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DEVELOPING TWENTY FIRST CENTURY SKILLS IN VET

An International Specialised Skills Institute Fellowship.

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Sponsored by The Higher Education and Skills Group

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1. Acknowledgements

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2. Executive Summary

The aim of the Fellowship was to investigate international approaches to developing twenty first century skills in vocational education and training (VET) learners and how to build the capacity of VET teachers to develop and assess these skills in their students. As routine tasks are progressively overtaken by disruptive technologies such as automation and virtualisation, workers are required to take on more complex roles in increasingly digitised, ambiguous and uncertain environments. This requires enhanced skills in communication, collaboration, critical thinking and problem solving, creativity and innovation, and enterprise and entrepreneurship, alongside greater personal and social responsibility. The literature indicates that current approaches to vocational training in Australia are insufficient to develop an appropriate level of these twenty first century skills, and in particular, that the Certificate IV Training and Assessment (TAE) is inadequate for equipping VET teachers to develop and assess these skills in their students.

The Fellowship was undertaken in two distinct phases spanning September 2018 to June 2019. The first consisted of three brief visits to Dunedin, New Zealand to observe workshops and final assessments in the recognition of prior learning and professional practice learning (RPL/PPL) pathway of Otago Polytechnic's Bachelor of Culinary Arts. The second phase involved a month-long stay in Europe including visits to VET and higher education providers in England, Spain, France and Italy. I interviewed teachers, students, managers, and teacher trainers; I also observed classes and examined teaching, learning and assessment materials.

I have spent 28 years in the vocational, higher education and adult community education sectors, including working as a private consultant, focused primarily on academic development and educational research in TAFE providers of higher education. I am currently employed at William Angliss Institute (WAI) in Melbourne as Associate Dean (Scholarship). The Fellowship brought together themes that have characterised my career such as teacher training, innovations in pedagogy and a focus on the future.

While supplementary learning was gained from the visits to other providers, the main focus of the European trip was the Spanish Basque VET pedagogical model of collaborative, challenge-based learning. Learners work in teams to develop alternative solutions to real-world, workplace-based challenges. The methodology focuses explicitly on the development of twenty first century skills alongside technical skills and knowledge. Evaluation of the model found that it is suitable for equivalent AQF Levels 3 to 6 across all industry sectors, and that a significant majority of employers, teachers and students support it. While presenting challenges to existing VET arrangements, it could be adapted for implementation in Australia with a significant impact on the development of VET learners' twenty first century skills.

Otago Polytechnic in New Zealand and Middlesex University in England both offer expedited delivery of three-year bachelor degrees in one academic year (effectively eight months) to experienced industry practitioners via an RPL/PPL pathway while they remain in full or part time work. This represents a possible mechanism for the rapid upskilling of Australian VET practitioners and appears to foster a profound transformation in thinking that could assist VET teachers to acquire the requisite higher order skills for developing and assessing twenty first century skills in their students.

Substantial similarities were noted in the approaches to developing twenty first century skills in each of the settings visited. They each involve learners in:

» Some form of experiential, problem-based learning

» Engagement with authentic workplace/community scenarios

» Holistic integration of learning across multiple subjects and/or disciplines

» Use of design thinking and/or tools

» Working collaboratively in teams

» Use of critical reflection and self-reflection

» Formative assessment for learning including ongoing feedback and mentoring

» Generation of a portfolio of authentic assessment evidence

The most significant insight from the Fellowship is that twenty first century skills cannot be developed using traditional teaching techniques. The practice of twenty first century skills requires a transformed mindset that is developed through a teaching and learning process deliberately designed for this purpose: teachers themselves must undergo this transformation before they can begin to foster it in their students. The findings from the Fellowship suggest that constructivist pedagogical underpinnings, whereby learners actively construct and critically reflect on their own knowledge through carefully designed, authentic learning and assessment experiences, are essential. This represents a fundamental change in traditional VET pedagogy.

Learnings from the Fellowship are being disseminated to the VET sector through speaking engagements, which have already generated considerable interest from other providers, and through an ongoing program of collaborative research and publication with Otago Polytechnic. Plans are under way to pilot collaborative challenge-based pedagogy in WAI patisserie courses and a suite of RPL/PPL pathway qualifications are also planned for development at WAI.

Thus, recommendations arising from the Fellowship are that:

1. A pilot collaborative challenge-based learning program and accompanying learning and assessment resources be designed, developed, implemented and evaluated in one or more Australian VET providers

2. A pilot professional development program inducting VET teachers into challenge-based learning be designed, developed, implemented and evaluated in one or more Australian VET providers

3. Findings from the pilots be disseminated throughout the Australian VET system

4. A Community of Practice for providers interested in implementing collaborative challenge-based learning be established to provide ongoing support and guidance

5. A suite of degrees based on the RPL/PPL model be designed, developed, implemented and evaluated at a VET provider registered to deliver higher education qualifications

6. Awareness of the RPL/PPL model be disseminated and promoted throughout the Australian VET system

3. Fellowship Background

Context

The aim of the Fellowship was to research innovative ways to address the development of twenty first century skills in vocational education and training (VET) learners, and to skill up the VET teaching workforce so that they can foster the establishment and growth of these skills in their students. Twenty first skills are the skills and competencies young people will be required to have in order to be effective workers and citizens in the knowledge society of the 21st century.

The world of work has changed. Routine tasks are progressively being taken over by digital technology, automation and virtualisation, requiring many workers to take on more complex roles that demand greater social and intellectual skills (European Centre for the Development of Vocational Training, 2018; Seet, Jones, Spoehr, & Hordacre, 2018). Training workers in higher level technical skills is no longer sufficient for workplaces in which employees must deal with complex problems and unpredictable situations in increasingly digitised, ambiguous and uncertain environments. This will require the acquisition of higher order skills and behaviours (Voogt & Roblin, 2012). In addition, many workers are no longer being employed by traditional companies but are starting up their own businesses in the 'gig economy'. They too need training in more than just technical skills.

These changes have generated increasing calls for a broader, more holistic approach to knowledge and skills acquisition, for example: Ananiadou and Claro (2009); Commonwealth of Australia (2017); Wheelahan and Moodie (2011, 2016). While what have variously been known as 'key competencies', 'employability skills', 'soft skills' or 'transferable skills' have been embedded in VET training for a long time, the emphasis on these skills has intensified and new skills have been added. Although the definition and scope of twenty first century skills varies in the literature, they typically comprise critical thinking including complex problem solving; creative thinking including innovation, enterprise and entrepreneurship; written and oral communication; collaboration and teamwork; digital competence, as well as personal and social skills such as emotional intelligence, self-awareness, adaptability, resilience, cultural awareness and ethical understanding (Ananiadou & Claro, 2009; Binkley et al., 2011; Commonwealth of Australia, 2017; Queensland Curriculum & Assessment Authority, 2017). These skills are also sometimes referred to as 'future skills' (Commonwealth of Australia, 2017).

However, the Australian VET system appears to be falling short of employers' and others' expectations of graduating appropriately skilled twenty first century workers. For instance, the Department of Education and Training (DET) discussion paper titled *Training Product Reform*: *what is the case for change?* (Commonwealth of Australia, 2017) suggests that the ten reviews of the national training system undertaken since 2000 are evidence of an endemic failure to identify and address problems with the training products. It criticises current training products for focusing too much on technical skills for a particular job rather than broader skills and the underpinning theoretical knowledge base which can be transferred and applied to multiple contexts.

In addition to technical skills, the paper identifies the need for workers to acquire twenty first century skills. The need for these skills is particularly acute in training workers at Australia Qualification Framework (AQF) Levels Five and Six because the paraprofessional roles that these graduates typically fill involve increased

complexity as well as higher levels and a broader scope of responsibility. The paper also questions the capacity of the existing VET workforce to appropriately deliver and assess these skills.

Unfortunately, the factors that arguably have failed to deliver a workforce equipped to adapt and thrive amid the challenges presented by the fast-paced changes in the nature of work remain in place under the DET paper's proposed changes (Commonwealth of Australia, 2017). Suggested reforms continue to be based on units of competency packaged into qualifications and skill sets. This approach is inherently reductionist, founded on the premise that a work function can be broken down into its component parts, which leads inevitably to highly contextualised knowledge. It is my contention that this fails to foster workers' capacity to discern and analyse underlying patterns and their systems of complex interaction, which are essential to solving complex problems.

Moreover, competency based training is founded on a behaviourist worldview that focuses on the observation of demonstrated behaviour. Yet the capabilities identified in the DET discussion paper such as resilience, adaptability, emotional intelligence and self-awareness deal with the inward experiential realm and cannot be reduced to a checklist of observable behaviour. They require the development of critical thinking, reflexivity and ways of knowing and being that are sufficiently complex to enable tolerance of uncertainty, ambiguity and multiple perspectives.

Not only does VET training come in for criticism, but the literature decrying the inadequacy of the Certificate IV in Training and Education (Cert IV TAE) and its prior incarnations as the mandatory minimum qualification for the VET teaching workforce is prolific – see for example Clayton and Guthrie (2011); Department of Education and Training (2016); Guthrie, McNaughton, and Gamlin (2011); Productivity Commission (2011); Rasmussen (2016); Smith and Grace (2011); Training and Assessment Working Group (2016); Tyler and Dymock (2017). Tyler and Dymock (2017, p. 44) sum up the situation by asserting that: 'the Certificate IV Training and Assessment, a key conduit through which […] professionals are created, has been demonstrated through the literature to be ineffective and inadequate in this role'.

In the executive summary of a recent Australian Research Council funded project it is reported that, although higher level qualifications in VET pedagogy make the greatest impact on teaching quality, the key qualification level is a bachelor degree, regardless of whether it is in a vocational discipline or education (Smith, Yasukawa, Harris, & Tuck, 2018). Moreover, these researchers found that the higher the qualification level, the more VET teachers engaged in professional development. They concluded that any deficiencies in the initial Certificate IV TAE are therefore not compensated through later professional development. However, as the above scan of the literature attests, many pleas have been made over the years for higher level qualifications for VET teachers; pleas which have been consistently resisted by industry. It remains to be seen whether the latest call will have any systemic impact.

Against this backdrop, including the most recent Federal Government review of Australian VET that advocates business as usual in many key respects (Joyce, 2019), Australia seems locked into the current system for the foreseeable future. This Fellowship therefore explored alternative international approaches that could potentially adapt in the shorter term, and challenge in the longer term, the constraints of the Australian training system to foster a more holistic approach to developing twenty first century skills for the current and future workforce, including the Australian VET workforce.

Methodology and timeline

The Fellowship took place over an extended period from September 2018 to June 2019. The overarching questions that guided the research were: what models and approaches to twenty first century skill development are in place internationally? How do teaching workforces acquire the requisite capabilities to foster and assess the development of these skills?

The Fellowship involved multiple components, some of which related to teacher training and some to development of twenty first skills in VET learners. Phase One of the Fellowship consisted of three short trips to Dunedin, New Zealand in September 2018, February 2019 and April/May 2019, which enabled the observation of workshops and assessments of learners in the RPL/PPL pathway at Otago Polytechnic's Bachelor of Culinary Arts. During and between these visits, course documentation was also examined, and discussion undertaken with staff teaching into the course. Otago Polytechnic was selected because of its innovative design-based curriculum, whose alternative RPL/PPL pathway warranted investigation as a potential model for upskilling VET practitioners.

Phase Two involved a trip to Europe in May/June 2019 which comprised visits in chronological order to: Middlesex University in London; Tknika, the Basque Centre for Innovation and Applied Research in VET, Spain, and three VET colleges there; the Institut Paul Bocuse in Lyon, France; and the Free University of Bozen-Bolzano, Italy. Middlesex University was selected because the RPL/PPL pathway model adopted and adapted at Otago Polytechnic was originally designed and developed there, while Institut Paul Bocuse and the Free University of Bozen-Bolzano have their own way of paying particular attention to the development of twenty first century skills. These latter three visits entailed discussion with teachers and senior staff.

However, the main focus of the European part of the Fellowship centred on two weeks in the Basque Country, where the whole VET system is in the process of transitioning to collaborative challenge-based pedagogy that is specifically designed to give priority to the development of twenty first century skills alongside technical skills and knowledge. The visits there consisted of five elements: 1) detailed presentations by teachers, coordinators, principals and project workers and in-depth discussion of their approach to curriculum, pedagogy and the training of teachers in the new approach; 2) examination of course documentation, learning and assessment materials and teacher guidelines and templates; 3) campus tours to observe the changes to learning spaces designed to facilitate the new ways of learning and teaching; 4) observation of classes in which teachers and learners were engaged in the challenges; and 5) informal discussion with learners about their perspectives on the challenge-based approach to learning.

Biography

Originally trained as a secondary teacher in languages and literature, I joined the Victorian TAFE system in 1994 after a period of teaching adults in the community education sector. My roles in TAFE entailed training VET trainers and assessors, managing educational projects, developing curriculum, and conducting research into various aspects of vocational training and assessment and the national VET system. During this time, I completed a number of postgraduate qualifications in education and training.

In 2005 I started my own business as an academic development consultant and scenario planning facilitator. Working with a specialist scenario planning consultancy, I was one of a team of four who designed and facilitated the inaugural project of what is now the Australian Institute for Teaching and School Leadership. This two-year project built 25-year scenarios for the future of teaching and involved working with teachers and principals from K-12 schools across Australia. I subsequently completed my PhD using this project as the basis of my research.

However, most of my consulting consisted in working with TAFE institutes that were venturing into higher education (HE) delivery. I led discipline teams in the development of curriculum of over 25 undergraduate qualifications. During this time it became apparent that these providers required assistance with fulfilling the regulatory requirement that staff delivering HE qualifications engage in scholarship that informs their teaching (Commonwealth of Australia, 2015). A significant component of my later consultancy work evolved into mentoring providers and individual staff in the establishment of scholarly culture and practice. I also researched and published in this area.

In 2015 I returned to the public tertiary education sector and continued my academic development work there until my current appointment as Associate Dean (Scholarship) at William Angliss Institute in 2016, where my primary role is to lead and mentor staff across both vocational and higher education in taking a more scholarly approach to their learning and teaching practice.

The common threads throughout my career have been an abiding interest and investment in the professional development of teachers, innovation in curriculum, educational research directed towards improving practice and a focus on the future. All of these aspects have been brought to bear in my Fellowship.

Abbreviations, acronyms and definitions

AVETRA Australian Vocational Education and Training Research Association

AQF Australian Qualifications Framework

BCA Bachelor of Culinary Arts

DET Department of Education and Training

HE Higher Education

PPL Professional Practice Learning, a learning and teaching approach that uses learners' existing professional practice as the basis for reflection, theorising and further learning

RPL Recognition of Prior Learning

Cert IV TAE Certificate IV in Training and Assessment

TAFE Technical and Further Education

Twenty first century skills the skills and competencies young people will be required to have in order to be effective workers and citizens in the knowledge society of the 21st century. They typically include skills related to communication, collaboration, digital literacy, creativity and problem solving.

VET Vocational Education and Training

VTA Victorian TAFE Association

WAI William Angliss Institute

4. Fellowship Learnings

I investigated two main curriculum/pedagogical models:

1. Collaborative challenge-based learning, increasingly practised throughout the VET system in the Basque Country, Spain; and

2. Design-based curriculum delivered via the RPL/PPL pathway as practised at Otago Polytechnic, New Zealand and Middlesex University, England.

The initiatives I encountered at other institutions provide additional features that could supplement and enhance the above approaches. I shall outline the key features of each of the models and discuss their relevance to the Australian VET system in terms of the research questions that drove the investigation: namely, international approaches to developing twenty first century skills and mechanisms for building the capacity of VET teachers to develop and assess these skills in their students.

Model 1: Collaborative challenge-based learning: Spanish Basque Country

Basque VET system-level changes

While the Basque Country is accountable for the delivery of VET qualifications that meet the same learning outcomes as those across the rest of Spain, the Basque government has responded at a systemic level to employers' demands for less focus on training in technical skills and more on the twenty first century skills that companies need to maintain competitiveness.

The Basque VET system has transformed itself from providing traditional technical training much like that currently delivered in Australia, by reorganising how providers relate collaboratively to local industry, each other and the VET system, as well as transforming its pedagogy. Tknika, the Basque Centre for Innovation and Applied Research plays a coordinating role and has led the transformation through a range of initiatives such as:

» Designing the new pedagogy

» Training and supporting teachers in its use

» Developing learning and teaching materials and templates for use/adaptation by teachers

» Leading the development of innovation projects in which VET teachers collaborate with industry locally and internationally to solve their real-world problems in real time

» Providing funding for teacher mobility programs so that VET teachers can travel internationally to seek out and bring back innovations in their vocational fields for dissemination throughout the VET system.

While there are many useful lessons to be learned for Australia though a closer examination of the Basque VET system and the role of Tknika, the focus of this Fellowship is on the pedagogical aspects of the transformation.

The new pedagogy – ETHAZI

The new pedagogical model is called 'ETHAZI', a made-up word equivalent to the notion of 'openness' in the Basque language. It brings together technical skills

with a specific focus on twenty first century skills in collaborative challenges, the aims of which are to improve the professional competence of VET learners in order to produce good professionals, good citizens and good people. Thus, although the training is vocational, it also embraces a broader personal and social mission.

ETHAZI has four key characteristics:

1. Holistic learning, in which multiple units are reorganised into cycles of 11-step challenges that mirror real-world workplace scenarios. The method is similar to problem-based learning, but the 'challenge' terminology is preferred because it encompasses the idea of positive opportunities for developing creativity, innovation and entrepreneurship, not 'just' solving problems.

2. Self-managed teaching teams which share responsibility for all aspects of group and individual tuition throughout each training cycle. This requires a high level of collaboration and flexibility in terms of timetables, physical spaces and teacher availability.

3. The integration into the training cycle of feedback, assessment and evaluation of competency development on a continuous basis. Learners receive frequent feedback on both an individual and team level, while formal assessment involves teacher, peer and self-assessment components.

4. The modification of learning spaces to optimise flexibility and foster open, collaborative and experiential learning.

To date 52 of the 56 VET colleges in the Basque Country are implementing ETHAZI. It started as a pilot project in 2012 with just five colleges; each year more colleges have come on board. At the time of writing, 5625 learners have been trained using the ETHAZI method and 1650 teachers have been trained in its use.

Learning predominantly takes place through three or four person teams of learners designing solutions to a series of challenges that progress through cycles of planning, implementing, reflection and assessment, which are entirely consistent with Kolb's (1984) experiential learning model.

All teachers involved in the delivery of a course work as a multidisciplinary team to analyse and map the technical and twenty first century skills across the units in order to incorporate them into a series of challenges relevant to local industry that can be addressed using the equipment available in the college. The challenges are co-designed and/or verified by industry collaborators, with whom teachers are in daily contact through their 'dual' pathway model where learners spend the mornings in college and the afternoons at work. (It should be noted that all learners spend time in the workplace as part of their course: those not enrolled in the dual pathway spend the final three months of their eighteen-month course working in industry.)

A challenge must reflect as closely as possible a problematic real work situation that:

» Is relevant to those who carry the responsibility for resolving it

» Is vague or 'fuzzy', requires thought and has more than one solution

» Requires collaboration between learners

» Is based on some level of previous knowledge, produces measurable results and generates new learning

» Is sufficiently flexible to include personal elements that particular learners may bring to it

» Requires information gathering and interpretation.

A challenge may be a project, a simulation, a problem, an inquiry, object analysis, a case study or a mixture: for example, a challenge may start with a case study and evolve into a project. A challenge must involve more than one unit in a course in order to foster holistic learning and reflect the complexity of real world scenarios.

Each challenge follows the same eleven steps of the model designed by Tknika shown in Figure 1 below.

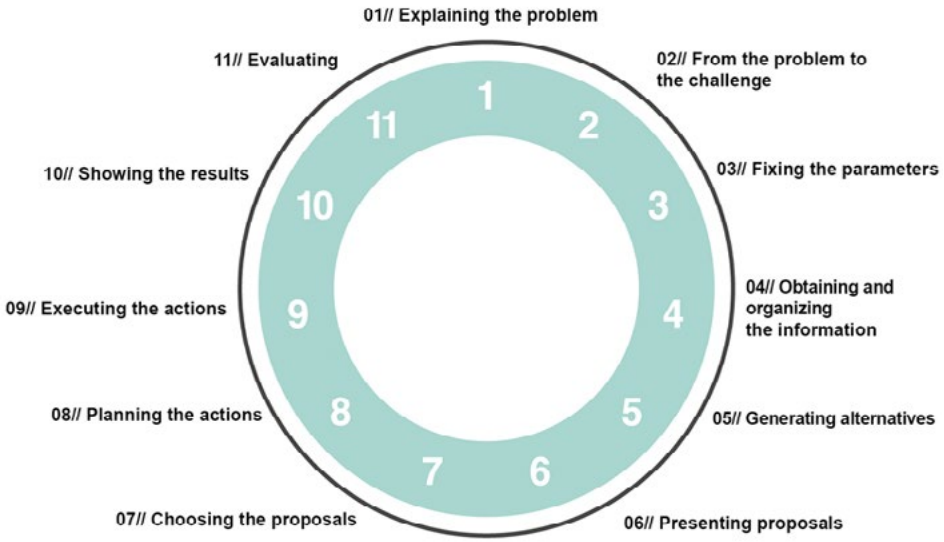

Figure 1: The eleven-step ETHAZI challenge

Step1: Each challenge is launched in a way that is designed to motivate and attract the learners. For example, it may involve a site visit to a company, a video or a case study.

Step 2: Each learner needs to understand the challenge, why it is important, and connect with it.

Step 3: The parameters are usually expressed as a series of questions that the teachers use to guide the learners in what they need to know in order to resolve the challenge. This is not a didactic process: rather it resembles the Socratic questioning method.

Step 4: Both theoretical and practical information are required for each challenge. Learners typically research this themselves but in some cases mini lectures or learning activities may be required to establish foundational knowledge or when the whole class is stuck.

Step 5: Each learner individually generates alternative ideas for how the challenge could be addressed.

Step 6: Each learner pitches their ideas to their team members and answers questions about it.

Step 7: The team negotiates and selects the one idea that they think will best address the challenge or a hybrid of more than one idea.

Step 8: The team must develop a project plan with a timeline and tasks assigned to each member.

Step 9: Somewhat counterintuitively, implementing the plan is typically neither the longest nor the most important step in the cycle. This is usually step 4.

Step 10: Teams jointly present and defend their results to the whole class, responding to questions and receiving feedback from their peers.

Step 11: Teachers work with learners individually and in teams to reflect on and evaluate their learning in order to make improvements for the next challenge.

Typically, each course starts with a small challenge that enables learners to move quickly through all eleven steps and become familiar with the process. Challenges become increasingly open at higher course levels, which demands higher levels of creativity from the learners. Feedback and assessment are integrated into each stage of the process, as is the development of twenty first century skills.

Twenty first century skills

Through its consultation with industry, Tknika has identified a dynamic list of twenty first century skills currently relevant to the industries the VET system services. This list is reviewed regularly, and skills are added or deleted. All skills fall within the following categories:

» Creativity
» Communication
» Collaboration
» Digital competence
» Creative thinking
» Personal and social responsibility

The teaching team for each course decides which are the most relevant skills for their discipline area and interprets and integrates them into the challenges. However, the development of these skills arises primarily from the teaching method rather than the curriculum. A recent evaluation of the ETHAZI method found that learners develop more twenty first century skills than those which are formally assessed (Egiguren, Sala, & Echeverria, 2019).

Learner teams

Teams are selected by the teachers using a variety of team building tools and a team leader is assigned. The remainder of the team roles and tasks are negotiated between the learners. Team members work on their own tasks and are responsible for communicating their learning to their teammates because all may be questioned about any aspect of the challenge at any time. Learners must try at least two or three times to find a solution within the team when they get stuck before teachers will intervene with guidance. Every day starts with the teams reflecting on progress and learning that has occurred through the previous day's tasks and team processes before planning and diarising their agenda for the current day. These are then presented to the class for feedback before work commences.

Feedback and assessment

When the teaching team designs a challenge, they must also identify what evidence of learning they will collect, both individual and team based, and at what points during the challenge it will be collected. Teachers take notes and photos as evidence of the learning they have seen demonstrated. Significant emphasis is placed on assessment for learning, so feedback is very important. Each week every learner meets individually with a teacher to gain feedback on their learning and assessment, which is primarily based on teacher observations of individual and team performance and covers both technical and twenty first century skills. In some cases, an industry person is also involved in the assessment.

Learners sign a learning contract at the beginning of each challenge that sets out what they will do in order to achieve the required learning. This becomes an important component for assessment purposes as learners are jointly responsible for their assessment. They gather evidence such as taking photos of the learning that they consider they have demonstrated.

Learners have the opportunity during the weekly feedback meeting to reflect on their own performance, learning and processes, as well as those of the team. Teachers and learners use a common rubric as the basis for reflection, discussion and assessment. This ongoing conversation is intended to raise learners' awareness of their own learning, with an emphasis on demonstrating evolution and continuous improvement in their skill development. This is particularly important in regard to twenty first century skills; learners are not assessed on a common baseline. Rather, they must demonstrate improvement in each cycle from wherever their starting point may have been.

Some elements of assessment are individually marked, and some are team based. This varies from course to course and from challenge to challenge, as does the

relative weighting between technical and twenty first century skill components. Some courses have exams to ensure that each individual has achieved the minimum technical skills required for the national Spanish VET qualifications. However, if a learner fails to pass the twenty first century skills component, then they fail the challenge. Self, peer and teacher assessment all contribute to the final mark for each subject. Again, the relative weighting varies between courses and challenges.

Table 1 below summarises how various features of the ETHAZI method foster the development of twenty first century skills.

ETHAZI feature	Twenty first century skills development
Learning contracts	Autonomy, responsibility
'Fuzzy' challenges	Creativity, innovation, enterprise, entrepreneurship, problem solving
Generate ideas individually, then team selects one	Critical thinking, negotiation, conflict resolution
Researching potential solutions	Analysing, interpreting and organising information, digital competence
Daily planning	Organisation, time management, communication, negotiation
Presenting & defending plans & results	Communication, digital competence
Separate team roles	Teamwork, responsibility, leadership, communication, negotiation
No immediate help from teacher	Autonomy, initiative, resilience, persistence, creativity, problem solving, teamwork
Continuous reflection & feedback, peer & self-assessment	Self-awareness, metacognition, emotional intelligence, critical thinking, teamwork

Table 1: ETHAZI and twenty first century skills development

Teaching teams

All teachers associated with each course work together in self-managed teams. They are jointly responsible for designing and mapping the challenges and assessment tasks. They stay together with each cohort of learners rather than teaching their specialist units across multiple courses. While each teaches and assesses their specialty subject, the whole team of three to five teachers is usually in the classroom at the same time. Those not teaching do their marking, preparation and so on, usually at the back of the room. Because of the multi-disciplinary nature of the challenges, all teachers need to be available for learner consultation when needed.

The whole teaching team is responsible for developing and assessing twenty first century skills so being in the classroom most of the time provides plentiful opportunities for observing their development. The teachers also support one another with providing feedback to learners, and where necessary, managing conflict and learner behaviour. Traditional unit-based timetables need to be modified to accommodate this arrangement.

In contrast to typical Australian conditions where teachers often only know the units they teach, Basque VET teachers develop a good understanding of what others do and know how each of the units connects with the whole course and its overall objectives. ETHAZI has opened their teaching to scrutiny, feedback and the sharing of good practice.

Teachers require significant support, working within a continuous improvement model. Substantial work is required up front to design and develop the challenges; teaching teams typically start preparation a year before implementation. Stability within the teaching team, goodwill, and well-functioning relationships between the teachers are seen as critical to the effective deployment of ETHAZI.

Teacher training

Tknika provides training to teachers in using the ETHAZI method. There are two levels of training: 70 hours of basic training comprising 21 hours in face to face workshops and the remainder online, and an additional 30 hours for teachers who take on the role of ETHAZI coordinator for their college. Teachers learn the ETHAZI method experientially the same way that learners do - by working in teams through the eleven steps to develop their first challenge for learners.

Training takes place twice a year with the majority completed during semester breaks. The training is undertaken in the teachers' own time: they are not paid to attend and nor are they given time out from their teaching. While not compulsory, as the Basque system transitions to 100% uptake of the ETHAZI method, teachers will find it increasingly difficult to be employed without this specialist training.

Learning spaces

The ETHAZI method is best supported by flexible, open spaces that allow learners to work in groups, in some cases around specialist equipment within a generalist classroom. VET colleges in the Basque country are gradually being modified to accommodate the new teaching method. Writeable 360 degree glass walls, multiple ICT hubs and wheeled, geometrically shaped tables that can fit together in different configurations enable learner activity to take place anywhere in a room without a focus on the teacher at the front. Each classroom has an associated break-out room that typically contains comfortable furniture, coffee-making facilities and is wired for playing music. These rooms may be used at any time by learners or teachers who need a relaxing space in which to think. They are also used for giving feedback to learners. The walls in the break-out rooms are also glass, so everything that goes on inside them is visible from the main classrooms.

Figure 2a: Classrooms at Usurbilgo Landibe Eskola

Figure 2b: Classrooms at Usurbilgo Landibe Eskola

At Usurbilgo Landibe Eskola, set in a village in the Basque countryside, teachers also consider the landscape to be an important factor in creating spaces conducive to learning and learner wellbeing. The light-filled, glass-walled classrooms afford access to uninterrupted views to the lush green hills surrounding the town.

Figure 3: Landscape as a factor in learning and learner wellbeing at Usurbil

Evaluation of the ETHAZI method

Informal evaluation

While visiting the colleges I was able to ask staff and learners informally about their views of ETHAZI. Both were enthusiastic supporters of the method, while conceding some drawbacks. Learner views were remarkably consistent. Most reported feeling lost at first because of not knowing how to set about solving the challenge, coupled with an intense sense of frustration at time lost in searching for answers rather than being able to go straight to the teacher for assistance. They especially disliked getting stuck and not being able to generate ideas for how to proceed. However, they reported a strong sense of satisfaction once they were able to understand and solve the problem. They valued the suggestions and feedback from the teachers and other learners and appreciated the opportunities for networking and helping each other. Learners also reported enhanced ability to take the knowledge in and make sense of it, but they felt that it took longer than the traditional way of learning.

These views were corroborated by the teachers. They reported initial resistance from learners, citing, 'Just tell me what you want me to do!' as the most frequent reaction. They observed that learners find reflecting on and questioning their own truths uncomfortable, yet the learners ultimately prefer the new method, as evidenced by the dramatic drop in absenteeism and attrition since the introduction of ETHAZI.

Teachers conceded that learners acquire less detailed technical knowledge than under the traditional system. However, they claimed that learners achieve a deeper understanding of the knowledge and of the significance of what they have learned. They argued that learners understand *why* they need the knowledge - i.e. in order to solve a problem – and *how* knowledge from different discipline areas fits together. Teachers also asserted that employers, who have been clamouring for workers with twenty first century skills, prefer the ETHAZI method because it develops more rounded people who understand how to learn.

One college CEO commented that for ETHAZI to work, management must be interested in the revolution in industry, committed to society and its development and understand the needs of companies and the benefits for learners in the form of better jobs and improved employment opportunities. She also stressed the importance of empathising with both teachers and learners and supporting them in the challenges associated with transitioning to the new system.

Formal evaluation

Tknika recently commissioned Mondragon University to conduct a formal evaluation of ETHAZI. Much of the following is an unofficial and approximate translation from their presentation at the 2019 International Congress on Vocational Training (Egiguren et al., 2019).

> *The purpose of the research was to analyse and evaluate the impact of ETHAZI in order to identify the key factors that drive innovation and change. Questionnaires containing closed questions for quantitative analysis and open questions for qualitative analysis were distributed to 1031 teachers and 5780 students in 64 colleges, and 633 instructors/tutors during November 2018 to February 2019. Responses were received from 3199 students from 52 colleges, 716 teachers from 57 colleges and 90 instructors/tutors. This represents a response rate of 69% of teachers, 55% of students and 14% of instructors/tutors.*

The research validated the findings from my informal interviews with staff and learners. Some of the key conclusions were that:

» *Both teachers and learners endorse and support ETHAZI. Teachers felt that it is an appropriate model for intermediate and advanced level training* [equivalent to AQF Levels 3 to 6] *across all industry sectors*

» *Implementation is somewhat more problematic: for instance, traditional timetabling of discrete units obstructs ETHAZI*

» *ETHAZI seeks to be current and respond to workplace needs – it is based on the processes and content of the workplace in increasingly digital contexts*

» *It seeks the balanced development of technical and transferable skills*

» *ETHAZI is pedagogically up-to-date in that learners work on challenges that are directed towards personal, social and professional development in terms of both technical and transferable skills*

» *Assessment is complex and, while it is also summative, it is primarily used formatively to enhance student learning*

The researchers raise questions not addressed in the study, which speak to the ongoing improvement of ETHAZI:

» *How to adjust the challenges to the needs and prior knowledge of the learners*

» *Why learners feel that their opinions (when forming teams and selecting topics) are not taken into account*

» *How to improve the dynamics of the challenge development (choice of topics, applying and building on previous knowledge, content development) throughout the process*

» *What type of (complementary) training teaching staff need to better manage and assess learners' teamwork*

» *How to develop the proficiency of teachers so that they can better facilitate student learning*

» *How to improve the coordination of teachers to make them more effective*

» *How to improve the organisation of college management teams so that* the work of teachers is easier and more effective

» *How to always ensure that the challenges develop the skills (technical and transferable) that companies require (Egiguren et al., 2019).*

Application to the Australian VET system

While it would require no less of a revolution in the Australian VET system to implement the full scale reforms than that which has taken place in the Basque country, there is no reason why ETHAZI could not be adapted to Australian conditions. In the same way that the Basque Country VET providers must deliver and assess Spanish national qualifications, Australian vocational training packages are fixed by external Service Skills Organisations. However, neither national system dictates how learning should occur. Therefore, it is within the control of VET providers to change their pedagogy, just as the Basque Country has done. Even without the symbiotic relationship with local companies that is the hallmark of the Basque VET system, very significant advances could be made in developing twenty first century skills in Australian VET learners through adopting collaborative challenge-based learning over the current traditional training techniques.

While the various, arguably punishing, compliance regimes that apply to Australian VET render holistic learning and assessment problematic, Basque providers face a lesser, but similar hurdle in mapping the challenges to the Spanish national qualification curricula. Careful and detailed mapping is the key to success in both Australian and Basque contexts.

As in the Basque country, teachers will need training and substantial support in how to deliver and assess challenge based learning. Support could perhaps best be made available through interested teachers forming a cross-institutional Community of Practice to design and pilot versions of collaborative challenge-based learning that are adapted to local conditions.

Model 2: The recognition of prior learning/ professional practice learning (RPL/PPL) pathway

Otago Polytechnic, Dunedin, New Zealand

The second pedagogical model was encountered in the Bachelor of Culinary Arts (BCA) at Otago Polytechnic, New Zealand. The program offers two pathways: both use design-based curriculum and pedagogy but one is offered on campus to students who may or may not have previous experience in the culinary arts. The other accepts only highly experienced, senior practitioners whose professional practice is recognised through RPL and then used as the basis for further learning as they fast track through the remainder of the degree. The latter, referred to as the RPL/PPL pathway in this report, was the focus of my investigation because it represents a possible model for efficiently and effectively upskilling the Australian VET workforce, including building capacity and capability to develop and assess twenty first skills.

It should be noted that Otago Polytechnic also offers the RPL/PPL pathway for a range of other discipline specific and generic areas though its dedicated PPL 'arm', Capable New Zealand. However, the BCA was of interest because of its affinity with WAI's specialist offerings in foods and hospitality and because the program has evolved its own distinctive methodology.

In this model, selection into the course is by professional portfolio and a challenge task. Meeting the entry criteria gives approximately one and a half years' advanced standing into the degree. The remainder of the program is delivered in one academic year (February to September) in online mode through weekly individual mentoring via Skype or similar, and two on-campus workshops of three and four days' respective duration. This enables learners to continue in full or part time work while they study.

Through meeting the entry criteria for the RPL/PPL pathway, learners have already demonstrated the technical skills and knowledge that mainstream students learn on campus. These learners spend the year of largely independent study reflecting on, critiquing, theorising, articulating and demonstrating the application of their philosophy of practice. The Otago Polytechnic PPL cohort often includes secondary or VET teachers in food and hospitality related areas because, although specialist technology teachers can teach under supervision in New Zealand schools without a bachelor degree, they are paid at an extremely low rate. They therefore use the RPL/PPL pathway to expedite upgrading their qualifications. They generally focus on their teaching as a particular form of professional practice in their discipline and this would be equally appropriate for Australian VET teachers if a similar model were adopted here.

The core disciplinary body of knowledge for the degree is design, which participants learn about through the workshops and online resources. This injects a major theme of creativity and innovation into the degree. The course is structured around a series of design briefs in what is essentially a creative variation of problem-based learning. The design briefs enable learners to demonstrate the course learning outcomes using design thinking methods, tools and techniques from sources such as Stanford University's d.school <https://dschool.stanford.edu>, the British Design Council <https://www.designcouncil.org.uk/> and IDEO <https://www.ideo.com/>, whose purpose is to foster creativity, innovation and creative problem solving. Some of these design activities are undertaken in pairs, which fosters collaboration while simultaneously presenting opportunities for challenging and interrogating habitual ways of working and thinking.

Figure 4: A learner's response to a design brief

The briefs are broad, enabling learners not only to explore their individual areas of professional interest, but also enable the inclusion of an eclectic range of theories to inform their practice. The RPL/PPL pathway is radically learner-directed in this regard. In contrast to the mainstream pathway where learners are given a theory with which to experiment, in this instance the academic mentors take their lead from the direction individual learners are interested in pursuing and suggest literature and theoretical frameworks that they think may be of use in furthering that direction. This requires a significant degree of flexibility, openness and a broad grounding in sociological theory on the part of the academics. However, this approach deeply validates learners by enabling them to take their existing professional practice as the point of departure for exploring theoretical frameworks, philosophies and values with which to enrich their understanding of their practice. It also helps them to situate their practice in a broader professional, social and philosophical context.

The first three-day workshop in February sets the holistic tone for the course, addressing the development of the whole person. The initial workshop aims to help learners get to know themselves as professional practitioners: how they have arrived at where they are now and how to use that to take the next step in their learning and career. Considerable attention is paid to unpacking and debunking notions such as 'academic', 'research', 'success' and 'value' as learners are typically those who have equivalent AQF level 4 or 5 qualifications and do not have a history of academic success in the formal education system. Holding these notions up to scrutiny and critique starts the process of fostering critical thinking and embracing multiple perspectives. Such activities are designed to trigger deep reflection and encourage the questioning and reframing of the hitherto unexamined conscious and unconscious assumptions and values that have driven learners' professional and personal histories to this point.

A design brief is set as an assessment task for completion in eight weeks. Learners have to design a product for a commercial context and keep a design journal that shows the development of their idea, articulates their design process and tracks their thoughts and feelings. The point of the brief is not what they design. Rather,

it provides a context for learners to slow down their professional practice so that they can critically examine and reflect on *how* they work and *why* they work in particular ways. Successful achievement of this task completes the second year learning outcomes.

The second four-day workshop in April focuses on the values and philosophical underpinnings of professional practice. Again, concepts such as 'creativity', 'craft', 'authenticity', 'perfection' and 'quality' are held up to critical scrutiny and broadened out to make linkages with philosophical and sociological theories. Notions of constructed reality in the kitchen context and food as symbolic communication are examined and again, with an eye to the academic profile of the learners, theoretical concepts are usually explored using YouTube clips, TED talks and documentary film rather through traditional 'heavy' textbooks and academic journal articles - resources which also present opportunities for exploring issues of social responsibility. Academic staff refer to this softly-softly approach to introducing theoretical content as 'hiding the vegies'.

The use of narrative is an important tool in the transformation of learners from chefs as 'doers' to 'thoughtful doers' and thinkers – a shift from practice to praxis. Narrative also helps them to find their authentic voice as professional practitioners. Each brief requires learners to link their design to something of personal significance for them and tell the story of why it is significant. For instance, early briefs reference a childhood memory, while one of the later assessment tasks involves writing a media article about themselves and how their upbringing and culinary influences have shaped their values and philosophy of practice. Leaners are introduced to personality tests such as the Myers Briggs Type Indicator https://www.16personalities.com/ and Values in Action Inventory https://www.viacharacter.org/ as a means of enriching their self-knowledge. The media article also fosters digital competence.

Academic staff who facilitate the workshops and their guest speakers also disclose personal stories and expose their own vulnerabilities, which helps to build a trusting environment in which it is safe for learners to explore personal terrain. Mentors' feedback and challenging of assumptions fuel ever deepening critical reflection and self-reflection as learners tell their story. This further develops self-awareness and helps build emotional intelligence and resilience as they come to recognise repeating patterns, both positive and destructive, in their careers and lives more generally. Evidence of this self-reflection is assessed as part of their final portfolio.

Final year-level study (AQF 7) is characterised by a major project. The brief asks learners to design a dish or system that embodies their philosophy of practice and to articulate it in an accompanying exegesis. Many learners take this opportunity to design the next step in their career, often involving a career change. It is quite common for those who still work in industry to transition to teaching or for existing teachers to design and establish their own business. They develop the entrepreneurial skills to accomplish this through following the discipline of the design process, as a number of alumni who return as guest speakers attest.

Assessment

A formative approach to assessment is taken with no final marks assigned until the end of the course. Learners receive only indicative marks on each piece of assessment throughout the course, alongside substantial feedback on their progress. At the end of the course learners submit their complete portfolio of assessment evidence and make a final presentation on their philosophy of practice and how it is embodied in a product or process that they have designed. All of the evidence is then assessed against the course learning outcomes, which means that if a later piece of assessment evidence shows improved performance, indicative marks from an earlier piece may be revised upward. However, no mark is ever revised downward.

Mentors are not involved in assessing their own learners' work. Final assessment is undertaken by a panel, comprising other teachers in the course, an assessment

expert who is external to the course and an industry representative – usually a previous alumnus of the RPL/PPL pathway.

Transformative learning

What is noteworthy about Otago Polytechnic's PPL approach is that in the space of eight short months, learners appear to demonstrate outcomes consistent with transformative learning theory. All of the core elements of a transformative approach to teaching for change are present in the pedagogy: experience, dialogue, critical reflection, trusting relationships, a holistic orientation, and awareness of context (Taylor, 2009).

According to Kegan (2000, 2009), the difference between 'ordinary' learning and transformative learning is that in the former, new knowledge is linked to current knowledge and accommodated within existing meaning-making structures or 'frames of reference' (Mezirow, 2009). In contrast, in transformative learning the meaning-making structures, which consist of the system of underlying beliefs, assumptions and values that both consciously and unconsciously define our experience of the world (Koltko-Rivera, 2004), are themselves transformed. This enables learners to understand the world and their place in it in a new way. Furthermore, coming to critical awareness of the influence of these beliefs, assumptions and values on the way we perceive, understand and respond to our experience – and of the limits to knowing that they impose – constitutes the development of what is known as 'epistemic cognition', a form of higher order thinking which some authors consider to be the quintessential hallmark of transformation (King & Kitchener, 1994; Kitchener, 1983; Mezirow, 2000; Williams, 2016).

Evidence of progress towards transformation in the terms described above was apparent in my witnessing of learners' participation over the course of the workshops and was most powerfully present in the final presentations and assessment portfolios that I observed. Learners were able to articulate how previous understandings had shaped their professional choices and behaviours, and to demonstrate their 'transformed perspectives' (Mezirow, 1978). Indeed, some of the outcomes achieved appeared consistent with masters' level study. The significance for Australian VET is that this approach could represent an opportunity for VET practitioners to gain a bachelor level qualification, which Smith et al. (2018) identify as having the highest impact on teaching quality, in a relatively rapid and cost-effective manner while continuing in full or part time work. Importantly, the approach fosters a profound transformation in thinking that could assist VET practitioners to acquire the requisite higher order skills for developing and assessing twenty first century skills in their students.

Middlesex University, London, England

The model that Otago Polytechnic uses is based on the original development work at Middlesex University. Although the model has evolved independently in both places over time, the essentials are the same. However, an important difference is that the curriculum for Otago Polytechnic's RPL/PPL pathway shares the discipline-based culinary arts learning outcomes with the on campus coursework pathway. In contrast, the professional practice degrees at Middlesex University have neither a coursework counterpart nor specific, discipline-based learning outcomes. The curriculum consists of generic, practice-based learning outcomes that apply to professional practice in a range of industries. The specific specialism is negotiated with each learner and the nomenclature of the degree is selected to reflect the content of the study; for example, *Professional Practice, Arts and Creative Industries (specialisation) BA Honours.*

The key to developing curriculum in this model is finding appropriate benchmarks that can guide the formulation of the learning outcomes. Where they exist, professional standards can be used. An English supplementary document titled *Credit level descriptors for higher education* (seec, 2016) provides guidance on the complexity of learning that is appropriate for each qualification level. With appropriate mapping of English qualification levels to the AQF, this publication would be helpful in the Australian context as well.

This generic model may be suitable for Australian VET teachers whereby they can choose a specialism in either their vocational or their teaching practice. Shell subject outlines could be developed that accommodate a range of specialisms within the one degree. This would represent a new curriculum model for Australia and would need to be developed in concert with TEQSA to allay any concerns that the reduced volume of learning or the perceived lack of a specific disciplinary body of knowledge may compromise the integrity of the qualification.

Supplementary models

Institut Paul Bocuse, Lyon, France

Housed in a chateau in a small town on the outskirts of Lyon, Institut Paul Bocuse is an eponymous private hospitality college of around 1,000 students that was co-founded by the famous culinarian. The guiding philosophy of education at this college is one of recognising individuals and encouraging the formation of their identity and passions. While the pedagogical model is generally more traditional than those outlined above, some of the characteristics of the Basque model are also in place here. For example, teams of second year learners are given the challenge of designing, setting up and running a pop-up restaurant, while leadership and management skills are fostered through third year learners supervising first year learners in the kitchens.

The main mechanism for developing twenty first century skills is their program of ‘individual accompaniment’. Talent managers work with learners on an individual basis to identify their preferred career and help to place them appropriately in industry. They provide mentoring, guidance and counselling to build self-awareness, emotional intelligence, resilience and problem solving skills. Through these sessions and in other parts of their coursework learners gather an online portfolio of evidence of their twenty first century skills to show to potential employers.

Figure 5: Institut Paul Bocuse

Free University of Bozen-Bolzano, Bolzano, Italy

The Free University of Bozen-Bolzano has developed a niche program of entrepreneurship and innovation which runs alongside a traditional master’s program within the Department of Economics and Management. There was considerable resistance to the new course and its emphasis on the development of twenty first century skills from faculty members who considered traditional theoretical knowledge to be of paramount importance. To overcome this impediment academics from the Faculty of Design and Art were brought in to help develop and deliver curriculum and pedagogy based on design thinking and project based learning.

Social innovation is a strong theme in the program, whereby entrepreneurial logic and approaches are applied to social problems, aiding learners in the development of social responsibility. The university has a 'Fablab' – a multi-disciplinary space for digital fabrication and other traditional technologies, which is open to the city. This enables learners to intermingle with the town's citizens and be exposed to a broad range of real-world projects. In one part of the program companies come to the university and pitch their real workplace problems for the learners to resolve in multi-disciplinary teams.

Figure 6: FabLab, Free University of Bozen-Bolzano

Learners must come up with design ideas, which are then challenged by academic staff. This forces learners to validate both their framing of the problem and the proposed solution, which aids the development of their critical thinking skills. Design thinking with its core of human-centred design is used specifically to compel learners to listen to people and develop empathy for their needs. Learners are also exposed to algorithms and coding to develop their digital competence and generate an understanding of flows, outcomes and non-linear thinking.

Graduates of the program typically either form their own start-ups or become project managers in innovative companies throughout Europe.

5. Personal, Professional and Sectoral Impact

A significant benefit of the Fellowship for me has been the refreshment of ideas about what is possible for a languishing Australian VET system and the reinvigoration of my hopes and enthusiasm for contributing to its improvement. While I have been aware for some time that the Australian VET system has been slipping further and further behind where it needs to be if it is to provide value to industry, society and the economy into the future, until now possible solutions have not been as clear. It is hoped that a program of collaborative challenge-based learning that has been piloted and evaluated may be disseminated to provide a model that can be scaled up for others in the sector to adopt and adapt.

Further, I have learned about new pedagogies and, through the generosity of my hosts in all of the countries and institutions visited, I feel well prepared to implement them. My exposure to Otago Polytechnic's pedagogy has given me an insight into a relatively quick and effective way not just to upskill, but to transform the thinking of VET practitioners in a way that will equip them to understand and cater to the needs of students entering a very different world of work than that which they themselves trained for.

Several measures are being put in place to disseminate and implement the findings from the Fellowship. Within WAI presentations have been made to governance committees responsible for the oversight of the Institute's learning and teaching, as well as to delivery managers, program leaders and interested teaching staff. A plan is under development for the design and piloting of a form of collaborative challenge-based learning in WAI's patisserie program. Taking a lesson from the Basque experience, where at least a year's advance preparation is required to train staff in the new methodology and prepare the challenges, the pilot will be for implementation in 2021.

In addition, WAI's Higher Education Academic Board has given approval to begin developing a suite of courses based on the RPL/PPL pathway. These will probably follow the Middlesex University model of generic professional practice degrees.

Both of the above initiatives will be developed within WAI's Framework for Scholarly Practice, which will embed research and scholarship in the development process, contributing to the body of knowledge about how such initiatives may be implemented in the Australian VET context. At the time of writing Otago Polytechnic's Professor in Food Design is on a Visiting Professorship at WAI as a direct outcome of the Fellowship. The intent of the visit is to establish an ongoing collaborative program of research and publication on the RPL/PPL pathway model. This will ensure that the impact of the learning from the Fellowship will continue to permeate the tertiary sector as we research, document and disseminate our progress.

In the immediate future I have been invited to present the Fellowship's findings at the VET Development Centre's Thought Leaders' Breakfast and have already presented at Victorian TAFE Association (VTA) networks where keen interest from other providers was shown.

6. Conclusions and recommendations

In spite of the differences between countries and cultures, and between VET and higher education, there are very significant similarities in the approaches to developing twenty first century skills in all of the settings I visited. They involve learners in:

- Some form of experiential, problem based learning
- Engagement with authentic workplace/community scenarios
- Holistic integration of learning across multiple subjects and/or disciplines
- Use of design thinking and/or tools
- Working collaboratively in teams
- Use of critical reflection and self-reflection
- Formative assessment for learning including extensive and ongoing mentoring and feedback
- Generation of a portfolio of authentic assessment evidence

The most significant insight from the Fellowship for me is that twenty first century skills cannot be developed using traditional teaching techniques where the focus is on the teacher at the front of the classroom transferring knowledge and demonstrating skills for learners to observe and copy. Neither can the continued use of simplistic online learning and assessment tools, which are often touted as learning innovation, progress the development of twenty first century skills. Further, developing twenty first century skills is not just a matter of learning new content, so incorporating them more explicitly into training packages, as advocated by the Commonwealth of Australia (2017), will not be sufficient either.

Rather, the practice of twenty first century skills requires a transformed mindset that is developed through a teaching and learning process that is deliberately designed with this aim in mind. My research from the Fellowship suggests that constructivist pedagogical underpinnings, whereby learners actively construct and critically reflect on their own knowledge through carefully designed, authentic learning and assessment experiences, are essential. This requires a fundamental change in traditional VET pedagogy. I believe that this is not yet understood in the Australian VET system.

If, as the literature claims, the Certificate IV TAE has not adequately skilled VET teachers to date, then how much more deficient it will be for equipping teachers to develop and assess learners' twenty first century skills into the future. Teachers themselves must undergo a transformation in mindset before they can begin to foster this in their students. It is my contention that the Certificate IV TAE is simply incapable of facilitating this transition. Models such as those in use at Otago Polytechnic, Middlesex University or Tknika, which step teachers experientially through the same design/challenge/problem based learning as that which they must design for their students, may point a way forward for building the capacity and capability of Australian VET teachers to develop and assess twenty first century skills.

With these conclusions in mind, it is recommended that:

1. A pilot collaborative challenge-based learning program and accompanying learning and assessment resources be designed, developed, implemented and evaluated in one or more Australian VET providers

2. A pilot professional development program inducting VET teachers into challenge-based learning be designed, developed, implemented and evaluated in one or more Australian VET providers

3. Findings from the pilots be disseminated throughout the Australian VET system

4. A Community of Practice for providers interested in implementing challenge-based learning be established to provide support and guidance

5. A suite of degrees based on the PPL model be designed, developed, implemented and evaluated at a VET provider registered to deliver higher education qualifications

6. Awareness of the PPL model be disseminated throughout the Australian VET system

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