

E-learning's contribution to workforce development

Research report

May 2013



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Lastly, this report summarises the findings of a larger scale study into e-learning's contribution to workforce development prepared by Dr. Damian Oliver and Garima Verma of the Workplace Research Centre at the Business School, University of Sydney. This summary report was prepared on the basis of the material contained in the study.

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1. Executive summary

This report examines the evolving contribution of e-learning to workforce development and productivity. In 2010, the Australian Flexible Learning Advisory Group commissioned the Workplace Research Centre (WRC) to assess the contribution of e-learning to workforce development (see Australian Flexible Learning Framework, 2011a). As part of this research, the WRC developed a matrix identifying the factors that either hinder workplace training or that e-learning can enhance (Table 1 below). This matrix helps to identify areas in which e-learning can promote skills growth. These factors are grouped into three categories.

1. **Access** refers to particular characteristics which can result in ease or difficulty receiving or providing training.
2. **Motivation** refers to the drivers that impel training, or may instead discourage the uptake of training.
3. **Experience** refers to previous encounters, as well as knowledge and expertise which can facilitate participation in, or distribution of, training.

The current research assesses the factors in the matrix to determine whether they are still major issues in workplaces, or whether there are other factors presenting greater hindrances to the uptake of training. This is mainly done through interviews with 24 employers, employees, RTOs and industry stakeholders in three sectors currently implementing e-learning strategies:

1. Aged care and community services
2. Renewable energy
3. Glazing and glass manufacturing.

Preliminary data from a survey of renewable energy students are also used (23 responses) (Data provided by the Clean Energy Council).

REFINED TRAINING MATRIX

The research has identified that as e-learning approaches have matured, individuals, workplaces and industry are recognising additional benefits of e-learning. In light of the research, the following changes have been made to the matrix:

1. Access
 - **literacy** is changed to **literacy & learning challenges** — to reflect the potential role for e-learning to assist people with learning challenges.
2. Motivation
 - **support** is now called **supportive environment** and is in bold, as there is now more evidence that e-learning models can provide greater workplace levels of support to undertake training and career development
 - **awareness of training** added as a workplace factor, as e-learning can bring training into the workplace and encourage others to train
 - **consistency** added as a workplace factor — this was identified in the previous research but is now a much stronger driver for workplaces
 - **job design** added as a workplace factor — e-learning is contributing to the way work is performed, especially with the use of new technology, in a way that other learning approaches do not
 - **quality assurance** added as an industry factor — as e-learning can delivery consistent training, which helps maintain quality standards through an industry.
3. Experience
 - **learning pathways** added as an individual factor — e-learning helps people maintain continuity of learning.

Changes to the 2011 training matrix are in ***bold italics*** in the table below. The factors have also been ordered so that those to which e-learning can make the greater contribution — such as work intensification, location, timeliness, and past learning experiences — are at the top of each cell.

Table 1. Refined training matrix — the role of e-learning

	INDIVIDUAL	WORKPLACE	INDUSTRY
ACCESS	Work intensification Form of employment <i>Literacy & learning challenges</i> Computer access	Location Workplace size Sector	Fragmentation Networks Industry structure
MOTIVATION	<i>Supportive environment</i> <i>Awareness of training</i> Career paths	Timeliness Cost benefits <i>Consistency</i> Type of training <i>Job design</i>	<i>Quality assurance</i> Skill shortages Labour shortages Industry champion
EXPERIENCE	Past learning experiences Learning types <i>Learning pathways</i>	Past experiences Expertise	Pre-existing model Leadership

Note: Within the substantive cells **bolded** terms refer to workforce development factors for which e-learning can make a significant difference, while newly added factors are in ***bold and italics***. Non-bolded terms refer to challenges that e-learning can do little to overcome unless it is part of a broader battery of workforce development initiatives.

SUPPORTS FOR E-LEARNING

In the experience of workers, managers, trainers and industry stakeholders, e-learning functions best when:

1. e-learning is integrated into a **course design** structured around workplace outcomes and which cater to a range of learning approaches
2. students and workplace sponsors have access to **appropriate learning and technical support**
3. e-learning is integrated into the **organisation's strategic approach and culture**.

PRODUCTIVITY IMPACTS

The research has identified anecdotal evidence of the following impacts of e-learning on productivity in the workplace:

1. less disruption of work schedules in the delivery of e-learning
2. deeper learner outcomes and application of learning, with a consequent reduction of mistakes and injuries across the sectors studied
3. greater confidence with learning, and faster integration of new technology into work processes
4. broader diffusion of learning and a learning culture.

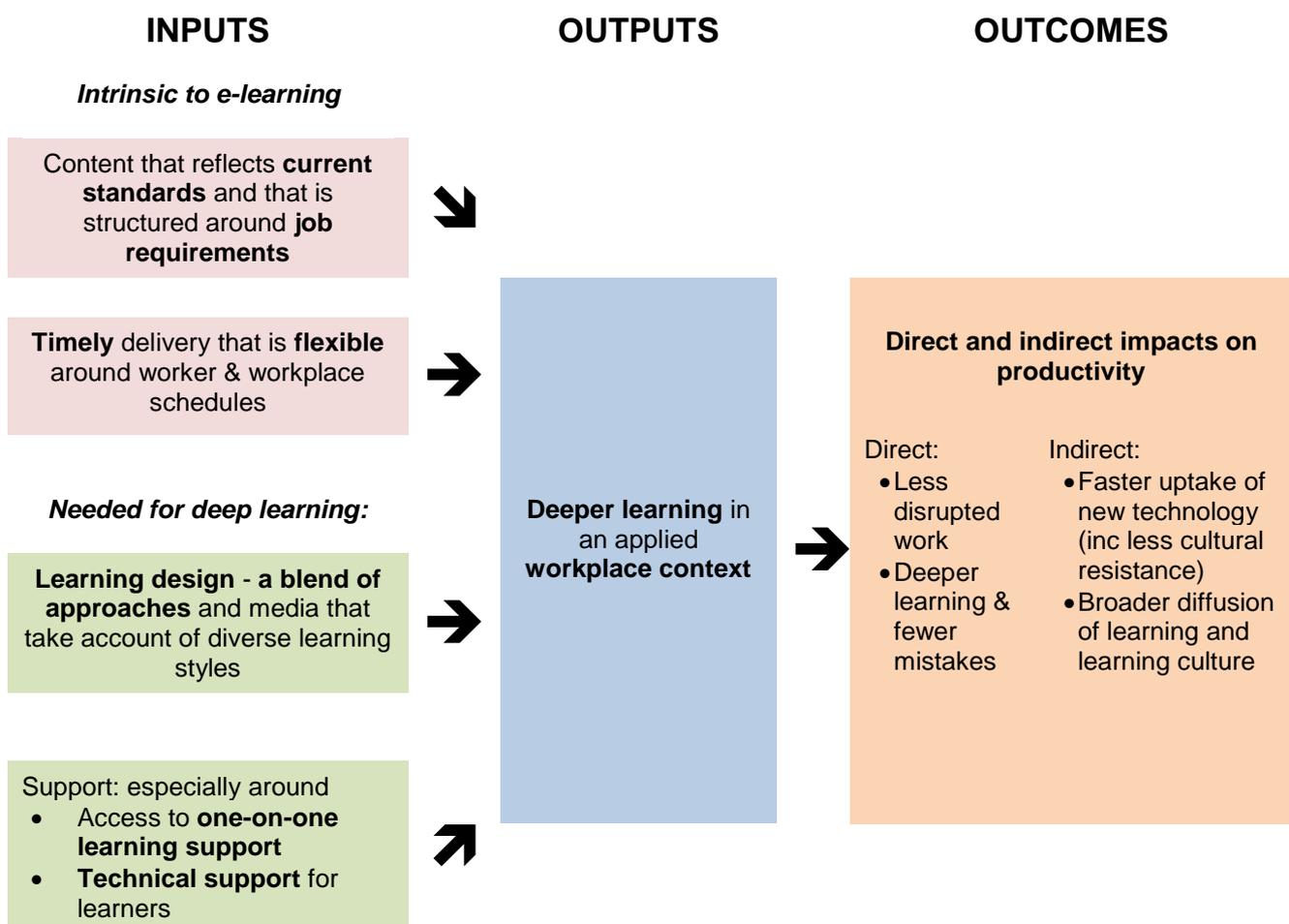
LINKING E-LEARNING DELIVERY TO ITS EFFECTIVENESS

The research found that there are strong links between factors in the matrix, support factors and productivity impacts. Figure 1 below outlines these relationships, which involve the following.

- Two groups of **inputs**:
 - i. Inputs ***intrinsic to e-learning*** i.e. where e-learning has distinct advantages over more traditional forms. These are about flexibility in delivery, currency of training, and connection to the workplace.
 - ii. Inputs ***needed for deep learning*** i.e. that enhance learning effectiveness and which are not intrinsic to e-learning. These require an investment of additional resources and are what distinguishes effective e-learning from other examples. The **emphasis should be maximising quality and not minimising cost**.
- **Outputs**: immediate results of e-learning courses; and
- **Outcomes**: broader impacts of e-learning on individuals, workplaces and industries (as mentioned in the previous section on productivity impacts).

This figure provides an example of key relationships, and does not contain all factors identified in the research. The figure can be used as a framework and be modified for different relationships.

Figure 1. Linking e-learning inputs, outputs and outcomes



2. Background

2.1 The 2011 report

The National VET E-learning Strategy's Industry System Change activity aims to support the national agenda's goals which, as well as increasing the proportion of the workforce with post-compulsory qualifications, include increasing productivity, skills and innovation as well as developing a more flexible and responsive training system.

This report provides a revised framework for assessing the contribution of e-learning to workforce development. The issues were first investigated by the Workplace Research Centre (WRC) in an earlier study of e-learning in workplaces (Australian Flexible Learning Framework, 2011a). As part of this research, the WRC developed a matrix identifying the factors that either hinder workplace training or that e-learning can enhance (Table 2 below). This matrix helped identify areas where e-learning can promote skills growth. These areas were grouped into three categories.

1. **Access** referred to particular characteristics which affect the ease or difficulty in receiving or providing training.
2. **Motivation** referred to the drivers that impel training, or may instead discourage the uptake of training.
3. **Experience** referred to previous encounters, as well as knowledge and expertise which can facilitate or impede participation in, or distribution of, training.

These barriers were considered to arise at three levels — individual, workplace and industry — and those in bold text identified barriers that e-learning was found to help overcome.

Table 2. Original training matrix — the role of e-learning

	INDIVIDUAL	WORKPLACE	INDUSTRY
ACCESS	Form of employment Work intensification Literacy Computer access	Workplace size Sector Location	Industry structure Fragmentation Networks
MOTIVATION	Career paths Support	Timeliness Cost benefits Type of training	Skill shortages Labour shortages Industry champion
EXPERIENCE	Past learning experiences Learning types	Past experiences Expertise	Leadership Pre-existing model

Note: Within the substantive cells **bolded** terms refer to challenges for workforce development that e-learning can make a significant difference in overcoming. Non-bolded terms refer to challenges that e-learning can do little to overcome unless it is part of a broader suite of workforce development initiatives.

This report reviews the relevance of the original matrix by testing it in three case studies: aged care and community services, renewable energy, and glazing and glass manufacturing (See section 2.5 and **Appendices 1A, 1B and 1C** for more details). It also explores other impacts of e-learning — such as on training quality, productivity and organisational culture — and identifies factors that enhance the effectiveness of e-learning.

The following key research questions are investigated in this report:

- Are the barriers to training identified in the 2011 matrix still relevant? If so, how can e-learning help to overcome them?
- What characteristics of the workplace e-learning environments improve the effectiveness of e-learning?
- How can e-learning promote productivity and innovation in workplaces?
 - Directly through increasing the skills and capabilities of workers who participate in e-learning.
 - Indirectly, such as through promoting new use of technology, prompting redesign of work practices, or encouraging a learning culture within organisations and industries.

The remainder of this report is structured as follows.

- Section 2 provides contextual background to the research.
- Section 3 presents findings about e-learning's role in overcoming barriers to training, and assesses each element of the matrix.
- Section 4 presents findings about factors that enhance the effectiveness of e-learning
- Section 5 presents findings about the direct and indirect impacts of e-learning on learning and productivity.

2.2 The landscape in 2013

Since the 2011 research was undertaken, there have been a number of developments in the vocational education and training (VET) sector, as well as technological changes that potentially affect the uptake of e-learning and its contribution to workforce development.

In particular, **increases in access to high speed internet**, and **rapid spread of mobile technologies** (such as tablet computers and smartphones) provides access to e-learning, opportunities to bringing e-learning into workplaces, and has broader impacts on technology in the workplace. E-learning is also playing an increasing role in the delivery of VET courses .

See **Appendix 2** for further information.

2.3 Workforce development and e-learning in context

AUSTRALIA'S NATIONAL WORKFORCE DEVELOPMENT AGENDA

Workforce development is critical to deliver productivity gains, enhance the Australian economy, and mitigate the effects of an ageing workforce (Skills Australia, 2010). It is defined as:

...those policies and practices which support people to participate effectively in the workforce and to develop and apply skills in a workplace context, where learning translates into positive outcomes for enterprises, the wider community and for individuals throughout their working lives.

(Skills Australia, 2010, p. 7)

Workforce development encompasses a range of factors, including the ability of workers/learners and employers to learn and build on their capabilities, the availability and responsiveness of educators to industry needs, and for these to be able to work with industry to ensure workers are developed and deployed in sustainable ways.

Workforce development through Vocational Education and Training (VET) has been identified as a national priority (Australian Workforce and Productivity Agency, 2013; COAG, 2012b; Skills Australia, 2010). The first National Workforce Development Strategy, *Australian Workforce Futures*, was released by Skills Australia in March 2010, and the new strategy — *Future Focus* — was

released in March 2013 (Australian Workforce and Productivity Agency, 2013; Skills Australia, 2010).

WHAT IS E-LEARNING?

E-learning has been identified as a key avenue through which to achieve the national agenda's goals of increased qualifications, innovation and productivity. The National VET E-learning Strategy 2012-2015 (the Strategy) defines e-learning in the following way.

E-learning uses electronic media to deliver flexible vocational education and training. It includes access to, downloading and use of web, CD-ROM or computer-based learning resources in the classroom, workplace or home. It also includes online access to and participation in course activities (e.g. online simulations, online group discussions); directed use of the internet, mobile and voice technologies for learning and research purposes; structured learning-based email communication; and online assessment activities.

National VET E-learning Strategy consultancy brief 2012

HOW IS E-LEARNING USED?

Although most stakeholders consider e-learning to involve some type of technology in delivery, there are varying perceptions of how these technologies can be utilised. Broadly speaking, e-learning can be considered to encompass two approaches.

1. **Self-directed approaches** that focus on content and are typically 'hands off' approaches. Courses that entirely involve self-paced learning are based on the distance education model of learning, which involved minimal interaction between students and teacher, and among students.
2. **Interactive approaches** that, while still requiring good quality content, are designed to focus on communication and more closely resemble classroom teaching in terms of the interaction among teachers and learners. Highly interactive approaches include and virtual classrooms and virtual worlds.

Interaction is widely considered to be an essential element of best practice e-learning (Callan & Bowman, 2010; Lim, Lee, & Nam, 2007), and many courses involve both self-directed and interactive e-learning, as well as **blended delivery** using both e-learning and traditional classroom teaching.

The balance between these depends on course requirements, and enterprise and student needs. For example:

- self-directed courses often comprise information followed by quizzes
- interactive e-learning courses can involve students and teachers interacting in a virtual classroom, often after having completed a self-paced module or background reading
- blended delivery can mix classroom teaching, self-paced content such as background reading and quizzes, and face-to-face assessment.

Section 4 further discusses the use and effectiveness of e-learning and blended learning approaches.

2.4 This report

NATIONAL VET E-LEARNING STRATEGY

The National VET E-learning Strategy (Strategy) 2012-2015 was established to pursue COAG's skills aims by enhancing the uptake of e-learning in Australia (National VET E-learning Strategy, 2011). The Strategy continues the work of its predecessor, the Australian Flexible Learning Framework (Framework), and is funded jointly by federal, state and territory governments with the

purpose of providing flexible e-learning in the VET sector. In particular, the Strategy seeks to promote both technical capability as well as innovative approaches to improve participation and workforce development.

These activities pursue the Strategy's three goals.

1. Develop and utilise e-learning strategies to maximise the benefits of the national investment in broadband.
2. Support workforce development in industry through innovative training solutions.
3. Expand participation and access for individuals through targeted e-learning approaches.

The Strategy's second goal is aligned with the Industry System Change business activity, the focus of this report, which seeks to 'enable support for larger scale industry wide e-learning plans and programs' (National VET E-learning Strategy, 2011, p. 5).

Industry System Change supports industry sectors through co-investment, support and coordination services to employers, peak bodies and registered training organisations (RTOs) in order to develop, implement and promote e-learning initiatives within priority industry sectors. The Industry System Change business activity is managed by the Canberra Institute of Technology. This business activity has commissioned the research underlying this report.

2.5 Industry sector case studies

Research for this report involved case studies of e-learning projects in three industry sectors:

- Aged care and community services
- Renewable energy
- Glazing and glass manufacturing.

Each of these industry sectors has completed or is undertaking one or more e-learning initiatives, through support from the Industry System Change business activity. The majority of industry sectors being researched are part of the Industry System Change 2012-13 activities. To gain a broad range of perspectives on e-learning, especially in relation to post training impacts, this report researches e-learning activities under the Strategy as well as other e-learning activities of interest to this research.

The research involved 24 interviews with employers, employees, RTOs and industry stakeholders in three industries currently implementing e-learning strategies, as well as preliminary data from a survey of renewable energy students (23 responses). This is outlined in the table below.

Table 3: Stakeholder engaged in each case study industry sector

	Aged care and community services	Renewable energy	Glass and glazing
Key informants	3	1	1
RTOs	3	3	1
Employers	4	1	1
Employees	3	23 respondents to Clean Energy Council survey	3

Key benefits of e-learning for each industry sector are as follows.

Aged and community services

- Flexible training around shift-work and client care schedules.
- Multi-site training, which particularly benefits small and regionally located centres.

- Facilitating the use of technology, such as electronic patient records and using iPads and mobile devices when visiting clients.
- Encouraging broader use of technology, which can attract younger staff and potentially re-engage older workers in education and training.

Renewable energy

- Online access reduces time away from work, and consequent loss of income.
- Facilitates flexible options for continuing professional development of Clean Energy Council accredited installers, especially through short courses.
- Blended delivery: videos and animations for theory, and practical sessions for demonstration and assessment.
- Multiple formats and media to help overcome literacy difficulties.

Glass and glazing manufacturing

- Flexible, workplace based training that can overcome thin training markets and increase qualification levels, especially in regional and rural areas. This can help address skills shortages.
- Technology based training that is attractive to younger workers, especially apprentices.
- Blended delivery: videos and animations for theory, and practical sessions for demonstration and assessment.
- Multiple formats and media to help overcome literacy difficulties.

Appendices 1A, 1B, and 1C contain details of the industry case studies.

3. E-learning and workforce development

This section presents an evaluation of the training matrix developed in previous research (Australian Flexible Learning Framework, 2011a). That research found that overall e-learning can help to promote workforce development through training. The original matrix (Table 2) identifies three categories of factors that affect the uptake of training: access, motivation and experience.

The present research assesses these factors to determine whether they are still major issues in workplaces, or whether there are other factors presenting greater hindrances to the uptake of training. It results in the following changes to the matrix.

1. Access

- ***literacy*** is changed to ***literacy & learning challenges*** — to reflect the potential role for e-learning to assist people with learning challenges.

2. Motivation

- ***support*** is now called ***supportive environment*** and is in bold, as there is now more evidence that e-learning models can provide greater workplace level support to undertake training and career development.
- ***awareness of training*** added as a workplace factor as e-learning can bring training into the workplace and encourage others to train;
- ***consistency*** added as a workplace factor — this was identified in the previous research but is now coming out stronger;
- ***job design*** added as a workplace factor — e-learning is contributing to the way work is performed, especially with the use of new technology.
- ***quality assurance*** added as an industry factor — as e-learning can deliver consistent training, which helps maintain quality standards through an industry.

3. Experience

- ***learning pathways*** added as an individual factor — e-learning helps people maintain continuity of learning, especially for apprentices;

Changes to the original training matrix are in ***bold italics*** in the table below. The factors have also been ordered so that those to which e-learning can make the greater contribution – such as work intensification, location, timeliness, and past learning experiences – are at the top of each cell.

Table 4. Refined training matrix — the role of e-learning

	INDIVIDUAL	WORKPLACE	INDUSTRY
ACCESS	<i>Work intensification</i> <i>Form of employment</i> <i>Literacy & learning challenges</i> Computer access	<i>Location</i> <i>Workplace size</i> Sector	<i>Fragmentation</i> <i>Networks</i> Industry structure
MOTIVATION	<i>Supportive environment</i> <i>Awareness of training</i> Career paths	<i>Timeliness</i> <i>Cost benefits</i> <i>Consistency</i> <i>Type of training</i> <i>Job design</i>	<i>Quality assurance</i> <i>Skill shortages</i> <i>Labour shortages</i> Industry champion
EXPERIENCE	<i>Past learning experiences</i> <i>Learning types</i> <i>Learning pathways</i>	<i>Past experiences</i> Expertise	<i>Pre-existing model</i> Leadership

Note: Within the substantive cells **bolded** terms refer to workforce development factors for which e-learning can make a significant difference, while newly added factors are in ***bold and italics***. Non-bolded terms refer to challenges that e-learning can do little to overcome unless it is part of a broader battery of workforce development initiatives.

The remainder of this section outlines the research findings underlying the refined matrix.

3.1 Access

3.1.1 INDIVIDUAL

For individuals, the greatest reported benefits of e-learning relate to the **reduced time away from work**. Work intensification is cited by stakeholders in all case study industries as a major barrier to training, and the ability to do short e-learning sessions or do modules outside work hours makes it easier to undertake training. This is especially the case for tradespeople in smaller glass and glazing manufacturing and renewable energy businesses who lose revenue for every hour they are away from work; and for people working outside standard hours (such as shift-workers) who can do self-paced modules or catch up on sessions outside their work hours.

Because a lot of them are small businesses. If they are not installing panels, they are losing money... e-learning has potential because the time away from work is really significant ...

Key informant, renewable energy

I tend to do it on a weekend, but it is good. It's good for me because I'm time-poor, so at least I can fit it into my life when it suits. I don't have to be anywhere specific.

Employee, aged care and community services

E-learning can also help people with **literacy** challenges to access training, e.g. videos provide information in different ways, and some learning management systems can translate into different languages (note that accompanying media might need to be changed, e.g. subtitles or dubbing videos). However, e-learning cannot by itself overcome all literacy and numeracy issues, and stakeholders in renewable energy and glass and glazing manufacturing note that some students need additional support.

Learning challenges are distinct issues not fully explored in current research. One stakeholder undertaking a self-directed, text based course commented that he would find multi-media delivery (such as videos) much more engaging than traditional learning, and help to overcome his concentration difficulties.

E-learning is also found to help to improve **digital literacy** — the ability and confidence to use computers and technology (Australian Flexible Learning Framework, 2011a; Callan & Bowman, 2010). In a 2011 survey, 62 per cent of VET students reported that e-learning increased their ability to use computers and technology, and 58 per cent stated increased confidence in using these (Australian Flexible Learning Framework, 2011b). This is supported by findings from all three case study industries, especially for older workers.

Well, I didn't think I could cope with e-learning... but so far it's been, really good...it was just daunting to start with, because you didn't know what really to expect. Because it wasn't a mode of learning that I've used before.

Employee, aged care and community services

...some of the older guys have increased their computer skills tenfold because they're made to do certain things. They're made to do quizzes online or search the internet or that sort of stuff....I'd say that two thirds would improve their computer skills by using the e-learning and that sort of stuff.

RTO, renewable energy

...[commercial glazing is] a very computer generated system...so by introducing it in our online learning resources that helps [the glaziers] dramatically.

Key informant, glass and glazing manufacturing

In earlier research, a lack of access to computers, often because of location, job role and socio-economic status, was found to sometimes hinder access to e-learning. Such access issues were much less prevalent in the current research. RTOs in glass and glazing manufacturing and renewable energy are providing students with tablets (such as iPads). Overall, training participants find this more convenient, however sometimes other media are more suited e.g. using paper to draw diagrams.

It's fine for me because I'm the manager, but if I wanted my [subordinate] to have the same access, it's not freely gained...so I've got every blooming opportunity under the sun, but it doesn't sometimes go past the senior members of the team.

Employee, aged care and community services

Half of renewable energy participants responding to a Clean Energy Council survey reported that e-learning 'definitely' or 'somewhat' made their training course easier to access.

WRC analysis using preliminary data from a Clean Energy Council survey students

Completing workbooks on an iPad... annoying. Especially when drawing symbols and diagrams

Training participant, renewable energy

Learning design and **technical support** are vital to addressing literacy and learning challenges. More information can be found in section 4. Supports for e-learning.

Digital literacy also relates to **job design** (section 3.2.2: Motivation, Workplace) and **productivity impacts** (see section 5).

3.1.2 WORKPLACE

All stakeholders cited significant benefits of e-learning in overcoming geographic barriers to training, and e-learning is especially beneficial compared to block training as it **reduces travel time, accommodation expenses** and **time away from work**. In this respect, e-learning especially benefits small workplaces, which are less likely to have the resources for training.

E-learning's impacts are particularly noted by stakeholders in the glazing and glass manufacturing and renewable energy industries, which are promoting e-learning particularly to small organisations and those in regional and remote areas (Key informant, glass and glazing manufacturing; Key informant, renewable energy).

Say you need to train 20 people in something, if that is an e-learning course you are not losing 20 people in one day out of the office...

Employer, renewable energy

There was only block training, no on the job training, none for regional or rural areas...no-one was really interested in doing any training, especially as they didn't need to have a qualification to work... the regional and remote employers are most rapt about the e-learning and really taking it up.

Key informant, glass and glazing manufacturing

Staff live far out of town, so it's not worth them spending an hour coming in, then wait around after class for their shift. This way, they can video conference.

Employer, aged care and community services

3.1.3 INDUSTRY

Industry features can significantly hinder training. Some industries are geographically dispersed, others use a variety of machines and some are dependent on other industries (such as glaziers depending on builders) that can create work instability. Also, small trades businesses often involve

on-the-job learning from colleagues who themselves might not be aware of the latest standards and innovations. A large number of RTOs can also result in large variation in training courses and standards.

There are 50 RTOs across the country delivering the course but we have installers everywhere including central Australia and NT... Having resources that are high quality and consistent means that we are more likely to get consistently higher quality training across the country.

Key informant, renewable energy

E-learning has been found to help deliver consistent training to all participants regardless of location. Additionally, reduced time away from work and potentially shorter training times can help improve employers' ability to undertake training.

To take an apprentice on is a big cost to a business and to lose them within a year is a major cost to them... What we've found is that with the more flexible training options, more people are willing to take the risk of apprentices, and we have seen more apprentices coming through.

Key informant, glass and glazing manufacturing

E-learning can also help to improve networks between RTOs, employers, industry bodies and employees. It can also facilitate simultaneous training to multiple workplaces, which could reduce delivery costs per workplace. For example, the Aged Care Safe Handling project in Victoria involved three aged care and community services providers located in both rural and remote locations (National VET E-learning Strategy, undated). As well as connecting people while undertaking a course, e-learning can also promote ongoing collaboration at an industry wide (through tools such as websites and blogs) that continue to develop and strengthen networks.

There are installers groups that have blogs. I'm sure all of that is very good. It's the younger cohorts that are much more embracing.

RTO, renewable energy

3.2 Motivation

3.2.1 INDIVIDUAL

A key motivator of training is support from employers and the workplace environment. The current research finds that a **supportive environment** includes workplace factors such as study leave and management support. E-learning cannot directly create a supportive culture, but indirectly affects it by, for example, making it easier to implement workplace learning management systems and monitor training. For example, the Australian Glass and Glazing Association has developed software that helps to monitor apprentices' progress through training, which can be used by RTOs and supervisors.

A supportive environment also requires **learner support** and **technical support**, which are usually provided by the RTOs but can also be provided by workplaces. As these are features of e-learning courses, they are described in detail in section 4. Supports for e-learning.

Another way in which e-learning can indirectly create a supportive environment is by enhancing **awareness of training**. Stakeholders in the glass and glazing manufacturing and renewable energy industries report that, compared to traditional offsite training approaches, e-learning can help to bring learning into the workplace and make people more aware of learning and development. For example, in the glass and glazing industry e-learning is compatible with mobile devices and can be used in the workplace, which encourages others to undertake training and encourages the use of technology within the workplace.

With the tablets physically being in the workplace and our trainers going there as well, there's a higher level of knowledge of what's going on with that student's learning and with the employer as well, we're finding we're getting more and more staff now wanting to come on board, which is ...increasing the retention rate for the student, because now he's got a peer group around him to help him either help himself or to help others with their learning.

The current research supports previous findings (Australian Flexible Learning Framework, 2011a; Skinner, 2009) that e-learning cannot overcome limited **career paths** or lack of promotion opportunities. However, e-learning can indirectly help, e.g. a large renewable energy employer allows staff to access all available courses in its internal e-learning system, and encourages staff to undertake courses that align to roles they are interested in pursuing. Additionally, industry level initiatives can help attract people to careers. For example, the 'Careers in Glass' website developed by the Australia Glass and Glazing Association (Australian Glass and Glazing Association, 2013a).

People look at the industry before they come into it...we've got little video clips of all the different jobs we do in the industry and they're only two minutes to three minutes...then under that we've got the different jobs ...then we have a little test for them to do.... so by the time they've looked at all the different roles they've got a better understanding of our industry ... we've got a more informed kid who wants to become an apprentice...

Key informant, glass and glazing manufacturing

A supportive environment strongly relates to a **learning culture**. Section 4. Supports for e-learning outlines how an existing learning culture can enhance the effectiveness of e-learning, Section 5. Productivity impacts details how e-learning can promote a learning culture.

3.2.2 WORKPLACE

E-learning can greatly improve the motivation for employers to undertake training. Past and current research reveals the following major motivators:

- Timeliness
- Cost benefits
- Consistency
- Types of training — particularly compliance training
- Job design.

3.2.2.1 Timeliness

Timeliness — e-learning can reduce time off work due to its flexibility around work schedules and reduced need to travel. This way, courses can often be completed faster than other training, particularly where it avoids the need to wait for block training to be available. Flexibility also helps individuals to **better manage their workflow**, especially with self-paced programs which allow training during downtime. Short e-learning sessions also reduce the amount of work to catch up on, and reduce the pressure on training participants.

...more around the efficiency of the delivery ...if people can do training on demand, just in time, and they can log on and just run through a package, that makes it more effective than having to wait for the next session to arrive in town, or enrolling in the next session or whatever.

Employer, aged care and community services

Word of mouth and feedback from managers is that e-learning enables employees to manage their own workload. It's that ability to train when your workload is a bit quieter, and that flexibility. In terms of productivity that has been very good.

Employer, energy sector

3.2.2.2 Cost benefits

The **cost benefits** of e-learning have been widely cited, particularly due to faster completion rates, reduced time away from work, travel and associated costs, and greater numbers of staff completing training (Australian Flexible Learning Framework, 2011a; British Educational Communications and

Technology Agency, 2010; Callan & Bowman, 2010). This is particular the case for participants in remote and rural locations.

However, whether a course itself is cheaper depends on the type and training and learning design, particularly how interactive it is. Self-paced courses are generally cheaper to run per person, especially for larger organisations. However, highly interactive courses can require similar teacher:student ratios as classroom learning, and there can also be costs from workplaces needing to upgrade IT infrastructure. It may be beneficial to pursue multi-employer and multi-site training (such as in the Victorian Aged Care Safe Handling project) or industry led e-learning (such as in the renewable energy industry). Apart from scale benefits, such approaches could also help organisations obtain quantity discounts or tailored delivery from RTOs. Additionally, RTOs and teachers need to have the resources and skills to develop content, especially in multiple formats.

You've got people with various types of internet connections and computers... Also I'm finding that you've got the different platforms now with the iPad and PC and that sort of stuff. So you've got to be very careful of what you're writing and what you're producing. A lot of the old stuff with Flash and that now does not work on Macs. So that's probably the frustrating bit at the moment for me is what platform do I write it for? Or I've got to write it on multiple platforms which — if you talk to the average teacher — again they don't understand.

RTO, renewable energy

[engaging students] where the virtual classroom's been great, because we've been able to get all the benefits of the distance mode without compromising the learning outcomes. Having said that, it's still obviously a more expensive method for ourselves than if we were to do a pure distance mode.

RTO, aged care and community services

The cost of courses can depend on **learning design**, which is discussed in section 4. Supports for e-learning.

3.2.2.3 Consistency

In line with past research (Australian Flexible Learning Framework, 2011a, 2011b) e-learning has been found to greatly impact the **consistency** of training.

It can deliver consistent content across diverse operations or geographical areas. It is easier to edit courses and tailor electronic content compared to hardcopy materials, as well as update materials in line with changing standards and regulations, which assists to maintain quality standards.

It's very easy and very quick to supplement a new video, supplement a new picture of a new machine that's just come out, update terminologies or whatever and it's done quickly, it's done efficiently and it's done very cost effectively.

Key informant, glass and glazing manufacturing

3.2.2.4 Types of training

E-learning can help to improve motivation for particular **types of training**, notably **compliance** training.

E-learning helps to deliver 'short, sharp compliance training' (RTO, aged care and community services), stimulate interest in compliance-based training, ensure consistency, and monitor quality across industry. However, stakeholders note the potential for compliance training to become a box ticking exercise, and just doing courses '...as quickly and as cheaply as they could find them, so they [can] get the accreditation' (Key informant, renewable energy). In this respect, e-learning can go further than simply disseminating information, for example, a Victorian aged care and community services project delivered occupational health and safety training through a highly interactive approach. The different design and interactivity reportedly made the training more engaging and enjoyable than previous compliance training.

... where we have this legislative need to roll out compliance such as occupational health and safety or equal employment opportunity training to all our employees... about 2000 employees in Australia across many of the states, it's a good method to deliver consistent training at a reasonable cost.

Employer, renewable energy

The content was engaging and then the way in which the group [virtual classroom] sessions were conducted was a great way of reinforcing the topics.

Employee, aged care and community services (National VET E-learning Strategy, undated, p. 14)

3.2.2.5 Job design

E-learning can also contribute to the integration of technology in work, and facilitate changes in **job design**.

One aged care and community services provider reported that e-learning made staff more confident with paperless systems, sped up paperwork and communication, and freed up time for staff to do substantive work. Similarly, stakeholders in glass and glazing manufacturing report that e-learning tools developed for training are being incorporated into daily practice, with training participants using programs such as calculation apps that assess the weight and handling requirements of glass panels.

Outcomes from giving people the confidence to use the software include: they can turn the dollar around better; more accurate and consistent reporting; not spending heaps of time doing up the notes, because they are more proficient; frees up time for care work, and we have perceived improved care outcomes... electronic reporting has resulted in better information to GPs and carers.

Employer, aged care and community services

We've built in a series of, similar to say a mobile phone application, where the student can use an app to calculate the weight of the glass, which can be a safety issue, especially for the larger sheets...what we're finding now is that the tradesman or the owner of the business is starting to use some of those tools that the apprentice has got within his online learning tools to actually go out to site and specify glass, using the applications within the online learning tools.

RTO, glass and glazing manufacturing

3.2.3 INDUSTRY

3.2.3.1 Quality assurance

The current study finds evidence that e-learning contributes to enhanced quality of work across an industry and better maintenance of accreditation standards, which work to provide **quality assurance** and protect industry reputation. E-learning can help disseminate information about common problems and provide consistent messages about correct approaches. The renewable energy sector anticipates higher quality device installations as a result of e-learning initiatives under the Strategy (Key informant, renewable energy). Similarly, stakeholders in the glass and glazing sector anticipate fewer mistakes and rectifications from rework, as well as associated cost benefits and safety improvements. The aged care and community services projects are all promoting safety, and aim to implement safer work practices and cultures, particularly in relation to manual handling.

[E-learning helps to] maintain and increase the skill levels and improve the work that is being done, protect the reputation of businesses, and ensure safety'

Key informant, renewable energy

A lot of companies are looking to manage risk around rework, which is a huge cost. If you look up any studies on the cost of quality, typically it can be around 40 per cent of

total costs. So if somebody puts something in wrong, the cost of rectifying it is significant.

RTO, glass and glazing manufacturing

3.2.3.2 Skills and labour shortages

Another industry level driver for training is **skill and labour shortages**, which exist in all case study industries. In renewable energy, government policies in particular have spurred demand for solar installers and other renewable energy experts, driving significant demand for timely and flexible training. E-learning is also being used to upskill existing workers and attract more workers, especially younger people. One aged care and community services project aims for its e-learning to both deliver content and improve computer skills, which is expected to facilitate its move to electronic record keeping and attract younger workers. Similarly, the tight trades labour market helps motivate the glass and glazing industry to explore more attractive training options. One renewable energy employer is using e-learning to encourage broader skills that are transferable to other parts of the business.

We do want to attract younger people in to replace the older workers who will move on. Younger people will be technology savvy. They're going to know about the latest piece of technology out there. They will know how to use it.

Employer, aged care and community services

...we've got to attract a lot of newer people, and it's a [tight] market...there's a small group of young people that we've got but you've got the electrical industry wants them, the brickie industry wants them, the joinery industry wants them...so we've got to be more attractive to the kids in regard to how we train them ...the use of online learning is one of the major tools we've got to attract them to our industry.

Key informant, glass and glazing manufacturing

3.3 Experience

3.3.1 INDIVIDUAL

As found in previous research, stakeholders in all case study industries cited that past learning experiences create barriers to training or preferences for particular types of training. Much of this related to (detailed in section 4):

- learning design
- learning support
- technical support.

In the current research, workers undertaking VET qualifications are more likely to be students with low past educational attainment or poor past experiences. For those who have undertaken formal education many years beforehand, the concept of formal learning education can be daunting. E-learning is reported to help overcome these barriers by providing alternative formats, better allowing people to work at their own pace, and catering to a range of **learning types** including visual, auditory and hands on (see Australian Flexible Learning Framework, 2011a).

Many students and RTOs report preferences for hands on learning, especially for tradespeople and competency assessment. E-learning can contribute in some instances, e.g. the glass and glazing and renewable energy industries provide videos and animations, however this works best when complemented with face-to-face training.

I find that I've still got to bring them in and do practical workshops with most of the courses... tradies really do like to be shown and hands on.

RTO, renewable energy

E-learning can also enable more continuous engagement with **learning pathways**.

...at that Certificate III, IV level, they're either have left school early, which is why they haven't progressed essentially in the system or they've got English as a second language and they've come from overseas... we find a lot of people are quite apprehensive and nervous but once they - you can make them feel very comfortable and relaxed, which our trainers are very good at doing, then they respond really well.

RTO, aged care and community services

What we find at the moment is new students, especially if they come out of high school, or TAFE, or some other learning institution, before going into the workforce, they're used to learning and they want to keep learning, so one of the big issues we find is, if you delay the start of their learning journey, they get frustrated real quick. So the beauty of online learning is, we can start them the day they start their apprenticeship, so that works out really, really well.

RTO, glass and glazing manufacturing

Negative experiences with e-learning creates strongly relate to learning design, usually purely online courses with little support or interaction (Key Informant, renewable energy; RTO, aged care and community services). Well-designed e-learning and blended delivery courses are considered more engaging than lecture formats. Of VET students surveyed in 2011 'would like at least a little e-learning in their course', while 26 per cent want 'a lot' of e-learning (Australian Flexible Learning Framework, 2011b).

3.3.2 WORKPLACE

Workplace have often experienced learning, particularly block training, to be intrusive and costly. This is particularly the case for smaller workplaces that often do not have the resources or **expertise** for internal training systems. The relative ease of updating material in line with industry practice standards is also a significant benefit compared to hardcopy materials. As with individual experiences, whether e-learning improves workplace experience heavily depends on (detailed in section 4):

- learning design
- learning support
- technical support.

[Management] see [e-learning] as something positive. But they are not sure how it will work. They want someone to develop it so they can just use it.

Employer, aged care and community services

They can just get their iPad out or their iPhone out and get online ...It's just one tool in what we do. But it's filled a gap that's caused us a lot of problems in the past in regard to using out dated and basically incorrect hard copy manuals. Whereas now we know that the knowledge areas that we use, which is online learning, is totally up to date. If it's not, it's very quick and very easy to change.

Key informant, glass and glazing manufacturing

3.3.3 INDUSTRY

At an industry level, current research is in line with past findings (Australian Flexible Learning Framework, 2011a) that effective industry wide training needs pre-existing models of learning and leadership, and that e-learning is found to contribute to the first of these.

Whilst I can see such programs providing a lot of benefits we still have a long way to go in overcoming resistance to e-learning particularly of older more entrenched staff. This also requires a big commitment from the industry as programs such as these have a big time commitment, particularly in the early stages as people become more familiar with the technology.'

Employee, aged care and community services (National VET E-learning Strategy, undated, p. 15)

4. Supports for e-learning

Stakeholders identified a number of features that enhance the effectiveness of e-learning. These relate to features of the training course itself, learning support, IT support and strategic approaches to workforce development.

4.1 Learning design

Past and current research has identified the vital importance of learning design that is appropriate to course content, course aims, student cohorts and workplace context. The following features of learning design can contribute to effective e-learning.

Learning design must be in line with **adult learning principles**, and teachers must understand how training outcomes relate to learners' work environments (Lim, et al., 2007).

Providing **online access** to training materials as well as downloadable content where internet access is unreliable. Compatibility with computers, tablets and smartphones is also beneficial in enhancing access (see 'Technical Support', below).

Interaction is considered to be an essential element of best practice e-learning (Callan & Bowman, 2010; Lim, et al., 2007), and many courses involve both self-directed and interactive e-learning, as well as **blended delivery** using both e-learning and face-to-face teaching. Information should be provided in **multiple formats** (such as videos, text) to cater to a variety of learning styles and also helps to overcome hardware and software capabilities as well as unreliable internet access.

Keep it fun. Keep it light. Mix the learning delivery. This is good pedagogy anyway.

Employer, aged care and community services

I mean you do it on the online thing, you answer the questions and you're like, I've read the information, answered the questions but when it actually comes to doing it, wouldn't have a clue on how to do it. I'd pretty have much a fair idea how it goes, but still ask for like see how it actually works, how they actually use it.

Employee, glass and glazing manufacturing

The biggest complaint we had from a lot of people was the online units are big and bulky and your download speed is not that good, it's very distracting trying to use them...[we designed approaches] that were interactive without being heavy with photographs and videos that weren't needed.

Key informant, glass and glazing manufacturing

Suitable technologies for the content and the type of interaction. The type of software can affect course objective, for example, one RTO reported that software features inhibited interaction during webinars. Technologies can also be used innovatively for traditionally face-to-face activities e.g. the glass and glazing industry sector uses point of view glasses as one form of competency assessment.

...with Blackboard Collaborate...[participants] had to ... indicate that they wanted to switch on their microphone, then switch on their microphone and then talk ... hardly anybody interacted verbally...

RTO, aged care and community services

Online learning resources are designed to deal with theory component and underpinning parts of practical training ... therefore instead of having a two hour practical training session on how to move a piece of glass, it might only be an hour because the underpinning knowledge of it now has already been signed off.

Key informant, glass and glazing manufacturing

The point of view (POV) assessment program, which is using video cameras to capture workplace activity in remote and regional areas so we can then do a formal assessment using that video as the evidence, and that's going down very well indeed.

Key informant, glass and glazing manufacturing

E-learning tools do not have to be professionally produced to be effective, but effective e-learning requires **teachers to be savvy with their tools**.

Sometimes...they're trying to produce a Hollywood blockbuster instead of simple backyard video [which would do the job]...

RTO, renewable energy

...he knows how to use webinar really well. I've never had that level of expertise before, so I thought it was really good. He had us voting and all sorts of things, which I'd never done before, so I thought it was excellent.

Employee, aged care and community services

There are benefits where students can **revisit materials** as a reference or to catch up, e.g. recorded webinars.

...you can learn at your pace...sometimes it's probably there more clearly because you haven't got someone there speaking. You can rewind it, you can stop it, you can go back. It's certainly more effective and more efficient.

Employee, aged care and community services

Stakeholders report better learner experiences, higher completion rates and better learning outcomes where content is well presented, and well-paced by the teacher.

I'm going through them all and I'm finding the easiest ones to do first, I'm not necessarily doing the course in order. I'm just going through the whole thing and going, oh, I know that, I'll do that...But yeah, some of the guys are a little bit confused as to what order to do things in...

Employee, glass and glazing manufacturing

Where possible, there should be flexibility in module choices and employer involvement in training design. This requires significant up-front planning and liaising between RTOs, employers and training participants.

...the content has really been customised to suit us, and you know, I guess over the past we've had a lot of external training that is quite general - generic and generalised. Whereas this is very ... specific, and it's good.

Employer, aged care and community services

I've got my opinion on what's best for our company what's best for [the apprentice]. We set up the right plan so we got the right modules for what we need and what he needs...they are very flexible and very good about what we did and understood that every company is different.

Employer, glass and glazing manufacturing

4.2 Learner support

Learner support is crucial to effective learning and positive learning experiences, and the extent of support needed depends on the course itself. Research has identified the following features to be considered when providing learner support.

Effective **communication** with learners in relations to courses (also recommended for technical support). For example, **regular emails** or **text messages** (especially for younger students).

They've been very good with the information that we've been getting and keeping everybody up to date. I think that's fantastic.

Employee, aged care and community services

Designated contacts for one-on-one support when required by training participants.

...it's exactly the same as our face-to-face...they have what's called a main trainer for the course... That person is the primary contact...what goes out in their information pack, right at the beginning is the trainer's phone and email contact. So they can contact them any time.

RTO, aged care and community services

Teachers should **monitor** student progress and understanding, which can be supported by data collected through e-learning systems.

...we do look at what's happening: how many times that the students are trying certain questions...This is the answer they're giving so clearly either the question isn't expressed properly, the material isn't expressed properly or this is a common issue with this cohort. So you have to be very proactive in how you analyse what the students are doing, how they're doing it and you have to be willing to make changes yourself to your material.

RTO, renewable energy

Feedback to supervisors and mentors, especially regarding apprentices, to help and support students progress through courses.

I did a traineeship with a guy three years ago and he was failing really bad and I got no feedback...they said, 'well we do classes and he sits there and listens and he does notes and he's supposed to do his assignments'...all he's done is draw pictures.....with [the current apprentice], with the feedback I'm getting it's a lot easier for us to make sure [he's] doing the right things...

Employer, glass and glazing manufacturing

Mentoring systems including assigning and training mentors.

... [mentors] get a package that tells them how to mentor people through the qualification... when we set up a classroom we have the mentor that's linked to that person within the classroom and then we engage them that way... We encourage them to have a supervisor but some people choose someone outside of the organisation or they'll choose someone who...might be in another part of the organisation who's agreed to be a mentor...

RTO, aged care and community services

Workplace **collaboration** and study sessions, especially if multiple people within an organisation are undertaking the same course.

4.3 Technical support

Technical support is another crucial aspect of effective e-learning, especially with students who might not be familiar with the technology used.

Orientation sessions, such as initial face to face meeting to walk learners through the technologies.

We talk them through the idea that they're going to be part of a virtual classroom, because that can be quite confronting for many who are not all that computer literate. ...Often they come from the lower socio-economic end of the spectrum and they may or may not have had regular access to a computer at home and they're a little bit fearful of the whole thing....we are really the nanny...

RTO, aged care and community services

Handbooks and guides, especially hardcopy/printable guides for reference.

People wanted clear step by step instructions that they could keep by their desk. They didn't want someone to show them then walk away, they wanted to physically do it themselves with someone on hand to check what they were doing.

Employer, aged care and community services

Contact persons for one-on-one technical support available at all relevant times.

...we have tech support full time [during webinars] because what we noted was that the confidence to continue was very much associated with how quickly they could get help if something went wrong... we need to have somebody who's pretty much on standby [when the webinar sessions are running]...

RTO, aged care and community services

Well-tested technology — which is part of learning design — to ensure that workplace IT infrastructure can support e-learning courses.

Technical knowledge and support for teachers and potentially workplace supervisors is beneficial, especially to avoid delays in developing resources and to minimise inaccuracies in translating content to e-learning formats.

there is a need for a basic level of teacher training so teachers can themselves undertake simple e-learning such as YouTube videos and avoid 'Chinese whispers' issues in translating content to courses

RTO, renewable energy

Compatibility with multiple platforms is beneficial for student flexibility and access (on computers, iPads and smartphones). However, this can be expensive. Compatibility with software systems is also essential where resources are centrally developed. For example, one stakeholder noted major drawbacks of the Strategy's e-learning Toolboxes in terms of long development lead times, and the incompatibility of the materials with most RTO systems (such as RTOs having older versions of Moodle).

We've deployed what's known as lean or agile software development concepts. That's just a methodology of planning and sequencing work, which helps speed everything up and avoids delays and rework...we've basically doubled our development rate.

RTO, glass and glazing manufacturing

4.4 Learning culture

Effective e-learning is enhanced by learning cultures in workplaces, and integration of learning into business strategies and goals (see British Educational Communications and Technology Agency, 2010; Callan & Bowman, 2010). Organisations with more mature e-learning approaches tend to have established workforce development strategies. One aged care and community services organisation aims to use e-learning as a catalyst to develop its learning culture, while another is using it to deliver safety training and support its strategic goals of a safety culture.

A combination of training options is also considered to enhance employee choice and improve the uptake of training. One aged care and community services provider sends learning development staff and coaches onsite to run group sessions, as well as utilising self-directed learning packages. It considers this mixed approach 'probably been the most effective way we can get to all our staff' (Employer, aged care and community services).

Learning cultures contribute to a **supportive environment** for individual learners, as discussed above in section 3.2.1: Motivation, Individual.

5. Productivity impacts

Businesses seek improved productivity and innovation as key outcomes of e-learning. Although the current research was not designed to measure productivity improvements arising out of the e-learning projects, the following impacts on productivity were observed. They have been divided into direct and indirect impacts.

5.1 Direct impacts

Across all three case studies, there were examples of the following direct impacts of e-learning on workplace productivity.

- Less disruption to work routines during delivery of training
- Deeper learning leading to fewer mistakes and injuries.

The **reduced disruption** to work routines has already been commonly noted as a benefit of e-learning and was discussed in section 3.

There were also instances of e-learning contributing to **deeper learning and retention** by workers.

Learners from aged care and community services and glass and glazing reported that they were better able to incorporate their learning into their job, because there was **no delay in applying what they had learned** in the workplace.

Also important is the ability with e-learning materials to **revisit concepts**, mentioned by employees in all industries. A survey of 23 renewable energy students found positive impacts of e-learning: just over one-fifth found that e-learning 'definitely' helped them to learn more; and a further 65 per cent found it helped 'somewhat' (WRC analysis using preliminary data from a Clean Energy Council survey of students).

In one organisation from the aged care and community services case study, e-learning courses had reduced **accidents and injuries**, particularly in relation to manual handling. Stakeholders anticipate benefits to sick leave, WorkCover costs and staff morale.

Glass and glazing and renewable energy stakeholders anticipate **fewer mistakes and rectifications** from rework (see section 3.2.3: Motivation, Industry).

5.2 Indirect impacts

It is also clear from the case studies that effective e-learning can generate other indirect benefits for productivity. These benefits flow from a workforce that:

- Has greater confidence with technology, and with incorporating new technology into more efficient and more accurate work practices
- Is more comfortable with ongoing learning
- Shares an organisational culture that is more innovative and is less threatened by change.

An aged care and community services provider finds that previous e-learning has improved staff **confidence** with electronic records management, even though the technology and platform used has changed since the e-learning was undertaken. This has **sped up paperwork, and generated better client outcomes** through better quality information for e.g. doctors, and freeing up time to spend with patients.

Employees at another aged care and community services provider report similar efficiencies from the introduction of iPads to nurses.

...the girls will take a photo, they'll download it onto a PDF form, which is our Proper Wound Care tool...so they'll put the photo on that, they'll type anything they need to

about that, put the measurements onto that, and then email that directly to the GP. It's all in colour, it looks good, and it's just more professional. You get a response if you email GPs...If you send paper-based stuff, it sits in a pile and gets lost.

Employee, aged care and community services

Confidence with new technology and improved digital literacy were found across the aged care and community services providers, which is especially significant as this industry is characterised by older workers, many of whom lack post-school qualifications. Renewable energy stakeholders also reported increased confidence, especially for the older tradespeople (see section 3.1.1: Access, Individual).

Greater confidence can encourage the use of technology, and there were examples of productivity gains from workers **incorporating technology features** from their e-learning into their work. In glass and glazing manufacturing, students are using mobile technologies in timesaving ways, including using **tablets at worksites to email images and requests** to colleagues, who then arrange for delivery of the required glass panels.

What we're finding is that they're actually using the tablet as a work tool as well as a learning tool ... let's say a shop-front got smashed in the weekend, they get called out, they'll take a photo of the shop-front with the broken glass, they'll measure it up and they'll send the size of that glass back via e-mail to the boss or the estimating department back in the office. Within an hour another sheet of glass turns up to the same size.

RTO, glass and glazing manufacturing

Also in glass and glazing, employees and their colleagues using e-learning **calculation apps as work tools** (see section 3.2.2: Motivation, Workplace).

In the renewable energy industry, an app is currently being developed and tested to guide learners in power system installation requirements. It is anticipated that workers will also be able to incorporate this into their work routines as a **work guide and checklist**, leading to fewer mistakes and rectifications.

At the individual level, stakeholders in aged care and community services have reported that some staff who undertake e-learning training are **motivated to continue with studying toward formal qualifications**, especially where integrated and collaborative teaching has resulted in better than expected learning outcomes. There were also examples of workers in aged care and community services and in glass and glazing enrolling, or intending to enrol, in further e-learning courses.

In all the case studies, the e-learning projects were an opportunity for workers to re-engage with learning. Beyond the immediate goal of the training, there were indications that e-learning was fostering a **broader learning culture**. Interactive e-learning activities such as virtual classrooms and forums can result in **greater collaboration between trainees within and between workplaces**, and this is encouraged by some organisations who seek greater knowledge sharing.

...the e-learning materials were enjoyable and that having the ability to hear about issues in other centres was a real plus.

Training participant, aged care and community services (National VET E-learning Strategy, undated, p. 14)

When you are in that collaboration it also helps those people that are in remote locations engage in the business. So it helps them connect them to that bigger business and not feel like they are just isolated and the poor cousins out in the country, but they are part of this bigger organisation where they can talk to colleagues in other states as well.

Employer, renewable energy

6. Conclusion

This research explores the use of e-learning in industry sectors supported by the National VET E-learning Strategy's Industry System Change business activity predominantly in 2012-13. Three case studies were undertaken in: aged care and community services, renewable energy, and glass and glazing manufacturing.

Although there are varied interpretations of what e-learning involves, the research finds that there is wider recognition that e-learning spans both self-paced to highly interactive approaches using a range of technologies.

One aspect of the research was to assess and refine a matrix developed by earlier research into e-learning (Australian Flexible Learning Framework, 2011a). As detailed in section 3, most factors identified in this matrix remained relevant, however e-learning and its use is evolving and can contribute to the following additional areas.

- improving **access** to training, with some limited (though not fully explored) evidence that e-learning can help overcome **learning challenges**
- improving the **motivation** to engage with training, particularly at a workplace level, by helping to develop **supportive environments**, greater **awareness of training**, facilitating changes in **job design**, and by promoting **consistent** training across organisations which has consequent impacts on **quality assurance** at an industry level
- the flexibility of accessing e-learning can improve **experiences** of learning, by facilitating continuous engagement with learning and thus encouraging **learning pathways**
- the benefits and impacts of e-learning strongly relate to **learning design** and **support**, particularly **learner support** such as access to tutors, and **technical support** from RTOs and workplaces. These features can enhance the effectiveness of e-learning courses.

The research uncovered instances of e-learning contributing to workplace productivity:

- **direct impacts** involving less disruption of work, and deeper learning
- **indirect impacts**, of greater confidence with technology and faster integration of technology into work processes.

As most e-learning projects are in early stages at the time of the research, it is anticipated that more examples of productivity impacts will be identified following project completion.

The key messages are as follows:

- the inherent characteristics of e-learning continue to promote flexibility in delivery, currency of training, and connection to the workplace
- additionally, **deep learning** requires an investment of additional resources, particularly for **learning design** and **support**. This distinguishes effective e-learning from other examples. **The emphasis should be on maximising quality and not minimising cost**
- e-learning has **significant opportunities** in the future due to expanding **internet access and use of mobile technologies**.

Further research would help understand the contribution and potential of e-learning. Useful topics include:

- the impact of e-learning in overcoming learning challenges
- more precisely measuring the relationships between e-learning, learning outcomes and productivity
- infrastructure and support required to promote knowledge sharing and collaboration, and establish networks between individuals, employers, industry groups and trainers
- the impact of e-learning on motivation — the majority of employees interviewed were required to do the training, and many of these were already motivated learners. Additional research could focus the impact of e-learning on encouraging people who are disengaged from the learning process.

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Appendix 1A: Aged care and community services case study

This case study explored three projects that the Strategy has supported. Organisations involved in this industry sector were predominantly located in regional and remote areas, although participants in the NSW Business Chamber project were also located in metropolitan areas. Due to the manual nature of the work, safety practices and cultures were a key focus of the projects.

LEAD AGENT: PAKENHAM AGED CARE (NOW MILLHAVEN LODGE)

Aged Care Safe Handling Safety First (Gippsland region, Victoria): 2011-12

- RTO: GippsTAFE
- Participants: Pakenham Aged Care (now Millhaven Lodge), Hillview-Bunyip Aged Care, Neerim District Health Services (regional and rural areas)

This project involved a self-directed online package, virtual classrooms facilitated by trainers, and practical assessments. It was drawn from units within the Certificate III in Aged Care. A total of 45 employees across all facilities undertook the training (National VET E-learning Strategy, undated).

LEAD AGENT: NSW BUSINESS CHAMBER

Safety Culture and Leadership (Brisbane and northern NSW): 2012-13

- RTO: Australian Business Training Solutions
- Participant: Blue Care (metropolitan, regional and rural areas)

This project seeks to develop safety behaviours and cultures among management personnel at Blue Care through 3 units of competency aligned with the national Certificate IV in Work Health and Safety. Blue Care also has other e-learning initiatives in place, such as driver safety training. Blue Care runs a range of services, including residential care, respite and community care services. It has recently moved to an integrated model of delivery.

LEAD AGENT: ST JOHN'S RETIREMENT VILLAGE

St John's Village (Wangaratta and Benalla, Victoria): 2012-13

- RTO: Leading Age Services Australia, Victoria (LASA)
- Participants: St John's Village, and 4 other aged care centres in Wangaratta and Benalla (regional and rural areas).

The St John's Village project 'is about both simultaneously undertaking training but it's also about helping people to become more comfortable with the whole virtual medium, the IT and to promote a learning culture' (RTO, aged care and community services). Whereas the other projects in this industry are focussed on delivering a set of safety training, the St John's Village project has developed a single-unit module relating to workplace coaching and supporting colleagues. It seeks to implement learning cultures and enhanced career development across the organisation. The project is supported by an e-mentor funded by Adult and Community Education (ACE) in Victoria.

Technologies used

Hardware tools used in these projects include personal computers, laptops, headphones, and quiet learning spaces. Software includes learning management systems (including moodle, Blackboard), virtual classrooms, online forums, videos and YouTube, PowerPoints put up online, DVDs, and learning tools such as spread sheets and other templates.

Training and the nature of service delivery

The aged care and community services industry is composed of not-for-profit, for profit and government providers operating in a subsidised and heavily regulated environment. Residential facilities are of varying sizes, and organisations often service clients in the community including through home visits. The workforce is older and ageing, many with low rates of computer skills and access.

Most older staff were done with learning when they left school. That was their idea of learning. [It's a] new concept that you can learn without being in a classroom and having someone talk at you. Not just to sit and listen. It is about the actions. They are taking control of their own learning. E-learning is a driver to teach people that learning isn't sitting in a classroom listening to a teacher.

Employer, aged care and community services

Companies in this industry tend to have managerial and frontline staff (usually shift-workers and those who travel to clients). Computers are widely used among managerial staff, however in most of the case study workplaces much of the daily paperwork relating to patient management is done manually. St John's Village has implemented an electronic patient records system, while Blue Care is rolling out iPads to reduce paperwork done by clinicians.

There are high compliance requirements in this industry, and staff traditionally undertake these through block training. Stakeholders report significant interruptions and costs involved with releasing staff for this.

In the last 6-7 years especially life is too busy for staff, with children, grandchildren. There are 4-5 staff usually doing some type of outside training as well. Before staff would come in on their day off for paid education sessions. [The increase in other commitments] makes it harder to get everyone through the 7 compulsory topics.

Employer, aged care and community services

The following are key benefits of e-learning for the **aged and community services industry sector**:

- Flexible training around shift-work and client care schedules.
- Multi-site training, which particularly benefits small and regionally located centres.
- Facilitating the use of technology, such as electronic patient records and using iPads and mobile devices when visiting clients.
- Encouraging broader use of technology, which can attract younger staff and potentially re-engage older workers in education and training.

Appendix 1B: Renewable energy case study

This project involves industry-wide e-learning activities, led by the Clean Energy Council (CEC). It follows from a Phase I project conducted in March–June 2012 which assessed the scope for e-learning and developed and piloted e-learning resources including the Harness the Sun toolbox, Watts Smart and the Clean Energy Career Hub. A number of RTOs and solar businesses have advisory positions and have contributed to resource development. The current Phase II of the project focuses on developing training videos, a smartphone app and increasing the uptake of e-learning by RTOs and workplaces.

LEAD AGENT: CLEAN ENERGY COUNCIL

- RTOs: the project is designing material that can be used by a number of RTOs. RTOs involved in advising the project include Holmesglen Institute of TAFE and Global Sustainable Energy Solutions.
- Participants: training participants will be engaged through employers and RTOs once the materials have been fully developed and incorporated into courses.

The project is developing units of competency in the domestic solar photovoltaic (PV) area. These units are aligned with Certificate IV level courses, and can be used as part of courses to enter the industry or for professional development. Some RTOs are incorporating the CEC's apps and resources, and many others are independently delivering a range of both accredited and non-accredited e-learning. These are predominantly Certificate III and IV qualifications in solar energy and photovoltaics, and short courses that contribute to qualifications or are used for professional development.

Technologies utilised:

E-learning activities in this industry use a range of technologies. Hardware includes personal computers, laptops, mobile phones and tablets. Software tools include learning management systems (including Moodle, Blackboard), e-learning resource kits, videos, animations, mobile phone and tablet apps. One larger employer has a Microsoft SharePoint based intranet, which has functionality for team sites e.g. online chat-rooms, forums, wikis, group activities, document management, collaboration. It also uses videoconferencing and virtual classrooms. Employers also use social media (such as instant messaging, yammer, email).

Training and the nature of service delivery

Although the renewable energy industry in Australia encompasses both small trades businesses and large utility companies, this case study focuses on the majority of the workforce which works in solar energy, specifically in domestic solar photovoltaic systems. Key capabilities relate to the design and installation of solar power systems. In order to be eligible for government rebates, installers need to be accredited with the Clean Energy Council. The CEC has recently introduced professional development requirements to promote ongoing training for accredited installers.

The majority of workers in this area are in businesses of 3 or fewer people, however many larger companies entered the market when government rebates drove demand for solar installers (RTO, renewable energy).

...it brought very big players into the market which meant that a lot of the smaller businesses were compromised to some degree. But it meant then that the quality of installers that these large companies were using bore no checking.

RTO, renewable energy

The spike in demand for solar PV training focussed on designing and installing domestic grid-connected installations. Due to this increasing demand on RTOs, there have been reports of variable quality of training across RTOs, increasing the risk that not all installation work meets the necessary standards (RTO and Key Informant, renewable energy).

Solar installers are looking for RTOs that are offering high quality training, but are delivering the course with minimal time away from work... It's a really good opportunity for e-learning, but unless it is done well, it risks compromising the quality. Having resources that are high quality and consistent means that the courses might be more consistent.

Key informant, renewable energy

Stakeholders in renewable energy cite the need for improved standards and quality of training across the industry.. Currently, the overwhelming driver of training in solar PV systems is the need for electricians to obtain accreditation before commencing work as a solar PV system designer or installer. Given that a large proportion of businesses are small trades, the time and cost aspect of training are a major barrier, demand for cheaper and more flexible learning options available.

Another factor affecting training motivation relates to the generally lower educational qualifications of workers. For example, one RTO mentioned that some students require considerable assistance with their numeracy skills, and low digital literacy can be an issue especially for some older workers.

...in the beginning their literacy and numeracy were not great. They were not familiar with computers. They didn't understand when you ask them well what browser are you using...? They don't understand how to convert percentages to decimals ...so you really have to go back to that basic level.

RTO, renewable energy

The following are key benefits of e-learning for the **renewable energy industry sector**:

- Online access reduces time away from work, and consequent loss of income.
- Facilitates flexible options for continuing professional development of CEC-accredited installers, especially through short courses.
- Blended delivery: videos and animations for theory, and practical sessions for demonstration and assessment.
- Multiple formats and media to help overcome literacy difficulties.

Appendix 1C: Glass and glazing manufacturing case study

The Australian Glass and Glazing Association (AGGA) is leading workforce development across the industry and is implementing a national licensing scheme. AGGA develops yearly workforce development plans, particularly as the industry has skills shortages, and is undertaking the project under the Strategy as part of broader moves to make industry training more flexible.

LEAD AGENT: AUSTRALIAN GLASS AND GLAZING ASSOCIATION

- RTOs: the project is designing material that can be used by a number of RTOs. The lead RTO involved in designing resources is the Improve Group, while many public and private RTOs are incorporating the resources into their courses.
- Participants: training participants are engaged through employers and RTOs who are incorporating the e-learning material into courses.

The project involves the development of 23 units of competency that contribute to a Certificate III in Glass and Glazing. Eight of these units are online. AGGA has also led the development of other training resources, including a website on careers in glass that includes videos on different roles and careers, and software that tracks each step of apprentices' training.

The employees and employers spoken with were undertaking the course through an RTO based in Brisbane. This RTO's delivery approach is highly personalised, with trainers regularly visiting training participants in their workplaces to conduct lessons and classes.

Technologies utilised:

Hardware used for e-learning includes computers, laptops, tablets (iPads), mobile phones and video-equipped point of view glasses. Software includes learning management systems, virtual classrooms and webinars through the Elluminate program, online forums, videos and YouTube.

Industry structure

This industry comprises glass manufacturing, glass processing and glazing. The one Australian glass producer is a very large company, and there are approximately 500 glass processors. Approximately 60 per cent of glaziers are small to medium enterprises with 1-5 employees, while the remainder of the market consist of four large companies (Key Informant, glass and glazing; Australian Glass and Glazing Association, 2013b).

The industry has been experiencing skills shortages, and there are also many experienced people without formal qualifications. AGGA develops annual workforce development plans of which e-learning is now a component.

There are a lot of labouring jobs that you can come in and obviously do pretty quickly. There are a lot of senior blokes here that have been in the industry for a long time...

Employer, glass and glazing

...because they've got skill shortages ...we develop [a workforce development plan] each year ...the use of online is part of that plan now. Previously, 18 months ago, it wasn't even contemplated. But now it forms quite a strong part of the plan.

Key informant, glass and glazing

Commercial glass processors are more likely to have larger operations and use Computer Numeric Controlled machinery (Key informant & Employee, glass and glazing). The workplace involved in domestic glass production did not require the same extent of computerised equipment in its production process (Employee, glass and glazing).

Training available and undertaken

Workers in the industry have not required formal qualifications, and together with the inflexibility and expense of block training approaches, stakeholders indicate that the industry has achieved relatively low training rates especially in rural and regional areas. Additionally, many workers have had limited or difficult past experiences with education. Currently training is driven by apprenticeships, with approximately 70 per cent of training participants being apprentices and 30 per cent being mature workers (Key informant, glass and glazing).

...because we've not had a formal requirement to have a qualification and because of the restrictions that our previous training providers had in regards to not doing flexible delivery or on the job training in regional areas, a lot of our members, a lot of our glaziers are not qualified though extremely competent.

Key informant, glass and glazing

I don't employ the best demographical [sic] people...most of them are usually school dropouts, bad life experience that they're not well educated. Especially with the younger blokes, it's hard to find good younger blokes that are willing to do any more training.

Employer, glass and glazing

Career paths are related to qualification levels, and two of the workplaces we researched had enterprise agreements recognising these qualifications and one also included financial support for workers undertaking training. Labour intensive jobs can limit career paths, and there is also variety in peoples' inherent interest in and motivation to undertake training which is not of itself affected by e-learning.

AGGA is leading an industry level initiative to boost training rates, as well as researching e-learning and flexible delivery options and in some cases providing training to RTOs.

The following are key benefits of e-learning for the **glass and glazing manufacturing industry sector**:

- Flexible, workplace based training that can overcome thin training markets and increase qualification levels, especially in regional and rural areas. This can help address skills shortages.
- Technology based training that is attractive to younger can attract younger workers, especially apprentices.
- Blended delivery: videos and animations for theory, and practical sessions for demonstration and assessment.
- Multiple formats and media to help overcome literacy difficulties.

Appendix 2: Policy and technological context

Since the 2011 research was undertaken, there have been a number of developments in the vocational education and training (VET) sector, as well as technological changes that potentially affect the uptake of e-learning and its contribution to workforce development.

THE VET SECTOR

Since 2010, VET sector reforms have moved towards a more market based approach, with national level regulation. In mid-2011, the Australian Skills Quality Authority was established to implement the VET Quality Framework that regulates the VET sector in most states and territories. While the regulatory approach changed, there were no major changes in requirements for RTOs (Australian Skills Quality Authority, 2013; COAG, 2013). In early 2012, the Council of Australian Governments signed the National Partnership Agreement for Skills Reform and revised the National Agreement for Skills and Workforce Development (first signed in 2008), which promote entitlement/demand based funding and set specific targets to improve qualification levels at or above Certificate III level (COAG, 2012a, 2012b, 2013).

These policies continued the market based path of VET that commenced in the early 1990s, and aim to make the VET sector more competitive and dynamic (COAG, 2013; The Australian, 2012). Key concepts progressed since 2010 include student entitlement models which enable students to enrol in either private or public providers, expanding income contingent loans to the VET sector, and funding contestability (under which private and public providers compete for government funding) (COAG, 2013; The Australian, 2012; Weelahan, unpublished).

Increased competition may enhance incentives for RTOs to implement innovative delivery models, including through e-learning. However, competitive pressures and the budget cuts in particular are likely to affect the ability of both TAFE and private RTOs to deliver courses, as well as the ability to obtain and invest in the infrastructure required for the development of e-learning content and training of teachers in e-learning techniques.

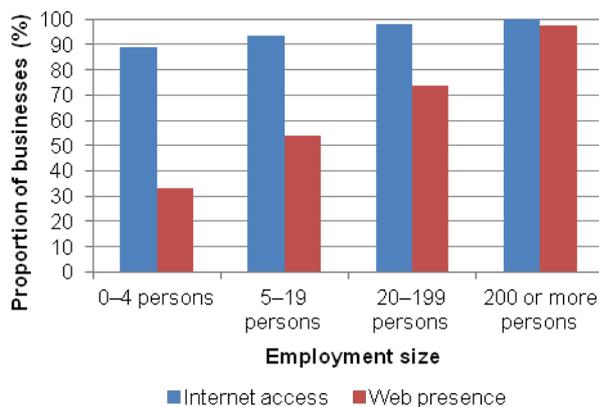
TECHNOLOGICAL CHANGES

Already high by international standards, the take-up of internet access and other new technologies by Australian businesses and households has continued to grow since 2010. Over 89 per cent of Australian businesses have internet access, irrespective of size and industry (Australian Bureau of Statistics, 2011a, 2012).

Data from the Australian Bureau of Statistics (ABS) indicate that large businesses are significantly more likely to have a presence on the web, with one-third of businesses with less than 4 employees having a web presence compared with almost all businesses with 200 or more employees (see Figure A1). However, a 2011 survey conducted by Telstra of 1,000 small business owners finds that 36 per cent have an online presence, and over two-thirds are selling products online (Hammond, 2011).

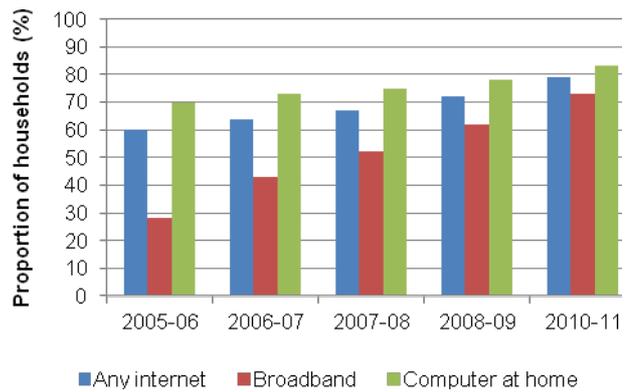
Households and individuals are also increasingly using technologies, with around three quarters of Australian households having internet access and computer devices at home, and broadband access growing two and a half times since 2006-07 (see Figure A2). In 2010-11, 95 per cent of persons who accessed the internet did so from home, including using mobile devices, while 49 per cent used the internet at work (Australian Bureau of Statistics, 2011b, 2012).

Figure A1. IT use in Australian business, 2010-11



(Australian Bureau of Statistics, 2012)

Figure A2. Household access to internet, 2006-11



(Australian Bureau of Statistics, 2011a)

Internet use is mainly undertaken through fixed line networks, however there is increasing use and availability of mobile internet through WIFI hotspot growth, and the introduction of 4G broadband in late 2012 (Australian Communications and Media Authority, 2013). The rollout of the National Broadband Network is likely to enhance fixed line as well as wireless access. These services are already implemented across the eastern seaboard of Australia, and services over the next three years are planned to for inland areas (see Figure A3).

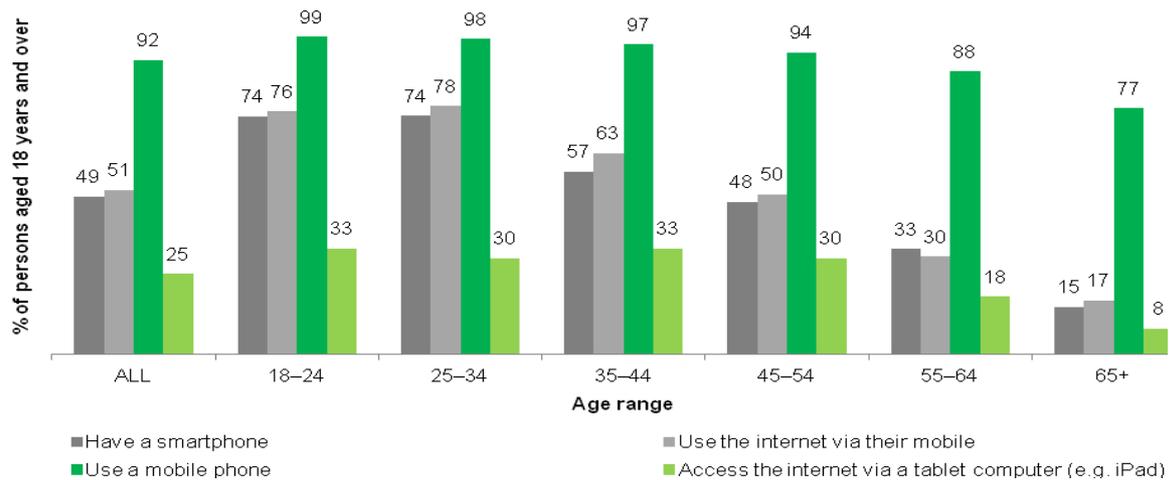
Figure A3. Rollout of the National Broadband Network



Note: rollout plans as of 1 March 2013. Purple = service available, Orange = construction commenced, Blue = construction commences within 1 year, Green = construction commences within 3 years. (NBC Co Limited, 2012)

The increasing availability of mobile broadband and WIFI services is also driving rapid increases in mobile technologies, namely smartphones and tablet computers. The proportion of Australian adults using smartphones increased from 25 to 49 per cent between June 2011 and May 2012, and there was a 22 per cent increase in mobile internet subscribers over a similar period (Australian Communications and Media Authority, 2013). 54 per cent of smartphone and 28 per cent of tablet users are in capital cities, compared to 39 and 17 per cent respectively outside capital cities. These technologies are more likely to be used by younger people, although between 8 and 50 per cent of persons aged above 45 use the internet on their mobile phone or tablet computer (Figure A4).

Figure A4. Mobile phone, smartphone and tablet usage by age, 2012



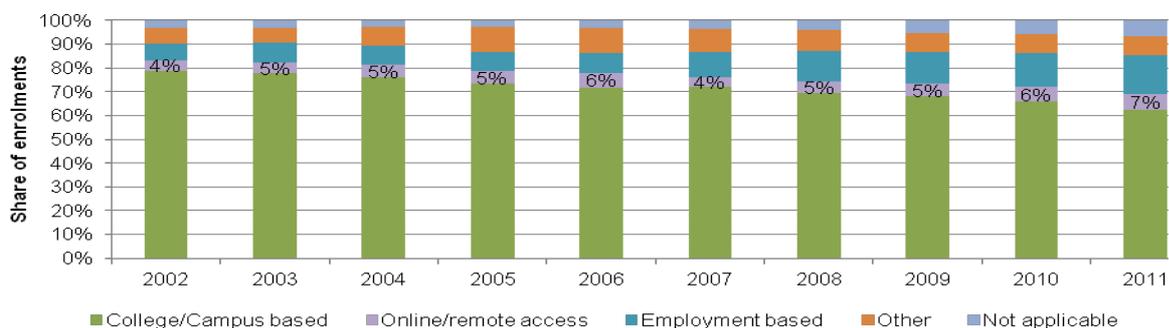
Note: Mobile phone and tablet internet use relates to use in the six months to May 2012.
 Base: Persons with a fixed-line telephone and/or a mobile telephone.
 (Australian Communications and Media Authority, 2013, Figure 8)

TRENDS IN E-LEARNING

A range of sources indicate that e-learning is increasingly involved in the delivery of training programs. The 2011 E-learning Benchmarking Survey found that 50 per cent of businesses used e-learning to provide training in 2010. Over the past three years, between 82 and 91 per cent of VET students have used at least 'a little' e-learning in their course, and is mostly involved together with other forms of training delivery (Australian Flexible Learning Framework, 2011b).

Data are limited on the number of registered training organisations (RTOs) investing in e-learning. Although over half of VET teachers use online resources, only one third of RTOs incorporate e-learning into their business strategy (Australian Flexible Learning Framework, 2011b). VET enrolments into online/remote access subjects has doubled in magnitude, and increased from 4-7 per cent of enrolments from 2002-2011. This excludes courses primarily delivered on campus or in workplaces that may involve an online component.

Figure A5. Subject enrolments by delivery type, 2002-2011



Note: these data might only reflect subjects delivered wholly online and may be affected by subject trend.
 (National Centre for Vocational Education Research, 2012)

Nonetheless, there is increasing awareness of e-learning as an approach compatible with the move to more flexible, autonomous workplaces and working cultures (Callan & Bowman, 2010). Of particular interest for the Industry System Change activity is the extent to which e-learning innovations are becoming a permanent features of workplaces in which the Strategy's projects are implemented.

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