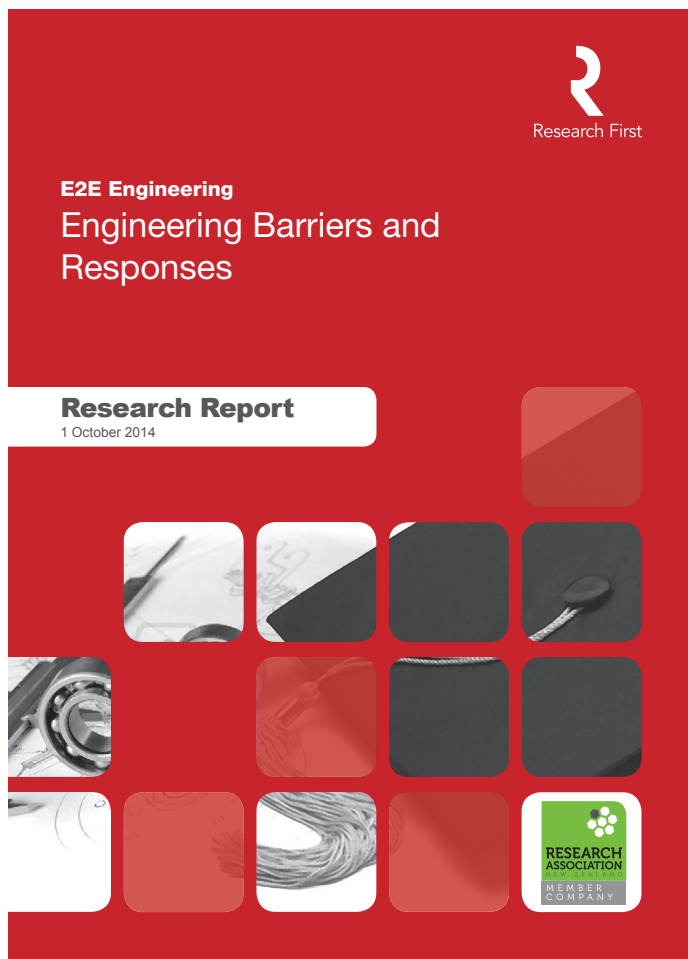
## MAKING ENGINEERING MORE ATTRACTIVE

The first challenge is to make engineering more attractive and to ensure it is better understood, particularly amongst students and their influencers. Addressing this challenge will improve the overall pipeline and make it possible to address the more specific needs of ITPs.

### ENCOURAGING FEMALE STUDENTS

As the research suggests, the easiest way to increase the market for engineering students in general (and ITPs in particular) is to make a special effort to recruit female students to the subject.

While gains have been made in recent years, it is clear that projected demand for engineers could be met if participation rates among female students were raised to those for male students.



The report suggests six ways to reposition engineering:

- Distinguish the different meanings of engineer. Make it clear there are middle-ground career paths and engineering includes a wide range of roles.
- Emphasise the need for problem-solving and creative thinking.
- Show how engineering is the instrument of social change and connect it to real world applications.
- Use role models.
- Connect with industry and demonstrate employment possibilities.
- Focus on the international relevance of New Zealand qualifications.

“This report raises some potentially contentious issues which need further examination and discussion amongst the various stakeholders,” says the Chair of the Engineering E2E Steering Group Neville Jordan.

“It therefore provides a valuable springboard for further discussion amongst our educational and industry groups as we all look to raise the profile of engineering as a major contributor to New Zealand’s social and economic development and a challenging, fulfilling choice of career.”

[READ THE FULL REPORT >>>](#)

IF YOU HAVE ANY ENQUIRIES, PLEASE CONTACT US: ENGINEERING E2E PROGRAMME TEAM

Tertiary Education Commission Te Amorangi Mātauranga Matua  
Phone 04 462 5256 Email [engineeringe2e@tec.govt.nz](mailto:engineeringe2e@tec.govt.nz)  
[www.engineeringe2e.org.nz](http://www.engineeringe2e.org.nz)