The VET era: equipping Australia's workforce for the future digital economy

Reeson, Andrew and Mason, Claire and Sanderson, Todd and Bratanova, Alexandra and Hajkowicz, Stefan

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THE VET ERA

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Andrew Reeson, Claire Mason, Todd Sanderson, Alexandra Bratanova and Stefan Hajkowicz

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1 BACKGROUND AND OBJECTIVES

The role of the Vocational Education and Training (VET) sector is to provide Australians with the skills they need to participate in the labour market. It is broad and diverse in scope, ranging from short courses in single subjects providing entry-level skills for workers in lower skilled occupations, through to multi-year advanced diplomas preparing students for highly skilled jobs. It is increasingly overlapping with higher education (i.e. universities), particularly as technology increases the demand for technical skills across the workforce. The Australian VET sector is large, with around 3.8 million students, compared to 1.3 million in other higher education institutions.

The nature of work is changing rapidly, driven particularly by technological innovation alongside demographic and societal changes. The increasing rate of technological change means that some jobs have already been automated, and many more could be (Frey and Osborne 2013; Edmonds and Bradley 2015; PwC 2015). While headlines about robots taking over the workplace are somewhat overblown, many current and future workers are nonetheless at risk of having their careers disrupted by technology. However, technology is also creating many opportunities, expanding employment in some occupations and creating entirely new roles in others (Autor 2015; Edmonds and Bradley 2015; Hajkowicz et al. 2016).

At the same time, the Australian workforce is becoming more educated; however, so is the rest of the world, and large emerging economies (notably India, China and Indonesia) are likely to produce unprecedented numbers of educated workers. This both threatens our comparative skills advantage and offers many new market opportunities (Hajkowicz et al. 2016). As the population becomes older and more affluent the service sector is growing in importance, creating new opportunities for suitably skilled workers.

In this constantly evolving environment, the role of VET is critical in ensuring that our workforce remains productive and competitive. However, the education sector is far from immune from digital disruption. It is becoming possible for students to access educational material from anywhere in the world. While VET may be less vulnerable to digital disruption than higher education (since many courses require hands-on training that cannot be delivered remotely), significant change is inevitable.

The increasing pace of change, and the need to work beyond traditional retirement ages, means that many future workers will not only require different skill sets, but are also likely to need ongoing education to avoid being marginalised by technological disruption. There is therefore an opportunity for organisations such as TAFE Queensland to further enhance their role of providing skilled workers for the digital economy through thinking strategically about how such trends are likely to unfold.

This report is the product of a joint project undertaken by CSIRO and TAFE Queensland which investigates how the VET sector can best support Australia's future workforce in the context of evolving skill needs and forthcoming digital disruption. TAFE Queensland, with over 130 years of experience in delivering VET, and CSIRO as a key contributor to the future direction of Australia, are well placed to deliver an insightful piece of work that will support further discussion of this issue.

The report provides a VET focused analysis of the trends influencing education, including changing demand for skills in the Australian economy and future models of delivering education. Our analysis draws upon reviews of the literature, modelling of employment data and interviews with experts in the sector. Based on these analyses, we identify ways in which the VET sector might adapt both its course content and the delivery of training to ensure that workers are well-prepared to contribute to Australia's future social and economic prosperity.

2 OUR APPROACH

Drawing on CSIRO's foresighting and megatrends methodologies and materials (Hajkowicz et al. 2012), we reviewed the relevant academic and industry literature and databases to identify trends in the demand for skills in the Australian economy.

To complement this analysis, we also carried out in depth interviews and a focus group with representatives of key stakeholder groups for VET. An initial list of interviewees was developed based on advice from TAFE Queensland and internet searches, which provided representation from:

• VET providers

• VET students

• VET employers

• Educational technology providers

• Educational technology researchers

• Government departments with responsibility for VET

The interviews were semi-structured, allowing us to focus in on the issues most relevant for each interviewee but in general, the discussion focused on answering the following key questions:

1. What key opportunities are likely to arise for VET providers as we move towards a more digital economy and society?

2. What risks might arise for VET providers in this more digital economy and society?

3. Looking ahead over the next five years or so, how do you think VET providers could be deploying digital technology to achieve greater agility, transparency, efficiency and quality in their service delivery?

4. What is the role of interpersonal interaction and face-to-face learning? What value do they add and in what contexts are they needed most?

5. What actions and resources are required to enable the VET sector to maximise the potential (and minimise the risks) of digital technology in the future?

Twenty-four of those who were contacted agreed to take part in the research, providing representation from each of the groups identified above. They worked across a range of sectors (health, transport, utilities, professional services, building and maintenance, education and training, government), which meant that they could also provide insight into the diversity of the VET sector. Interviewees also worked in a wide range of organisational levels and roles.

All participants gave permission for the interviews and focus group to be recorded which meant that we were able to identify important themes across the interviews and illustrate these themes using participants' own words. To protect participants' confidentiality, quotes are linked to a random code.

Input from VET students was captured at a focus group hosted by TAFE Queensland Brisbane (a list of 20 students was provided to the research team who randomly invited twelve of those listed to take part in the 45 minute focus group). Students were offered a twenty dollar shopping voucher in return for taking part in the research. In the group, the students were asked to discuss three questions (adapted from the interview protocol to better reflect students' experience and expertise):

1. Looking ahead over the next five years or so, how do you think VET providers (such as TAFE Queensland) should be using digital technology to improve students learning experience and ensure that they are skilled and prepared to participate in the workforce?

2. Thinking about the use of digital technology to support education and learning, what factors need to be taken into account when deciding how or when to use technology versus face-to-face learning? What are the strengths and weaknesses of learning via digital technology or face-to-face and when should you use each to support students' learning?

3. How do you think VET providers should prepare (what actions do they need to take now) in order to make the best use of digital technology in the future?

3 CURRENT AUSTRALIAN VET POLICY CONTEXT

The VET sector is traditionally an area that has been the subject of 'policy flux' and the current period is no different, with an element of uncertainty surrounding a number of key policy questions. The policy context of the VET sector is also complex. Its complexity is derived from all of the policy intersections and competing demands to which the sector responds.

Unlike the school and higher education sectors, VET does not have defined boundaries. VET services young people in school, young people who are disadvantaged and have left the formal schooling system, those gaining skills for their first job, those needing new skills for a better or a new job, those starting a new business and those who just love learning. The sector services nearly every industry sector of the Australian economy and is one of Australia's top exports.

Reform of the sector is currently impacted by a number of high profile national policy debates including: the review of choice, competition and contestability for human services; reform of the higher education sector; redesigning VET FEE-HELP, reform of the federation and taxation reform; evaluation of the National Partnership Agreement (NPA) for Skills Reform; the national science, innovation and quality agenda; and the establishment of new arrangements for industry engagement and quality in VET. Some of these issues are discussed in further detail below, however it is apparent that the sector is (once again) going through a period of significant reform. Over the past five years, reform of the sector has been driven by a push to 'marketise' VET by way of increasing competition, choice and diversity in the sector. Most recently the NPA on Skills Reform introduced, among other things, a national entitlement for Australians to access government funding for training qualifications through a provider of their choice. In relation to student choice, the states and territories have each implemented a student entitlement system based on a demand driven model. This has been implemented to different degrees within the jurisdictions, with Queensland having some of the most advanced market settings, including significantly increased contestability for training delivery and the deregulation of fees.

As with many reforms under this National Partnership, implementation of the national entitlement has varied across Australia and has led to the current situation where there are essentially eight different VET systems operating in Australia, all with different qualifications, providers, pricing and eligibility criteria. A recent review of the NPA undertaken by ACIL Allen (2016) found that some of the key objectives of the NPA may not have been achieved to the level envisaged when the agreement was entered into. The four outcomes sought from the NPA were accessibility, transparency, quality and efficiency and effectiveness.

In relation to accessibility the review found that student choice in relation to providers has increased and enrolments for a period had also increased. However, recently total enrolments have declined (-3.5% in 2014) and there has been a contraction in a number of indicators including total number of courses available. From a transparency perspective the introduction of Total VET Activity and the Unique Student Identifier have increased information in relation to the sector. However, information available to students on provider performance continues to be an issue in the sector and is viewed as contributing to quality issues. These quality issues continue to plague the sector, illustrated by falling completion rates, particularly for VET FEE-HELP students and the review points to the rapid rate of reform in the sector across a range of areas and the impact that VET FEE-HELP expansion has had.

The NPA also facilitated the expansion of the VET FEE-HELP scheme and this has led to an increase in the number of providers delivering training through the program and a dramatic expansion in the number of students accessing the scheme. Not surprisingly, expenditure under the scheme has exploded from a relatively modest $25.6 million in 2009 to $1.7 billion in 2014 (Australian Government, 2015). With this expansion has come a raft of unscrupulous behaviour by providers and use of the system as a profit making exercise as opposed to a program to remove financial barriers to students. These issues have been highlighted by a number of media reports, ASQA audits and the analysis of completion rates within the program.

These quality concerns have adverse impacts for students, and have the potential to impact the sector as a whole now and into the future. It should be noted that the Australian Government has introduced a range of measures targeted at addressing misuse within the sector and is currently undertaking a consultation process aimed at redesigning the VET FEE-HELP system for implementation in 2017.

Another key component of reform has been the move toward increasing the commerciality and financial sustainability of public providers within an environment of increased competition from the private sector. This change has however placed public providers in a difficult position as they attempt to move toward more commercial models, while at the same time being expected to meet historical expectations that have been placed on them by both government and the general public, which oftentimes may not be of a commercial nature. This issue once again illustrates the need for a clear articulation of the role of the public provider.

Recent reforms have also been undertaken in relation to the development of training packages. This review process saw the introduction of five new Skills Service Organisations (SSO) to work with Industry Reference Councils (IRCs) on the development of training packages, following a contestable process. The SSOs will work under the IRCs to support consultation with industry to identify the key skills being sought by employers.

The financing of the VET sector represents an ongoing source of uncertainty. Total revenue provided by the Australian Government increased by $571.6 million (22.3%) from 2013 to a total of $3.1 billion in 2014 (driven by VET FEE-HELP). However, during this time revenue from state and territory governments decreased by $318.5 million (7.9%; NCVER, 2015). The fundamental issue here is that state government funding, which targets localised skills demand, is being replaced by VET FEE-HELP expenditure.

Despite the fact that the VET sector provided training to 3.9 million students in 2014 compared to the 1.3 million students enrolled in universities in 2014, VET funding growth continues to lag behind the higher education sector (Department of Education and Training, 2015).

This is illustrated by work undertaken by the Mitchell Institute, which finds that (in real terms) VET funding has only grown by 5% in the last ten years, while other higher education funding has seen growth of 40% over the same period (Noonan et al. 2015).

In addition to ongoing quality and funding concerns there continues to be ongoing debate in relation to the current federated model and whether a shift of full responsibility to one level of government would address some of these longstanding issues. Higher education reform continues to be on the agenda and is currently being considered through the 'Driving Innovation, Fairness and Excellence in Australian Higher Education' report. This discussion paper represents a significant opportunity for the VET sector to contribute to the debate and illustrate what it can provide to the broader higher education system.

Despite the significant reform process outlined above the pending expiry of the NPA in June 2017 represents an opportunity for governments and the VET sector to come together and develop a strategy and roadmap that will provide the high quality VET that will be needed for Australia to prosper in the coming period of digital disruption. The review of the NPA carried out by ACIL Allen recommended that, in the short term "…any further reform beyond the current NP should be guided by the development of a strategic roadmap that provides clear articulation of the role and purpose of VET within the broader education and workforce development systems in Australia, and defines stages for achieving the transition…" (ACIL Allen, 2016). This recommendation encapsulates the fundamental task that needs to occur to continue to enable this critical sector to continue to evolve.

4 THE EVOLVING WORKFORCE

The Australian workplace is changing at an ever faster rate, with technology as a key driver. The effect of digital disruption is differentiated from other technology-driven change because of the exponential rate of change that is being experienced. Innovations facilitate further innovations and recombinations of technologies (Hajkowicz et al. 2016). Figure 1 shows that the rate of change in the composition of occupations in the overall workforce is trending upwards, which may in part reflect the impacts of technological disruption. To be responsive in this more disrupted environment, VET providers need foresight into the skills that will be in demand in the future.

4.1 Growing demand for skilled workers

To understand how employment is changing in a more technologically-enabled work environment, we examined data from the Australian Bureau of Statistics (ABS) Labour Force Survey (detailed, quarterly, cat. no. 6291.0.55.003), covering the period from 1986 to 2015. This database uses the Australian and New Zealand Standard Classification of Occupations (ANZSCO) to define occupations and associated skill levels; these skill levels are approximately matched to qualifications, though for individual occupations or workers relevant experience may substitute for formal qualifications.

The data (depicted in Figures 2 and 3 below) show that employment is showing the greatest growth in the more highly skilled occupations, specifically skill levels one and two (equivalent to a degree or diploma level qualification respectively). Skill level three (certificate III or IV) is relatively flat in terms of overall employment numbers and represents a declining proportion of the workforce. Skill level 4 (certificate II or III) has also grown by around a million workers, but in proportional terms this is less than the growth in skills one and two. The lowest skilled occupations (represented by Skill 5) show relatively little growth. These trends are likely to continue, as more routine jobs are increasingly automated. That is, as more work functions are automated, we should see continued growth in demand for highly skilled workers and slower or no growth in demand for lower-skilled workers.
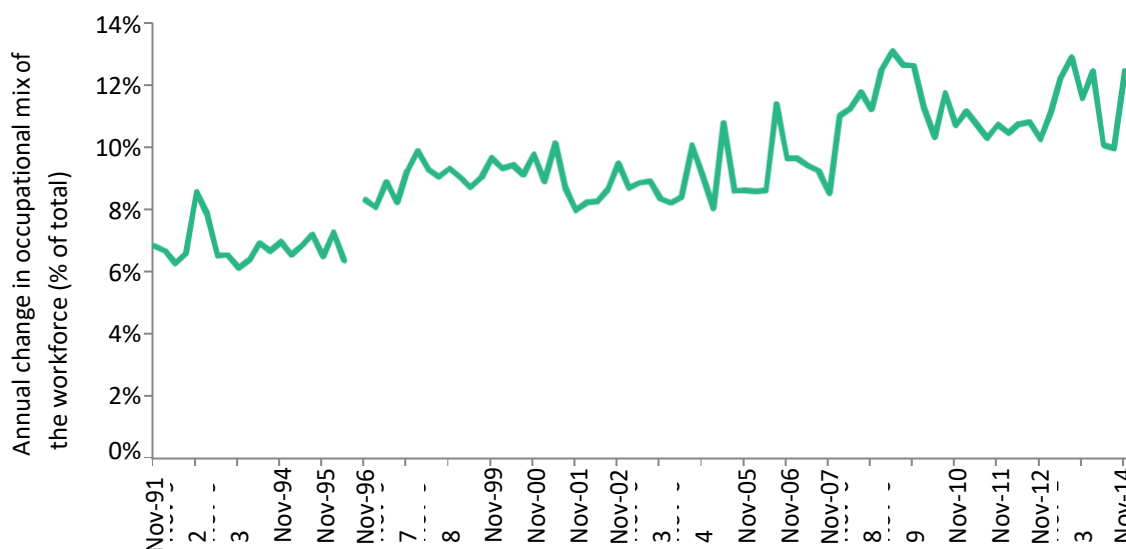

Figure 1: **Proportional change in occupational mix of the Australian labour force (from ABS Labour Force Survey).**
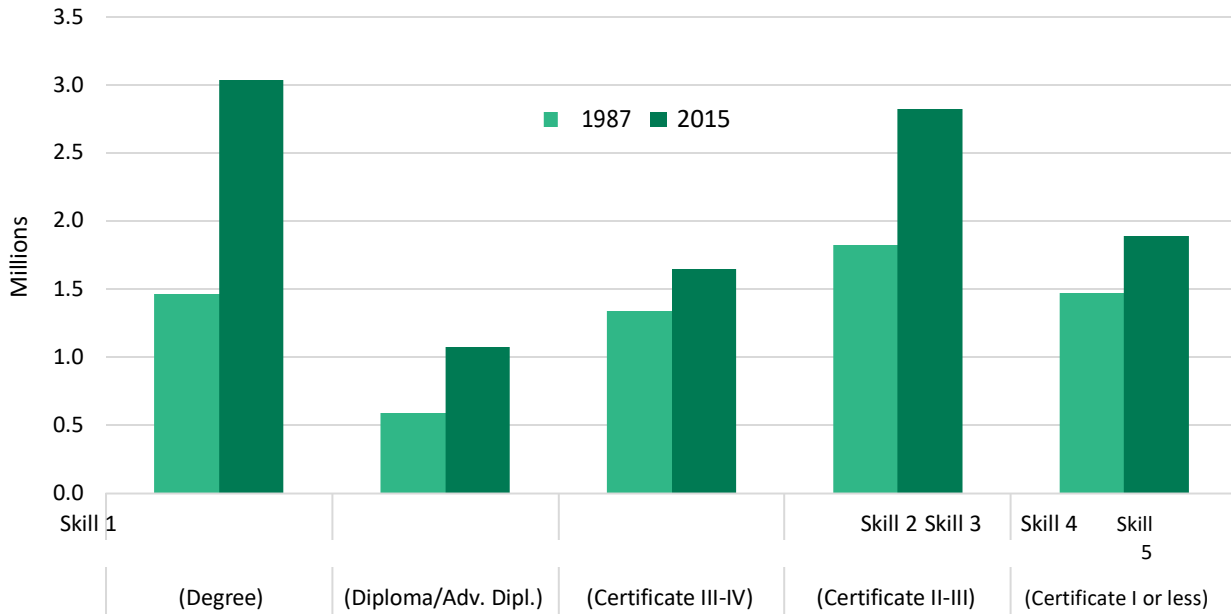
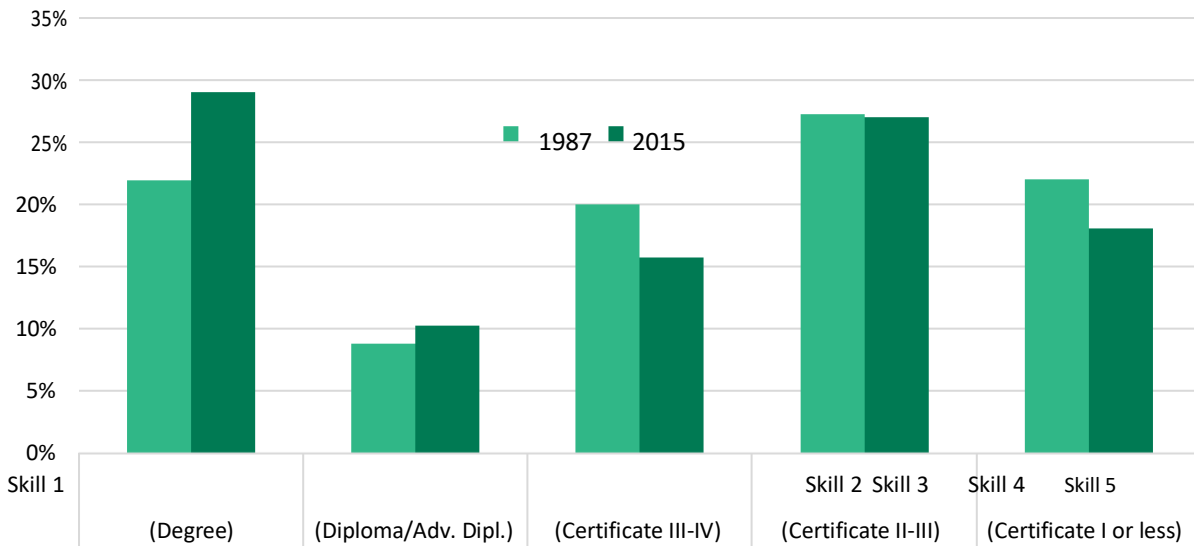**Figure 2: Employment by Skill level (number employed).**

Figure 3: Employment by Skill level (% of total).

The rapid rise in employment for the most highly skilled (degree level) occupations corresponds with increases in higher education participation (the Australian Government currently sets no limit on number of bachelor-degree students at publicly funded universities). These trends in the Australian labour market differ somewhat from international research which finds that medium skilled technical jobs are now the most susceptible to automation (PWC 2015). In some regions of the world a polarisation of the workforce is occurring as the middle-wage group of jobs is shrinking (Acemoglu and Autor 2011; Goos et al. 2014) and workers shift into either higher- or lower-skilled (and paid) jobs (Jung and Mercenier 2014). This trend may play out in the Australian market in the future.

What is clear is that digital literacy will be increasingly important for all workers. This does not mean we will all need to become programmers – most workers will need only the skills to work with technology, not the ability to design or develop the technology. Nevertheless, achieving this level of digital literacy across the workforce will be a challenge given that many Australians still do not have the literacy and numeracy skills needed to participate

effectively in the workforce and approximately 15% of Australians are not regular internet users (ABS 2016). Digital literacy skills (or the knowledge and skills to use digital technology to achieve desired valued outcomes) are likely to become a foundation skill set in the future.

There are also clear trends in the industry composition of employment (Figures 4 and 5). Employment in the manufacturing sector has been in decline (though it is still a major source of employment), along with agriculture. Conversely, mining, healthcare and professional services have seen considerable growth in employment. While the absolute number of people employed in mining remains low, the health sector is already a large employer. Furthermore, demand for healthcare workers will continue to grow as the population becomes older and wealthier, and as the incidence of mental disorders, chronic diseases and obesity continues to rise (ABS 2007, ABS 2012, AIHW 2014). In general, the service sector (which includes health) will continue to be the major source of employment growth (DoE 2015). This trend means that people-centric skills will continue to be sought after.
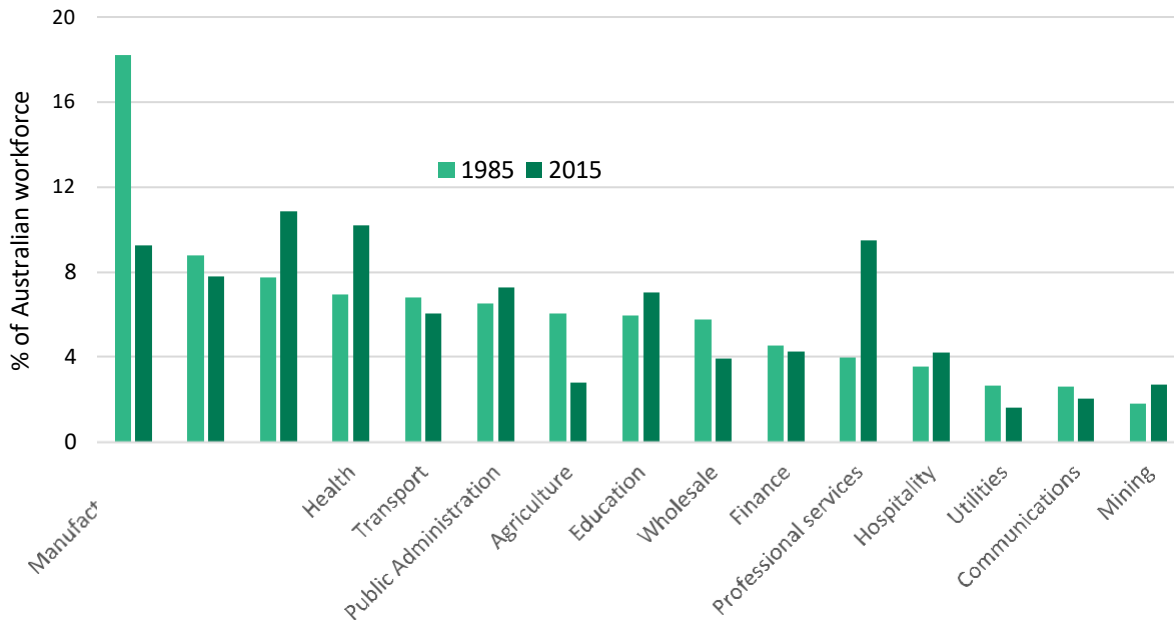
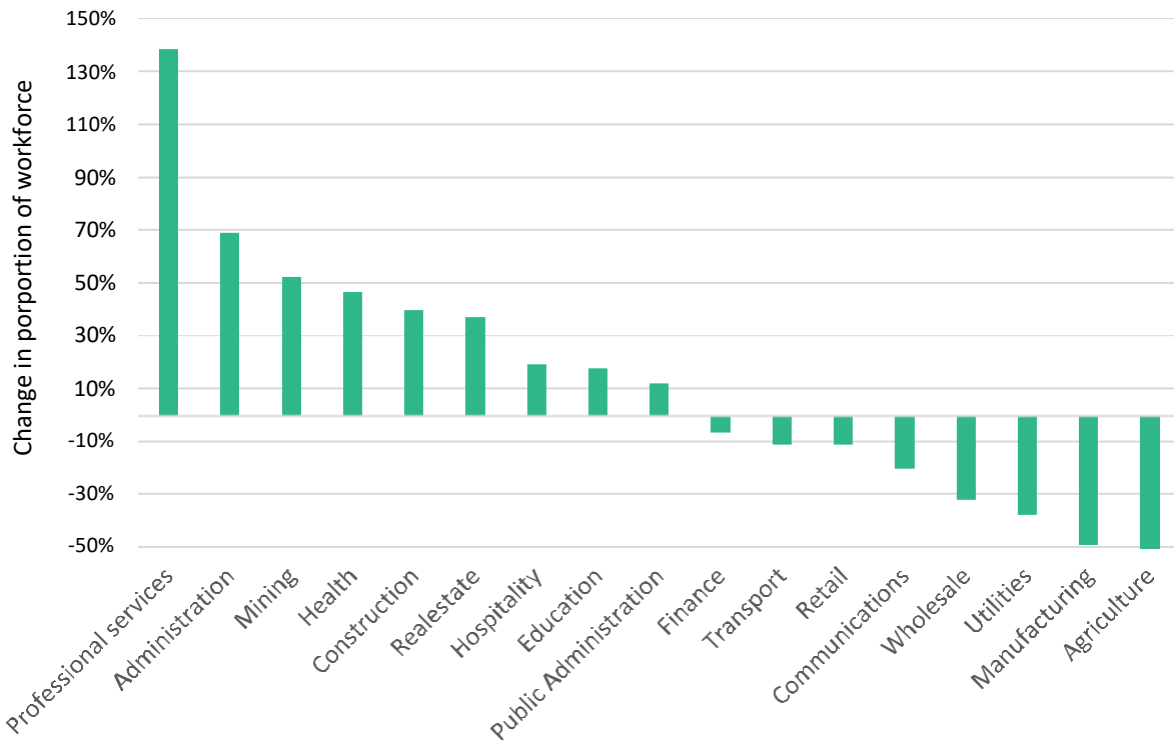**Figure 4: Employment by Industry (% of total), largest change.**

Figure 5: Employment by Industry (% of total), least change

4.2 Trends in demand for individual skills

We have already argued that digital disruption will require employees to train and learn throughout their working lives. In this section we explore what types of skills will be in demand in the future.

We again drew upon ABS employment data for insight, this time focussing on occupational categories (e.g., hairdressers, social workers, electricians and physiotherapists). We linked this data with the Occupational Information Network (O*NET) provided by the United States Department of Labor, Employment and Training, which provides the most comprehensive descriptions of individual occupations. The Department carried out a survey of human resource managers in relevant industries to establish what skills and abilities were required in each occupation and how important they were to the occupation. These skill and ability rankings can be matched to 311 of the ANZSCO occupations listed in the ANZSCO database. By linking these databases, we could determine (based on the changing patterns of employment in the Australian economy) which skills and abilities were becoming more or less important in the workplace. For clarity, we have clustered these skills and abilities into three categories: (1) science, technology, engineering and maths (STEM) skills; (2) communication skills; and (3) technical skills. Table 1 below provides a brief definition of each of the skills included in the analyses.

Table 1: Skill and ability attribute definitions of the Occupational Information Network (O*NET), United States Department of Labor, Employment and Training.

SKILL	DEFINITION
STEM skills	
Computer Use	Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information.
Critical Thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
Engineering	Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
Mathematics	Using mathematics to solve problems.
Programming	Writing computer programs for various purposes.
Science	Using scientific rules and methods to solve problems.
Systems Analysis	Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes.
Technology Design	Generating or adapting equipment and technology to serve user needs.
Communications skills	
Active Listening	Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
Coordination	Adjusting actions in relation to others' actions.
Instructing	Teaching others how to do something.
Negotiation	Bringing others together and trying to reconcile differences.
Service Orientation	Actively looking for ways to help people.
Speaking	Talking to others to convey information effectively.
Writing	Communicating effectively in writing as appropriate for the needs of the audience.
Technical skills	
Equipment Maintenance	Performing routine maintenance on equipment and determining when and what kind of maintenance is needed.
Installation	Installing equipment, machines, wiring, or programs to meet specifications.
Management of Financial Resources	Determining how money will be spent to get the work done, and accounting for these expenditures.
Management of Personnel Resources	Motivating, developing, and directing people as they work, identifying the best people for the job.
Operation and Control	Controlling operations of equipment or systems.
Operations Analysis	Analysing needs and product requirements to create a design.
Troubleshooting	Determining causes of operating errors and deciding what to do about it.

First, we compared the three skills sets in terms of how strongly they are represented in the occupations showing higher than average employment growth (over the period from 2011 to 2015). Figure 6 shows that Communications skills tended to be represented more often than STEM and Technical skills in the occupations that grew most strongly. This finding suggests that Communication skills should be given greater focus in courses so that students graduate with skills that are required by occupations that are experiencing the greatest growth. We also carried out separate analyses to understand how demand for skills was changing within a given skill set.

STEM SKILLS

The first model analyses the STEM skill set, which included Science, Technology Design, Engineering, Mathematics, Programming, Systems Analysis, Critical Thinking and Computer Use. Figure 7 shows the extent to which each of these skills was required in the occupations experiencing higher or lower growth than average. We can see that Technology Design skills were often represented in the occupations showing greatest employment growth. Mathematics, Computer Use and Critical Thinking skills were also commonly required in the occupations showing growth in employment. In comparison, occupations requiring Science, Programming, Systems Analysis and Engineering skills showed less employment growth over the relevant period (2011 to 2015).

We carried out the same analysis using data on employment vacancies (over the period from 2011 to 2015) as another indicator of demand for skills. These analyses produced very similar results. For example, we found occupations in which Science is an important skill were approximately 77% less likely to be experiencing a labour shortage than other occupations requiring STEM skills. Likewise, occupations with a focus on Engineering and Systems Analysis skills showed lower than average employment vacancies.

The demand for Technology Design, Computer Use and Mathematics skills was further confirmed by our interview participants. One interviewee, who worked in the health sector, gave the following explanation of the different types of skills and understanding required in a more data-oriented workplace:

> we're working very differently with our support services… So it's the doctor making that decision, but everyone that's put that information in would come from vocational training. So even the administration person at the front when they take the booking, when they ask the patient about their demographics, that's all there… they're putting the allergy in… every bit of information is so vital to the actual wellbeing of the patient… [15]
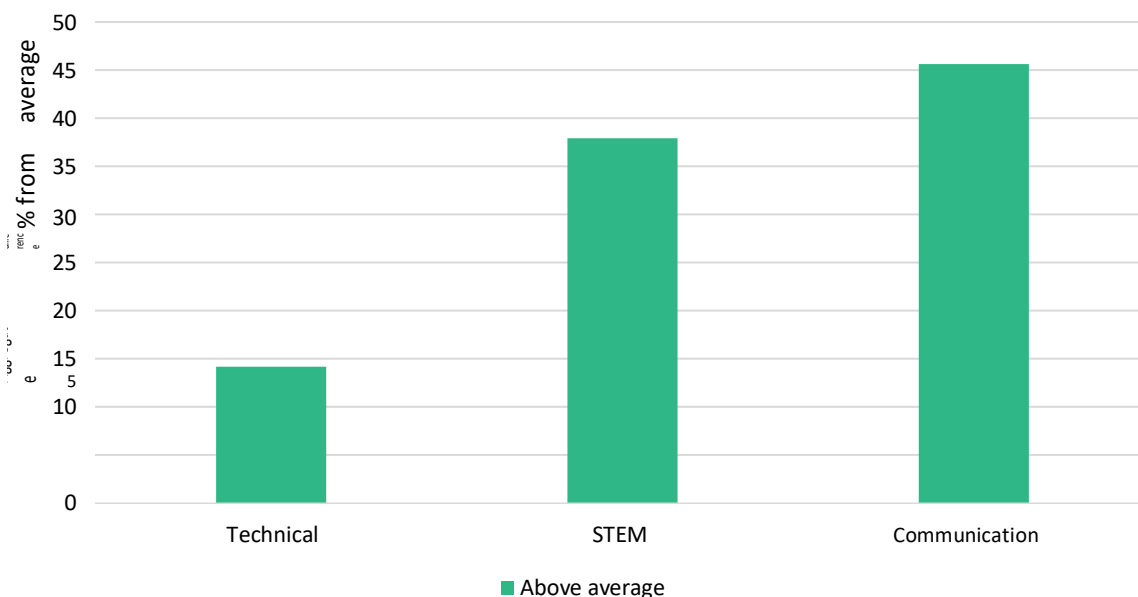

Figure 6: Comparative employment demand for STEM, Communication and Technical skills (2011-2015), aggregated for skills displaying above average demand.
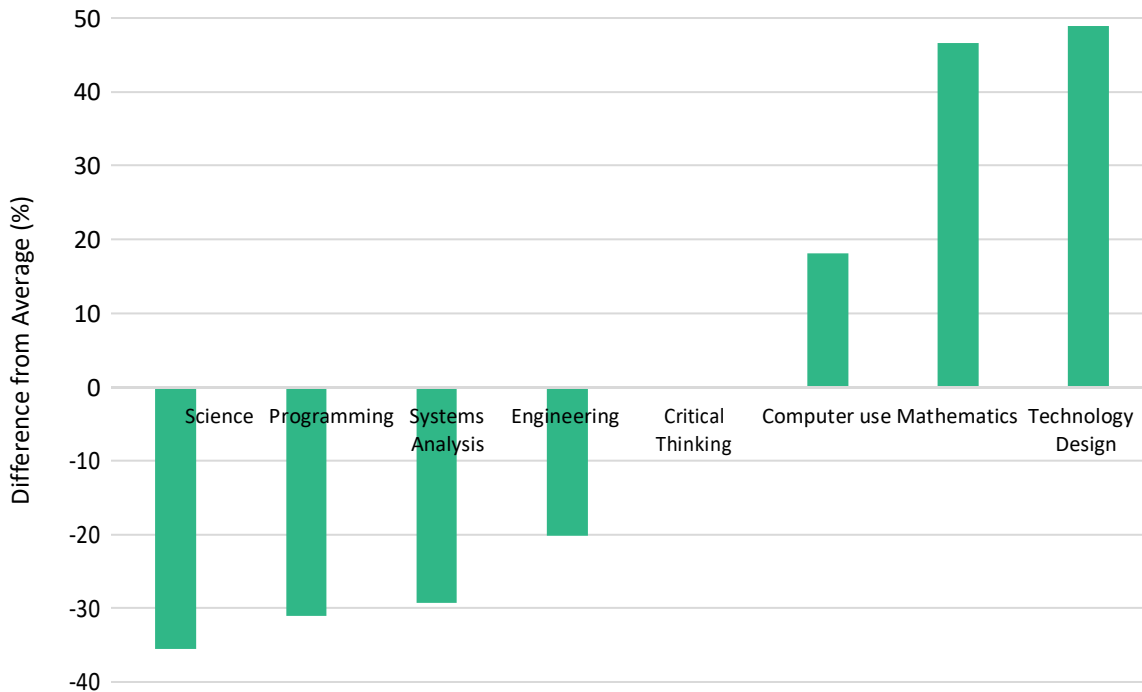
Figure 7: Relative growth in occupations requiring STEM skills. Note that negative parameters do not imply demand is shrinking, rather that demand for that particular skill is growing less rapidly than the STEM average.

Workers in more technical vocations will also need to understand and work with data in new ways. For example, predictive analytics, enabled by the Internet of Things, require an understanding of:

basic fundamental statistics…. so people understand… where the numbers came from first of all and what the numbers mean and not just to say, oh, the computer said. That's the absolute worst answer you can have… my calculator tells me this. [13]

Those who can work with data will become more productive:

using my Apple watch to support my management of my chronic disease, that goes into my phone and I can see that an enrolled nurse would be the person at the end of the screen … I don't think it would be a registered nurse. I think it would be an enrolled nurse… in a centre where they manage their patients by their data that streams in from their wearable devices. [15]

As machines become more capable, workers often need more rather than fewer skills in order to get the most out of them:

> *we need to ensure that our training covers the reasons why the sensors respond as they do. We don't want the sensor to provide a red light or a green light and people just do what the machine tells them – that is the wrong type of sensor. We need to ensure that people are trained in statistics and probability so that they can evaluate the information that the sensor provides. [13]*

Interestingly, Programming skills were associated with lower than average demand compared to other STEM skills, perhaps reflecting that this type of work can be readily outsourced or offshored. Technology Design is likely to require a closer understanding of the end user or application, and so is less amenable to outsourcing and offshoring, but new courses may be required to unlock its full potential:

> *there's a good education module that can be done around privacy, data management and cybersecurity. It's quite important in the management of health as well. [15]*

COMMUNICATION SKILLS

Next, we examine employment growth and vacancies as they relate to the different Communications skills, namely Active Listening, Speaking, Writing, Coordination, Instructing, Negotiation and Service Orientation (see Figure 8). Again, the analyses showed fairly similar results regardless of whether we examined employment demand or employment vacancies. Service Use, Negotiation and Active Listening were often required in the occupations showing higher than average demand. The same three skills were also associated with higher than average employment vacancies, although in this analysis, Active Listening was more important than Service Orientation. Speaking and Instructing were associated with occupations with an "average" level of employment growth or vacancies. In contrast, Writing and Coordination skills were associated with occupations where there was relatively low employment growth and employment vacancies.

Figure 8: Relative growth in occupations requiring Communication skills. Note that negative parameters do not imply demand is shrinking, rather that demand for that particular skill is growing less rapidly than the Communication skills on average.

Our interviewees did not comment on the importance of Communications skills for the future. However, these findings are consistent with other research which suggests that interaction and social skills will have growing importance in future work (Hajkowicz et al. 2016). Our analyses also point to the importance of Service Orientation, which is in line with the sector-specific analyses showing that the services sector is the largest (and still growing) employer in the Australian economy.

TECHNICAL SKILLS

Finally, we report on employment growth and vacancies as they relate to the Technical skills, namely Operations Analysis, Operation and Control, Equipment Maintenance, Troubleshooting, Management of Financial Resources, Management of Personnel Resources, and Installation. There was some variability in our findings dependent on whether we examined growth in employment or employment vacancies, hence we show the findings from both models below (see Figures 9 and 10).

When we look at growth in employment, those occupations showing higher than average growth tended to require Installation, Management of Personnel Resources and Management of Financial Resources skills. In general, occupations requiring Troubleshooting skills showed average growth and occupations requiring Operations Analysis, Operation and Control and Equipment Maintenance skills showed lower than average growth. In contrast, employment vacancies were highest for occupations requiring Installation, Management of Financial Resources and Troubleshooting skills. Employment vacancies were relatively low in occupations requiring Equipment Maintenance, Operation and Control, Management of Personnel Resources and Operations Analysis. In combination, the two models suggest that Installation and Management of Financial Resources skills are showing greater demand than Equipment Maintenance, Operation and Control and Operations Analysis skills.

Figure 9: Relative growth in occupations requiring Technical skills. Note that negative parameters do not imply demand is shrinking, rather that demand for that particular skill is growing less rapidly than the average occupation requiring Technical skills.
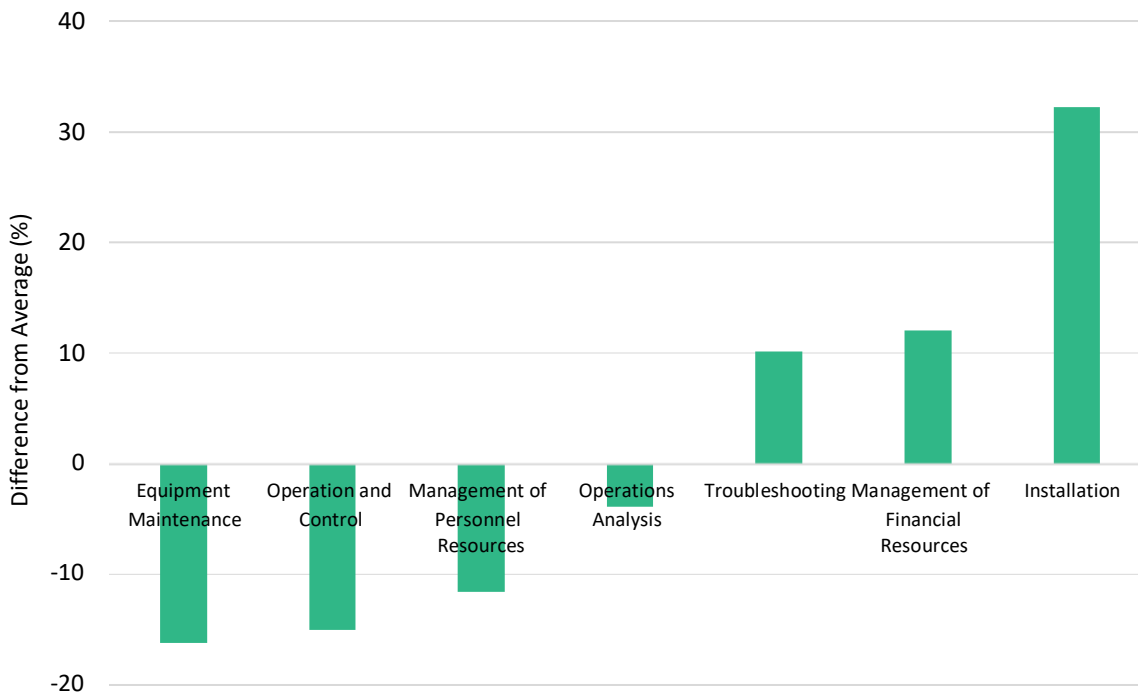
Figure 10: Relative levels of employment vacancies in occupations requiring Technical skills. Note that negative parameters do not imply demand is shrinking, rather that demand for that particular skill is growing lower than average.

Research on the emerging demand for particular occupationally aligned skills has also been undertaken by the World Economic Forum, most recently in *The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution* (WEF 2016). This research also found that social and communication skills are experiencing the most significant and growing demand among the majority of industries and countries surveyed. Parallels between this study and the analysis presented above provide some independent corroboration for our conclusions, in particular with growing patterns of demand identified for skills of Persuasion/Negotiation, Instructing others, Computer Use , Active Listening and Mathematical Reasoning. Similarly, narrow technical skills, such as Programming and Equipment Operation and Control, were found to be in relatively low demand and likely to experience contracting demand.

In addition to these core skills, entrepreneurship is increasingly important across all sectors of the economy (see Hajkowicz et al. 2016). However, it is often neglected in the education system. Interviewees identified the need to offer training in running a business or start-ups, in line with the way in which younger generations (and older ones) are now choosing to engage in the workplace:

> *introduce the career path of entrepreneurialism and start-ups and what that looks like with every course, because that's great if you want to learn whatever and go out and get a job, but not everybody wants to do that [10]*

4.3   Lifelong learning

Australia's demography will continue to evolve over the next 20 years, and will inevitably be a major influence on future work patterns. The recent Intergenerational report (Treasury 2015) provides demographic forecasts; based on an annual growth rate of 1.3% the population will reach 32 million by 2035 (up from 23.9 million currently). The key drivers behind population growth are immigration and declining mortality rates. Net overseas migration
has averaged 220,000 per year recently (Treasury 2015). The decline in mortality results in a growing proportion of older people in the population; by 2035 around 19.5% will be over 65, and 3.2% over 85, compared to 15% and 2% respectively today (Treasury 2015).

Increased life expectancy means most people will need to work for longer. Unfortunately older workers are at greater risk of redundancy, and many are likely to need to re-skill (Callan and Bowmen 2015). At the same time for industries like health and construction, that face skills shortages and increasing competition for skilled and educated labour, retention of older workers in the industry, their continuing inclusion and application of their skills and knowledge for work and training is crucial. For example, the proportion of health and welfare workers aged 55 and over in Australia has increased from 2.5% in 1987 to 11.2% in 2015; for carers and aides this figure has grown from 3.1% to 10.4%. Similarly in 2015 the share of older construction trades workers was 7% – up from 4.5% in 1987 (ABS Labour Force, Australia, Detailed).
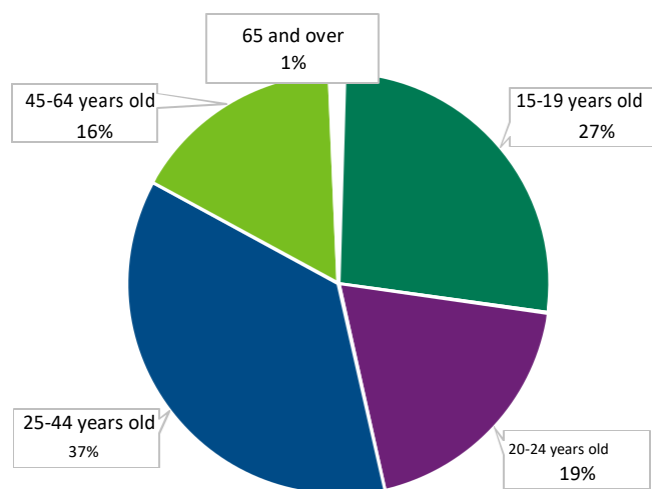

Figure 11: Age distribution of the government-funded VET students in 2014, Queensland. (Source: NCVER 2015).

Almost one in six VET students in government-funded programs in Queensland is 45 years old or over (Figure 11). Educational programs for older workers will likely require additional emphasis on new technologies, new management practices as well as new standards and norms, compared to the emphasis on practical skills required for young students. As classes become more diverse (e.g. with greater numbers of older students), classes may need to be carefully constructed (Kahu et al. 2013). One or two older students are unlikely to thrive among teenagers (or vice versa), but diverse groups could provide a better experience for all concerned.

There is also an increasing tide of disruption in the economy, as incumbent firms are displaced by technologically-driven competitors. Virtually all jobs are impacted to some extent by technology. Some occupations such as photographic developers are disappearing, while new ones such as autonomous vehicle technicians are being created (Hajkowicz et al. 2016).

The combination of technological change and longer working lives means that many workers will need formal education and training throughout their working lives, rather than just at the outset. Among current younger workers, around half expect to pursue further formal education during their career (Deloitte 2016). It is also likely that many employment relationships will become shorter and less exclusive; businesses will have more 'agile' workforces, and freelancing and portfolio work will become more common (Hajkowicz et al. 2016). A recent US study documents a rise in the proportion of workers in non-standard employment (covering casuals, freelancers, self-employed and independent contractors), from 10.1% of the workforce in 2005 to 15.8% in 2015 (Katz and Krueger 2016). This means that employers may be less willing (or able) to invest in training their employees, even as the need for training grows.

Despite these trends, there is evidence that established Australian workers are actually becoming less likely to change employers (Molloy et al. 2016). Figure 12 shows the proportion of Australian workers who are less than a year into their current job. The trend is mostly flat, with a step change downwards around the onset of the global financial crisis (perhaps as new jobs suddenly declined, and a less favourable labour market made workers more reluctant to leave their current job). This does suggest that many workers may not be taking full advantage of opportunities to re-train and move into different jobs, which could limit their career prospects and labour productivity more broadly.
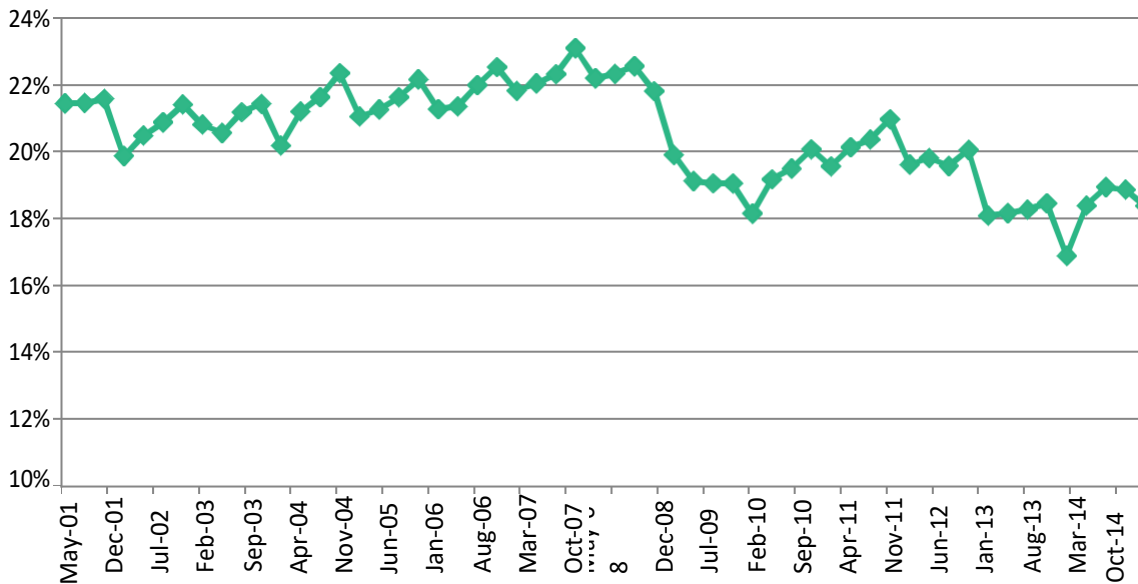
Figure 12: Proportion of Australian workers who have been in their current main job for less than 12 months (ABS Labour Force Survey).

It may also reflect the increasing importance of 'soft' skills such as problem solving and relationship building relative to the technical skills that are becoming increasingly automated. Soft skills are likely to be more firm-specific (increasing the costs of changing firms, to both workers and employers) and more difficult to demonstrate to prospective new employers, both of which could reduce job mobility. As discussed above, the growing demand for soft skills such as negotiation and communication suggest that these skills should be formally taught and assessed in a far greater range of courses than is currently the case. Increased certification of soft skills might open up new opportunities to workers, and allow employers to hire with greater confidence.

Disruption of existing ways of working will also increase the training market amongst those who are already employed but need to update their skills so as to be able to work with new technology. Training, and its associated qualifications, may need to become more modular, allowing workers to build a portfolio of recognised skills through their careers:

maybe you can actually get them earlier on so instead of completing the two years of a diploma maybe you do your first six months and learn a set of skills there and that gets you into employment and then over the next 18 months or two years or whatever it is you progressively gain that qualification [4]

[the] world is changing so… fast that every qualification is out of date before you even gain it, so it doesn't make sense to have someone locked up for two years before they're qualified... I think it's the concept of being able to have a base set of qualifications that give you your ticket to the world and then you have the ability to keep adding units… [9]

In addition to offering staged learning and qualifications that are built over time, there is likely to be greater demand for short courses, focussing on particular new technologies:

> with health care, for example, there's absolutely going to be a huge market where nurses and all sorts of different people… who actually have higher level qualifications will possibly need to do ongoing upskilling to learn how to use all sorts of new technologies and robotics that are actually going to help them in their jobs. [2]

VET providers such as TAFE Queensland already provide courses of this kind but some employers (or technology vendors) deliver these in-house. The move towards greater reliance on digital technology to support learning may represent an opportunity to shape VET offerings to better suit a lifelong learning approach:

> access to digital platforms will allow learning to be undertaken in a more frequent manner… So to deliver a vocational diploma may not necessarily mean, going forward, that you have to do it consecutively, all at the same time. I think there's going to be an avenue for this to be delivered that better suits the customer. [8]

With the data provided by digital technology, there is potential to track students over time as they participate in training and capture their activity and development via a virtual "educational passport" rather than a standardised qualification (we touch on this idea again in the section on certification and verification of credentials). However, interviewees noted that formal qualifications are not always most relevant to employers' needs and can add significant cost and complexity to the training process. Formal qualification may not always be necessary:

> even the idea…that qualifications is the answer is coming under question as to whether in fact it is skillsets… So you might do - as part of a certificate in something you'll do widget making and widget grinding and it might actually be four to do to get the full qual, but you only do two, because that's all you need to do. I've got the skills I need. On the other hand we need to consider whether skill sets provide individuals with the best employment outcomes over the long term. [17]

> I think governments want to be able to track taxpayer funded money, so they like to try and encourage people to actually finish, whether it's with TAFE or a private provider, finish with an actual qualification, an accredited qualification… the reality is that a lot of existing workers, people who are already in the workforce, don't necessarily want to do that whole qualification so I think there's a bit of a disconnect … [2]

5 TRAINING SUPPLY

In this section of the report we shift from focussing on demand to instead focus on training supply. First, we examine the outcomes achieved from VET (in terms of student completions and types of employment achieved). We also review the feedback from VET stakeholders (captured in the interviews and focus group) which includes suggestions about how the VET sector might adapt so as to achieve the greater agility and responsiveness that will be required in the future.

5.1   Enrolments and completions

Figure 13 below shows enrolment trends in the major subject areas across the VET system. The composition of enrolments has stayed fairly consistent over time, with Management and Commerce and Engineering and related technologies consistently representing the most popular areas of study.

Figure 14 shows completion rates, which are around 34 % for students enrolled in a government-funded VET program (certificate I and above). Completion rates are broadly similar across the states.
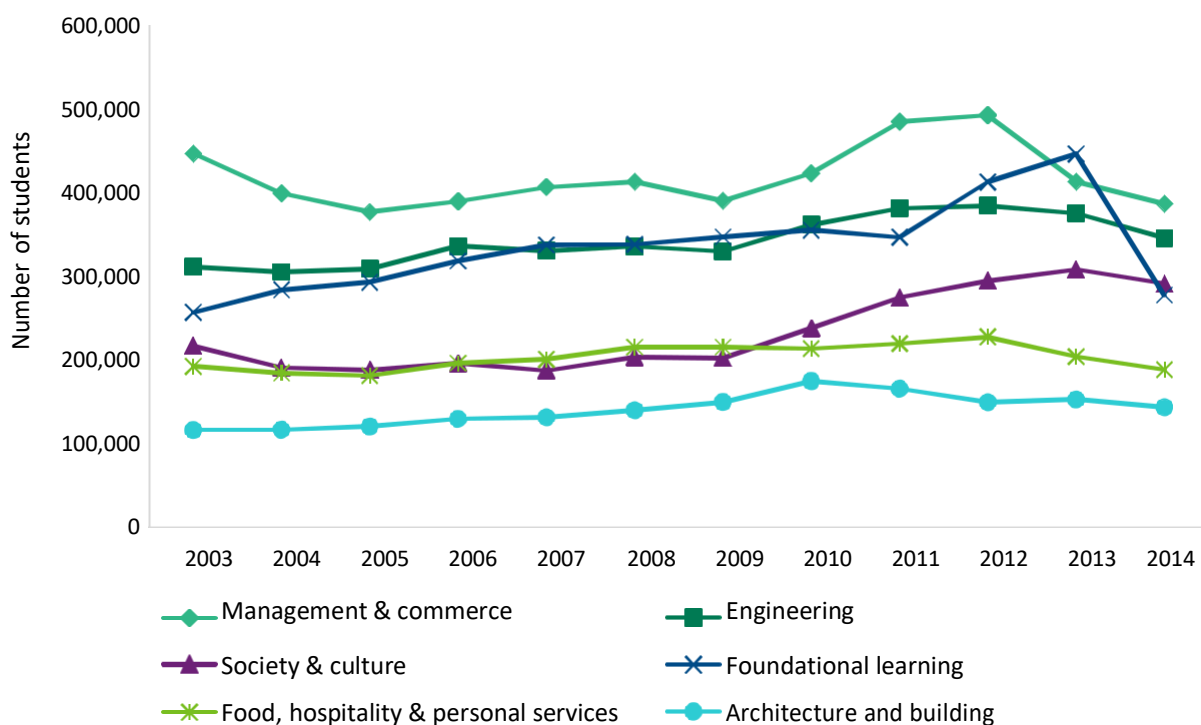

Figure 13: VET student enrolments across top 6 fields of study. Source: NCVER.
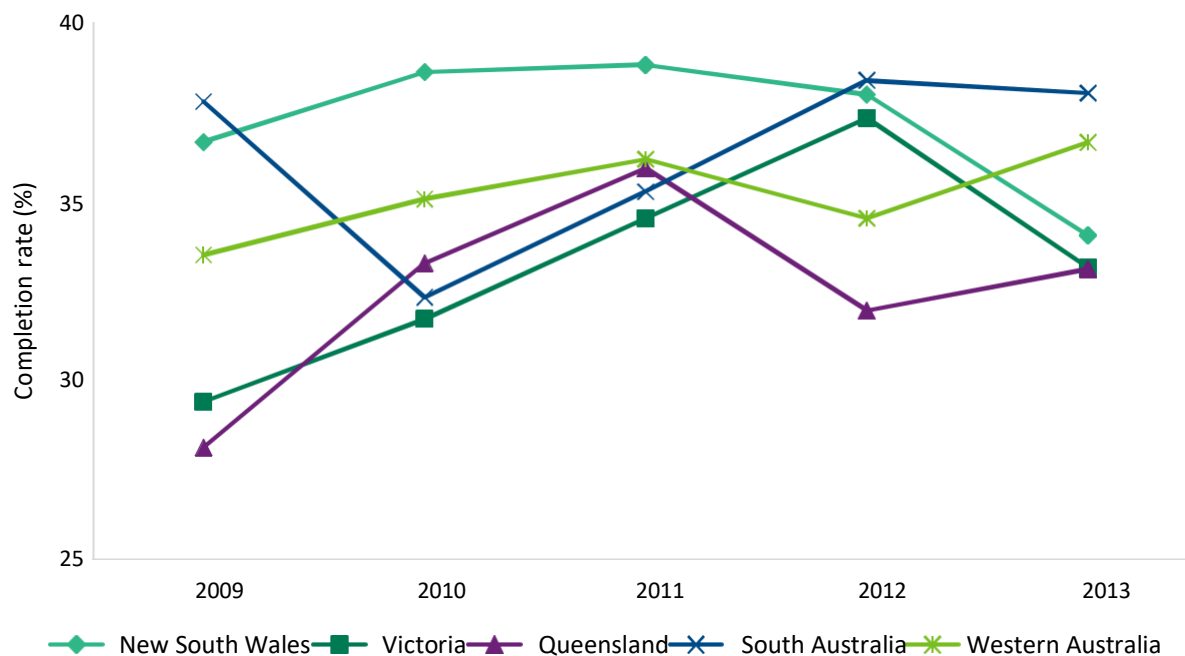
Figure 14: Estimated completion rates by state for government-funded VET programs at certificate I and above, commencing 2009-2013. Source: NCVER.

There is greater variability in completion rates when we look across fields of education. Completion rates range from 27% for programs in food, hospitality and personal services to 58% for students in education (Figure 15). It is important to note that qualification completion rates may be influenced by the funding system. Government funding is available for students enrolling in courses which provide qualifications, even if they are only seeking a particular skill set taught as a component of the course. This means that some students may still have achieved their desired training outcome even if they did not complete the formal qualification. It is therefore difficult to determine the extent to which incomplete qualifications represent an informed choice or a failure.

A noteworthy trend is the number of VET students who already have higher education qualifications. Figure 16 shows a marked rise in the proportion of students entering TAFE institutions who already have a Bachelor's degree or higher (although education qualifications across the rest of the VET sector have remained flat). In 2014 there were over 91,380 TAFE students with a university degree; given around 175,000 people graduate with a Bachelor's degree each year (DET Canberra 2014), this suggests a substantial proportion subsequently seek vocational training (though note that the TAFE figure represents overall enrolments at the time of the survey, not annual enrolments).
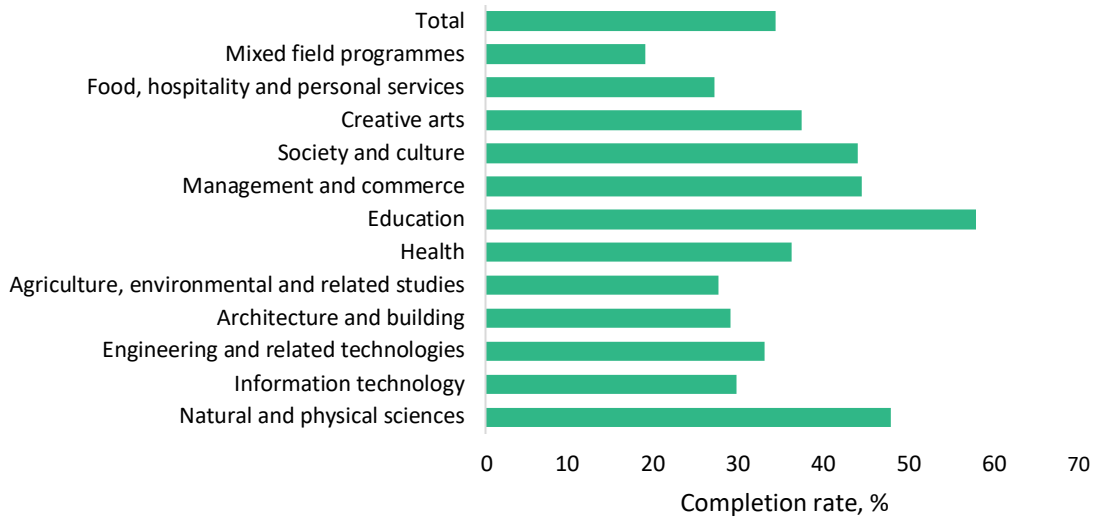
Figure 15: Estimated completion rates and load pass rates by field of education for government-funded programs at certificate I and above, commencing 2013. Source: NCVER.
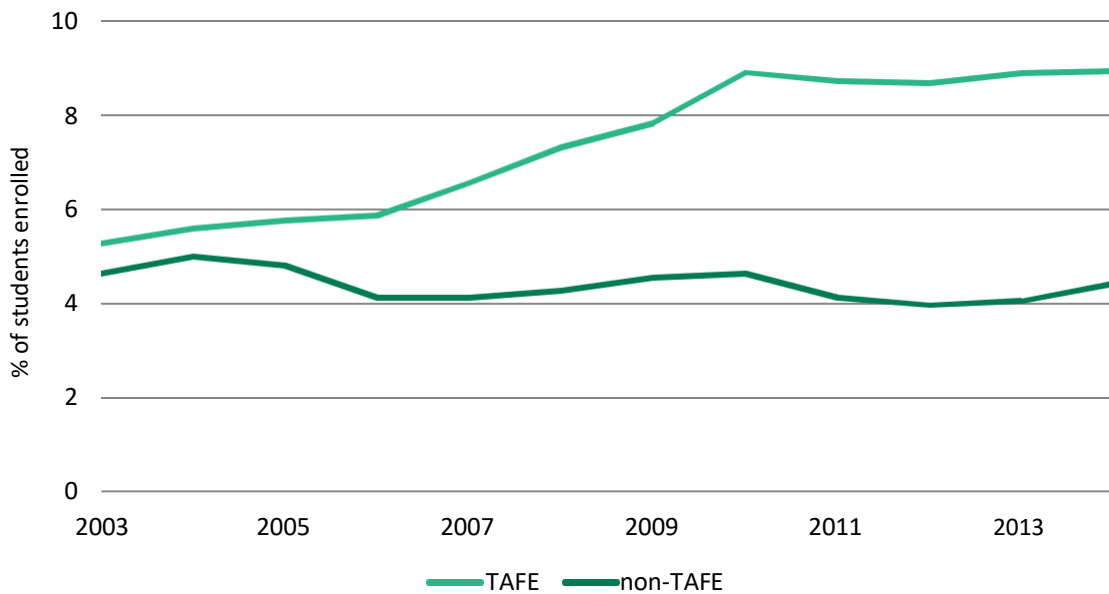

Figure 16: Proportion of students enrolled with previous highest education level of Bachelors (or higher) degree level, TAFE vs. non-TAFE (rest of VET) sector. Source: NCVER.

As more people around the world (and particularly in Asia) gain access to education, the future is likely to see increased competition from lower cost workers from overseas, enabled by high-speed broadband and digital platforms that connect workers with those who have need of their skills (Hajkowicz et al. 2016). The quality of Australia's VET is one means through which Australia's workforce remains competitive on the international stage without lowering incomes. One means of assessing the quality of VET is by examining completion rates and employment outcomes.

Completions in the VET sector can be analysed against patterns of occupational vacancies in the Australian economy. Data reporting completions in the VET sector for the period 2007-2013 are available through the VOCSTATS database, and can be disaggregated at the ANZSCO 4-digit occupation level. In addition, the TAFE vs non-TAFE status of completing students can be identified. A panel data estimation procedure was applied to the data, which reveals the extent to which a student completion addresses occupational vacancies. The results indicate that VET graduations are significantly correlated with job vacancies, suggesting that the VET sector is addressing skills shortages in the economy.

The skills outputs of the VET sector can be compared against the trends in demand described in the previous section by examining the importance of skills and abilities to graduate occupations (using the O*NET skills database described previously). This analysis aims to reveal the extent to which the VET sector is contributing to the skills demands of the Australian economy. Figure 17 shows the results of our analyses for STEM skills.

To provide context for these findings, we also examined the profile of STEM skills across the entire workforce (see Figure 18). We can see that the occupation skills profile of VET graduates is not dissimilar from the profile of the overall workforce. We can discern some differences however. For example, relative to other workers, VET graduates are more likely to go into occupations for which Engineering skills and Computer Use skills are highly important. However, they are less likely to go into occupations for which Mathematics skills are highly important.

We carried out a similar analysis to examine the extent to which VET students were graduating into occupations requiring low and high levels of Communications skills. Figure 19 reveals that most VET students (whether from TAFE or other providers) end up in occupations requiring moderate levels of Communications skills.

Again, for reference purposes we show the importance of these Communications skills in the Australian workforce overall (see Figure 20). Here, too, we can see a similar pattern of skills for occupations held by VET graduates and occupations held by the Australian workforce overall. There is some evidence to suggest that VET graduates are less likely than other workers to go into occupations for which Communications skills are highly important. For example, Instructive skills, Active Listening skills, Negotiation skills, Speaking skills, Writing skills and Coordination skills are less likely to be "highly important" for VET graduate occupations relative to workforce occupations in general.

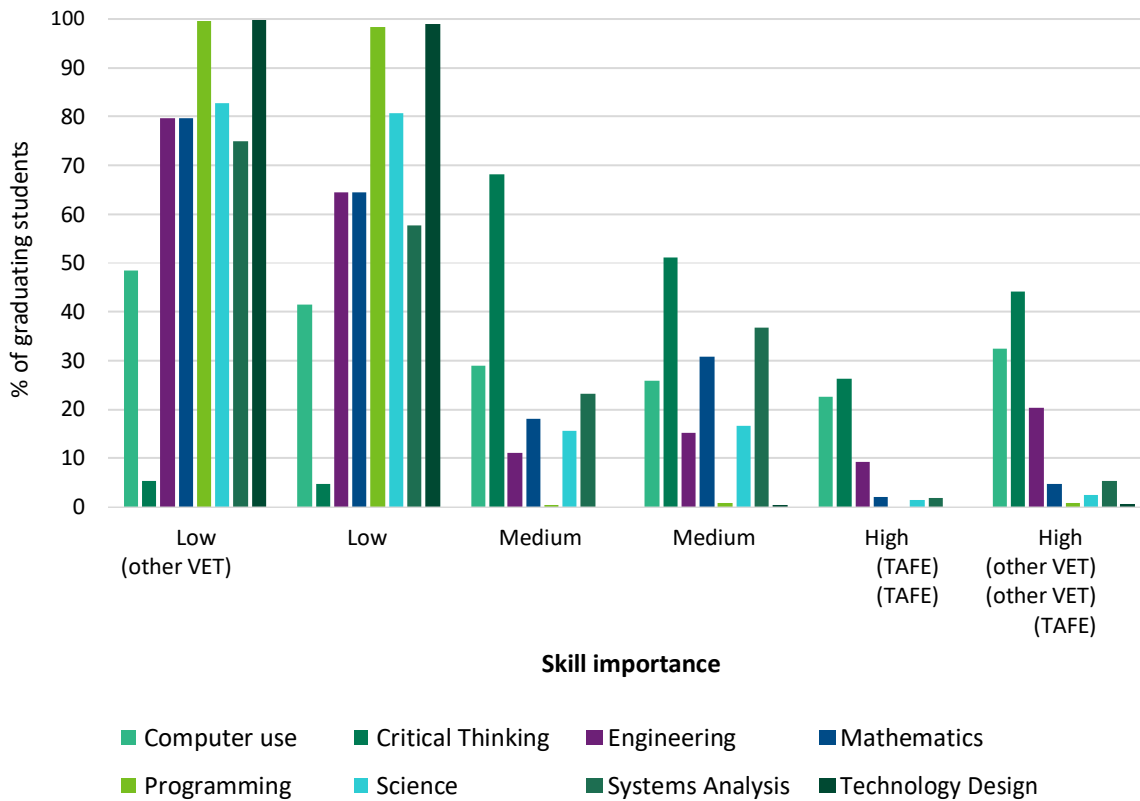**Figure 17: Importance of STEM skills for graduating VET student occupations (2007-2013).**
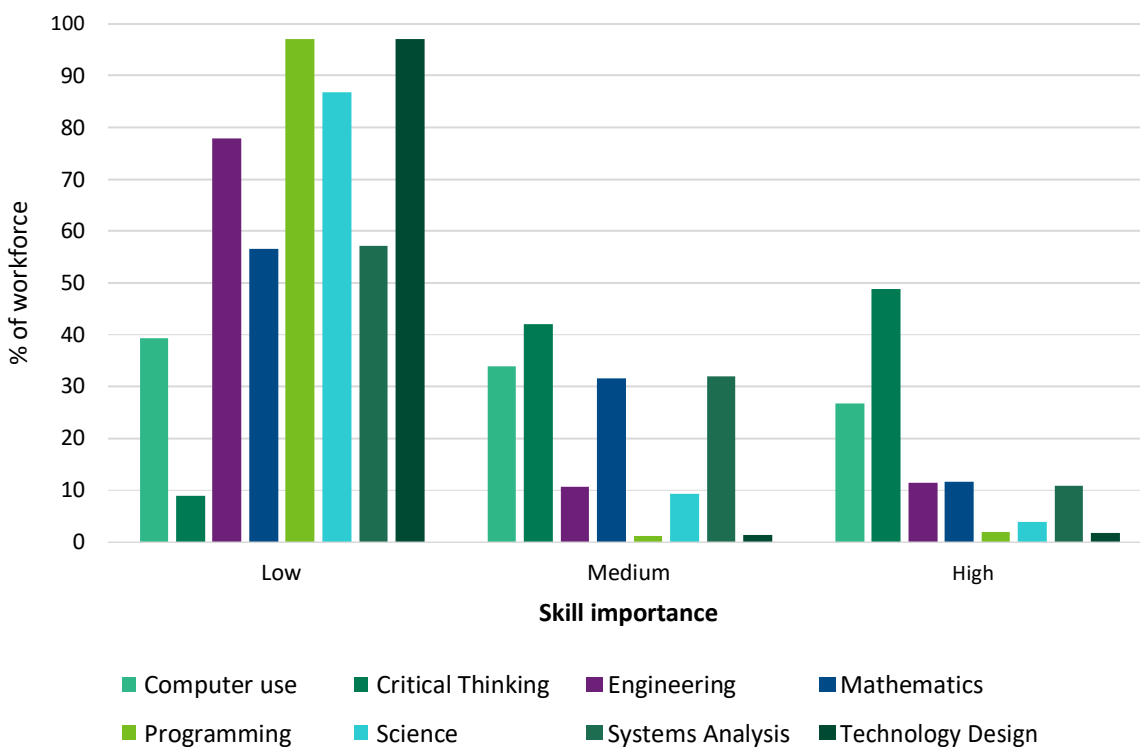

Figure 18: Importance of STEM skills across all occupations held by the Australian workforce (2007-2013).
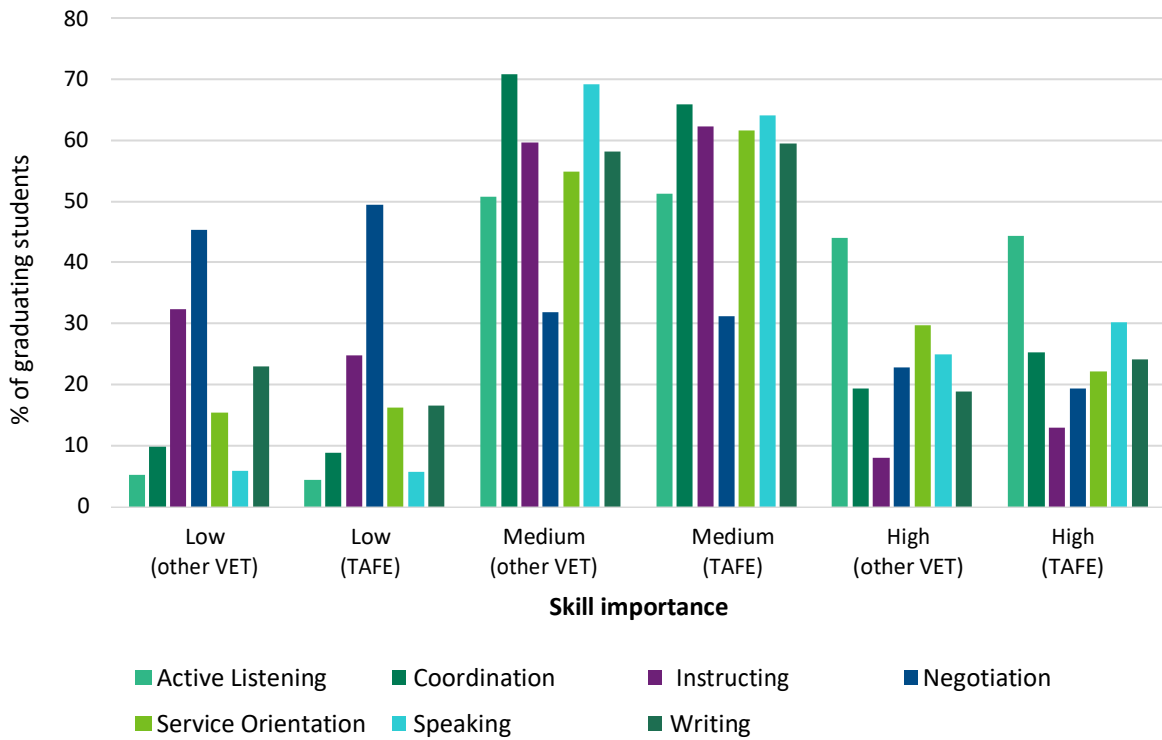
Figure 19: Importance of Communication skills for graduating VET student occupations (2007-2013).
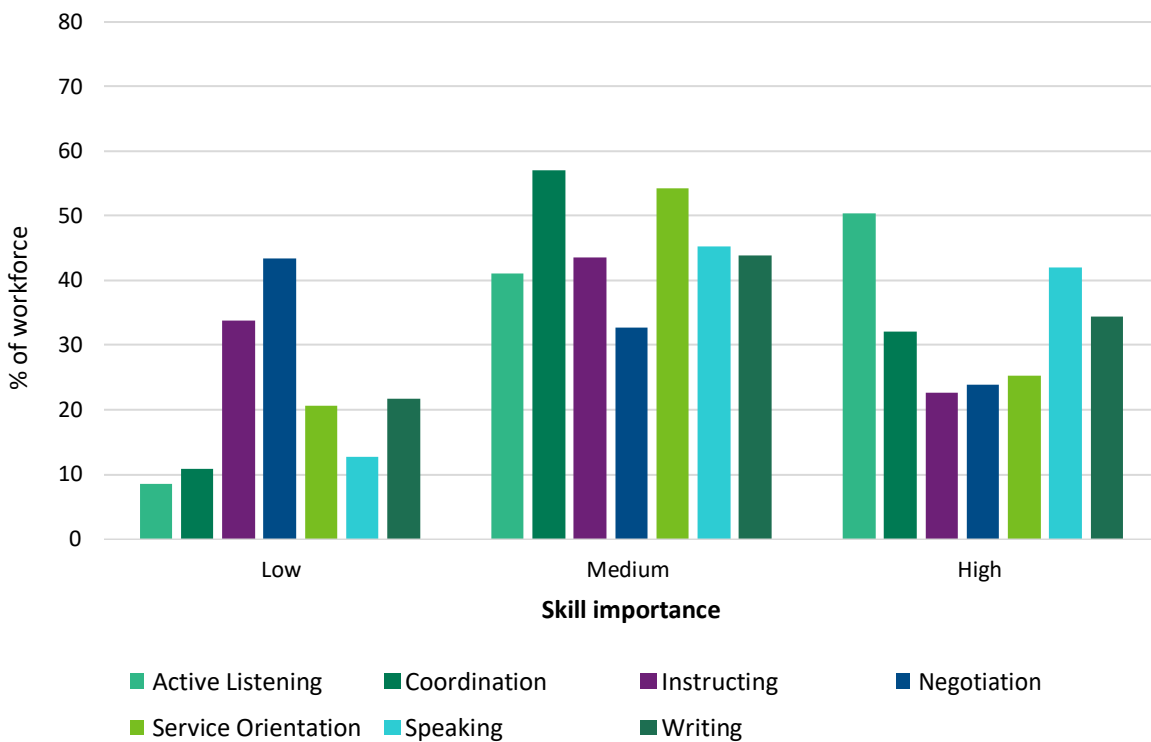

Figure 20: Importance of Communication skills across all occupations held by the Australian workforce (2007-2013).

Figure 21 shows the importance of Technical skills in VET graduate occupations, which can be compared with Figure 22 (which shows the Technical skills profile of the Australian workforce overall). These analyses contrast with the previous ones in that they show that VET graduates are more likely to be in an occupation for which Technical skills are highly important (especially Equipment Maintenance and Installation skills) than Australian workers in general.

Considered together, these analyses are one indication that the skill level of VET graduates compares favourably with the skill level of the Australian workforce as a whole. However, within an occupation there will be considerable variation in individual competency which these models cannot reveal. Some of our interview participants reported that the skill level of VET graduates had decreased in recent times. For example, one employer said:

> the dumbing down of the training is really concerning… The skill levels are decreasing all the time. The amount of effort that we have to put into training our own staff now is huge [10]

Interview participants (both employers and representatives of VET providers) connected the decrease in standards with the introduction of greater competition in the VET sector. They commented on private training providers who seemed to be delivering less training so as to offer training at lower prices and in shorter timeframes and thereby capture market share. Although not all VET providers were following this practice (some interviewees specifically noted that the best practice standards historically required of TAFE institutions meant that their trainers and assessment was of higher quality) the number of VET providers now in the market and the difficulty of monitoring standards across all these organisations meant that employers did not always have confidence in the standard of VET qualifications.

5.2 Adapting to changes in training requirements

THE CHALLENGE

One of the great strengths of the VET sector in general, and TAFEs in particular, is delivering education and training that is directly relevant to employment. This is in contrast with much (though not all) of the higher education sector which focuses mainly on academic disciplines rather than employment needs. As one interviewee put it:

> Universities are having trouble staying relevant because their professors teach what they think should be taught rather than responding to the demands of employers. [13]

However, remaining relevant requires considerable effort to understand employers' requirements and modify courses accordingly. And if current predictions about the impacts of digital technology are even partially correct, the challenges already being faced by VET providers are only going to increase. Although technology is changing workplace practices at different rates in different sectors, there was a strong consensus amongst our interviewees (who worked across a range of sectors) that technology would become more integral to work and jobs in the future.

The difficulty is that best practice use of technology can change within the timeframe of a student's training program, so that students can end up graduating with skills that are no longer required by employers. As one interviewee explained:

> so many technologies have come on the market and appear for five minutes and go again, so how do you choose the technologies that are staying and the technologies that are going?... the things that are no longer relevant need to be removed a lot quicker so they don't need to spend time learning how to weld aluminium because, you know what, they're never going to do it. [1]

Some interviewees commented that VET providers had an especially difficult brief because VET graduates are expected to be "workplace ready" to a greater degree than university students. For example, one interviewee said:

> often individual employers needs change so frequently... no one would dream of changing the school curriculum three times in the middle of the year, that would be unheard of, but that's often what's expected in the VET sector... I feel for quality providers because there just isn't the same ability to hold the line as there is, for example, with curricula either at university or secondary school. [9]

The challenge of keeping up to date with the way in which technology is being used in the workplace is compounded by the fact that different employers are using different technologies. Despite this variability in practice, VET providers have to make a decision about which technology to use in training. One interviewee outlined the problem:

> we're just trying to work out what is the best program to use for those students... There is no industry standard… it's very varied …Which one is really the one that we need to focus on in the future?... you can give [students] a bit of a flavour for the other one, but you've really got to focus on one to give them the in-depth skills and understanding. [11]
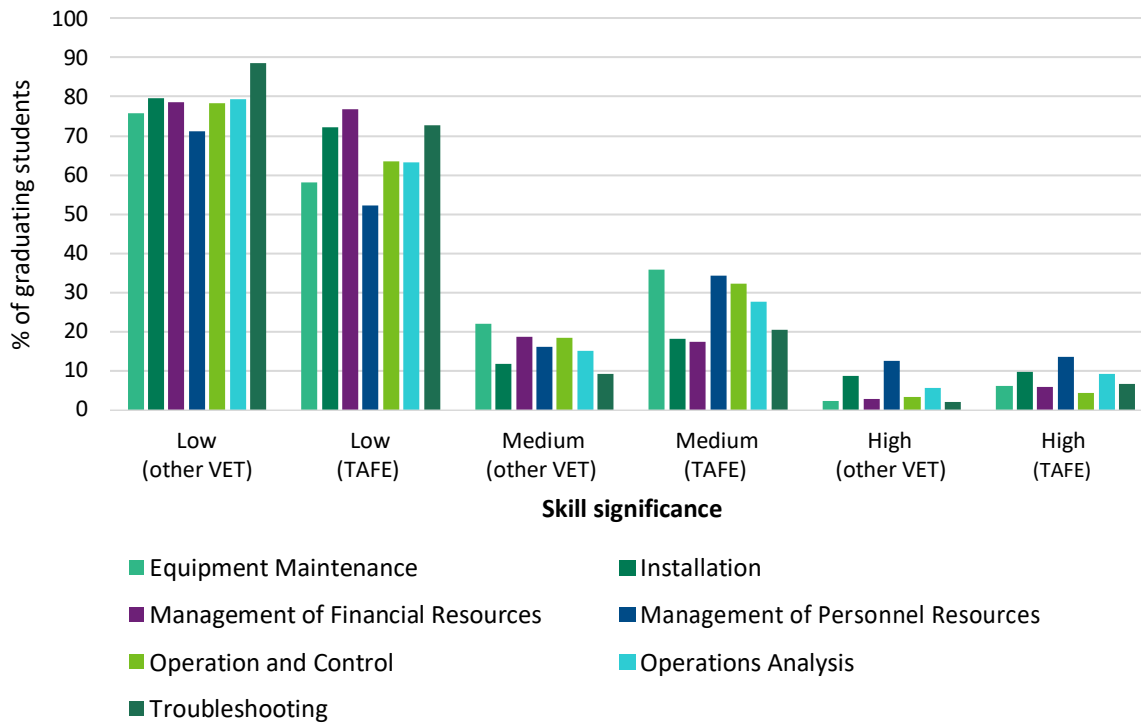
Figure 21: Importance of Technical skills for graduating VET student occupations (2007-2013).
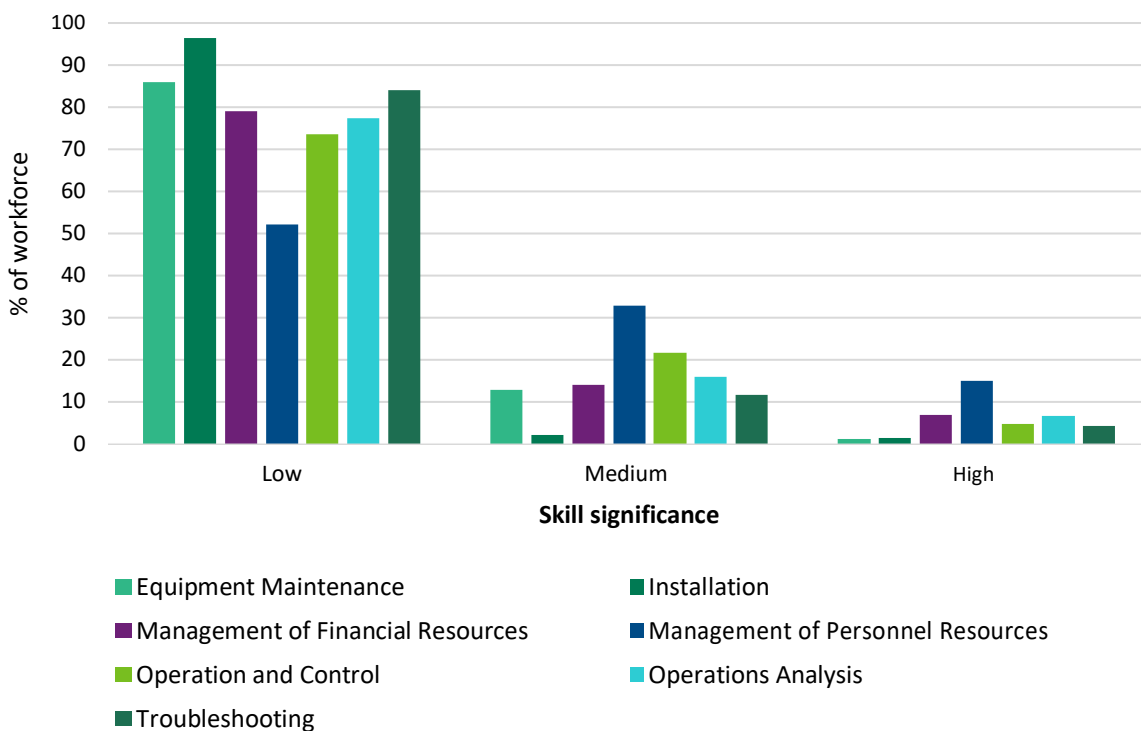

Figure 22: Importance of Technical skills across all occupations held by the Australian workforce (2007-2013).

Furthermore, each change in the use of technology represents a training and development requirement for educators. Educators need to be proficient users of the technology so that they can teach students how to use it correctly and troubleshoot the errors that occur when technology is used inappropriately or the system fails. And not all educators are comfortable with, and proficient users of, digital technology. Some educators gained their industry experience many years ago, when technology looked very different. One representative of VET providers commented:

most of our teachers are not necessarily very comfortable in the digital space and the online space. Again, a lot of them come from practical backgrounds and even those that haven't come from practical backgrounds don't necessarily have high level digital skills. [2]

In TAFE Queensland, educators complete annual placements in their vocational area as one means of keeping up to date with industry practice. These placements were generally seen to be important and valuable but some interviewees reported that the placements weren't focused on contexts that were relevant for apprentices and trainees.

Educational practice has also been impacted by digital technology, with the result that students are now learning through digital technology in their primary school years. Future VET students will not only have higher levels of digital literacy, they will also have higher expectations of educational providers, expecting them to use digital technology to provide the flexibility, convenience and more engaging learning experiences to which they have become accustomed. This, too, will increase the demands on educators:

this new generation is going to come through with… higher and higher expectations of what we can do in terms of technology, even, like, in face-to-face classrooms they're going to expect all sorts of fantastic presentations using the latest technologies and all sorts of different things. And I think that a risk is that a lot of our teachers are just going to feel completely out of their element. [2]

Yet, interviewees expected that educators should have:

a baseline ability to interact with the students in channels that the students are most comfortable with… [4]

Students commented that student engagement and peer support tended to fall off when they were expected to use new digital platforms to collaborate and learn, especially when the educators were not making use of the channels in an ongoing and meaningful way. They believed that more VET providers should make use of the tools that they were already using, such as Facebook and mobile websites and applications.

…it's all well and good having a discussion group...what happened with ours....when it first started it was like "Hi, I'm so and so " on the discussion group but if you look on ours now there's been nothing posted since February...
Everyone just communicates on Facebook constantly, no-one goes to those TAFE discussion groups. [Student 5]

Education and learning will increasingly be delivered through digital channels and educators will need different pedagogy and skill sets in order to use them effectively in their teaching.

Unlike incremental changes to teaching content, the changes to teaching practice associated with digital learning actually require different skill sets. Today's VET teaching workforce will need support to build the capability required to deliver innovative teaching practices that respond to tomorrow's needs. As one student explained, even when using digital channels, the educator makes a difference because:

[if] they know how to run the system, they can provide us with a better experience of learning, of the course... [Student 5]

However, the greatest hurdle to maintaining the relevance of VET offerings in the context of digital disruption may well be the multi-year national consultation process that is required for any changes to accredited VET courses. Consultation between VET providers and industry is meant to ensure that educational offerings reflect industry practice and needs. For accredited training packages, offerings have to be standardised across the country, and the process of consultation and reaching agreement at a national level requires so much time that training packages are only updated every few years. Once agreement is reached, the content of the course is fixed and training providers cannot make changes to the package without further national-level consultation. Thus, when it comes to accredited training, there is very little ability to respond in a timely manner to changes in workplace practices and skills requirements. According to one interviewee from the

VET sector, the problem was not lack of information but the flexibility to respond to that information:

we could run reports and everything... we can see what industry needs, we can see the demands for the future, we can see all the data, but the training package doesn't allow us to do what industry wants... [11]

Employers who understood the process viewed it as a serious impediment to keeping up with developments in technology:

curriculums can take two years to develop before they are rolled out, and to be learning relevant material for our industry, that is just too long. The industry could have significantly moved. There could be new technology out. I would say it needs reviewing and updating every six months to stay relevant. [10]

Training providers have greater freedom to change the content of training that is not nationally accredited. In this context, VET providers are meant to carry out their own consultation with industry representatives to ensure that their offerings keep step with industry requirements. One interviewee gave a very positive account of the relationship she had with TAFE Queensland:

I have a wonderful relationship with the Skills Tech – all the TAFEs that I deal with - because we are all – we're friends, but it's a two-way relationship, and I've spent years cultivating that, and I see the importance, and the people that I deal with at TAFE are just excellent. I mean, really, from the enrolment, from woe to go, the TAFE people are wonderful [12]

In contrast, another interviewee reported about training providers:

my observation … is that they are not connected with industry... I think they need to step outside and go and talk to some more people. [8]

In summary, change associated with technological developments represents a challenge for VET providers because of the demand it poses in terms of keeping up with best practice (both in a given vocational domain and in the delivery of education). Furthermore, current consultation practices are not seen to be adequate in terms of ensuring that educators are informed. We therefore used the interviews to capture feedback as to how the agility of VET providers (in responding to future digital disruption) might be improved.

SUPPORTING AGILITY

While a range of suggestions were offered on how to support greater agility in the VET sector, four ideas came up repeatedly across the interviews. They involved:

• One-on-one and two-way relationships between VET providers and employers

• Time for educators to learn and experiment with new technology

• Allowing flexibility by differentiating between fixed (core skills) and modifiable elements of training packages

• Using predictive analytics and modelling to better understand industry trends and student pathways

Below, we explain why and how interviewees expected these changes to support greater agility and relevance in VET.

First, although some interviewees saw deficiencies in the current consultation process between VET providers and employers, they nevertheless believed that the relationship between VET providers and employers would be critical for the future effectiveness of the VET system in Australia. One interviewee explained:

training is an input. It's not a means to an end. …you have got to ask yourself, how do you make sure that you are informed, in touch, and connected to the changing nature of an industry, and its practices, and then the interaction between the practices of that industry, and the skill component? [8]

To achieve the depth of understanding required to design training solutions which reflect industry needs (encompassing not only training content, but also the mode, timing and scale of delivery), interviewees believed that more one-on-one conversations were needed. One interviewee envisaged the staffing of VET providers changing, to have:

development officers who actually go out to industry, do the industry needs analysis – actually…talk to the industry, what do you need, how can we help you – and then they put the right trainer and assessor in contact with the industry and then just check that everything's going well… for TAFE to be successful in the future, 10, 15 years' time… there would be more of the online educators creating online content, more business development officers working with industry, more trainers and assessors working in industry and less administrative staff. [2]

It was acknowledged that building stronger, one-to-one relationships would demand a significant time investment from VET providers, perhaps even necessitating greater specialisation:

…you've got a really interesting tension happening between government funded TAFE who are providing 6-700 courses … and they struggle constantly with the concept of currency, versus the registered training organisations who are specialising around training packages…TAFE are going to have to get their head around… not doing 6-700 courses, but doing 100 of them incredibly well in five or six sectors and deeply integrating themselves … they will be welcomed with open arms and will find that there will be plenty of opportunity for genuine partnerships and joint funding of things like platforms, tools, passports, whatever. [9]

Good VET provider and employer relationships were two-way, with learning and support flowing in both directions. The ability of VET providers to anticipate employers' training needs is enhanced when employers share more of their plans for innovation, growth and change. In turn, educators should be well placed to provide feedback, drawing upon their own expertise and experience. One employer described how this worked:

so if we have a new product come out I'll go down there and say … "You mind if I have a chat to them, get some feedback?" ….they also incorporate or have involvement

in the development of standards and we have a code of practice in Queensland which is now law, which the TAFE has contributed to… we don't view the training facility up here just as a training facility…you're feeding off them to get development for our industry, our products and our services so it's a two way street for us….I enjoy the concept of support and the whole vibe of the TAFE environment because it supports what we do. [5]

The system of industry placements for educators might also be viewed as an opportunity for two-way learning. One digitally innovative employer welcomed the idea of having educators spend time in their organisation so as to:

see how the courses have worked and are working, and also allow people to see what the workforce looks like in the digital environment. [15]

One VET provider gave an especially compelling argument in favour of a more two-way relationship:

it's a two-way support process with industry… we also should see things and share that as well...I don't believe it should just be industry driven… we all have that responsibility … what we're trying to do is make Australia globally successful at the end of the day. [11]

The second factor that was recommended to support relevance and quality in the VET sector was increased investment in educator capability. Interviewees were

clear that greater reliance on digital technology to deliver training content would not diminish the importance of educators' skills and capability. Effective utilisation of digital technology in the delivery of VET should serve at least two ends. One objective is to give students exposure to, and confidence with, technology as it is used in the workplace. As noted above, this means that educators need time to keep up to date with current industry practice so as to be able to train students in using the technology and provide real life scenarios and context for that learning.

A second objective is to provide richer learning environments for students - to promote engagement, deeper learning and higher workplace readiness. With digital technology playing an increasingly important role in the delivery of learning, educators need time and support to build this capability:

> *you really want them to unpack and reveal to them how digital technology can apply to their context... you're having conversations with teachers who have been teaching ceramics for 20 years around a pottery wheel and saying, well, how can we do this online...how can we improve your teaching and your students learning experience...there isn't necessarily a one size fits all. [3]*

Those educators who were already using digital technology in their teaching practice needed exposure to digital pedagogy and time to learn, reflect and experiment with new approaches. One interviewee said:

> *one of the best…ways of learning… it's actually to work with those teachers in action projects, where they themselves already develop those courses… and through the actual work of designing their curriculum, and designing their materials, and designing their delivery, they also learn… [6]*

Interviewees and students generally agreed that there was no one "right" way to use technology to support learning:

> *….it really depends on the industry and the occupation and the specific skillset… [2]*

Students added that younger students needed more "handholding" than older students and that different vocations tended to attract different personalities with different learning styles, requiring different approaches to the delivery of training.

However, educators would need the skills to interpret the data generated by digital learning systems (on how students were participating and engaging with different learning content and media) and modify training offerings in response. Finally, along with data and understanding of the latest pedagogy, educators also needed time and freedom to "play". One interviewee working in the VET sector described new technology-enhanced classrooms which had been designed to promote the soft skill of working in groups. However, they ended up being adopted most enthusiastically by the trades instructors. He said:

> *you have to allow a play room, a place for people to play and make mistakes. …the outcome has been fascinating and when you go in there and we bring in tours of people while the class is going on and you can just see there's this group of students that now are working like a group of employees out in the field. [13]*

The third idea for enabling greater agility was to focus on identifying those basic and core skills associated with a qualification (which needed to be standardised at a national level) but allow high-quality VET providers the flexibility to modify other components of the training package (in collaboration with employers and industry bodies) so that they could be updated more quickly to reflect changing training needs.

While consistency and standards were understood to be important, they also needed to be balanced with the need for relevance, as one participant explained:

….one of the ways of addressing this is by making this vocational education more liberalised and giving more agency to the institutions to teach it as well. So that it wouldn't be so over-regulated... it's always a trade-off between wanting to have particularly consistency and flexibility. So if we really want to achieve this flexibility, perhaps we need to think about how to achieve the trade-off between consistency and flexibility. [6]

Another participant described the benefits of flexible educational offerings not just in terms of supporting agility but also as a means of tailoring educational offerings to individuals' and employers' unique contexts and needs:

…the only way we're going to be able to respond to the pace of change in industry is by accepting the fact that everyone's got to agree on a baseline set of goals that gets delivered and then have far more flexibility in how you might complete that qualification with an optional set of units…giving people the flexibility to effectively create their own type of qualification on top of that which goes to their own personal strengths, changes in the marketplace, changes in emphasis of qualification across different industry sectors, changes in the qualification in different countries and different workplaces, cities. [9]

Finally, VET providers will have a role in supporting many of the individuals affected by labour market disruptions associated with the automation of work. In this role, it is necessary to understand the types of career transitions or pathways that are more or less viable for different individuals (based on their skills, experiences and dispositions) and the types of skills and training required to make this transition. While government, industry and research institutions will all have a role in this process, interviewees suggested that VET providers could make use of predictive analytics and modelling of big data (e.g., drawing upon online listings of job vacancies) to gain ongoing insight into the types of vocations and skills that were experiencing increased demand. One participant said:

there's a tremendous wealth of resources on the internet which could be harvested and analysed for trends… being much more agile about curriculum development and approval processes internally. .. It would be looking at skills that are being requested today. It would be looking at things like … new products that have just been

launched …looking at… online industry publications and seeing what they're writing about, looking at research… and incorporating that into what are the trends that are coming in the industries [4]

One interviewee suggested that the Universal Student Identifier recently introduced by the Australian government could be used to achieve new insights into the pathways and options for vocational students:

unique student identifiers… should allow [us] to learn from what's actually happening to students. The student started here, did this qual, ended up there. At the moment it's more lumpy and harder to discern that - are people following the pathways we think or is it simply not working like that? [17]

Furthermore, they saw value in making some of these data and models publically available to inform students' choices. The VET sector would benefit from more "informed consumers" – and digital technology could be used to give individuals a better window into the different vocations and the types of training and experience that would equip them to follow that vocation. One interviewee described how such an approach might support students' choices:

there's all sorts of cool things you can do online where I go, what does this look like? And it spits out, well, you could be this, this, or this at the end of it, and if that could even further connect to Seek or jobs on LinkedIn, you can actually see the whole path. …there's these Diplomas and so on and now I can watch some industry case studies of people doing that, so I can kind of go, gees, they're pretty cool, and that sounds like a fun job, and then here's the jobs on Seek right now, and see what they look like, and maybe even go and do some work experience opportunities. [10]

6 VET AND DIGITAL DISRUPTION

Our research focuses not only on the ways in which future education and training requirements are impacted by trends such as increased reliance on digital technology, but also on the ways in which such technology can be deployed *within* the VET sector to achieve greater efficiency, agility, transparency and quality. Digital technology is already widely utilised in the delivery of training and so we begin this section by providing an overview of how this shift is taking place and how it may continue to unfold. We then look more generally at potential applications of digital technology in VET internal business processes.

6.1 The promise of digital education

Digital technology means there is growing potential for training to be delivered online. It offers many advantages, allowing students to access course material when and where it is most convenient for them. It also offers ongoing measurement of student participation as it relates to specific content, which can be used to target improvements to course material and/or support for students. It therefore offers the potential to reduce the cost and increase the quality of education (Cowen and Tabarrok 2014).

Digital technology also allows the consumer to meet training requirements in a way that is adaptive to their current conditions. One interviewee said:

> ...you will be able to consume your education to better meet the needs of your life, your job, i.e. where you work, how you work, when you work, how you like to work, and it will also, therefore, allow you to build up your education supply – so how you consume your product, in a manner that allows adaptability. [8]

Currently courses within education follow a distinct program of study in which learning and assessment occur within a specified time period. Digitally delivered learning allows greater flexibility, so that:

> [if] suddenly, your work, your home life, if something changes you get the ability to have your education supply respond to that in a positive way. Not say, "Oh, if you don't turn up this semester you're getting kicked out." [8]

Content delivered by digital channels can also allow students to learn at their own pace. Those who have difficulty understanding concepts or who learn more slowly have the opportunity to revisit information or specific content. The mitigation of time constraints represents an incentive for educators as well as students in that the implementation of digital technology within education alleviates the need for revisiting content and resolving a given issue multiple times for multiple students. One VET provider reported:

> I have not seen an instance where we created a video and it hasn't helped the student, because they can re-watch it and re-watch it. And this is with students who have also had learning disabilities…sometimes just hearing it once in class is not enough, they need to go home and go through those steps in their own time, in their own way…. And the educators, the ones that have embraced it realise that it's actually very helpful for them, because their time is freed up where they don't have to go through the same thing 20 times individually to students, they can just direct them to these additional digital resources. [3]

Digital training also allows both educators and students to continually assess performance through monitoring and testing. The opportunity is available for triggers (indicators of poor performance) to be identified through progressive learning whereby the student attempts tasks based on their skill level in order to advance. This allows educators to assess the attempts the student has made, how often the content is accessed and identify specific content that the student is struggling with. They can then engage the student when it is needed, whilst allowing self-directed and self-paced learning:

> they could go through it until they got to a point where they needed help and either they knew they needed help because they couldn't do it and they would ask or we could see through multiple attempts at individual assessment items or through a few other measures that they needed help and we would have a human reach out to them proactively. So, basically saying hey, I think you need some help here, let's schedule a time and have, like, a little tutorial session, a one-on-one tutorial session. [4]

The trend towards online delivery is clearly a major factor in the future of education and training. However, despite some of the more extreme claims, teaching is unlikely to be fully automated any time soon. The potential of digital technology is enormous, but it should be noted that previous communication technologies such as broadcast radio and television failed to realise their claimed potential to revolutionise education (McPherson and Bacow 2015). However, the internet does offer a marked improvement on previous technologies, for example facilitating student-teacher and student-student interactions, and providing rapid feedback.

In higher education, Massive Open Online Courses (MOOCs) have begun to offer access to course material from leading universities free of charge. Huge numbers of people from around the world have enrolled, though completion rates are low (typically below 10%) (Navarro 2015). In the Australian VET sector, fully online courses have seen similarly low completion rates. Despite their egalitarian potential, MOOCs appear to be most effective for already educated students from affluent backgrounds (Hansen and Reich 2015). Self-discipline appears to be a particularly limiting factor in online higher education (McPherson and Bacow 2015), and is potentially even more so for students entering vocational education.

The relative effectiveness of online compared to traditional training delivery is clearly a key issue. However, pedagogy is multidimensional so simple comparisons are not necessarily informative (McPherson and Bacow 2015). Automated 'intelligent tutoring systems' have proved effective at teaching relatively complex information such as breast cancer risk for example (Wolfe et al. 2015). These systems interact with students and modify their approach based on the student's response.

The best digital tutors have been shown to perform comparably with individual and small group human tutoring, and to outperform large group tutoring and standard digital tutoring (Ma et al. 2014). However, these are cutting edge applications, which are generally limited to specific issues rather than a broad curriculum. While the technology will improve and spread, this will take time. Most digital learning relies on simpler interactive systems rather than true artificial intelligence.

We should also note that online education is not necessarily associated with low completion rates. In reality there is wide variability; courses with active discussion forums, complementing media and collaborative activities, have been shown to perform best (Creelman and Reneland-Forsman 2013). In the "flipped classroom", students learn basics (e.g. watch lectures) outside, allowing classroom time to be used for demonstration and discussion of more complex concepts. This is likely to be particularly attractive for VET, allowing more hands-on class time for practical learning. One student outlined how she saw digital content and educator input working together to support her learning.

I would really support development of that flipped classroom model to encourage achievement of those basic learning objectives... using technology. I reflect on ....the google analytics training that you do online... it's a video of a guy presenting, it's like a taped lecture...
it's short, it's like 2 to 5 minute modules that you're watching him and then there's comprehension questions

at the bottom and then you move on to the next one. I thought that was a really great delivery mechanism. ... You've got to understand what you needed to to tick off those key criteria... in bite sized chunks instead of ....PowerPoint series. [Student 3]

Having successfully absorbed the core content prior to the class, she would then be able to gain more value from her time with the educator:

…when we had done some preparation and got to spend time working on our assignments with our teacher, that was the most effective. [Student 3]

Technologies to support learning continue to improve. Digital learning tools have now been developed to support collaboration and social learning so that students learn to participate in a field, rather than just learning the material (Brown and Adler 2008). Developments in augmented reality, mobile learning and simulated learning environments continue to expand the possibilities. Simulations are likely to be particularly important for VET since they offer a means of improving students' work readiness:

…we need our training providers to be really dynamic in the onsite kind of training that they do to try and meet the needs to match what's in the hospitals. And often that isn't easily done and needs to be done through simulation... there's a lot of different software programs and mannequins that we can be using and try and simulate it as closely as possible to what it would be like to look after a patient without actually looking after a patient with that illness. So yes there is space [for simulated learning environments] because we need to find smarter ways to train people to be prepared for a hospital without sometimes actually doing as much time in a hospital as we would essentially like them to do. [7]

Simulations are also useful for learning tasks which are potentially dangerous, or consume costly materials (Pullen and Varley-Winter 2014). Simulations can reveal mechanisms that in real life are hidden; for example, through augmented reality students can see the engine moving and better understand how it works (London Knowledge Lab 2013). They can also provide exposure to work environments that cannot be reproduced in a traditional learning environment (e.g., the stack system in a high rise building) or don't yet exist, such as:

…an engine simulation for engineering trainees…who were going to be working on a destroyer that had not yet been built... we worked with them to create a simulated environment using a video game engine that would allow the engineers to go into a virtual engine room essentially as a video game character, an avatar

and interact with all the controls and be given different scenarios around what could happen that would require manual intervention with this engine and they would have to go and they could completely encircle the engine…You could enter in commands and pull the levers and push the buttons and turn the knobs, whatever you needed to do in response to those scenarios. [4]

Online education technologies both substitute and complement teaching labour (Navarro 2015). The role of teachers is likely to evolve, with less emphasis on subject matter expertise and more on facilitating learning. The digital world enables teachers and students to access the very best expertise online; the local value proposition will move further towards helping and motivating people to learn. The "sage on the stage" will steadily be replaced by the "cyber-guide on the side" (McPherson and Bacow 2015). Our interviewees stressed the need for educators to build confidence, skills and expertise in using technology to support learning. However, they were also keen to emphasise that digital delivery of education and training was not a solution in and of itself. Several commented on instances in which digital training that had not been done well - where traditional content had just been put online without re-designing it to reflect digital learning pedagogy. For example:

….this online training you've got to do, which is just a box-ticking exercise… [and] takes about an hour. It's the same rubbish over and over again… so… we have one of our staff sit… and does it for everyone… he'll have four screens going at once, because there's just no other way of doing it. [1]

Nowadays, best practice digital learning tools can enrich the learning environment in a range of ways. But in spite of being aware of the developments in digital learning, our interview participants generally believed that VET would always require some degree of face-to-face and classroom based learning. Within the VET student population there are certain groups who are less comfortable using technology (e.g. migrants and older students) or cannot access technology (those living in remote areas or on very low incomes). Having traditionally been less academic, VET students may need more "in person" support. Therefore, most VET students would benefit from face-to-face and group learning in addition to online learning, though clearly this will vary between subjects and students.

VET providers are also limited (compared to other higher education institutions) in the extent to which they can deploy digital learning tools because they tend to teach

more practical skills. Practical skills typically require hands-on training in order to get the sensory feedback essential for learning. As one interviewee explained:

…we've tried to use actually welding simulators where in the welding mask there's a screen and you can practise your hand skills and you can get the sensory kind of thing in that. It's not the same and the students say that…one of the things that you miss are some of the senses, you miss the real time sound of sparks, you miss the smell, you get different odours from different things… [13]

Some face-to-face training which brought students together with educators was also seen to be important in building the "soft skills", the workplace etiquette and the networks needed in a vocational career:

…there's a certain amount of etiquette in the workplace, whether you're welding two pieces of steel together, or whether you're a solicitor or a High Court judge, there's way of communicating a message to people, and if everything is done too much technical, then maybe they lose a little bit of the good old Aussie nature, like, "How're you going mate? I'll give you a hand with it. Yeah, we'll work on that together."…when you do everything on a computer and you're by yourself, I think you lose maybe the ability to interact in a team, and become highly competitive, and it becomes a 'my' and 'I' sort of scenario, as opposed to 'we' and 'us' scenario… [12]

An international student highlighted the importance of this type of face-to-face learning for him, pointing out that if all the learning was delivered digitally, much of the value that he derived from in studying in Australia would be lost:

I'm [an] international student… if we are just learning from digital we just stay in our country and just google search everything but we came here [because] we want to learn the culture, we want to learn how to communicate with the western culture and if we just learn from the paperwork we only use translation… we need the person to explain for us, what is real about because when we use the dictionary or translator it just like show the word but we don't know the definitions so we need more face-to-face to help us…I want to know about more like step by step and to explain everything, why I do that... [Student 1]

Interviewees also noted that relying too heavily on technology to deliver training was dangerous because students needed the skills to carry out jobs when technology was not available (e.g., when working in remote areas, when the technology fails or when an

employer or customer does not have the latest tools or systems). "Real world" learning prepared students for random and unpredictable events which required workarounds. One interviewee said:

I actually learned, for example, how to do accounting and how to do check-ins and everything manually… I knew how the system worked… For the students that just learnt on a digital system only, they never learnt the reasoning behind why they were doing things or how it was intersected...I think that we underestimate the value of that underpinning knowledge or the underpinning application in a manual process before you go digital... So when the systems do crash, I have the ability to actually work it completely manual without the system… [11]

Thus current consensus, both amongst our interview participants and in the academic literature, is that, while digital technology can greatly enhance teaching, for most students and most courses it will complement, rather than replace, teachers. As one participant explained:

…I don't think it will ever replace a component of face-to-face; I think they'll always need residential school where they come in and they can actually touch, feel and play, and the clinical placement component. But if you've still got residential schools and the clinical placement component I think online is great. [7]

Digital technology may be most usefully deployed to allow students to come to class better prepared, and so make the best use of more costly hands-on training. In many subjects it can also complement the teacher in class.

But for the foreseeable future, digital technology will not replace the teacher and face-to-face learning altogether because it is still seen as the best means of building practical skills, procedural knowledge, soft-skills and networks. Furthermore, as routine tasks are automated and customers' service expectations increase, soft skills, etiquette and social connections will be increasingly important differentiators for human (as compared to robotic) workers.

EMERGING TRENDS IN DIGITAL VET

Data show that online and remote forms of course delivery have increased substantially as a proportion of total delivery throughout the VET sector since 2007 (Figure 23). Throughout the sector, online and remote forms of delivery are consistently highest among courses aligned with: education; health; society and culture; management and commerce; and information technology. TAFE Queensland (Figure 24) is on par in rates of online and remote delivery with national level TAFE counterparts (Figure 25). In the case of education and health courses, TAFE Queensland exceeds their national counterparts in rates of online and remote delivery. This theme is more pronounced when TAFE Queensland is compared to the National VET sector (Figure 23). In this comparison, TAFE Queensland exceeds the National VET sector in rates of online and remote delivery for health, education, society and culture, and management and commerce.
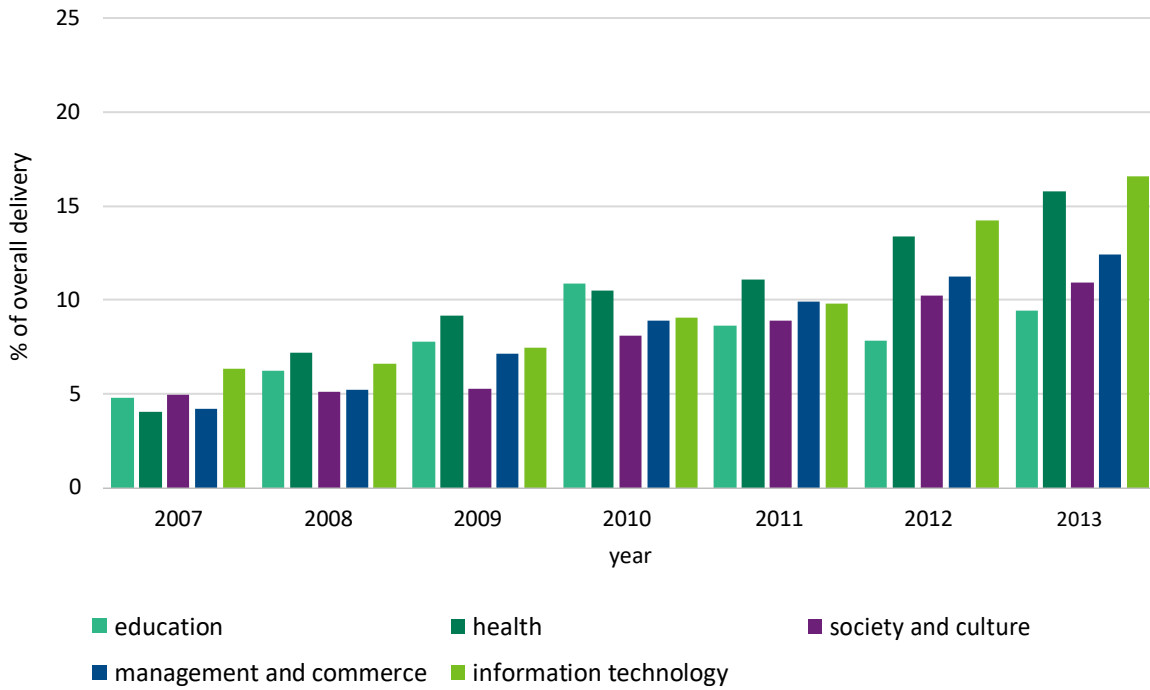
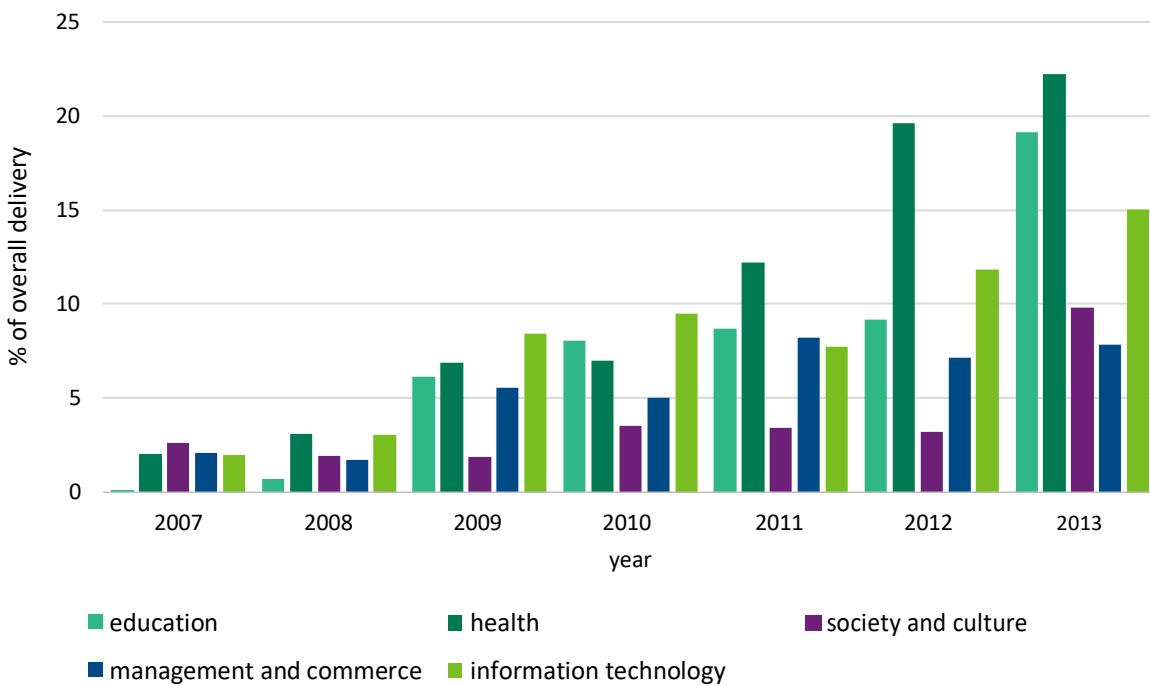**Figure 23: Online and remote delivery National VET system, top five fields of study.**

Figure 24: Online and remote delivery Queensland TAFE system, top five fields of study.
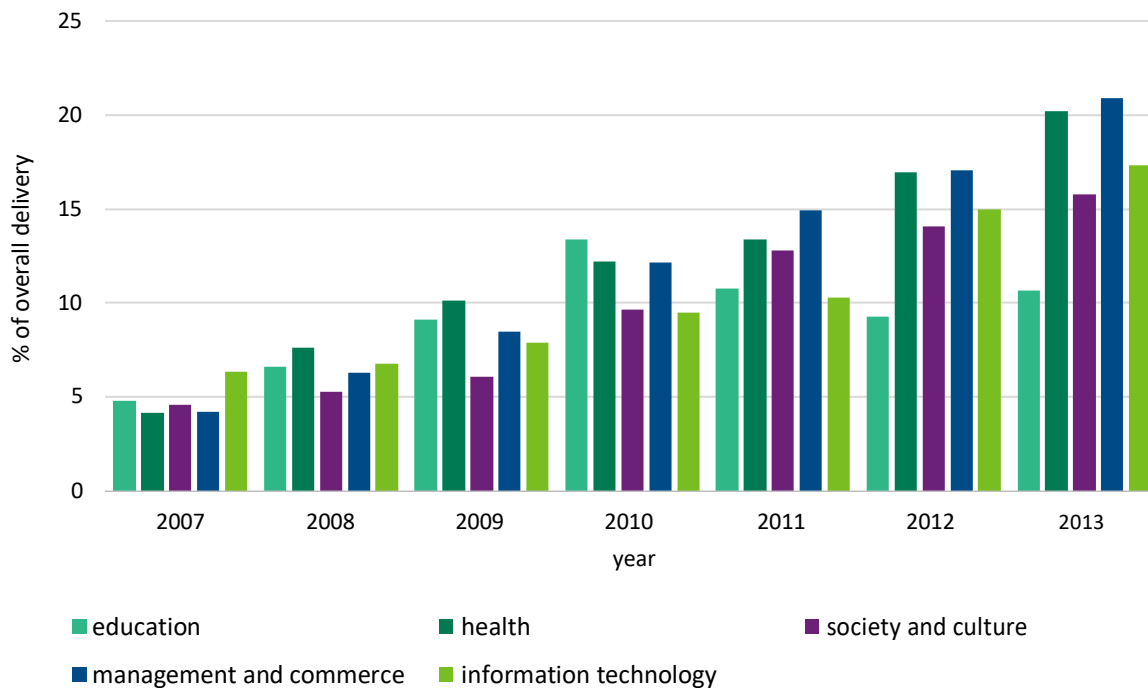
Figure 25: Online and remote delivery National TAFE, top five fields of study.

6.2   Digital business models

From a purely economic perspective, online training initially appears very attractive to training providers as it greatly reduces costs; for those with large numbers of students the marginal cost per additional student approaches zero. Ultimately online training alone is unlikely to be a sustainable business model, precisely because of this low cost, as the equilibrium price is likely to be zero. If some providers provide access to digital content free, as MOOCs currently do, other providers will struggle to cover their costs. The news industry provides an analogy to this; with so much free content available, even the major players in the industry find it challenging to attract paid subscribers.

While marginal costs are low, the fixed costs of online education can be extremely high, as students increasingly expect high quality interactive experiences, in line with their experiences of other digital products such as professional websites and games. Well-designed online material is likely to be more attractive to students than classroom lectures. However, posting videos of lectures and pdfs of supporting material online is no longer enough for an online training course. For higher education the costs can be in the order of $1 million for a course (McPherson and Bacow 2015). As one interviewee, with expertise in this space, commented:

….if someone thinks that online education is simpler and takes less time, they are absolutely wrong. Because online education takes much more time to prepare, and takes much more time to deliver at a high quality. [6]

The combination of high fixed costs and low marginal costs mean that as the market size increases, providers will invest more in quality, creating economies of scale and leading to a concentrated market (Cowen and Tabarrok 2014). There is already considerable movement in the sector due to marginal providers leaving the market. Mainstream training courses are likely to become highly concentrated around a small number of providers, analogous to the textbook market, while a diversity of niche courses will proliferate (Cowen and Tabarrok 2014).

In this environment, digital course material should be developed with at least the national scale in mind. This is likely to be most efficiently and effectively done by digital specialists working with educators, rather than a piecemeal approach to getting content online. Varying rules and requirements across jurisdictions will complicate matters, so digital courses must retain the flexibility to be adapted to local conditions. A key question for a provider such as TAFE Queensland is whether to develop such material in-house, in partnership with other TAFEs or to purchase it.

The digital paradigm does mean that location is likely to become less important. It should be possible to offer a greater range of courses in a greater range of places, through the combination of online material and local teaching expertise. An organisation such as TAFE Queensland, with a broad regional footprint and a trustworthy brand starts with a comparative advantage in this space. In addition to VET courses there is the potential to further expand into higher education. As most students will benefit from skilled teaching and social learning, digital universities will need to be complemented by local teachers and group facilitation to reach their full potential.

There is therefore currently an opportunity to support the delivery of a much broader range of courses, in a broader range of places, using the best available online material (sourced from anywhere in the world) combined with excellent local teachers. It is no longer necessary to directly employ star lecturers, as they can be made available online. VET providers such as TAFE Queensland could partner with one or more universities from anywhere in the world to provide Queensland students with new educational opportunities.

Ultimately the digital marketplace will not support a large (or even medium) number of providers offering similar courses. VET colleges will be forced to amalgamate (whether through partnerships or mergers) or else retreat into protected niches. First-mover advantage will count for a great deal. VET providers (and other higher education providers) therefore face some pressing strategic decisions.

However, digital technology can support improvements in other aspects of VET, not just in the delivery of training content. Below, we outline specific business processes that are amenable to digital transformation.

ONLINE ASSESSMENT

A recent discussion paper released by the Australian government highlights assessment as an area for focus due to its role in ensuring the quality of VET outcomes (DET Canberra 2016).

Online assessment has come a long way since the early offerings of multiple choice quizzes that allowed the learner to repeat a question until they arrived at the right answer. While declarative knowledge can be assessed more thoroughly using randomly varying questions, even procedural knowledge can be assessed through digital technology such as video recordings or (as in the following example) point of view glasses.

> *You might have a teacher…they might be delivering to apprentices out in – outside of Brisbane, and they'll use something like point of view glasses, which are a bit like glasses that record – you wear them and they record what you are doing as a video…. then they can see that the apprentice knows how to – I don't know – spray paint a car, whatever it is that they're learning. [3]*

The use of digital technology to carry out assessment is important in the VET sector because many students complete some of their learning in a workplace environment, through placements, internships and apprentices. Learning in the workplace can be valuable for both students and employers and the ability to carry out assessment in situ supports this type of learning. As one interviewee explained:

> *you can take a video of the haircut being done, and you can go out to the office and see people working in this environment, which is probably more realistic because it's actually the workplace, and be accredited for that… that kind of takes the focus away from going to a class and attending, to bring it into a workplace which perhaps is more relevant. [10]*

Currently, the administration of workplace based learning (the paperwork and reporting requirements) is seen to be time-consuming and not up to date with current practice, as the following quote illustrates:

so the student might need to… do 400 hours of clinical placement when they're with us. TAFE ask us to do an old school written list providing how many hours every single student does each day, so our system will actually download and say, right, your students have been here for X amount of time, this is how many sick days they've had and give a running printout. Now, Gold Coast campus of TAFE has said yep that's fine we'll use that, but other campuses have gone no we still need our school paperwork. [7]

One novel approach to assessment involves gamification, or more specifically, the use of game-like computer-mediated assessment environments (Seaborn and Fels 2015). One interviewee reported that professional services organisations were already using gamification to assess job applicants and suggested that this model could be used for assessment in VET. A benefit of assessment through gamification is that it tests not only whether students have absorbed the training content but also whether they can apply that content to solve problems or complete tasks that they are likely to experience in the workplace:

…gamification is potentially the big opportunity for the VET sector where…you've got a base set of skills that you acquire and then you're given scenarios or problems to solve… online…over a period of time …that really will go to underpinning flexibility because you'll be able to demonstrate the application of skills in different scenarios based on the problem that has been presented to you to solve... [9]

A challenge associated with online assessment lies in verifying the identity of the person completing the assessment. There is a clear risk of course credits being traded online, as Twitter followers and gaming credits have been. Here, too, technology can offer some solutions. Webcams can be used to take a photo of the student whenever he or she logs onto the training system and matched to some form of government-issued identification. Further verification of identity can be achieved by requiring students to log their typing pattern.

As with training content, however, it is unlikely that all forms of assessment will be digitised. In contexts where a worker's mistake could cost a life or cause damage to very expensive equipment or facilities, face-to-face assessment

may still be needed to ensure that the required learning had been achieved. As one interviewee said:

sometimes you really do need to be standing there, observing someone driving a $2 million piece of civil construction equipment, because it's deemed that by industry standard, by manufacturing competency, by the vendor who is delivering the product, that is what is required… [8]

Some employers may prefer to carry out this assessment in house. However, organisations such as TAFE Queensland, whose educators have industry experience, who have a reputation for delivering to regulatory requirements and industry standards and who have a broad geographic footprint, are well placed to provide face-to-face assessment in those situations where an "in person" complement to digital training and assessment is required.

CERTIFICATION AND VERIFICATION OF CREDENTIALS

The potential impact of digital technology in VET is likely to go well beyond the classroom. In a more crowded training market, where online training content can be provided at very low or even no cost it becomes increasingly difficult for students and employers to evaluate alternative training offerings, providers and qualifications.

Certification will become increasingly crucial for students, as prospective employers will need to rapidly assess candidates, each of whom will be claiming a growing range and diversity of qualifications. It is worth noting that the large MOOC providers, while giving their content away, are now charging students to provide identity verified certificates of achievement. Assessment, certification and verification of credentials may become a key source of competitive advantage in the future. Training providers with a well-established brand and reputation will do best.

A digital platform linking training providers and students could also provide an authoritative record of certifications and qualifications. The introduction of the Unique Student Identifier should support the more flexible and modular training activity required for the future since it represents a means of tracking students across courses and training providers – thus allowing them to build a virtual "educational passport" while engaging in training activity at a time and on topics that are immediately relevant to their work.

Such a system would have benefits for students, training providers and employers by providing a means of efficiently verifying an applicants' skill level and qualifications. In a lifelong learning context, where training activity will occur over a longer time period and in a less standardised manner, the facility to automatically capture training activity across time, locations and training providers is likely to be increasingly valuable. One interviewee spoke about the value of this proposition for students:

…particularly in the health sector, we all have requirements to continue professional development and learnings…by the end of this month, I have to go into my computer and put in all the courses I've done so I get my certificate, but if I had a passport… or an app, I would sign up to that tomorrow. [15]

Another interviewee spoke about it from the employer point of view:

We use a lot of QR coding on our products now to provide, all sorts of information… providing that information as a process for, not only looking at what the qualification is, but updating that qualification... because employers… if they employ somebody they want to know that they've got a level of qualification, rather than just being told that... [5]

WORKPLACE-BASED LEARNING

Not only did interview participants envisage digital technology streamlining VET assessment and reporting processes, they suggested that it might facilitate new types of work-based learning experiences. Digital platforms are very efficient at facilitating connections between suppliers (with a specific product) and consumers (with a specific need).

Already there are technology products coming into the market that facilitate this type of connection for VET students (who seek to build work experience) and employers (who seek workers with a specific skill set). Such tools can be used to provide internships for VET students or even paid work experience, as illustrated in the following example:

….we're actually aligning relevant casual and part time employment to a student's qualification so that they – instead of getting a job at Macca's …we'll get you a casual or part time job in the industry sector you hope to graduate into, so a really stark example of that is you're doing an aviation and aerospace qualification, for

example, you might get a job with us on the reception desk at the Moorabbin Flying School – so we're not putting you in a plane, but we're making sure that you're in the industry… you're learning context, you're soaking up terminology, you're meeting people, you're, kind of, getting how the whole big wide world works… [9]

The example above also reveals the way in which digital systems capture and track learning activity.

CONSULTATION WITH INDUSTRY

Consultation, in particular with industry, was also identified as a process with potential to be digitised. Personal and one-on-one consultation between training providers and industry representatives was seen to be essential for keeping training offerings up to date with workplace needs. However, digital technology could complement this type of consultation by allowing broader input to be captured efficiently.

Several of the employers who took part in the interviews reported that they would like the opportunity to inform VET offerings. Representatives of large employers expected a personalised consultation process but small employers suggested that online consultation (both online surveys and forums were suggested) would serve to allow their perspectives to be captured. A few specifically noted that group consultations carried out in person required too much time. They were keen to ensure that consultation be carried out as efficiently as possible, in line with the following suggestion:

…simple things like online surveys using tools like Survey Monkey or running webinars, so you can offer an industry perspective - even if you are inter-state on business travel would be better for me than having to be in a certain location at a certain time to provide my perspectives. If you want really good industry input, from people who are the cutting edge of what they are doing, you have to be flexible in how you involve them. They're very busy people… [10]

Technology offers the potential to greatly streamline this process, which is so integral to the VET sector. Australia's Digital Transformation Office recommends online consultation as one means of engaging in two-way consultation with stakeholders (http://webguide.gov.au/web-2-0/online-consultation/) and the Queensland Government offers a suite of consultation tools which comply with government policy and legislation (www.qld.gov.au/web/community-engagement/tools/online-consultation-toolkit.html).

ADMINISTRATIVE PROCESSES

Finally, many businesses and government organisations are achieving enormous savings by shifting customer transactions from expensive assisted services to online services (e.g. UK Cabinet Office 2009) with one study finding that online services can be delivered for one hundredth of the cost of an equivalent face-to-face transaction (PwC 2009). Shifting services online can also benefit customers, since they can access the service more conveniently, at a time and place of their own choosing. Online enrolments, course payments and classroom scheduling and notifications were all identified by interviewees as areas where significant improvements could be achieved (both in terms of customer experience and organisational efficiency) in the VET context. One of the students in the focus group suggested:

> ... if they can provide the mobile apps, we can download it and log in by apps, like, everything would be easier... you get a notification if your grades come out... what are you going to do next week and what are your classes next week and when is your exam and remind you of the due date of your assignment, that would be easier for us. [Student 1]

6.3   Supporting informed choices

Deregulation has, as intended, increased the range of choices available to prospective students and their employers. The great advantage of the market-driven approach is that it can support diversity and promote quality through competition. In theory, high quality providers will attract more students, while poor quality providers must either improve or be forced out of business. However, few markets work perfectly. A particular problem facing education markets is information asymmetry. The quality of a course is difficult for a student to observe in advance of actually taking it. Acknowledging this problem, our interview participants spoke about the need for better data to create more "informed consumers." In the current VET environment, price is the most obvious differentiator for consumers of training. In such markets there is a danger that poor quality offerings will push out the higher quality offerings. Since buyers cannot tell in advance what they are getting, they will opt for the best price – this is the 'market for lemons' problem (Akerlof 1970).

In the market for lemons, quality providers are unable to differentiate their product to buyers, and so lose out since their costs are higher than low quality providers. The original exemplar of such a market was used cars, but many of the same characteristics can be seen in VET.

Given prospective students are, almost by definition, uneducated, making informed choices in such markets will be difficult (though where others with more information and experience, such as employers or government, do the choosing the prospects should be better). The equilibrium outcome of the classic market for lemons is homogenous provision of low quality. However, this is not inevitable.

One potential solution is regulation. Governments and other institutions set minimum standards which training providers must meet. While attractive in theory, this is not straightforward in practice as VET is dynamic and multi-faceted. Setting and enforcing regulations can be time consuming and costly; they can also stifle quality-enhancing innovation. At the same time, regulations will encourage some providers to find innovative ways of circumventing them, potentially to the detriment of students. The more complex the sector and the necessary regulation, the greater the potential for loopholes to be found and exploited. The result will be an ongoing race between regulators and providers who seek to push the boundaries.

Reputation provides another solution, allowing high quality providers to differentiate themselves and charge a higher price. Digital networks mean it is far easier than ever before to access information and build reputation, potentially overcoming information asymmetry (Tabarrok and Cowen 2015). This suggests quality providers should invest heavily in their reputation and avoid reducing their quality in order to meet the competition. However, it still requires prospective students to make considered choices, something at which human decision-makers, and especially younger and less educated ones, do not always excel.

In other contexts, decision-making is supported by providing key information in a concise and comparable form (such as comparison rates for loans, fuel efficiency standards for cars, etc). For education this might include things like cost, hours of tuition, class sizes and graduate outcomes (employment, salary). For VET the myskills website (www.myskills.gov.au) provides some standard information on courses but has little that could assist students in choosing among providers. However, education is complex and multi-faceted, and may not be readily described with simple metrics.

This difficulty was acknowledged by one of our interview participants who was actually working on the design of a "TripAdvisor" type platform that could capture consumers' ratings of VET providers and courses. However, education is somewhat harder to assess than a hotel room:

> the only way that they can form a view about whether or not a course has been great for them is one, that they've enjoyed it and two that they've got a job.

…how on earth do we expect them to be experts? So we've, kind of, struggled with how valid that concept is for a student, and then you've got employers who just say, "Well this person knew what they were doing on day one, or they didn't." …So…we're still not confident that we have an appropriate framework for judgement on who does what best. [9]

Thus, although interviewees saw a need to capture and share data on the quality of VET offerings, they were aware that ensuring validity and appropriate interpretation of any such data would need to be addressed carefully. For example, providers who serve more disadvantaged students might appear to underperform others, unless the student population is taken into account. One of our interview participants, who had often sourced training for her organisation, described the type of portal that would inform her decision-making:

…like a map where you see these colleges deliver the course, this is the contact name or this is the email or the website of the college, this is the cost of the course, this is the duration, and you can quickly compare and contrast the different colleges that offer these different courses…. You're not going through tables and tables of all these different places. [14]

Standard information disclosure mechanisms require underpinning regulations to ensure all providers present comparable information, but they work primarily through supporting choice rather than mandating standards. There might even be potential to link a centralised information platform of this kind with other online data (e.g., links to relevant job advertisements or trends in job vacancies requiring the relevant skill set) towards further informing consumer choices regarding the desirability of alternative skills and qualifications.

6.4   Funding models

As more people seek more education, there is clearly a need for more funding. Given constraints on public spending, government funding seems unlikely to keep up with demand. This was recognised by interviewees:

I think the only way that we're going to manage this in the future is that employers and industry will have to pay a lot more out of their own pocket to upskill their workers and they won't be able to rely so much on government because I think governments will be just flat strapped trying to cope with funding the re-skilling and the education of those that really, really can't afford to pay for it themselves. [2]

Technology can reduce the costs of education, but only if economies of scale are realised. Ultimately it is likely that students will have to fund a greater proportion of the costs of their education. There is potential for innovative funding models. Currently many students have access to income-contingent government loans, where repayments are activated once their income passes a certain threshold. This does encourage some students, in some cases encouraged by unscrupulous providers, to take on loans they have little prospect of repaying.

One innovative approach is for education providers themselves to loan some or all of the cost of a course to the student. Having 'skin in the game' means providers' and students' interests become more closely aligned, and there is no incentive to provide poor quality training to students who are then unlikely to find gainful employment. Purdue University in the US has recently introduced an 'income share agreement', which funds tuition in return for a percentage of a student's income for a number of years after graduation. Such schemes could also be attractive to private investors (Friedman 1955); given the increasingly tight returns in other capital markets, human capital might become an attractive alternative investment.

A market-based system for matching loans to students would be likely to better match students with courses that enhance their earning ability. However, it is likely that students from disadvantaged backgrounds would find it harder to access training, and there would be under-investment in courses with strong social benefits. Income-contingent loans do not necessarily sit well alongside other funding mechanisms; if students have the choice between a regular loan and an income-contingent loan, those who expect higher incomes would be likely to select into the regular loan, reducing the returns to private investors.

Another possibility in a world of lifelong learning is a subscription model, in which workers (or their employers) pay an ongoing subscription for access to VET courses. This might be particularly suited to online courses, for which the marginal costs per student are very low (though as discussed above, access to teachers would increase the marginal cost, and value, of online courses). This could enable workers to readily acquire new skills as they find they need them, or to experiment with a range of different subjects. Subscribers could be entitled to a certain number of courses or hours of tuition per year (with perhaps different tiers of membership). In addition to the direct training benefits, membership would signal that a person, or employer, is actively pursuing education.

7 IMPLICATIONS FOR VET

As technology and lifelong learning become ubiquitous in the workplace, the future ought to be bright for VET providers. Though digital disruption and deregulation bring many challenges, VET has never been more relevant. However, the landscape is changing fast, so VET providers face some key strategic decisions. There are two key aspects to this. The first relates to what students need to learn, and when. The second relates to how this training will be delivered, and by whom, in an increasingly digital world.

7.1 Future skills and learning

Our research reveals a troubling gap between the skills profile of the current workforce and the growing demand for more high-skilled workers. Given that VET providers deliver training to the largest segment of our workforce, Australia's competitiveness in the future global marketplace will depend on VET providers being ready to deliver training to a larger, more diverse student population, at a much higher skill level.

In the current market, where it is easier for consumers to differentiate providers based on cost rather than quality, it will be challenging for VET institutions to secure the funding and resources they need in order to meet this demand. Building partnerships (with other VET providers, with employers and other key stakeholders) will be critical in order to surmount these challenges. Our participants spoke about the importance of two-way communication between VET providers and industry. VET providers need to harness this communication channel in order to build a shared understanding of the competitive advantage that will attach to a more highly skilled workforce in the future digital economy – and the means through which they are meeting this need. In light of the effort required, it may be strategic to focus first on those sectors where digital disruption is already being experienced and the need for re-skilling and up-skilling is already being felt.

Our research also finds that the required skills mix is evolving. While STEM skills have been given much press in the context of technological disruption, the research actually suggests that communication skills are more important than ever in the technologically-enabled world. In particular, higher order communication skills such as Active Listening and Negotiation, along with Service Orientation, are required in areas of employment growth. As technology advances there is ongoing competition between human workers and automated systems.

As humans, our comparative advantage is our humanity. Course offerings need to be re-oriented to reflect the growing importance of communications. And while digital learning needs to become a bigger component of course offerings, the use of digital learning channels needs to be balanced with face-to-face learning that teaches students about collaboration and teamwork and professional relationships.

Notwithstanding communication skills, STEM skills *are* becoming more important. This doesn't require everyone to start writing computer code, but it does require an increasing share of workers to be digitally skilled and capable of working with data. Basic digital literacy is essential; the 15% of Australians who don't use the internet (ABS Household Internet Use, Cat no. 8146.0) will be limited in their ability to find a job in the digital economy, never mind actually do one. Incorporating technological and numeracy skills into a broader range of courses will be of great benefit to students and employers. And while good customer service involves using those digital channels which students prefer, supporting workplace readiness requires that students learn to use technology as it is used in the workplace. In this context, digital literacy is about using technology to solve problems and achieve practical ends and it represents a higher order of digital literacy. How we use technology will continue to change as digital technology develops and is applied at an ever-increasing rate. VET providers, with their focus on practical skills and workplace readiness, should be well placed to deliver to this need.

The packaging and timing of VET offerings also needs to be re-evaluated. Rapid changes in the working environment and longer working lives will shift the formal education sector towards a lifelong learning model, rather than relying on an intensive period of formal education at an early age. Courses, and their associated qualifications, will need to become more modular, so they can be completed progressively and flexibly, alongside work. However, modular course offerings should serve as the building blocks for more long-term and continuous engagement between students, employers and VET providers, since time is required to build the higher skill level required of future workers. Ongoing, virtual engagement with students and employers may represent a means of supporting this longer-term relationship. It will also require new ways of tracking learning, such as a digital platform for skills recognition, certification and verification of credentials, all of which are now made possible by technology.

Public funding is unlikely to keep up with the growing need, and value, of education. Innovative funding models could help students and their employers to meet this shortfall. It is also essential that costs are minimised by making good use of digital technology, in both the administration and delivery of education. The increasingly competitive marketplace is resulting in lower standards among some providers; quality institutions should not be tempted to join this, as ultimately a good reputation is the best defence against cheap but inferior rivals.

Maintaining currency with industry requirements is central to VET, but becoming increasingly challenging. A more strategic approach is required, which would include sharing of information amongst educators (e.g., case studies or online communities on digital learning best practice, sharing learnings from annual placements with other educators in the same vocational area) and digitally streamlined consultation with employers. Agility can also be supported by better understanding the external environment. In the online environment it is now possible to obtain real-time data relating to job vacancies, skills requirements and shifting employment patterns across different industries.

7.2   Education delivery

Digital technology will significantly change the way in which education is delivered. However, it is unlikely that the role of teachers will be automated. Most students will continue to benefit from small group (or one-on-one) tutoring, particularly as the relative importance of solving complex problems in teams, versus carrying out routine tasks, increases in the workplace. Teachers will spend less time preparing, lecturing and marking and more time with students, helping them to understand the more difficult concepts of their courses.

Well-designed online course material will greatly enhance the learning experience for students, and should be embraced by educators. However, it needs to be developed to high standards, in line with students' expectations of modern technology. The fixed costs of this will be high, particularly for more technical courses, but once developed it can be delivered far and wide at minimal marginal cost. It is therefore not a viable model for each institution to develop its own online content.

Individual training providers have three options. They can choose to develop content themselves and seek to licence it as broadly as possible in order to cover the costs (or scale up their own delivery). This is a high risk strategy, as it is costly, and there may be fierce competition. Content markets are likely to be dominated by one or a few products, so it is not enough to be average. And given the costs involved, this is unlikely to be feasible across a large portfolio of courses. A second, less risky option is to partner with other providers to achieve the required scale to develop and deliver content.

Finally, providers can pay others for online content (which is likely to require a degree of customisation for local context and regulations) and focus on supplementing it through excellent teaching. The potential to access others' material (including internationally) also expands the possibilities for training providers. Already the lines between vocational and other higher education are blurring. World leading lecturers can now reach global audiences. Regional training providers can now partner with leading national and international higher education institutions, combining the best online material with excellent local teachers.

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