



Skilling the Current and Next Generation Workforce for a Digital Economy

Perspectives from Career and Technical Education (CTE) Leaders from the Asia Pacific

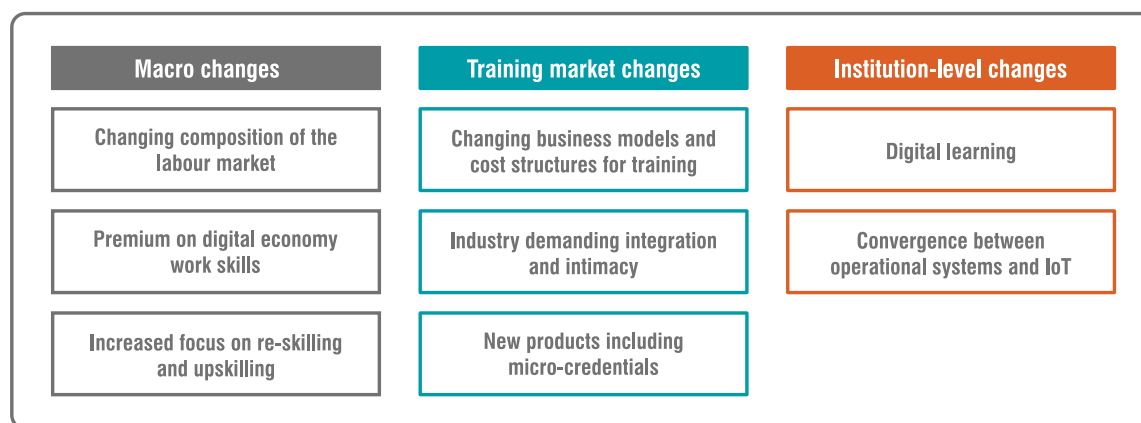


Executive Summary

Fast facts

- What:** Career and Technical Education (CTE) Summit
When: 26-28th March 2017
Why: Discuss implications of digital on the economy, training sector and institutes
Where: Singapore
Who: 14 CTE institutes/systems from 4 countries (Australia, Singapore, Malaysia and Thailand)

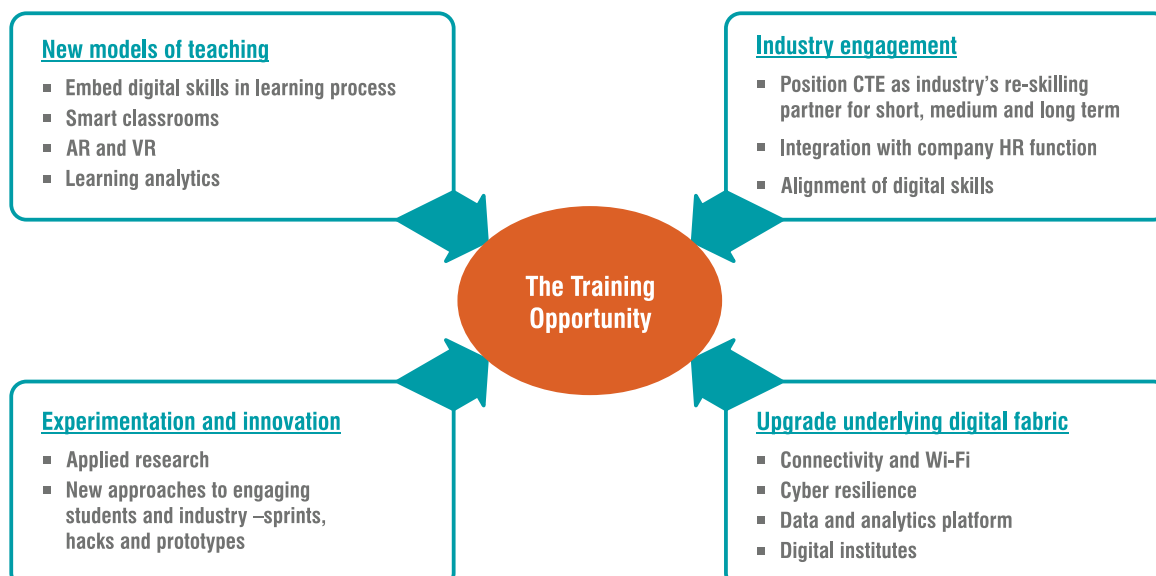
The Career and Technical Education is changing in fundamental ways



Major opportunities for CTE Institutions in the Asian Pacific region



Imperatives for institutions wanting to capture opportunities



Section 1:

Context: Career and Technical Education in the digital vortex

Industries, companies and institutions are being increasingly drawn into a digital vortex. Digital technologies have the potential to reshape markets faster than any force in history. Cisco recently interviewed¹ almost 1000 global business leaders from 12 industries and concluded that roughly four of today's top 10 incumbents (in terms of current market share) in each industry would be displaced by digital disruption in the next five years. As an industry, education is ranked 6th fastest in terms of disruption. Even though the pace of change is well behind industries like information and communication technology and media, many are arguing that the scale of change will be just as immense. Education and training change outlook can be described as 'long fuse but big bang'.

A major technology developments impacting on industry is the Internet of Things (IoT). By 2030 500 billion things will be connected, creating the capacity for a range of players to make better decisions using data. IoT is already having a major impact on industry, including driverless vehicles in mining, environmental monitoring in agriculture and tracking of inventory in manufacturing.

Digitisation has the potential to change all aspects of CTE

The CTE sector is feeling the effects of the digital vortex more acutely than most. Digital is impacting on the wider economy which CTE serves, the training market which CTE operates in and at the institution level. It is creating profound implications, particularly for publicly funded providers which have economic and social imperatives and not just a commercial one.

What's changing	Changes driven by digital	Implications for training
Macro changes		
<ul style="list-style-type: none"> Automation of process-oriented white-collar jobs Forecast growth of freelance economy 	Changing composition of the labour market	<ul style="list-style-type: none"> Need better data about forecast changes
<ul style="list-style-type: none"> Employers need 'horizontal' skills such as collaboration, communication, initiative, accountability 	Premium on digital economy work skills	<ul style="list-style-type: none"> Institutes may need to embed new types of skills into learning process even if not in training package
<ul style="list-style-type: none"> Digital disruption creating imperative for firms to re-train and upskill workforce 	Increased focus on re-skilling and upskilling	<ul style="list-style-type: none"> Potential shift towards training of people who are already working and away from school leaver focus
Training market changes		
<ul style="list-style-type: none"> Business models now have two-year lifespan AR and VR changing nature of training facilities 	Changing business models and cost structures for training	<ul style="list-style-type: none"> Need to critically assess how to make business and cost models more sustainable
<ul style="list-style-type: none"> Industry increasingly wants a partner that can help it think about and respond to its labour challenges, not a supplier 	Industry demanding integration and intimacy	<ul style="list-style-type: none"> Institutes will need to deeply understand firms' current and future business imperatives to add value
<ul style="list-style-type: none"> Potential shift towards micro-credentials, less formal learning products and more regular training 	New products including micro-credentials	<ul style="list-style-type: none"> Rethink pricing, delivery, packaging and marketing of new types of products and shift away from tradition
Institution-level changes		
<ul style="list-style-type: none"> Technology is transforming pedagogy 	Digital learning	<ul style="list-style-type: none"> Investment required in digitally enabled learning spaces and change management Investigate new approaches to assessment using tech
<ul style="list-style-type: none"> Digital allows legacy infrastructure to be re-purposed to be made more efficient and more flexible 	Convergence between operational systems and IoT	<ul style="list-style-type: none"> Leveraging data and using it to improve productivity, efficiency and teaching benefits (i.e. digital institutes)

Figure 1: Changes impacting on training institutions

1. <http://www.cisco.com/c/dam/en/us/solutions/collateral/industry-solutions/digital-vortex-report.pdf>

Section 2:

Three major opportunities exist for CTE institutions

Opportunity 1: mass re-skilling required by industry

Labour market disruption is accelerating creating profound implications for employees, job seekers, training providers and companies. Changes are occurring on three fronts:

1. Up to 47% of all jobs could be automated in the next decade. Most affected are white collar, rules-oriented jobs including accounting and legal roles
2. People will have potentially dozens of jobs, and many careers. The idea of training for a single vocation is almost redundant
3. The permanence of employment is dissolving. There is a shift from full time roles towards part-time, casual and contract roles. This is also fuelling an exploding freelance economy

The net effect of these changes for industry is simple: people who have been hired with a particular skillset may a) no longer have the job they were hired for and b) no longer have the skills needed to do their job in a digitally-disrupted world.

The CTE Summit interrogated industry's perspective on the opportunity presented by this situation. Both Cisco and Singtel Optus spoke of the imperative to get better at re-skilling and up-skilling their workforces if they were to remain competitive. The magnitude of the opportunity is significant when you consider that up to a third of the Cisco and Singtel Optus workforce require re-skilling at any one time. The stakes are particularly high for education institutions in regions where labour and skills are scarce. A successful partnership between such an institution and company on its up-skilling agenda could be the difference between keeping a company and talent in a community.

"We need to up-skill the current workforce and ensure experienced, mature-age people are equipped for new or evolving roles, and similarly, re-skill people who are re-entering the workforce after a period out. Lifelong learning will be an imperative." – Irving Tan, President, Asia Pacific and Japan, Cisco.

Specific opportunities/imperatives identified at the CTE Summit

Micro credentialing

Capitalising on the up-skilling and re-skilling agenda will require changes to the CTE offerings, as well as delivery approaches. According to Singapore Finance Minister Heng Swee Keat learners that are already in the workforce are likely to favour shorter courses and focus on the accumulation of micro-credentials rather than traditional diplomas or degrees. Micro-credentials could be offered at the single class level, but more likely by re-packaging subjects from a longer program. Some institutes are also investing in developing completely new offerings aimed at the micro-credential market. Micro-credentialing is more advanced in higher education than CTE and the opportunities globally will be significant for those that can get the offerings, delivery and business models right.

New models of industry engagement

To support re-skilling and up-skilling of a company's workforce will require deep trust and a true partnership mindset and approach. In an ideal scenario the CTE institute or system should be seen as an extension of the company's talent/human resources function and play an active role in helping to identify opportunities for development, creating or adapting products that fit and even measuring impact. TAFE Queensland's applied research centre uses a range of different tools to embed themselves in a company or industry problem, including hacks, sprints and rapid prototyping. By integrating some of these techniques into the standard industry partnership model institutes may be better positioned to add value. The emergence of polytechnic/industry competency centres is another example of how institutes are trying to embed themselves in the private sector, and vice versa.

Industry will also need to be prepared to pay for this service and invest sustainably. The Summit included a briefing from Singtel Optus on its investment in an internship program across all five polytechnics in Singapore. The program provides opportunities for 300 students annually to immerse themselves in IoT, cyber security, cloud and other digital skills for between six and 20 months. Singtel Optus also participates in hackathons and sprints with students with three objectives:

1. to expose them to industry problems,
2. to evoke passion in students, and
3. to differentiate Singtel Optus as an employer of choice.

“The vast majority of focus goes into equipping young people for their first job. This will remain a focus but the number of new grads coming into a company is potentially tiny compared to the numbers of people that are already employed in that company requiring new skills. As an institution, it’s an opportunity almost too large to comprehend.” – Institute overheard at the Summit

Opportunity 2: Create the talent pipeline for the digital economy

Forecasting skill demands has always been complex, and is even more difficult in a digital context. While some growth occupations are easy to identify – cyber security and data science as two examples – future talent demands are changing faster than industry can keep pace with. There were three major CTE conclusions that emerged from the Summit in relation to the changing economy:

1. **The importance of horizontal skills:** generalist knowledge and capability that allows people to perform in a variety of contexts (i.e. within teams, autonomously) and the ability to apply digital tools in a work-relevant context and not just a social one. These skills allows people to be productive as soon as they enter the workforce. The focus on horizontal skills shouldn’t be seen as reducing the need for technical mastery. In fact the notion of the T-shaped professional has been replaced by the Pi-shaped professional – someone with two areas of domain expertise in addition to their generalist ‘horizontal’ skillsets.



2. **The ability to constantly learn and adapt to their role in the organisation.** Employers are seeking workers who can see the ‘bigger picture’ and better understand the context within which they work. CEDA² concluded that almost five million jobs face a high probability of being replaced in the next decade due to digital disruption, meaning that employees (supported by employers) will need to constantly assess their context and adapt.

“A lack of ICT skills among graduates represents only part of the shortages being felt by industry. New technologies and processes mean businesses need to re-skill employees who were previously recruited for roles that have evolved.” - CEDA

3. **The importance of computational thinking, STEM and STEAM skills (science, technology, engineering ARTS and maths).** While around 75% of fast-growing occupations require STEM skills, only 16% of Australian high school graduates pursue degrees in STEM disciplines.

According to industry speakers at the Summit neither horizontal or STEM skills are being provided in sufficient volume to meet demand. It was acknowledged by industry that CTE providers – perhaps more than university – had a critical role to play. There are a number of reasons why CTE is particularly well-placed to respond:

- a) CTE is the natural partner of industry,

2. Australia’s Future Workforce. CEDA. 2015: http://adminpanel.ceda.com.au/FOLDERS/Service/Files/Documents/26792~Futureworkforce_June2015.pdf

- b) CTE institutions are leaner and should be more agile than universities, and
- c) CTE offerings tend to be of shorter duration and allow skill gaps to be addressed more quickly.

Specific opportunities identified at the CTE Summit

'Hyper-blended' learning

The training sector has demonstrated a capacity to evolve its teaching practices, although many at the Summit suggested change hadn't been dramatic or rapid enough. Training students for a complex digital world would require a re-design of learning approaches that take advantage of new digital tools in what was described as 'hyper-blended' learning. Polymall is a learning and sharing portal established by the Ministry of Education with all five Singaporean polytechnics. The learning content is intended to support a variety of pedagogical approaches, from instructor led through to immersive styles of teaching (see Figure 2).

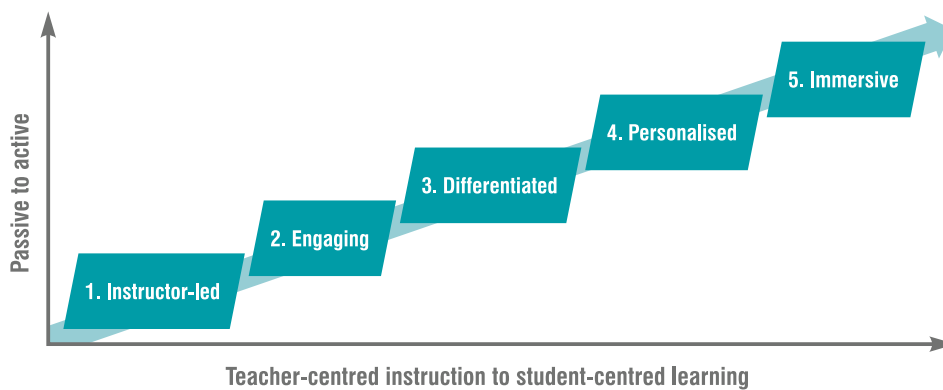


Figure 2: Content is aligned to different learning models via Polymall and shared across Singapore

"Classes need to move faster than a teacher can type – in a digital learning world teachers cannot be the learning bottleneck." – Dr Lance Ford, Educational Technology Advocate, Cisco.

Use of learning analytics to improve outcomes

Predictive analytics are a critical ingredient in personalised learning. By using predictive tools CTE institutes are able to make better interventions based on a range of data. Singapore Polytechnic's Learning ANTS platform was demonstrated at the Summit (Learning Analytics Networked Tutoring System). Learning ANTS was developed in collaboration with a startup and tracks the number of times students attempt a problem, their overall progress and patterns of incorrectly answered questions. Early trials with 700 students showed a 65% greater improvement among Learning ANTS users than for the control group.



Figure 3. Learning Analytics Networked Tutoring System (ANTS)

Creating a burning platform for teacher and trainer up-skilling

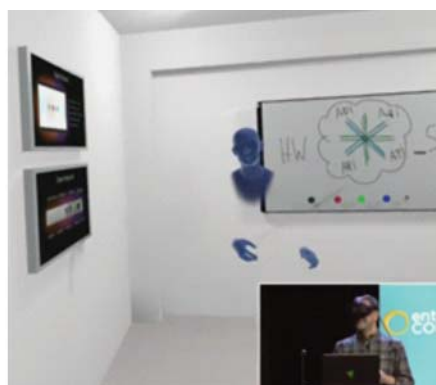
US educational technology advocate Dr Lance Ford described the emergence of an education bubble, analogous to a housing bubble. He argued that the education and training market was becoming increasingly saturated which could eventually undermine the value/price of education in an over-supplied market. Dr Ford argued at the Summit that this could provide an opportunity to create a burning platform for teacher change. His message to teachers and trainers is simple: their survival may depend on demonstrating the sorts of skills they are trying to impart to learners including the ability to adapt.

Training with augmented reality (AR) and virtual reality (VR)

Augmented and virtual reality have the capacity to take 'blended learning' a step further. The use of AR and VR offers a range of benefits:

- Allows training to be provided from traditional learning spaces which therefore reduces costs.
- Enables students to simulate working in conditions that are hazardous/difficult to replicate.
- Creates opportunities for students to spend more time on practical tasks and the capacity to more effectively assess students - for example by using analytics to identify patterns in terms of how individual or cohorts of students approach specific tasks).

The Institute for Technical Education demonstrated a virtual oil rig platform (see below) that is being used to train students in an environment that would otherwise have been inaccessible. It simulated the experience of working in different weather conditions and safety environments. The 3D virtual reality application was available from the institute's @CollegeCentral repository with a host of other AR/VR programs. One of the most challenging aspects of implementing these tools is not cost or technology but the fact that trainers needed to re-design their lessons around the tools.



Spark Virtual Reality

Opportunity 3: Accelerate benefits of digital for economies and communities

CTE is a major economic and community asset. As such it needs to be accessible to industry, entrepreneurs, notfor-profits, students and community organisations. Institutes that presented at the Summit spoke of the need for them to be digitally-enabled, if not digital leaders, if they are to create new opportunities for the communities they operate in. This is particularly true in rural and regional areas where the TAFE/Polytechnic can underpin the economic and social fabric of an entire region. A thriving CTE institute plays critical economic and community roles beyond their core function of delivering training. A major theme at the Summit was that institutes' economic and community value was greatly enhanced by the ability to share digital assets. While the primary purpose of these assets is training students, their use is far broader (see Figure 4).



Figure 4. CTE as a major economic and community asset

As an example, industry and the local community benefit from access to high speed connectivity (including Wi-Fi) which is increasingly important for start ups and entrepreneurs who are being lured on campus to bring the next generation of industry closer to students.

But digital-enabled institutes offer much more including access to leading edge tools and platforms that would be otherwise be out of reach. As such, Singaporean institutes are opening up datasets and platforms to industry to help them learn more and experiment with Smart Campus technologies that can potentially be commercialised.

Specific opportunities identified at the CTE Summit

Smart Classrooms

Investment in smart classrooms, or digital learning spaces, is exploding across the region as institutes realise they need to provide more immersive and interactive learning experiences, and provide more opportunities for students, trainers and industry to overcome geographic boundaries. By equipping classrooms with high-definition video and collaboration tools institutes are able to more effectively and efficiently serve remote learners, including those in a workplace setting. In some cases new enrolments enabled by smart classrooms are the difference between being able to offer a course in a particular institute or region or not.

As institutes embrace smart classroom, the understanding of what works has increased including:

- The criticality of a scalable and secure infrastructure to provide ‘anywhere, anytime’ connectivity to learners (fixed broadband, mobile and Wi-Fi);
- The importance of simple and consistent user interfaces across classrooms;
- The importance of tracking cameras to minimise the disruption to trainers; and
- Consolidation of systems (audio-visual, videoconferencing and electronic whiteboards) through systems such as the SparkBoard (image shown at right).



SW TAFE case study

SW TAFE is a regional Australian CTE institute with four campuses more than 100km apart. The decision by SW TAFE to invest in Smart Classrooms was based on:

- Ability to retain programs that were at risk of being lost to the region
- Capacity it offered to address new, but thin, markets and bring new programs to the region
- Ability to send a signal that SW TAFE was both progressive and future-oriented

“The results have been dramatic and I am bullish about the future for our Smart Classroom investment. It’s changed attitudes, it’s provided opportunities and most importantly it is providing SW TAFE with a sustainable model on which it can build.” – Mark Fidge, CEO, South West TAFE

Applied research

TAFE Queensland Chief Academic Officer Jenny Dodd illustrated that significant progress had been made in relation to applied research. It was argued that applied research is traditionally associated with universities, but shouldn’t be. TAFE Queensland has developed the RedSpace centre of applied research and innovation to support educators in growing a culture of entrepreneurship and innovation via applied research.

Pivoting towards research required a different mindset, but also a different set of skills and tools that are beyond those found in a traditional training setting. As an example, it developed methodologies to run ‘hacks’ and ‘sprints’ with industry to create value more quickly. TAFE Queensland has also focused on creating long-term, trust-based relationship with industry that underpins partnerships and simulated learning. As well as creating value for clients, these innovation-centric methodologies expose learners to thinking and practice that makes them more effective and employable.

Cyber range to practice institutes’ response to critical cyber events

Institutes are able to share their own digital expertise, not just their infrastructure. The Singtel Optus Cyber Security Institute has been developed in response and is intended to provide institutions and companies with access to a cyber ‘range’, in the same way you would think about a firing range. It provides an opportunity for organisations to test how they would respond in the event of an attack and critically review what happened, what they did and what they didn’t do. Institutes’ knowledge of cyber security and other digital issues are potentially valuable to companies and not-for-profits in the communities they serve but rarely disseminated.

Section 3:

What’s holding the training sector back

Challenges in transitioning from a traditional to digital world

There are a range of challenges for training institutions to overcome in capturing opportunities from digital. Experience in other industries – from hotels, to taxis and entertainment – suggests that even the most entrenched and seemingly resilient business models can be subverted.

A major message from the Summit is that the destiny of publicly-funded training institutions is largely in their hands. While these institutions are heavily regulated and have accountabilities to taxpayers, they have significant levers available at the institution level. These include the discretion to make decisions about where to invest (i.e. bricks and mortar vs digital), how to teach (technical vs horizontal skills), how to organise themselves and how to engage with industry. While the decision is not necessarily binary, institutions will need to act and invest digitally if they are to thrive (see Figure 5).

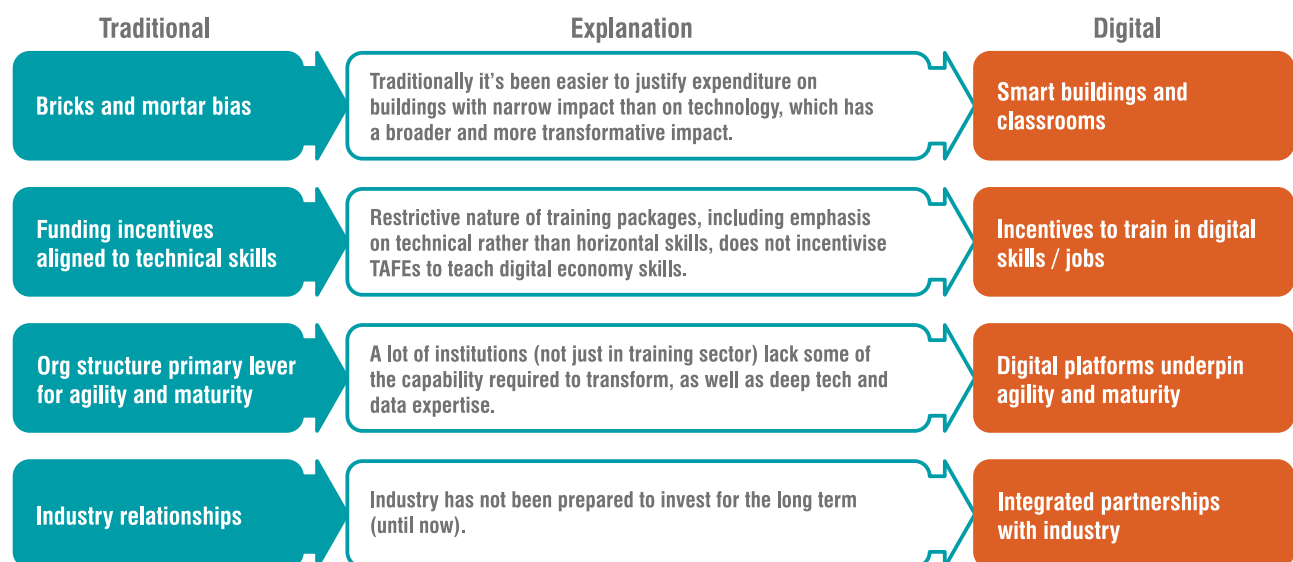


Figure 5: Impact of digital on all aspects of training

What's required to capture opportunities identified at the summit

CTE institutes recognise that their own transformation needs to occur on a range of fronts. Four major imperatives were discussed for institutes to pivot successfully to the digital economy (Figure 6).

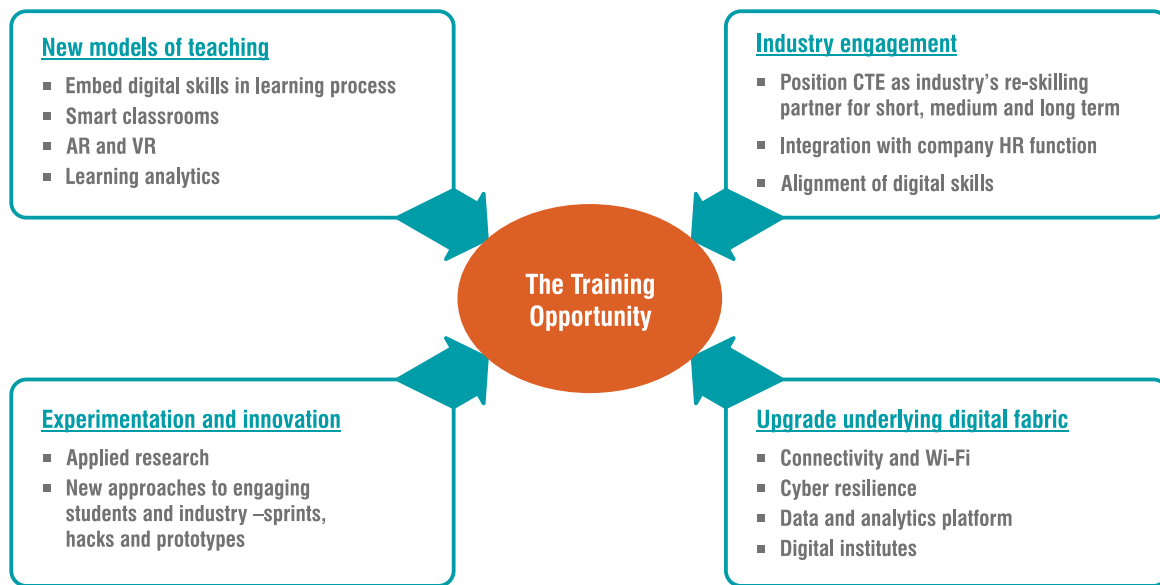


Figure 6: What's required to implement

The rationale for most of these imperatives have been discussed in the preceding chapter. The final one – the need to upgrade the digital fabric – warrants elaboration. The Summit focused on what was required to ensure that an institute's digital fabric was scalable and secure, as well as being a platform for innovation. The following points were identified as critical elements for digitised institutes:

- **Network connectivity:** fixed broadband, mobile and wireless technology are essential underpinnings of the digital campus. These technologies not only connect students and staff to the Internet and its resources, they increasingly act as a sensor in their own right, providing location and other services. Increasingly data captured by these networks are being opened to students to experiment with anonymised data and create new applications
- **Security:** IoT is increasing showing what's possible, but also creating inherent risks. In a sensor network of 50 billion things the 'attack surface' for cyber criminals and hackers is infinitely increased. All elements of the digital fabric, from applications to infrastructure and smart classrooms, need to be secured
- **Digital services:** technology now enables new data to be collected to create new services, including those offering significant cost reductions (smart energy, smart lighting, smart parking), productivity savings (attendance tracking, collaboration tools) and improved safety (IP surveillance, digital signage)

What it looks like at an institute level

Delegates were also asked at the completion of the Summit to identify aspects of digital that they were most likely to implement in their own institutions. Interestingly, the most common response was not specific services but the digital platform that underpins it (see Figure 7).

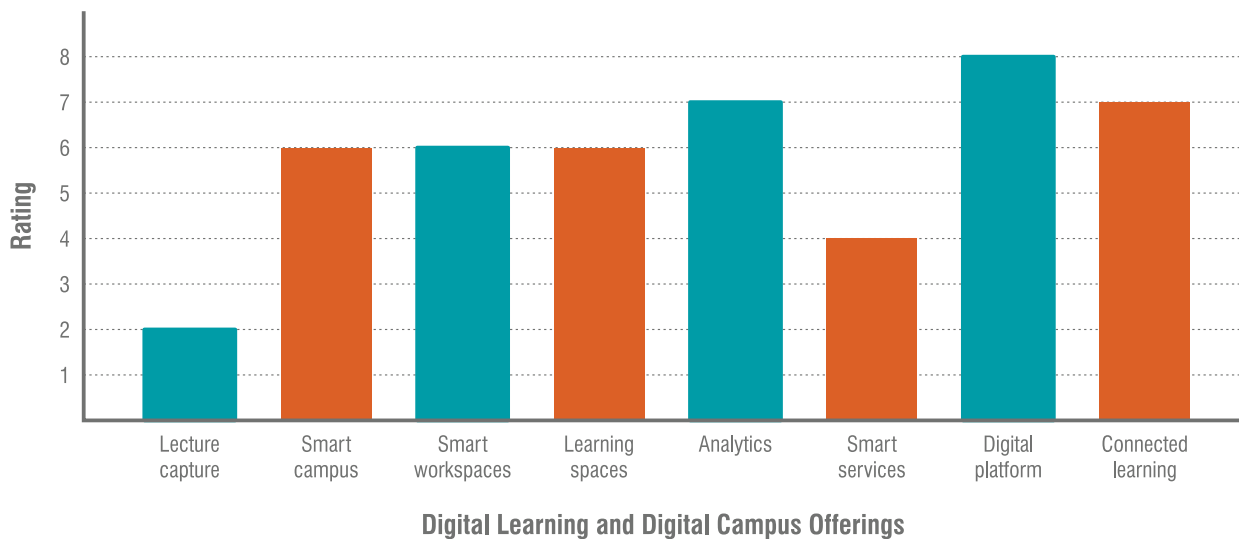


Figure 7: Areas of future focus for CTE institutions

And what's next...

The following next steps were canvassed at the Summit:

- Consideration given to the establishment of a digital industry advisory committee with Optus and Cisco as foundation members to ensure industry's voice is prominent in training sector discussions (including through TAFE Directors Australia (TDA))
- Advocacy to the government about the importance of CTE as an economic driver
- Staging a digital showcase at the TDA Annual Conference that picks up themes from the Summit. Invitations will also be sent to institutions from Asia that participated in the Summit
- Institutes that participated in the Summit to re-convene (virtually) to discuss
- Responding to a Commonwealth Government's review of rural and regional education. The review contemplates the role technology should play across K12, CTE and higher education

