Using Workplace Integrated Learning Experience to Fast-track Tertiary Engineering Studies and Engineering Accreditation

Introduction
In the engineering profession, workplace integrated learning (WIL) is perceived as a necessity for graduation from an engineering program. Typically this is to gain practice based experience by:

- Horizontal transfer of knowledge through working under supervision of their immediate engineering supervisor and senior supervising engineer.
- Everyday application of their fundamental or phenomenological knowledge in engineering;
- Hands-on applications and use of relevant standards and industry codes.
- Interaction of engineering activities and compliance to legislative legal requirements.
- Deeper investigation and discovery of engineering phenomena-based processes unique to their chosen discipline and overlapping into other multi-discipline engineering or professional strands.

WIL allows a body of practice-based experience to accumulate during an individual’s career that is relevant and ongoing to advance professional engineering accreditation.

Engineering Articulation accreditation
In the past 30 years, articulation from an advanced vocational trade to an engineering academic pathway has been made possible by the objectives and flexibility provided by the Australian Qualifications Framework (AQF).

Those with vocational engineering qualifications can now enter tertiary education to continue their career development and increase their engineering functional capability. In recognition of this trend and career articulation pathway, Engineers Australia (EA) has accreditation for:

- Associate Engineers based on graduation with a 2 year Associate Degree in Engineering.
- Stage 1 Technologist based on graduation with a 3 year Bachelor of Engineering Technology or Bachelor of Engineering Science degree, plus post-graduation e-portfolio demonstrating an equivalent of 5 years of appropriate engineering experience after graduation.
- Stage 2 Chartered Technologist based on achieving Stage 1, plus continuing demonstration of a high degree of specialisation in a technology area of choice, and documented e-portfolio of continuing professional management and development.
- Stage 1 Professional Engineer based on graduation with a 4 year Bachelor of Engineering Honours degree, or additional accreditation by completing an accredited Masters
Engineering Degree, plus post-graduation e-portfolio as evidence of equivalency to 5 years of appropriate industrial experience since graduation.

Stage 2 (Chartered) Experienced Professional Engineer is available to Stage 1 professional engineers demonstrating a high degree and depth of specialisation amongst their broader professional discipline, plus verification by an e portfolio of their continuing engineering professional leadership and management skills development.

Stage 3 Executive Engineer (Leadership and Management) by accredited e-portfolio career verification of a multi-discipline engineering and professional career interface development that is based on demonstrated complex engineering enterprise leadership.

Queensland Registered Professional Engineer accreditation by the BPEQ, is based generally by equivalency to Stage 1 Professional Engineer with demonstrated depth of experience and body of practice-based WIL knowledge in a specific accredited discipline strand specialisation. External professional bodies such as IPWEA are used as third party impartial assessors for accreditation in specific discipline strand specialisations. Engineers Australia, for Chartered Engineer accreditation provides a similar function in many different discipline strand specialisations.

Gradually over the past 30 years, there has been a change in perception of the inter-relationship between the different accredited engineering roles. Traditionally these roles were seen as being hierarchical in nature, based on the level of academic qualification. However with the change in complexity of engineering technology enterprise and its increasing connectivity, gradually a new perception emerged that engineering teams need to comprise all of these roles working together in a multi-discipline manner to develop, manufacture, operate, de-commission and recycle engineering assets and systems. Legally, review and compliance sign-off responsibility in many areas still remains vertically hierarchical, but this is driven by prescribed legislative compliance linked to academic and professional body accreditation. However, there is a perceived need for a horizontal continuum of these accredited and equally important roles to produce agile business focussed and industrial based engineering teams. Development and change in the function of accredited engineering roles continues apace to changes that are occurring in engineering enterprise, particularly as automation and fast manufacturing CAD/CAM processes are changing the engineering corporate landscape.

Career progression pathways
Many individual engineering personnel start from an engineering trade vocational background, and when their accumulated practical engineering skills and knowledge piques their curiosity and desire to understand more, which may lead to undertaking additional academic education. Articulation pathways allows non-matriculation mature age students to enter tertiary education. Many universities offer bridging tertiary preparation pathways for vocational engineering trade personnel to enter into a 3 year Bachelor of Engineering Technology or Engineering Science degree, or a 4 year Bachelor of Engineering Honours (BENH) degree. The alternative linkage to bridge engineering personnel with low or no matriculation tertiary entrance score and whom may have advanced technical trade vocational qualifications (e.g. TAFE Certificate III and IV in engineering disciplines) is the Associate Engineering degree program. Traditional university academic pathways allow graduates of the 2 year Associate degree programs to enter the 4 year professional Bachelor of Engineering honours degree with credit. The combined pathway for both the Associate Degree and Bachelor of Engineer Honours degree programs typically adds up to between 4.5 and 4.75 years of study with any engineering practice requirements. Upon graduation, there is a nominal 3 to 5 years of industry-based WIL experience required to gain EA Stage 1 Professional Engineer accreditation. It can take between another two to five years experience at EA stage 1 professional engineer to gain RPEQ accreditation in Queensland.

Using Work Integrated Learning experience for Technologists to your advantage – the Master of Engineering Practice program
At the request of Engineers Australia in 2002, the University of Southern Queensland (USQ) developed the Master of Engineering Practice (MEPR) which is a WIL based program for industry experienced Technologists in the major strands of engineering to be eligible
for graduate membership as a Professional Engineer. The MEPR program commenced in 2004 and is equivalent to a 1.5 year program comprising a maximum of 12 units of study and a practical residential school, which can be reduced by WIL based engineering competency claims to a minimum of 6 units of study. The MEPR program, provides the opportunity to increase the breadth and masters level technical skills in an engineering discipline, whilst also allowing the opportunity for professional practice and management development, within the core program. Graduates also benchmark their professional e-portfolio in preparation for future chartered professional engineer accreditation submission.

Since 2017, the Public Works and Infrastructure major has been offered as a specialised sub-discipline of civil engineering. This new strand is specifically developed for Local Council or Transport Engineers. It allows a choice of specialisations relevant to engineering professionals engaged in this sector of the engineering services industry. Overall, there are seven discipline strands offered:

- Civil Engineering
- Electrical and Electronic Engineering
- Environmental Engineering
- Mechanical Engineering
- Power Systems Engineering
- Public Works and Infrastructure Engineering
- Structural Engineering

Successful MEPR program graduation with an unblemished academic record normally results in EA granting Stage 1 Professional Engineering accreditation immediately on presentation of the MEPR testamur and a legal copy of the graduate’s academic testamur and transcript.

In 2017, USQ extended its practice pathway access to allow industry experienced Associate Engineers to potentially reduce their study load beyond the recognised prior learning credits granted on admission. Pertinent WIL industrial experience can provide up to an additional 4 units of credit towards the Bachelor of Engineering Science (BENS). This allows upon graduation the fast-tracking of EA Stage 1 Technologist accreditation and a potential entry point into the USQ MEPR program.

The USQ BENS practice pathway is an opportunity to develop a WIL based e-portfolio to prepare for EA Technologist Stage 1 competency accreditation. It also offers the opportunity to fill in minor gaps in technical knowledge when their WIL portfolio is scrutinised against the core discipline courses nominated for potential credit.

Currently the BENS Practice Pathway is offered for three disciplines, i.e. Civil Engineering, Electrical and Electronic Engineering and Mechanical Engineering. Successful completion of the USQ BENS practice pathway assists fast tracking Technologist accreditation with Engineers Australia.

Technologist accreditation then allows potential articulation entry into the MEPR program. As an example, a BENS graduate with Technologist accreditation in Civil or Environmental engineering can potentially articulate into the MEPR Civil Engineering, or Public Works and Infrastructure Engineer strands; and on a case by case assessment of pre-requisite knowledge into the Environmental Engineering strand.

The difference between the Practice Pathway and the Bachelor Engineering Honours outcomes?

The USQ practice pathways link an Associate Engineer to Stage 1 Professional Engineer through the 3 year BENS degree, to possible Stage 1 Technologist accreditation, and then articulation into the MEPR. In a best case scenario this would result in a minimum total of 4.25 years of study to attain Professional Engineering status via the BENS practice pathway from an Associate degree. In the worst case this would be 4.75 years which is the same as a normalised Associate Degree articulation into the BENH program. But with the practice-based pathway there are two potential fast-track career accreditation points. The intermediate accreditation is to Technologist level, while the end game result is to attain full Stage 1 Professional Engineering after graduating from the MEPR program.

The overall flexibility of these practice-based pathways allows study part-time and online, with a
few residential week long practice based courses, to allow peer activities and instruction from teaching staff to occur.

**Conclusion**

Workplace integrated learning (WIL) is a necessary practice-based body of knowledge that all engineering professionals and para-professionals must accumulate. Similarly, continued professional development (CPD) is a key part of this process to keep both technical skills updated and continue professional engineering business based skill evolution. Both of these can be captured via a practice-based e-portfolio. Referring to the following diagram, the e-portfolio of any engineering role is like a genetic zipper. One side strand of the DNA and its half-ladder components are engineering and science based tested fundamental knowledge and principles. The other side strand of DNA with its own half ladder step piece are the experience based professional practice and physical engineering domain discovery knowledge. The zipper that brings these two disparate knowledge bases together is reflective thinking. These three elements together define the unique and continuously developing ‘DNA’ of any engineering role career.

The longer the zipped together engineering ‘DNA’ of increasing knowledge and practice-based learning becomes, the higher the potential for career recognition, accreditation and potential useful engineering outcomes to underpin the future of society which is an engineer’s ultimate customer. Replicating parts of this ‘DNA’ in upcoming generations of engineering roles is the much needed mentoring role of senior engineers in later careers.

If your point of origin entry is from a vocational engineering background, then the USQ Practice Pathway along with the WIL experience accumulated in your industry employment can benefit your continuing educational pathway-based tertiary study and articulation to a professional engineering career. Both Associate Engineers and Technologists with 5 years industrial WIL experience relevant to their discipline, can benefit from the USQ Practice Pathways to attain Stage 1 Professional Engineering quicker than the traditional academic Associate degree and BENH academic pathway.

Please contact the USQ or authors if you have any questions of interest in the use of your WIL to further your engineering career using the USQ practice-based programs.