

# Engineering Pathways for Regional Australia built through Knowledge Partnering

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## CONTEXT

If Australia is to maximise the benefits from resource and manufacturing industries in regional Australia, it needs a workforce with the necessary knowledge and skills. There is a clear need for a new model of delivery which supports engineering Vocational Education (VET) and Higher Education (HE) programs in regional areas. Evidence to-date suggests this is difficult to achieve, with regional students often limited by their choices and access to HE and VET programs. Regional HE and VET campuses also struggle with the viability of engineering courses in geographically scattered and thin markets. While there are some excellent distance education programs these are often not appropriate for many prospective students who need personal support to make the transition into education and training at a tertiary level. The project aims to foster participation, engagement, and retention in education by up-skilling the engineering workforce and improving the productivity of resource and manufacturing economies.

## PURPOSE OR GOAL

A number of regional HE and VET providers have partnered to develop a flexibly delivered Learning Platform model for engineering, which aims to provide access to engineering pathways and expand curriculum choice and coverage. It reduces individual campus delivery costs and cross-institutional barriers, and improves the availability of engineers and associated para-professionals in regional economies.

## APPROACH

The project has its origins in a resource based view of strategic management and adopts a Regional Development Platform Method (RDPM) (Harmaakorpi, 2007) as a pragmatic but innovative solution to provide higher education in thin markets to dispersed populations. The project takes a cross-sectoral and Knowledge Partnering (KP) approach (Eversole, 2013), involving a staged process of identification, mapping and development, followed by pilot implementation and evaluation. It moves away from the traditional emphasis on developing resources for teaching and curriculum, but rather applies a social constructivist paradigm to focus on the development of student learning outcomes, lifelong learning, and student pathways.

## OUTCOMES

The project sets out to develop and pilot a platforms-based solution to the national issue of critical skills shortage in the resources and associated manufacturing industries, particularly in rural and regional Australia. By knowledge partnering across HE and VET institutions and industry, the learning platform creates a vehicle to efficiently utilise and share resources across the providers, to broaden access to pathways and engineering skills. The learning platform provides access, choice, industry relevance, and retention, generating economic and social benefits through a more skilled and stable workforce for regional areas.

## CONCLUSIONS/RECOMMENDATIONS/SUMMARY

A knowledge partnering and collaborative approach, not only builds cost-effective coverage and improves choice for students in regional areas, but also affords the opportunity to 'pioneer' an innovative solution which can be applied to other disciplines. By taking a collaborative approach to the design and delivery of such a model, this project aims to find a

solution which may be applicable to any regional area throughout Australia and can be adapted by other universities wishing to effectively service distributed markets.

## KEYWORDS

Para-professional, Engineering pathways, Articulation, Regional education

## Introduction

For Australia to take advantage of the ever growing need to increase productivity and international competitiveness, a more flexible and adequately skilled workforce is needed. While Australia's resource industries and associated manufacturing supply chains generate significant benefit to the Australian economy, productivity is adversely affected by a shortage of suitably skilled labour. The geographically scattered locations of these industries and associated thin education markets make it difficult to provide viable professional and para-professional engineering programmes in these regions. This often results in locally specific yet stretched Vocational Educational and Training (VET) solutions, which struggle to adequately prepare students for Higher Education (HE) and the wider industry. There is a clear need for a new model to deliver HE into regional markets, yet evidence to-date suggests this is difficult to achieve (Battersby, 2013).

In addition capable students in regions have limited access to HE, often choosing trades (VET) pathways (Australian Workforce Productivity Agency, 2012) where articulation pathways to further their skills are often 'piecemeal' and not helped by cross-institutional barriers. Other issues contributing to this are the significant advances being made in the areas of robotics and automation in industries such as mining and manufacturing. These advances are leading to a change in the nature and focus of the knowledge and skills required to support industry. Thus, there is a need for a more flexible engineering curriculum as well as an alternative skills pathway for those students entering these fields of study. Those currently in the workplace wanting to up skill are met with the reluctance of industry to release workers for study for any significant periods due to the associated loss of production. These concerns, ever present in regional Australia, require innovative solutions. One such solution is to provide a vehicle that improves access, industry relevance, and retention while generating economic and social benefits through a better skilled and stable workforce for regional areas. This is the aim of recently commenced office for Learning and Teaching (OLT) funded project which aims to bridge the gap between VET qualifications and higher education, by providing a para-professional qualification in engineering which utilises and shares resources across a number of providers to provide regional students with relevant and blended learning solutions.

The partnership between HE and VET providers, and industry partners aims to address critical issues constraining industry productivity and inhibiting the educational and career opportunities of those working and living in regional Australia. The partnership will extend the principles of access offered by Open Universities Australia through an innovative learning platform. One key component of this is the establishment of a partnership that acknowledges curriculum, pedagogical, and assessment differences between the partners and works to implement effective pathway and credit transfer arrangements. Bradley et al. (2008, p179) identified these differences as reasons for limited success of such initiatives. This partnership would see the development of a multi-partner solution to delivering HE in thin and dispersed markets, including the following shared institutional resources: Curriculum; Student navigation system; and Online delivery systems (including immersive environments and virtual classrooms). The partners will collaborate to resolve the curriculum and technical requirements necessary to build a learning platform which enables access and simultaneously reduces the barriers that inhibit student learning and confidence:

- The combination and sharing of knowledge and resources within the learning platform enabling students, regardless of location, to complete a flexible and personalised programme of study better suited to their individual and local/regional industry needs.
- The collaborative learning platform will generate guided learning pathways that effectively overcome the institutional and student learning barriers often experienced in remote and regional communities.
- The sharing of learning resources amongst the partners will contribute to the platform increasing choice, currency, and the opportunity for students learning experiences and specialised curriculum that are tailored to their individual or workplace requirements.
- The learning platform will enable learning providers to be more responsive to a range of different cohorts of students in thin and dispersed markets (e.g. mature age, first in family wanting a HE career outcome. For example, trades' people will be able to access para-paraprofessional and professional skills while working in industries in remote locations eg mining).

This paper reports on the development of a learning platform that supports tailored and contextualised study programmes and guided pathways, which facilitate credit transfer through knowledge partnering.

## **Cross Institutional Learning Platform for Engineering (CILPE)**

Nationally, 67% of productivity (outside tourism and education) occurs in regional Australia (Battersby 2013), yet very few HE providers deliver full or comprehensive access to engineering education in regional areas. A platform that creates a vehicle to efficiently utilise and share resources is proposed through knowledge partnering across HE institutions, VET providers, and industry. A Regional Development Platform Method (RDPM) (Harmakopi, 2007) approach is being utilised to develop a learning platform that gathers and reconfigures resources and capabilities into a competitive platform that will match and even create market change. By integrating, reconfiguring, sharing, and releasing resources, the RDPM generates a learning platform to create a sustainable solution for regional areas.

The CILPE develops a collaborative framework for the sharing of resources across multiple institutions, which can then be adopted for other discipline areas and by other institutions. The platform will be a launching pad for students to articulate into other programmes of interest, for example industrial design or business.

The learning platform will support tailored and contextualised study programmes and guided pathways, which facilitate credit transfer, are Australian Qualifications Framework (AQF) compliant, and professionally accredited. These programmes and pathways will be recognised across institutions (and where appropriate, industry bodies), enabling student choice of units across the partner providers.

The goal is to maximise access and choice through shared resources, whilst recognising there are limitations and costs associated with delivery into thin and dispersed markets. Overall, the learning platform will develop a methodology for 'blended learning' across partner institutions in the form of an Australian Quality Framework (AQF) level 6 Associate Degree made up of core units (largely common across providers) and electives, which could be shared across institutions. Each institution will own, deliver, and assess its own units, which contribute towards the learning platform. Workplace learning is also incorporated and reflected in the assessment tasks where possible, with industry mentors, tutors and workplace practitioners providing feedback, and commenting on student work where possible. For example, students in employment might be required to identify a 'workplace problem' for student projects (linking the theory to the practice), while full-time students

might be given a defined problem to solve. A shared understanding of each institution's units, and the articulation pathways, will be established between the partner universities and VET providers, enabling students to 'self-select' units to make up 'their' Associate Degree. This will allow unit choices/alternatives and cross-institutional enrolments to be streamlined (and formalised) through the learning platform. The navigation system would automatically reject/accept the student's unit choice, depending on their chosen path and the pre-mapping between the partners.

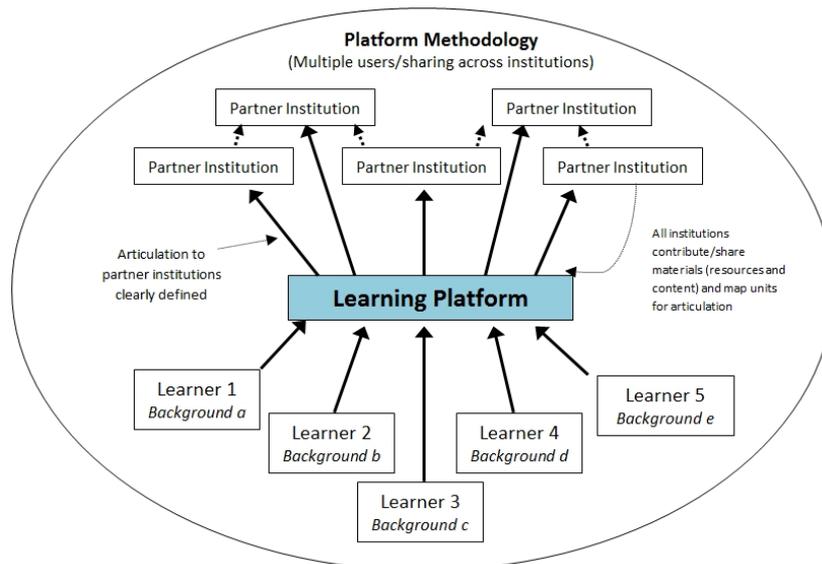
## **Engineering learning pathways**

The learning platform will support tailored and contextualised study programmes that are accredited by Engineers Australia. It will also include guided pathways, which facilitate credit transfer compliant with the AQF, the Australian Skills Quality Authority (ASQA), and the Tertiary Education Quality Standards Agency (TEQSA). The CILPE project extends the skills and career pathways of capable students in regional areas by developing a methodology that can be shared across the partner institutions (Langworthy, Johns, & Humphries, 2011). A blended curriculum design ensures core curriculum elements are addressed, whilst allowing flexibility for students to incorporate units of choice as electives. Students will therefore develop skills which are 'generic' in terms of engineering course requirements, whilst also studying topics that are aligned to industry needs and relevant to their regional context.

Courses and pathways will not only make them readily employable as para-professionals, but provide them with options to articulate into more advanced engineering or related programmes at a range of institutions and in a range of different specialist streams (Dowling, 2010: p8). The value of this approach lies in the sharing of learning resources and enabling pathways from and across tertiary education providers. Pathways that might lead to engineering, but also offer exit points or transfer to associated or relevant qualifications. For example: A Student could begin their studies with a local VET provider and then use their AQF compliant qualification (e.g. a trade) to articulate into an associate degree accessed through the CILPE where they would study content from local and partner institutions. The associate degree could then serve as a platform into a Bachelor of Engineering program consisting of units offered by their conferring university or partner universities through existing cross institutional mechanisms. Alternatively the associate degree will enable them to access other options (e.g. Industrial design, Business). Ultimately the pathway may lead to higher level studies or research degrees.

## **Methodology**

The project takes a cross-sectoral and Knowledge Partnering (KP) approach (Eversole, 2013), involving a staged process of identification, mapping, and development, followed by pilot implementation and evaluation. It moves away from the traditional emphasis on developing resources for teaching and curriculum, but rather applies a social constructivist paradigm to focus on the development of student learning outcomes, lifelong learning, and student pathways. It directly addresses the cultural, physical, and institutional barriers, which often halt progression and cause loss of momentum, resulting in low participation in HE in regional areas, particularly in the areas of science and engineering (NCVER, 2009). An evaluation framework, which reflects the staged approach of the project, will provide immediate and overall feedback to the project team. Figure 1 shows graphically the methodology behind the learning platform, with each institution owning, delivering, and assessing its units within the learning platform.



**Figure 1 Platform Methodology**

The development of the platform is undertaken in three stages:

### **Stage 1 – Building a curriculum portfolio and guided learning pathways**

The objectives of stage 1 are to identify HE courses, units, and related VET pathway qualifications offered by the project partners to maximise choice through access to different specialisations across the providers. This stage includes a full mapping of the knowledge required for students to articulate successfully into HE courses across the providers (i.e. entry requirements), including AQF compliance.

#### *Phase 1(a) Curriculum portfolio & guided pathways*

This phase includes consulting with industry reference groups (including professional bodies) to map the requirements against para-professional to professional engineering knowledge and skills needs, including work-ready and work-related learning components (Partridge, Ponting, & McCay, 2011).

The key outcomes of this phase will be:

- Identify key entry and exit points to align with industry requirements, student qualification needs, and the availability and suitability of partner institution resources and systems.
- Develop simplified pathway options by identifying appropriate bridging programmes articulating into related HE courses.
- Make the pathways and learning resources available online through a blended curriculum approach.
- Develop and support a community of practice amongst partner HE and VET institutions, which provide and deliver units towards tailored engineering pathways.
- Establish and implement an evaluation framework, which reflects the staged approach of the project.

#### *Phase 1(b) The development of a student navigation system*

This will involve a collaborative approach between the partner providers to analyse the structure of each partner's academic and administrative systems to determine the technical requirements for an appropriate student navigation system in the form of a 'systems portal' as a gateway to tailored student learning. The aim of the navigation system will be to resolve

technical barriers with regard to granting of credit, cross-institutional enrolments, and online access to units and courses across the partner providers.

The student navigation system will:

- enable students to access a flexible enrolment system, in which students can select units from various providers and therefore 'package' their own learning (in accordance with pre-determined parameters defined by the partner institutions);
- enable students to undertake cross-institutional enrolments wherever their location and carry the units from one education provider to the next with certainty of credit transfer (as pre-determined by partner institutions); and
- guide the student's learning pathway through a smart navigation technology that determines the most appropriate home institution based on unit selection, chosen field/pathway, and accessibility.

While there is a commitment to choice, it is equally recognised the learning platform for access to para-professional and professional courses will of necessity have some limitations. The focus will be on each partner adding curriculum to yield sufficient choice, but consideration will be given to factors such as cost of delivery, minimum student numbers and the need to share units/students in order to ensure viable delivery is achieved

Project partners will work with each other to identify the most effective ways to address barriers to the implementation of guided pathways, both within and across the partnering organisations. Through close collaboration the partners will develop a shared understanding of system needs.

#### *Phase 1(c) Effective and contextualised delivery systems*

The objectives of this phase are to explore the opportunities for mixed-mode, blended and virtual class rooms across the partner institutions. This will include a curriculum that provides options for blended/multi-modal delivery, access to localised workplace learning, and to involve engineering practitioners as tutors (and the recognition of each institution's approach to workplace learning, practice, experiences, and multi-model delivery). By providing choice across multiple providers, students are able to engage in a number of delivery modes to package their own tailored learning programme and pathway. For example:

- accessing resources such as expert commentary and interviews;
- facilitating and fostering engagement and robust dialogue with other students;
- networking with experts and peers from other states (through partner institutions).

The variety in delivery modes/curriculums across the partner institutions will also enable increased flexibility for students. For example, some providers use Open Educational Resources (OERs) to access core curriculum, others may have remotely accessible facilities, while others may have a greater emphasis on workplace learning projects and/or using local engineering practitioners as industry tutors/mentors. The students can select discipline subjects based on their preference, individual requirements, learning styles and their geographic location.

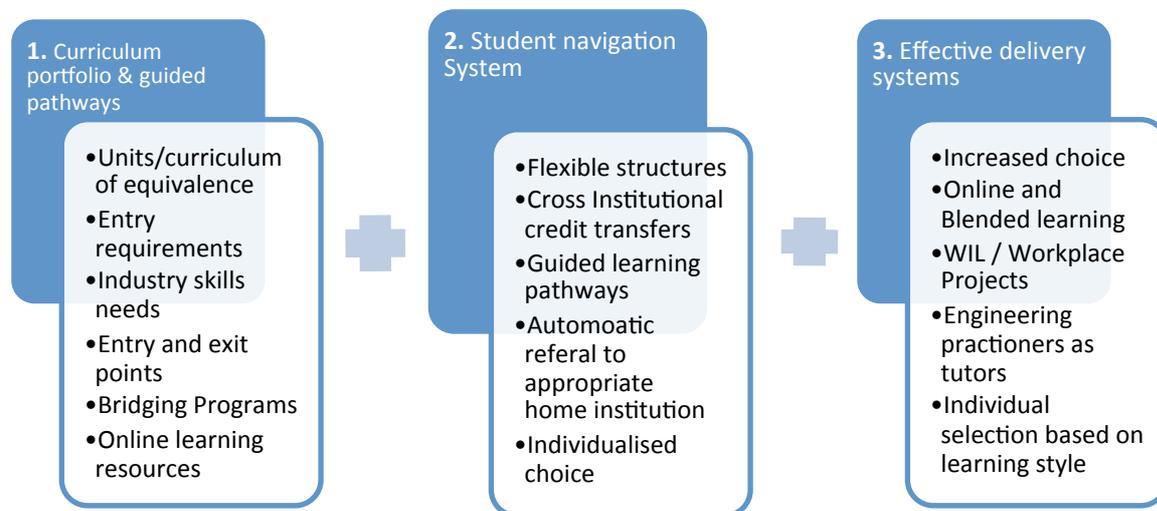
## **Stage 2 Piloting the learning platform**

The first trial of the learning platform is planned for Semester 1, 2015. Partners will be given the option of trialling a full course with access through the learning platform, with cross institutional choice of units through a guided pathway plan. Alternatively, partners may initially choose to phase in the adoption of the platform by permitting access to cross institutionally shared units, with increased participation as the system matures. Partner universities contribute towards the learning platform, which may range from to providing units to the platform, providing facilities and access points, to managing and coordinating full courses.

### Stage 3 Evaluating the pilot and dissemination

An external evaluator will oversee this process, with evaluation commencing in Stage 1 and continuing throughout the project providing feedback to the partners and the reference group.

The key role of the project Reference Groups will be to disseminate information to industry and the general community to gain support and enable prospective students to engage in the learning platform. Industry will be engaged from the start enabling employers to customise their employees' programmes to suite their business and skill requirements in tandem with the needs of the employees. The evaluation criteria were designed to engage key stakeholders in each stage of the project. The evaluation feedback will be used as a guideline in evaluating the overall project. Figure 1 provides a graphic of the three stages of the learning platform:



**Figure 2 The three stages of the Cross Institutional Learning Platform.**

### Project outcomes

The project sets out to develop and pilot a platform-based solution to the national issue of critical skills shortage in the resources and associated manufacturing industries, particularly in rural and regional Australia. Through knowledge partnering across VET providers, HE institutions, and industry partners, the platform creates a vehicle to efficiently utilise and share resources and broaden access and pathways to engineering knowledge and skills. For students, the platform provides access, choice, flexibility and industry relevance, which enhances employment prospects in regional areas. For regional economies, it generates economic and social benefits by providing a more skilled and stable workforce. For partner institutions, it provides a robust model for delivery into lean regional markets, whilst reducing student attrition. It also creates a shared understanding and documentation of units of equivalence and guarantees credit transfer across the partner institutions, to enable students to make informed choices about unit selection.

The system will refer students to the appropriate home institution according to the units selected. The structure of the platform will ensure recognised and formal pathways with a range of entry and exit points, articulating into Bachelor of Engineering programmes for students wishing to become professional engineers, and pathways to other programs that meet industry requirements.

The CILPE supports industry and fosters a broader engagement with, and valuing of, continuing engineering education. This in turn builds student confidence and participation in

HE, with a concomitant flow-on effect within the community around the importance of lifelong learning: “*our experience shows that if conversation is not happening in the home, then it needs to be generated across the community*” (Allison, 2010)

## Conclusions

Nationally, a large proportion of productivity occurs in regional Australia, yet very few HE providers deliver full or comprehensive access to engineering education in regional areas. If Australia is to maximise the benefits from the resource and manufacturing industries and their associated supply chains, it will need a workforce with the knowledge and skills necessary to respond to the challenges – particularly in the face of ever changing technologies in these sectors.

Through knowledge partnering and collaboration, this project proposes a new model for the delivery of higher education which fosters access and participation in regional areas, by demonstrating how effective partnerships can provide solutions to cross-institutional barriers and unviable delivery. Various partner institutions will contribute to the delivery of an associate degree, enabled through a flexible cross-institutional learning platform for engineering (CILPE), which not only builds cost-effective coverage and improves choice for students, but also affords the opportunity to ‘pioneer’ an innovative solution which can be applied to other discipline areas. By taking a collaborative approach to the design and delivery of a para-professional qualification, this project provides a flexible and supported pathway for students to pursue higher education without having to leave their regional community. The CILPE will demonstrate a model which may be utilised in any regional area and may be adapted by other providers wishing to effectively service thin and distributed markets in their discipline.

## References

- Allison, A. (2010). *Regional Campuses and their role in generated an educational community culture*. Paper presented to the Regional Campus Conference: University of Southern Queensland, Harvey Bay Campus.
- Australian Workforce Productivity Agency. (2012). *Future focus: Australia’s skills and workforce development needs: A discussion paper for the 2012 National Workforce Development Strategy*. Canberra: Commonwealth of Australia.
- Battersby, D. (2013). *Clever Regions, Clever Country: Policy Issues for Regional Universities*. *Regional Universities Network (RUN)*. A presentation at the 11th Annual Higher Education Summit.
- Bradley, D., Noonan, P., Nugent H. & Scales, B. (2008). *Review of Australian Higher Education: Final Report*. Retrieved from <http://www.deewr.gov.au/HigherEducation/Review/Pages?ReviewofAustralanHigherEducationReport.aspx>.
- Dowling, D. (2010). *A review of para-professional engineering education in Australia: Exploring the VET- HE divide*. Paper presented at the Australasian Association for Engineering Education Annual Conference, Sydney, NSW.
- Eversole, R. (2013). *The Knowledge Partnering Handbook*. Institute for Regional Development, University of Tasmania.
- Harmaakorpi, V. (2007). *Regional Development Platform Method (RPDM) as a tool for regional innovation policy*. *European Planning Studies* Vol. 14, No. 8.
- King, R., Dowling, D., and Godfrey, E. (2011). *Pathways from VET Awards to Engineering Degree: a higher education perspective*. A commissioned report for the Australian National Engineers Taskforce, Epping NSW: Australian Council of Engineering Deans.
- Langworthy, A., Johns, S., & Humphries, M. (2011). *The Path less Travelled: VET Articulation in Tasmania*, Launceston: Centre for University Pathways & Partnerships, University of Tasmania.

NCVER. (2009). Student Transfer: At a Glance. Retrieved from <http://www.ncver.edu.au/publications?2144html>

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