

FROM THE PRESIDENT

Researching vocational education in a post-truth world

Recently the Oxford dictionary has declared the term post-truth as its word of the year, defining post-truth as *relating to or denoting circumstances in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief*. This could have significant impacts for research and researchers working to collect and critically examine evidence for decision making and development of new ideas.

Commenting on the recent election in the United States, Selena Zito's [article](#) in the *Atlantic* magazine provides an example of post-truth, in this case, by referring to whether candidates for public office are taken either literally or seriously. In her assessment of voter behaviour regarding the sometimes bizarre pronouncements made by President-elect Donald Trump during the campaign, Zito said 'When he makes claims like this, the press takes him literally, but not seriously; his supporters take him seriously, but not literally'. This is an example of voters forming their opinions on emotion and personal belief and ignoring objective facts.

We have also witnessed the challenges of reporting scientific research in contentious areas such as climate change, where evidence is being assessed against opinion rather than fact. Reports in the media often provide no explanations about the complexity of the research and focus instead on simple messages for a range of audiences.

What then are the challenges in a post-truth world for those commissioning, undertaking and utilising research in the VET sector to make decisions? What is the role of professional associations like AVETRA?

Researchers might use the media to create interest in their research and the evidence provided. They may do this through metaphor or anecdote. However, it will be important to continue to promote academic discourse in all its forms. This will help to underscore the need for clarity of definitions and methods, reliability and validity of results, and

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integrity of conclusions. It will be increasingly more important to highlight the distinction between evidence and opinion and to articulate the value of research based on the systematic collection and analysis of data. By doing this in ways that make sense to the informed lay person we can better engage our audiences in key debates about independent and informed research.

As evident in the stories here, AVETRA members continue to provide a source of authoritative, well-structured and diverse research that has a deep understanding of context and history. This research connects to broader messages about VET today and possible futures. AVETRA members and their association can play an important role in identifying research that meets high review standards and acknowledges the limits of current knowledge. They can also help build expertise in research, grow the research community and communicate with authority from a research basis.

Our ongoing role then is to continue to ask difficult or uncomfortable questions of VET research to ensure an evidence-based debate continues and its value is acknowledged by participants and decision makers. ■

**Ruth Wallace –
President, AVETRA**



Secretariat
Mya Bilbao

AVETRA Secretariat
PO Box 576
Crows Nest NSW 1585
Ph: +61 2 9431 8690
Fax: +61 2 9431 8677

www.avetra.org.au

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Editor:
Josie Misko

In their words: learner ‘choice’ in fully-contestable training markets?

Justin Brown, ACER

The Australian Council for Educational Research (ACER) has been funded through the National VET Research Program to conduct research into the notion of ‘choice’ in VET. Anticipated to be published in early 2017, the study aims to investigate the drivers influencing VET student behaviour, and their impact on choice of provider and course.

Internationally, the European Centre for the Development of Vocational Training (CEDEFOP) recently made the observation that ‘collecting and analysing more information on young people’s individual motives, choices and trajectories will be a priority for the coming years’ (CEDEFOP 2015). With the introduction of market-based training systems and contestable funding arrangements in Australia, these information needs have come to the fore.

Policy language around improved student ‘choice’ and ‘market information’ has become ubiquitous (DET 2015; DEECD 2012; DIIRD 2008). So too has there been an emerging interest in improving understandings of the drivers, influences and information supplied by the VET system to guide student choices. For example, the newly-introduced RTO Performance Indicators Student Survey in Victoria asks respondents, ‘Did you think about training with any other training organisations when planning to do this course? If yes, how many other training organisations, including the one you trained with, did you consider for the course?’

To date, there has been limited independent research on notions of ‘choice’ in VET within these new policy arrangements. Even less has been published from the perspective of the learners themselves. Earlier research has argued that underpinning policy notions of choice in Australian VET was ‘an implicit assumption that choice-making in VET is an unproblematic process in which individuals engage freely, actively and rationally’ (Anderson 2003). In reality, choosing to undertake vocational training, Maxwell et al (2000) argued, requires ‘high-level personal decision-making

skills, including skills in obtaining and systematising information on providers and courses as well as skills in considering the match to personal needs, interests, capabilities and aspirations’.

Building on these earlier contributions to the knowledge base, the current research attempts to provide an updated understanding that reflects the new dynamic between young people and VET providers (and the system more broadly) since the introduction of markets, entitlements and contestable funding. The research seeks to illuminate some of the challenges and assumptions in what drives young people’s choices, and their freedom to choose, in VET.

So how do young people inform themselves of their training options under these new arrangements in the VET sector? What factors are influencing their decisions?

There are five research questions of interest to the study:

1. What are the main drivers influencing student behaviour and choice of provider and course?
2. To what extent are young people (15-24 year olds) aware of the various entitlements and eligibility criteria concerning their participation in VET? What are their attitudes towards them, and what impact do they have?
3. What role does ‘choice’ have when explaining the patterns in training participation and outcomes among groups of young people?
4. What are the perspectives of the target group (and the practitioners who train them) on the opportunities and ‘freedom to choose’ their provider, course, and occupation in their particular region?
5. How can current approaches to measurement and reporting in VET be broadened to reflect more comprehensive outcomes for young people?

Using a mixed methods approach the research has mapped what VET

opportunities are available for young people in Victoria through a detailed literature review, document analysis and analysis of the available quantitative data. The findings from these preliminary strands were then explored in more detail by working closely with three RTOs, each catering to different segments of the ‘youth’ or ‘school leaver’ market in Victoria. At each RTO a series of focus groups have been conducted with VET learners across a range of qualifications. The approach to data collection has sought to capture new information and fresh perspectives on these issues while retaining a focus on the learner perceptive.

This project is one of seven grants awarded in 2015 through NCVER’s National Vocational Education and Training Research (NVETR) program. The principal researcher is Justin Brown, Senior Research Fellow (VET) at the Australian Council for Educational Research (ACER) in Melbourne. ■

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Red or vermillion: is applied research in VET different?

Francesca Beddie and Linda Simon

The current innovation agenda does not factor the VET sector into its Research and Development (R&D) partnerships. Should it? Does VET have a role to play in bridging the gap between inventions or innovations and their application in the workplace? What skills and capabilities do VET teachers and organisations need to be effective collaborators in the innovation cycle?

We are exploring these questions, answers to which may offer one way to 'future-proof' the VET workforce. This project, [Positioned for the ideas boom: where does the VET workforce fit?](#), is being funded by the National Vocational Education and Training Research (NVETR) Program.

First we ask why is applied research important in the VET sector? This has required us to examine what we mean by 'applied research', which turns out to be a contentious term. We know it is not the same as university-based research or the applied research conducted in organisations like the CSIRO. We know it has a strong practical focus on solving problems. Yet it can create new knowledge, and/or use existing knowledge in new and creative ways to 'generate new concepts, methodologies, inventions and understandings' (ARC, 2014 in Simon and Waters, 2016).

So is the term 'applied research' the right one to describe the activity we will be examining? Or might 'research' be a word that is off-putting to some VET practitioners, who do not see their work as teachers or their industry engagement as also a research activity? They might describe that work as being 'red' while we are talking about 'vermillion'. These different labels (borrowed from Robert Luke, until recently Vice-President, Research and Innovation, George Brown College, Toronto) may be describing essentially the same thing. On the other hand, it may turn out that there is considerable variation in hue.

Would we be better distinguishing R&D activities in VET by adopting the terms used in the OECD's *Frascati Manual* (2015, p. 45):

- **Applied research** is original investigation undertaken in order to acquire new knowledge. It is directed primarily towards a specific, practical aim or objective.
- **Experimental development** is systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.

Or should we talk about scholarship, drawing on Ernest Boyer's 1990 model, which identifies four types of scholarly activity:

1. the scholarship of discovery, including original research that advances knowledge
2. the scholarship of integration or the synthesis of information across disciplines, across topics within a discipline, or across time
3. the scholarship of application or engagement that involves sharing disciplinary expertise with peers
4. the scholarship of teaching and learning.

In a discussion paper for a forum on innovation and applied research in VET (Waters and Sheehan, 2016) suggested that 'applied research' takes place in the following ways. This was not considered a definitive list.

1. Applied research partnerships with industry for:
 - developing and improving new products, services or processes, and/or
 - workforce development solutions.
2. Using applied research pedagogies or 'research-engaged teaching' (practice-based pedagogies) which directly engage students in applied research activities throughout their studies, with or without industry partners. This promotes inquiry-based learning that is more likely to develop: the cognitive skills of problem-solving; the interpretation, analysis and communication of complex

information; and the ability to apply this information in everyday work situations.

3. Applied research that involves VET practitioners undertaking research into teaching and learning practices. This advances both the quality of VET teaching and the development of students' innovation capability.

It is these sorts of practices – be they called 'applied research', 'scholarly activity' or 'experimental development' that we will be investigating during the case study phase of our research. We will be seeing whether there is a business case for VET involvement in the innovation system and will be mapping the skills and capabilities VET teachers and RTOs need to conduct the functions described above.

We are very keen to hear from VET teachers about their 'applied research' or 'scholarly practice' and about whether you think the system has the potential to be a more active player in the 'ideas boom'. Please contact us by email if you would like to be involved in this project:

Francesca Beddie:

fbeddie@makeyourpoint.com.au

Linda Simon: lindasimon2@bigpond.com

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Student engagement in nursing courses: the perceptions of nursing academics

Dianna Burr, Wodonga Institute of TAFE

This article reports on a mixed methods study exploring nursing academics' perceptions of undergraduate Bachelor of Nursing students' engagement with the course, and provides insight into a relatively unexamined field of professional practice.

What do we mean by student engagement? How is it defined? What are we engaging with? In this study we have focused on the broader concept of what Bowen (2005, p.4) refers to as "student engagement with the learning process...a concern as old as teaching itself". The NSSE National Survey of Student Engagement (retrieved from <http://nsse.indiana.edu/html/about.cfm>) explains student engagement as a two pronged measurement of time and effort put into students' studies together with efforts made by institutions to structure curriculum and learning opportunities which encourage student participation. Although not stated but implied, it leads to student success as a result of participation. Over time, it has been shown that this rather simplistic definition of student engagement is a lot more complex to actually achieve. Educational institutions have long been structuring curricula and providing learning opportunities in myriad ways to improve retention and recruitment. These activities do not always guarantee retention or even attraction of sufficient learners to maintain sustainable programs.

Themes of learner engagement such as these, and most others portrayed in the literature, have the learner placed firmly at the centre of the research. More recently there has been a focus shift which looks closely at the significant other in the relationship – the teacher. As the literature is very quiet about the subject of teachers' perceptions of student engagement and how it impacts on their teaching, it became the focus for this study. Leach et al (2014) make the observation that 'teachers' perspectives of student engagement are not often presented in the literature' (Leach et al, 2014, p19). Interestingly the teacher-student relationship as identified in the report is stated in terms of a growing disconnect, where staff are seen by

students to be less effective in providing satisfaction and retention strategies, despite the teachers' perceptions to the contrary (ACER, 2011). Both Jonasson (2012) and Sheard et al (2010, p14) agree that teachers and students' perceptions of engagement diverge, and that there is a clear 'misalignment of staff perceptions of student engagement', which needs to be addressed if the tertiary education sector is serious about curbing the growing disengagement trend.

It may be timely to note that as early as 1987 in the USA, Chickering and Gamson (1987) were identifying common sense principles for those engaged in higher education to aspire to, in order to address the criticisms such as '... apathetic students, illiterate graduates, incompetent teaching, impersonal campuses' (p2). In a study supported by the American Association of Higher Education, Chickering and Gamson (1987) presented their 'Seven principles for Good Practice in Undergraduate Education'. The first principle identifies the importance of frequent student/staff contact to help build rapport and foster personalisation. They also identified the importance of creating the culture to support this, and the role that policy can play in providing funding for strategies to improve environments to encourage good practice.

What institutions define as 'teaching activities' could play some role in determining acceptable levels of engagement by teachers. It might also explain why teachers do not see the provision of student support as being part of the 'teaching activities' that are required of them and why they might give this low or no priority. Research by Leach et al (2014) found that many of the teachers surveyed in their study felt that engagement is seen to be a shared responsibility, that is, '... a partnership between teachers, students, institutions and outside influences such as family and friends' (Leach et al, 2014, p19). Similarly, work by Zepke et al (2014) shows that teachers give the least priority to providing support to students in areas other than those with an academic focus. Teachers still do not see their role as providing any support other than academic, but rather that support should be provided by the institute, family and friends.

The very narrow perceptions of engagement responsibilities by tertiary teachers in Australia may be explained by understanding the history of teaching in higher education, universities in particular, where teachers require no teaching qualifications and teaching was, and possibly still remains, largely didactic. Further, Knapper goes as far as saying that ironically, in regard to the literature on teaching methods "most faculty are largely ignorant of this scholarship, and instructional practices and curriculum design are dominated by tradition rather than research evidence" (Knapper, 2008 p1). Therefore it would be fair to say that many teachers in higher education generally don't know what they don't know about student engagement, as being a fundamental responsibility in a teachers' role. And the move by higher educational institutions to address retention through policies such as the imposition of financial penalties if retention and completion rates don't meet benchmarks, leads to confusion between what does happen and what should happen (Leach et al, 2014).

Our small scale study used a mixed methods qualitative phenomenographic approach to collect information. We asked 26 nursing academics to complete an online survey and participate in a follow up interview. Of the nine academics who responded to the initial anonymous questionnaire, five participated in the follow-up interview. At the time of data collection the university was undergoing a period of change; this impacted directly on academic staff. The staff was unsure of their continued employment, and this is to some extent reflected in the small numbers of academics who responded to our survey. Consequently, inferences regarding implications for policy and practice regarding recommendations for curriculum and future models of delivery of nursing education were moderated due to our limited sample.

Findings showed that students entering university to study the Bachelor of Nursing directly from school share similar characteristics with typical first year university students as those identified in the literature by Kuh (2007), and James et al (2010). They also indicated that the current system of undergraduate nurse education at the said university shares

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the world-wide phenomenon of minimally engaged first year students (especially those who enter university directly from secondary school) and that this has the potential to negatively impact retention rates. In comparison, those students entering university with prior qualifications and previous exposure to higher education were found to be 'generally fully engaged'. In this they shared similar characteristics as students identified in the literature by Montgomery et al (2009), Ofori & Charlton (2002), Hoskins et al (1997) in Kevern et al (1999).

But of most interest are the Enrolled Nurse (EN) students who are converting to the Bachelor of Nursing (BN); this cohort is perceived by nursing academics to be more complex and varied. Here the findings support the literature related to recency of learning where prior knowledge can be both an advantage and a hindrance (Tsai & Tsai (2005). The nurse academics in our study perceive ENs converting to BN to be fully engaged if they have recently completed the Diploma or Advanced Diploma of Nursing, and to be struggling if they don't have this recency of learning. In addition they reported greater levels of enjoyment of teaching when students were perceived to be either 'engaged or fully engaged'.

Lack of engagement by first year undergraduates has a direct impact on the enjoyment of teaching by nursing academics. It interferes with planned delivery and subsequent content progression. When teachers have low self-confidence this might cause them to focus on their weaknesses, and exaggerate the negatives, resulting in a poor pedagogical experience for both teacher and learner (Bandura 1997 in Martin 2006). Poor pedagogical outcomes are likely to impact on retention, thereby adding weight to the already large body of evidence supporting the problem of first year retention rates.

What can be learned from this study is that students who undertake the Diploma of Nursing and subsequently articulate to the Bachelor of Nursing are perceived to be well prepared for studies in higher education; they are also perceived to be more fully engaged in learning. In contrast the current preparation for entry into higher education for direct entry and mature age students who have no recent higher education exposure is problematic. What is required is a national initiative for establishing more manageable articulation pathways for students who want to enter EN or BN programs, either directly from

secondary school or at opt in and opt out points. They are also required for those wishing to convert from EN to BN programs. Establishing pathways to qualifications based on incremental steps of progressively more complex skills (as described by the Australian Qualifications Framework), should better prepare students for academic success.

Information about pathways which integrate secondary school studies and vocational training could also be freely shared with secondary schools and careers advisors. These would illustrate the advantages of undertaking a combination course that introduces students to the higher or further education experience via a more manageable transition. ■

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Shedding light: private ‘for profit’ training providers and young early school leavers

Georgina Atkinson, NCVET

New research published by NCVET, and undertaken by George Myconos from the Brotherhood of St Laurence and research partners Kira Clarke from Melbourne University and Kitty Te Riele from Victoria University, examines the role of private providers in delivering training to young learners who have left school early.

The authors surveyed 130 private, for-profit registered training organisations (RTOs) to find out their perspectives on teaching and learning practices, engaging with early school leavers, and the educational and wellbeing support services provided to these young learners.

The findings indicate that young early school leaver learners face a range of barriers to participating in education and completing their qualifications. The extent and persistence of these barriers is not always evident until after enrolment, and can include:

- disengagement, lack of commitment, lack of motivation
- lack of support from family and friends
- health, drug, alcohol problems
- employment conditions
- learning difficulties
- lack of access to child care.

These challenges and barriers to participation can be exacerbated by individuals’ previous fragmented education experience, poor referral practices from employment agencies, and poor quality education and training from RTOs.

When it comes to working with these learners, the researchers found that the size of private RTOs is important, with private RTOs claiming their small scale nature appeals to early school leavers who may have struggled in larger institutional settings. Small RTOs can engage learners in small groups and individually in informal settings. However, the size of many private RTOs can also cause problems when they may be too small to provide adequate infrastructure and support services to the learners.

The types of support most commonly provided by private RTOs include:

- mentoring and pathways support staff
- language, literacy and numeracy programs and support
- strong employer/industry connections to facilitate workplace-based training.

The private RTOs in the study were eager to show a commitment to early school leavers and a willingness to support these learners to complete their qualifications. However, unsurprisingly, this is limited by the commercial realities of running a business in the ever-changing VET landscape and funding regimes.

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However, unsurprisingly, this is limited by the commercial realities of running a business in the ever-changing VET landscape and funding regimes. The authors conclude that private RTOs and the trainers who work for them could be better equipped and better supported to continue to provide training to this high-needs group of young learners. ■

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Links to what is making news in education and training

Tracking university completions

Indigenous students are among those groups most at risk of not completing their university studies. The Australian Council of Educational Research (ACER) is tracking students from the time they begin their studies to the time they complete them. It notes university students from disadvantaged groups have a lower completion rate than the national average. This research is aimed at coming up with better support strategies for these students.

Source: ACER – <https://rd.acer.edu.au/article/tracking-university-completions>

Dramatic growth in International Education

Education Minister Simon Birmingham has reported to the Australian International Education Conference that in 2015 the existing record of about 640,000 foreign enrolments had been surpassed in the first eight

months of 2016. Senator Birmingham said that while the growth was an ‘incredibly positive sign’ the sector could not afford to ‘rest on its laurels’.

Source: The Australian – <http://www.theaustralian.com.au/higher-education/international-ed-trumps-itself/news-story/3950c2a4db29fc61c6c452c774e630a9>

Apprenticeship funding in the UK

The UK government has released details on how the apprenticeship levy system will be used to fund apprenticeships. Justine Greening’s written statement, promises that all people, regardless of background or family circumstances, should have the opportunity to take up apprenticeships.

Source: TES – <https://www.tes.com/news/further-education/breaking-news/apprenticeship-funding-updates-key-details>

Unpacking STEM skills

Gitta Siekman and Patrick Korbel,
National Centre for Vocational
Education Research (NCVER)

The acronym 'STEM' (science, technology, engineering and mathematics) frequently appears in the media, often dramatically foreshadowing an imminent shortage of the scientific and technical skills and knowledge vital to the Australian economy and its international competitiveness. There are conflicting reports relating to shortages of graduates and workers with STEM skills from sources such as employer surveys and labour market data. The workforce development strategies and policies responding to these 'shortages' are complicated by the different meanings connoted by STEM education, STEM skills and STEM occupations. Furthermore, the current STEM debate has been heavily focussed on the secondary school and higher education sectors, and pathways between the two. This is surprising given that more than half of the population with qualifications in the STEM disciplines¹ obtained these from the vocational education and training (VET) sector (Australian Bureau of Statistics (ABS), 2013). Correspondingly, the majority of the 'STEM' workforce is vocationally trained (ABS, 2013).

The overall aim of the STEM project at NCVER was to clarify the definitions relating to STEM competency and to identify the place of VET in delivering the STEM skills required in the twenty-first century (Siekman & Korbel 2016).

Identifying STEM skills and their shortages

Occupations and qualifications are often sorted into discipline-specific categories, which leads to the dilemma of which categories and sub-categories are considered STEM or not. In addition the discipline grouping, and STEM itself, is not used uniformly in international educational policy or practice. While the inclusion of the core disciplines of natural and physical sciences, engineering and computer-related technology is not disputed,

¹ STEM qualifications defined by the ABS are certificate III and higher in fields of education 01 natural and physical sciences; 02 information technology; 03 engineering and related technologies; and 05 agriculture, environmental and related studies.

marked differences arise in the applied sciences such as medicine, agriculture and architecture. In Australia, various research agencies differ on the inclusion of education, health, the 'design' sciences and social sciences (Anlezark et al., 2008; Office of the Chief Scientist, 2012; Freeman et al., 2013).

There is also concern that a holistic education, which includes the humanities and the arts, is neglected in favour of a STEM focus in education (Spoehr et al., 2010; Zakaria, 2015). Technical knowledge and training is promoted as being the only way to survive economically in an age defined by technology and shaped by global competition. There is a growing need for people who possess skills that bridge disciplinary boundaries to enable the solving of complex problems (Spoehr et al., 2010).

Defining STEM skills

Defining the appropriate mix of skills for a broad purpose has been difficult in other areas. Current and past examples are soft skills, green skills and innovation skills. STEM skills are problematic to define as they do not exist in isolation; similar to innovation skills they are guiding, enabling or facilitating skills and borrow content from other skills groups.

Based on a synthesis of the literature and expanding on a version originally developed by the United States' STEM Educations Caucus (2015), we propose

the following overarching definition, the aim of which is to capture the concept of STEM in relation to its intended outcomes, such as improved education, workforce capacity and a nation's productivity.

To improve the understanding and application of the STEM concept we have unpacked and identified the major components within. For this purpose we will illustrate a 'deconstruction exercise' with the analogy of a building with different rooms (figure 1). A skill model by Cunningham and Vilasenor (2010) has been of value in sorting skills into categories that are useful for targeted intervention. The skill model describes four skill set definitions based on economics and psychology literature, and a global meta-analysis on the skills required by employers:

- socioemotional (e.g. resilience)
- basic cognitive (e.g. numeracy)
- higher-order cognitive (e.g. critical thinking)
- technical skills (e.g. coding).

Skills most demanded by employers are higher-order cognitive skills and socioemotional skills (Cunningham & Villasenor, 2010). In our analogy, STEM is the roof covering the building, which is based on a foundation of skills needed for everyday life, such as literacy and numeracy. To succeed at all levels of education and employment, a sense of

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STEM is an acronym for the disciplines of science, technology, engineering and mathematics taught and applied either in a traditional and discipline-specific manner or through a multidisciplinary, interconnected and integrative approach. Both approaches are outcome-focused and aim to solve real-world challenges. STEM education and training establishes relationships between the four disciplines with the objective of expanding people's abilities by supporting technical and scientific education with a strong emphasis on critical and creative-thinking skills. STEM education should start in primary school and continue into tertiary education if the nation is to develop the STEM skills required for economic productivity and innovation. It is also essential to invest in developing the skills and intellectual capacities of:

- teachers and educators to successfully teach foundational STEM knowledge and skills in an integrated and inspirational manner
- scientists, engineers and digital specialists to research and develop the technological advances required for a nation's economic success and, ultimately, for solving global challenges
- technologically proficient workers to create, design, support and operate complex and evolving technological innovations
- scientifically and technologically literate citizens who can critically examine/understand/respond to and improve the world around them.

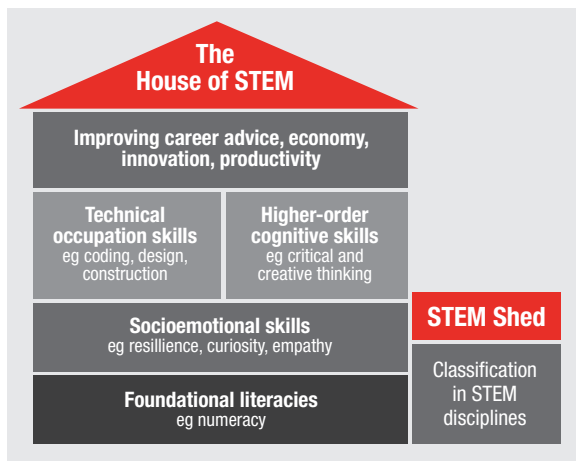


Figure 1: Deconstructing the concept of STEM

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agency and self-efficacy is supported by socioemotional skills, such as curiosity and resilience. Further rooms are separately occupied by advanced cognitive skills, such as critical and creative thinking and technical, occupation or discipline related skills. The ‘STEM Shed’ represents the tools that can be used to help categorise and measure skills and outcomes via fields of education, occupation or industry.

In order to estimate the number of programs and people who are learning, training and working in the science and technology related domains, standard categories or classifications such as ASCED and ANZSCO are currently the best approximation tools. The most appropriate method for identifying and quantifying skills — and giving the best approximation — for STEM discipline-related occupations is via the survey-based occupational database ‘O*NET’ from the United States (U.S. Department of Labor, Employment & Training Administration 2015). Its content model uses an occupational coding structure very similar to ANZSCO.

Identifying the role of VET

The VET system has a lot to offer in relation to foundational literacy and technical skill development. The sector provides, in effect, the major share of the technology and engineering workforce in Australia, and hundreds of qualifications to choose from. As these are mainly at sub-bachelor degree level, they may often be overlooked, given that STEM skills and occupations are often equated with a university education.

Valuable links with industry and the ability to create targeted training such as skills sets for people on and off the job in a relatively short time are prime assets for

responding to skill shortages or skill mismatches. Existing and new developments in VET such as the implementation of foundation skills (Department of Education and Training 2016) and new thinking around vocational streams are effective structures for teaching and learning skills in demand (Wheelahan et al. 2015). Higher apprenticeships and Pathways in Technology (P-TECH) schools provide new avenues in technology training worth exploring.

Conclusion

Current definitions of STEM skills are inconsistent and not specific enough to inform education and skill policies and initiatives, potentially leading to a number of unsubstantiated and uncoordinated responses. There is a danger of generating a domestic oversupply of graduates in science, mathematics, engineering and technology while ignoring the changing nature of work and the workforce and the global mobility of STEM skills.

The policies associated with skill development need to distinguish between two different rationales in the ‘STEM’ arena and address them accordingly:

- Preparing all workers to cope with a technologically more demanding workplace: this kind of technical workplace skill needs to be considered under a general employability skills framework.
- Preparing the workforce and market for the generation of innovative, competitive, and wealth-creating ‘STEM’ products: a comprehensive skill stocktake and skill training across all fields of education (STEM disciplinary and non-STEM disciplinary) needs to be tied to expected industry/technology output, from conception to market introduction and establishment, including legislative and regulatory requirements.

In spite of the VET sector’s substantial share in the provision of engineering and technology skills, as well as employability skills, the sector’s contribution and potential are under-reported and under-represented in current STEM debates and statistics.

For more information see a range of publications on STEM skills on the NCVET website www.ncvet.edu.au/publications/publications/all-publications/what-is-stem-the-need-for-unpacking-its-definitions-and-applications ■

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