

Micro-credentials in engineering education

Background for the NZBED

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Every effort is made to provide accurate and factual content. The author, however, cannot accept responsibility for any inadvertent errors or omissions that may occur.

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The primary author is responsible for any omissions or errors of interpretation.



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Purpose

The purpose of this paper is to update the Quality Assurance Committee (QAC) of the New Zealand Board of Engineering Diplomas (NZBED) on progress with pilots of micro-credentials in engineering education.

Background

In 2017, the New Zealand Qualifications Authority (NZQA) announced three pilots of micro-credentials (NZQA, 2017). These pilots were part of the response to the report of the New Zealand Productivity Commission into tertiary education (NZPC, 2017) and aimed to promote student mobility through micro-credentials to “...credential all learner formal and informal learning leading to less duplication” (Goldsmith, 2017).

The current Government has continued support for micro-credentials arguing that they can promote lifelong learning, helping people to update their skills across multiple careers and adapt to the changing nature of work (NZ Labour Party, 2016), (Hipkins, 2018).

NZQA announced changes to the qualifications system to incorporate micro-credentials in August 2018 following a period of consultation. These changes included a definition of micro-credentials (see sidebar), updated ‘Training Scheme Rules’ and ‘Consent to Assess Rules’, a new register and an equivalence process for international organisations and local organisations that are not tertiary education organisations (TEOs).

The new rules provide a way for industry training organisations (ITOs), other TEOs, and employers, industry, community and iwi groups to offer micro-credentials. Applications need to provide information on their aims, evidence of stakeholder support and an unmet need, any assessment standards that will be assessed, and design, delivery, resources, regulations and assessment and moderation practices (NZQA, 2018a). Thirty-one micro-credentials were registered by January 2019 (NZQA, 2019).

The Tertiary Education Commission (TEC) is exploring how to fund micro-credentials. The TEC will rely on NZQA accreditation as a signal of end-user acceptance (TEC, 2018b) (or an equivalent in the case of the Industry Training Fund (TEC, 2018a)), expect most are privately funded (TEC, 2018c), link public funding to investment priorities (primary industries, innovation skills and Maori and Pasifika parity) and cap funding for micro-credentials at 5% (by value) of any TEO’s provision (Author, 2018).

The TEC will be concerned to avoid displacing the obligations of employers to provide workplace-specific training (such as the operation of particular machinery or equipment) or meet regulatory obligations (such as health and safety training), and a return to the problems with the monitoring of tertiary funding and performance during the 1990s and early 2000s (Smyth, 2018). The TEC may seek to achieve other goals through its investment decisions by funding micro-credentials that cater to priority learner groups even where the benefits are largely captured by the private sector (TEC, 2018d) and support wider policy goals for the vocational education and training sector (TEC, 2018e).

Not all smaller packages of learning will be recognised as micro-credentials. There is already considerable flexibility in the tertiary education system including the use of Limited Credit Programmes, Training Schemes,

NZQA Definition

A micro-credential certifies achievement of a coherent set of skills and knowledge; and is specified by a statement of purpose, learning outcomes, and strong evidence of need by industry, employers, iwi and/or the community.

They are smaller than a qualification and focus on skill development opportunities not currently catered for in the tertiary education system.

At a minimum, micro-credentials will be subject to the same requirements as training schemes or assessment standards and will also be required to:

- be 5–40 credits in size
- have strong evidence of need from employers, industry and/or community
- not duplicate current quality assured learning approved by NZQA
- be reviewed annually to confirm they continue to meet their intended purpose

Supplementary Credit Programmes, standalone and curated packages of assessment standards, MooCs and recognition of prior learning and current competency.

Outside of the tertiary education system in New Zealand there are a variety of models including 'nano-degrees', 'micro-degrees', 'MicroMasters credentials', 'certificates', 'badges', 'ratings', 'licenses', 'endorsements', 'memberships', or 'specialisations' (Milligan & Kennedy, 2017).

Key points of divergence from the NZQA rules include micro-credentials that involve fewer credits than the current minimum, the repurposing and repackaging of current assessment standards, and an explicit aim of contributing to the achievement of larger programmes.

Developments in engineering education

Concurrent with the NZQA pilots, Engineering e2e published a report in May 2017 that explored the potential for micro-credentials to improve the uptake of the New Zealand Diploma of Engineering (NZDE) and Bachelor of Engineering Technology (BEngTech) (Mischewski, Micro-credentials - A model for engineering education?, 2017).

The NZDE is a well-regarded, internationally recognised qualification. Graduate employment rates generally exceed those for the BE/BE(Hons) programmes and median earnings after five years range by provider between \$65,620 and \$74,539.

There were 2,365 students enrolled in the NZDE in 2017, an increase of 34% or 600 learners since 2013. The growth in learners predominantly reflects growth in international learners (up 143.7%) rather than domestic learners (up 7.4%). NZDE learners tend to be male (90.7%), non-Maori, non-Pasifika (84.0%) and aged 18-29 years (78.8%).

Along with some other vocational education and training, providers of the NZDE face persistent challenges generating economies of scale. Negative perceptions of non-university engineering education impact on number and quality of learners recruited into the NZDE which in turn constrains the level of available resourcing and affects public and employer perceptions of graduates (Mischewski, Micro-credentials - A model for engineering education?, 2017). At a course level, just 36 courses enrolled in by NZDE learners account for 25% of all enrolments, and the median number of enrolments for an NZDE course is equivalent to 1.4 EFTS (or 11 learners) (Mischewski & Edmonds, 2019).

Engineering e2e engaged with engineering education providers, employers of engineers, professional associations and policy agencies on the potential for micro-credentials as part of engineering education. This engagement led to the identification of feasibility studies that looked at whether micro-credentials were likely to be viable for aspects of the engineering workforce development pipeline. In October 2017, the Engineering e2e Steering Group recommended to the TEC that eight feasibility studies be funded.

The Engineering e2e Steering Group had taken a more liberal view of micro-credentials (see sidebar) than NZQA reflecting a desire to maximise uptake of innovative practice in the engineering education system.

The reports of the eight feasibility studies were reviewed by the Engineering e2e Steering Group, and five were considered suitable for pilot funding by the TEC. These pilots are detailed in

**Engineering e2e
working definition**

- Micro-credentials are packages of learning designed to meet specific learner needs.
- They are generally smaller than conventional qualifications and are emerging as an important part of the mix of alternative credentials.
- They validate skills and learning linked to specific workforce demands.

Appendix one – Pilots of micro-credentials funded through Engineering e2e. The TEC is supporting other innovative delivery arrangements through targeted funding and sees the engineering micro-credentials as potentially making a significant contribution to the shift toward more flexible, learner-centred provision.

Not all of the pilots will necessarily involve the delivery of teaching and learning that meets the NZQA definition of micro-credentials. The choice to align with the NZQA will be one for the relevant organisations informed by whether they wish to seek public funding, the perceived value of NZQA accreditation (as a micro-credential) and the needs of learners.

Our understanding of the implications for NZDE

Three (MIT, Unitec and Otago) of the five pilots involve teaching and learning leading to completion of the NZDE. Only two (MIT and Otago) are likely to seek recognition as a micro-credential from NZQA (see Table 1).

Table 1: Pilots, micro-credentials and the NZDE

Pilot	NZQA recognition as a micro-credential	Public funding sought	Leads to the NZDE
Professional development (NZEEA)	Possibly	N	N
Pasifika pathway (MIT)	Y	Y	Y
Alternative pathway (Unitec)	N	Y	Y
Graduate attributes (Otago)	Y	Y	Y
I.AM (IPWEA)	N	N	N

The three pilots with implications for the NZDE are:

- **Augmenting of NCEA assessment standards (MIT)** with micro-credentials that lead to the achievement of selected courses as part of the NZDE. MIT is likely to seek NZQA recognition as a micro-credential given the opportunity to tightly integrate with the secondary schooling system. Public funding will be sought for the relevant teaching and learning. This pilot has implications for the NZDE as it provides a pathway for learners to achieve one or more year one courses.
- **Alternative pathway for the completion of the NZDE (Civil) course Highway Engineering 1 (Unitec)** for people in employment through a set of five competency-based micro-credentials equivalent to three credits each. Unitec is not likely to seek NZQA recognition of the individual components of the course as micro-credentials given the credit minima. The pilot involves a novel, highly flexible competency recognition arrangement for an existing NZDE course. Public funding will be sought for the teaching and learning. The full benefits of this pilot will be realised through mutual recognition of the potential to cross-credit the micro-credentials to the Highway Engineering course.
- **Recognition of the attainment of graduate attributes for the NZDE (Otago).** The pilot involves the development of recognition of prior learning/assessment of prior learning pathways that allow candidates for the NZDE to demonstrate the attainment of attributes required of graduates rather than specific courses. Otago is likely to seek NZQA recognition of micro-credentials. Public funding will be sought for the teaching and learning. This pilot will involve engaging with NZBED to develop a robust system of RPL which reflects and establishes national standards for such a system.

The two pilots with no direct implications for the NZDE are:

- **Continuous professional development (EEA)** for practising engineers arranged by the Electricity Engineers Association. EEA may seek NZQA recognition as a micro-credential given the perceived value of credit and NQF level equivalence to some professional engineers. The teaching and learning will be delivered on a full-cost recovery basis. This pilot has no direct implications for the NZDE.
- **Badging of competencies required of public works engineers (IPWEA).** IPWEA is not expected to seek NZQA recognition as a micro-credential as the individual badges involve small packages of learning equivalent to 1 or 2 credits. The teaching and learning will be delivered on a full-cost recovery basis. This pilot has no direct implications for the NZDE.

Some key deadlines for the pilots in their contracts with the TEC that have implications for the planning cycle of the committees include that:

- Unitec staff are expected to complete the development of their systems for the alternative pathway for the Highway Engineering course by 8 March 2019;
- Otago staff are expected to have obtained NZBED ratification of the graduate capability pathways by 12 April 2019; and
- MIT staff are expected to have reported on learner awareness of the pilot by 28 June 2019.

Central role of the NZBED

The NZBED is central to the success of engineering education at the diploma level in New Zealand. The unified development and governance of the NZDE and NZDEP is a model for collaborative practice in qualification development and governance.

Through its committees, the Board provides strategic oversight, guidance and governance for collaboration between industry, TEOs and ITOs, maintains the quality and relevance of qualifications and underpins international recognition of the qualifications.

Engagement by the NZBED in the development of innovative delivery practices is essential in ensuring consistency of achievement, relevance and alignment with the graduate profile of the NZDE.

The feasibility studies that lead to the pilots indicated that the proposed micro-credentials were able to be accommodated within the quality assurance arrangements for the NZDE. The National Curriculum Document for the NZDE provides considerable scope for accredited providers to develop flexible teaching, learning and assessment within well-defined parameters. This flexibility includes scope for:

- up to 50% of the qualification to be awarded through recognition of prior learning (including credit transfer, cross credits, recognition of prior experiential learning, recognition of current competency, and assessment of prior learning) without recourse to the NZBED, and approval of a higher proportion under certain circumstances;
- variation from the recommended assessment schedule for courses within the NZDE by informing the NZBED Executive Officer and communicating with students in advance (NZBED, 2017).

The pilot study leads recognise the importance of aligning their efforts with the strategic direction set by the Board.

Next steps

The pilots that involve some implications for the NZDE look forward to close engagement with the Quality Assurance Committee and the relevant Management Committees. Particular areas of focus for the pilots include working with the Quality Assurance Committee to seek your guidance on ensuring that the:

- systems for recognition of prior learning and assessment of prior learning are robust and consistent with the standards for the NZDE;
- pathways are mutually recognised by the providers of the NZDE;

- proposed arrangements have credibility with employers and learners; and
- pilots fully understand the information requirements of the Quality Assurance Committee and the relevant Management Committees.

We welcome the opportunity to brief the NZBED and its committees on this paper and seek your feedback and comment on the key areas of focus.

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Appendix one – Pilots of micro-credentials funded through Engineering e2e

1. Strengthening a professional development system

The Electricity Engineers Association (EEA) is using a micro-credential to develop the next generation of professional engineers/technicians in line and cable design areas. EEA is working with employers, technical subject matter experts, micro-credential designers, other stakeholders and providers to deliver targeted, well-aligned credentials that address specific industry skills needs.

The pilot will also introduce employers to the opportunities around micro-credentials and how they could address skills gaps and strengthen the electricity supply industry's professional development system. It is hoped that micro-credentials will offer a broad mix of skill sets from a range of providers that deliver employers and learners a relevant and coherent programme of skills and current knowledge requirements.

The EEA's role in curation of learning will provide a more united, evolving approach to industry professional development. The focus for this pilot is to codify and deliver specialised competencies and assessment around line/cable design.

2. MIT's Pasifika Pathway Project

The Pasifika Pathway Project is a partnership between the Manukau Institute of Technology (MIT) and AIMHI (Achievement in Multi-Cultural High Schools) – a group of nine decile one urban secondary schools with a large proportion of Maori and Pasifika students.

The Project sets up a bridging programme to prepare students for engineering education. The students' NCEA credits are assessed against the New Zealand Diploma in Engineering (NZDE) course to identify gaps in their knowledge of mathematics. To fill these gaps, four delivery models will be explored and implemented by the school teaching staff, MIT staff or a mixture of both. The aim is to ensure a solid pathway is mapped out so that the students can progress into the NZDE programme – on successful completion students gain cross-credits towards the NZDE Engineering Mathematics course.

3. An alternative pathway for those unable to engage in on-campus courses

Unitec submitted a feasibility report on using micro-credentials to provide an alternative pathway for part of the NZDE (Civil) qualification. The report found that an alternative pathway had the potential to open up this programme to people who may be unwilling or unable to engage in on-campus courses.

Unitec's pilot comprises five three-credit micro-credentials recognising knowledge and capabilities in the design, construction and maintenance of urban roads. The micro-credentials will be online, on-demand and shareable. Learners can demonstrate competency through recognition of prior learning or through the completion of online learning resources. Assessors will review these and verify that the learner has demonstrated the related competency before awarding the micro-credential.

Those who complete all five micro-credentials will be able to sit the same exam as students enrolled at Unitec. Learners passing the exam can then receive a cross-credit to the equivalent course at Unitec.

4. Meeting the NZDE Graduate Attributes

Otago Polytechnic completed a feasibility study and a report on the use of micro-credentials in New Zealand engineering education and evaluated the appropriateness of Edubits – Otago Polytechnic's platform for delivery of micro-credentials – as a delivery mechanism.

The report identified several opportunities for Edubits to deliver micro-credentials, both within an NZDE framework and directly to industry. This included the development of the recognition and assessment of prior learning (RPL/ APL) pathways to demonstrate the meeting of the NZDE graduate attributes, thereby opening access to those in the engineering industry wishing to obtain an NZDE. Otago Polytechnic's pilot will involve the development of RPL/APL pathways, including the delivery of micro-credentials that allow candidates to demonstrate the attainment of graduate attributes.

5. I.AM badges for public works engineering

The Institute of Public Works Engineering Australasia NZ Division's (IPWEA NZ) pilot is a collaboration with employers of public works engineers and strongly supports their goal of addressing a skills shortage in the public works profession. IPWEA NZ will develop six I.AM badges – micro-credentials that demonstrate the development of distinct competencies aligned with the range of activities and roles in public works engineering. The design currently anticipates that learners will complete between 10-20 hours of learning for most micro-credentials.

IPWEA NZ plans to explore the use of existing platforms and qualification development expertise to develop online, on-demand micro-credentials. It also plans to offer an 'I.AM Accredited' badge that attests to the completion of a mix of I.AM micro-credentials.