E-learning for adult literacy, language and numeracy

Summary of findings

Literacy, language and numeracy research

This series covers research on teaching and learning in literacy, language and numeracy and analyses of international surveys on adult literacy and numeracy.

Authors
Professor Niki Davis and Jo Fletcher

Niki Davis, Professor of E-learning and Director of the University of Canterbury College of Education E-Learning Lab.
Jo Fletcher, Senior Lecturer, University of Canterbury School of Literacies and Arts in Education.

Email: Niki.Davis@canterbury.ac.nz; Jo.Fletcher@canterbury.ac.nz
Telephone: 64 3 366 7001

Fax: 64 3 343 7790

This report is available from the Ministry of Education's Education Counts website:
www.educationcounts.govt.nz

June 2010

E-learning for adult literacy, language and numeracy

Executive summary

EXECUTIVE SUMMARY

This research provides readers with a greater understanding of the potential of e-learning for adult literacy, language and numeracy. It investigates how e-learning can be employed as a means of reaching greater numbers of adult learners and how to better meet their learning needs.

Our overarching research question was:

> What characteristics of programmes, such as e-learning, mixed mode, and distance learning, have been successful in raising the literacy, language and numeracy skills (LLN) of adult learners and could be used to supplement workplace training?

The main message that we drew from our work is that e-learning is relevant to and useful for most adults with literacy, language and/or numeracy (LLN) learning needs. However, these benefits rely on a learning programme that is carefully designed to fit each individual's needs and lifestyle, his or her proficiency with digital technologies, and his or her level of reading literacy.

This *distance* e-learning, especially when blended with face-to-face support, can provide an effective way of developing the LLN skills of learners currently at Level 2 of the New Zealand Adult Literacy and Life Skills Survey (2006). In this report, we refer to this level as the *intermediate* level of literacy.

The 10 main findings to emerge from our research are as follows:

1. Literacy, language and numeracy skills in the 21st century include proficiency with digital technologies and practices, including e-learning.

2. E-learning for LLN is largely a recent development in New Zealand: very few well-established programmes exist.

3. E-learning is more effective if it is part of face-to-face training.

4. Māori approaches to e-learning can be used to build skills and knowledge within the Māori community.

5. As long as adequate support is in place, e-learning provides a good source of practice and motivation for second-language learners.

6. The diverse Pasifika peoples benefit from e-learning that fits their respective cultures and lives and is accompanied by induction activities.

7. Many of the e-learning strategies used for building reading and writing skills can also be successfully used for and by adults with disabilities that limit their ability to learn and/or access learning.

8. Using mobile digital technologies in e-learning contexts increases the flexibility of LLN provision.

9. Tutors and support staff require specific professional development in e-learning, and organisations need to develop so that they can successfully accommodate this type of learning.

10. Communities of practice can provide a supplementary means of professional development for tutors engaged in e-learning and can lead to the development of relevant resource banks.

Blending face-to-face LLN training with e-learning for individuals and groups has the greatest chance of addressing needs, but these types of provision must be accompanied by

professional and organisational development within and across organisations. We therefore conclude our report with nine recommendations for action:

1. Provide e-learning-related professional development for tutor educators and workplace assessors who work in adult education.

2. Ensure that the quality assurance measures used in relation to LLN programmes include regular assessment and updating of e-learning provisions.

3. Partnerships between and among key stakeholders are essential for the effective development and integration of sustained e-learning opportunities. These partnerships should include web-based facilities that offer access to e-learning content, tutors and professional development.

4. Increase the capacity for e-learning in all New Zealand contexts, including e-learning on marae in collaboration with Māori institutions and communities.

5. Research and develop e-learning in partnership with rural and remote communities. Immigrants' home countries can be party to this provision, but only if the e-learning infrastructure in these places is sufficiently developed to provide immigrant and transient populations with the opportunity to develop their LLN skills.

6. Establish banks of appropriate activities and resources for use by tutors and assessors, and support these people in a way that allows them to help develop and update those banks as part of their professional development activities. The scale of need in New Zealand suggests this approach could be a cost-effective one. However, achieving this aim would need centralised coordination (a national hub).

7. Support projects designed to investigate the potential that more recent digital technologies might offer learners with LLN needs. This potential could include, within workplaces, for example, mobile learning via mobile phones, simulations with game-like interfaces, and e-learning on hand-held computers.

8. Encourage continuing research in e-learning that is sufficiently complex to aid the evolution of pedagogical practice. How digital technologies can be used to advance learning and how the e-learning professional development needs of professionals and organisations can best be served are issues particularly in need of sustained research.

9. Collaborate internationally to continue to review research and development worldwide, and to disseminate the findings of this research to the New Zealand tertiary sector.

1 INTRODUCTION

1.1 The research

Our aims in conducting the research documented in this report were twofold.[1] First, we wanted to gain greater understanding of the potential of e-learning for adult literacy, language and numeracy (LLN) learning. Second, we wanted to investigate how e-learning can be employed as a means of reaching greater numbers of adult learners and better meeting their learning needs.

Our overarching research question was:

> What characteristics of programmes, such as e-learning, mixed mode, and distance learning, have been successful in raising the literacy, language and numeracy skills of adult learners and could be used to supplement workplace training?

As becomes apparent in this report, a lack of literacy skills can restrict adults' ability to engage in e-learning. More traditional pedagogical means of developing basic literacy are therefore often necessary. However, even here, e-learning can play a role (National Center for the Study of Adult Learning and Literacy, cited in Litster, 2007, p. 17).

The extensive training for all adults who need help with their LLN learning is, however, extremely challenging for the tertiary education sector in many countries. Countries are therefore considering e-learning as an additional mode of delivery. As this report highlights, only a few tertiary education organisations or workplaces in New Zealand have fully developed e-learning programmes for adults. However, many more providers intend to use e-learning in their programmes. We also found examples of existing programmes that are harnessing the potential of e-learning to engage learners and assist their progress.

In an effort to bring some remedy to this piecemeal situation, the government has created a national infrastructure directed at adults with LLN learning needs. The intention behind the framework is to provide the diverse parts of the adult learning sector with a common language for identifying, teaching and assessing LLN skills. This process would not only bring the different parties together but would also provide opportunities to create shared resources, such as an online assessment tool and an adult literacy and numeracy programme.

The same initiative involves supporting tertiary organisations to embed teaching of LLN within vocational qualifications. Although the Industry Training Federation (2009), amongst other organisations, notes that making literacy and numeracy part of educational programmes and work-based training is an effective strategy, it recognises that "the 'mechanics' of embedding literacy and numeracy are challenging" (p. 9).

Previous research emphasises that these challenges can be met and that adults do acquire LLN skills when well-prepared tutors use deliberate teaching strategies. E-learning offers a way to structure and support learning. Tasks can be made relevant to everyday life and within workplaces, where the need to have sound information literacy and numeracy skills is becoming more and more important.

Many adults with LLN needs are working and are not able to attend courses. Many such adults do not recognise their own need for this support or they feel too ashamed to seek help. E-learning, particularly when blended with face-to-face support, has the potential to offer these

---

[1] The research was conducted by members of the University of Canterbury E-Learning Lab, and the project was funded by the New Zealand Ministry of Education.

people more flexible and independent learning opportunities. Learners can learn in ways that fit their individual learning needs and life circumstances.

Our research included five major activities:

- An extensive international literature review;
- Online seminars involving international experts;
- Over 30 stakeholder interviews;
- Case studies;
- A synthesis of the research.

This report summarises the findings from this research and provides recommendations to inform practice in New Zealand. Our full literature review, accompanying reference lists, and account of our case study are available online at http://www.educationcounts.govt.nz/publications/tertiary_education.

The bulk of this summary report comprises the 10 main findings that emerged from all components of our research work. Each finding is accompanied by recommendations for tutors and those who support them. The report concludes with brief summative statements and recommendations for agencies involved in adult learning at regional and national levels.

However, before presenting our findings, we provide a brief overview of our understanding of the term "e-learning".

1.2 E-learning

In this report, we define e-learning as learning that is facilitated through the use of digital technologies. Standalone computers and all they offer, such as internet access, are probably the most prominent of these technologies, but they also encompass hand-held data storage and transmittal devices.

Because of the rapid and ongoing development of digital technologies, the field of e-learning is a developing one. Within e-learning contexts, tutors, learners and those who support them are the people who typically use these technologies. In general, the parties involved in learning create and recreate, whether individually, in groups or across society, e-learning applications and resources, as they gain a greater understanding and appreciation of what these tools offer as teaching and learning aids.

Tertiary e-learning programmes often blend in use of digital technologies so that learning can take place both with and without the presence of the tutor. Blended application of digital technologies can also be designed to fit in with learners' workplace and home-based experiences and activities. For example, distance learning in New Zealand workplaces commonly requires learners to make their way through workbooks, and that approach is supplemented with periodic visits by assessors. However, this mode of workplace learning can be usefully extended through e-learning. Directed use of web-based resources at home with support of whānau (immediate and extended family) is another example of extending workplace learning to home.

2 FINDINGS

The 10 major findings that we set out on the following pages emerged from our extensive review of international literature and the four other components of our research.

2.1 LLN skills in the 21st century include proficiency with digital technologies and practices, including e-learning

Proficiency with relevant digital technologies is a central feature of 21st-century literacy and numeracy skills. This proficiency includes the ability to selectively access and make use of resources on the web (Mellar, Kambouri, Logan, Betts, Nance and Moriarty, 2007). Given the prominent place that information and communication technologies (ICT) now have in most businesses, there is an increasing need for employees to have broad-based problem-solving skills, including those associated with digital technologies. Consider, for example, employees who are required to use digital tools that require understanding of weights and measures. If their numeracy skills are poor in this regard, they are highly likely to use the tools inaccurately, leading to errors and inefficient business practice (Coben, Crowther, Kambouri, Mellar, Mogey, Morrison and Stevenson, 2007; Noss, Bakker, Hoyles and Kent, 2007; Thomas and Ward, 2009).

Another rapidly developing expectation for learners and workers in the 21st century is the ability to access training via e-learning. Because e-learning programmes can transcend the barriers of geographic location and time, they can be customised to meet work and community-based learning needs in students unable to readily access traditional face-to-face learning provision (UNESCO, 2006). It is not surprising, then, that employers increasingly are using e-learning to update the skills of their workforce, and that most tertiary providers now enhance their programmes with e-learning. These developments underscore the need for adults to have digital technology skills as part of their 21st-century LLN repertoire.

In addition, digital technologies provide a relevant learning context for adults wanting to improve their LLN skills and help alleviate some of their anxiety about LLN learning. Adults who lack LLN skills are often embarrassed by these needs, and take care to conceal them with excuses such as not having their reading glasses at hand. Tertiary-level students report that their fear of attending and completing a literacy course would lessen if they knew the course offered a positive and non-threatening learning environment (Fletcher and Williams, 2008; Nash and Kallenbach, 2009). If these adults can also tell others they are studying a computer course, rather than an LLN course, their embarrassment is alleviated. Simmons (2002), for example, found that LLN programmes which included development of computer skills had higher enrolments.

According to the workplace stakeholders we interviewed, adults with LLN needs are attracted to learning activities that involve digital technologies because these tend to have immediate relevance to their lives at work and beyond. For example, a workplace tutor we spoke to supported three adults to improve their literacy by engaging them in a project on wastage in their department. The word-processed report that the three employees submitted to their manager included relevant photos. They had used their tutor's digital camera to photograph areas and techniques in their respective workplaces that contributed to waste. The opportunity to take photos not only helped the employees produce a useful report but also supported the development of their literacy skills and their ability to use digital technologies.

Many adults do not have access to computers at work, and some have had little exposure to computers in general. This situation is especially true for older adults and adults who have been

out of the workforce for some time. Tutors we interviewed told us that such adults sometimes fear they will damage the computer or make it crash. But although fearful, these adults generally appreciate the need to develop digital skills. These tutors are consequently providing these adults with intensive support directed at familiarising them with computers before they undertake LLN learning via e-learning.

The literature also warns of the adverse effects of poor access to computers and related technologies for adults who are already disadvantaged by their LLN needs. Their lack of access to digital technologies undermines their ability to secure employment, which contributes to less access to digital technologies, and so on (see, for example, Osborne, Gallacher and Crossan, 2004). Australian research on the digital divide—the name given to the gap between those who have ready access to digital technologies and those who do not—also highlights the increased literacy-based employment challenges for women, indigenous people, disabled adults and adults with combinations of these challenges (see, for example, Crump, Twyford and Littler, 2008). Induction programmes that include a focus on using digital technologies are particularly relevant for preparing such adults for tertiary education.

The relevance of numeracy to everyday life is commonly underestimated. As Alton-Lee (2003) points out, successful mathematics educators engage learners by using their everyday experiences and individual interests as occasions for learning. Such an approach can readily accommodate some form of e-learning, as we found when observing a polytechnic programme for the building trades. One of the tutors in this programme regularly illustrates concepts with digital photographs of building sites. He provides students with literacy and numeracy needs with presentations that include these images and accompanying notes. He told us that this practice makes his learners think mathematically because they have to consider the proportions and scale of objects within a photograph. The tutor further enhances his students' numeracy skills by working alongside a specialist numeracy tutor, who reinforces the students' underlying basic mathematical skills.

Recommendations for tutors and those who support them:

- Ensure that adults' first experiences of e-learning involve LLN activities that fit these adults' individual learning needs and lifestyles, and that take place in an emotionally safe learning environment. This approach builds learners' confidence and success;

- Provide guidance on e-learning opportunities for adults and those who support them, including provision of induction activities designed to develop any needed skills relating to use of digital technologies;

- Support tutors and others who facilitate LLN development, including employers and industry training organisations (ITOs), to develop and share e-learning activities that are relevant to workplace contexts;

- Use a wide range of strategies to encourage adults to participate in LLN programmes. These strategies include, but are not limited to:

  - Flexible course delivery, including ICT courses with embedded LLN;

  - Updating ICT skills (with embedded LLN) needed in the workplace;

  - Provision of personally relevant computer activities, such as email, to connect whānau;

  - Positive advertising of courses, with the message conveyed in various ways, including the web and recommendations from past students.

2.2 E-learning for LLN is largely a recent development in New Zealand: very few well-established programmes exist

Our efforts to locate international (let alone New Zealand-generated) sustained and robust research studies on LLN learning for adult students at foundation levels, where elements of e-learning are being used to enhance learning outcomes, proved challenging. Except for our single case study site in an urban polytechnic, we could only find one other well-established programme in New Zealand. Our stakeholder interviews clearly indicated that almost all existing e-learning at foundation level began only within the last year or so.

Although e-learning is widespread at higher levels in commercial workplaces, the level of e-learning provision for LLN at the foundation level is low in the UK (British Educational Communications and Technology Agency BECTA, 2008). Just under 40 percent of employers involved in a work-based e-learning initiative in Australia reported that, before enrolment, their staff needed basic literacy skills support. Others said their employees needed advanced literacy and/or e-learning skills so they could operate more successfully in the workplace (Smith, 2009). The employers we interviewed during our stakeholder interviews in New Zealand had identified similar needs amongst their employees. They were developing a wide range of e-learning initiatives designed to enhance their staffs' LLN.

This apparent willingness of New Zealand employers to facilitate employee skills gains support 3from a recent New Zealand-based study of e-learning in industry conducted by Clayton and Elliott (2008). They identified a growing incidence of e-learning initiatives in the workplace, and concluded that three levels of characteristics appear to be critical to the success of e-learning: those associated with the organisation, those associated with the training activities, and those associated with the learning itself. The two authors also observed that e-learning in large organisations tends to be more mature and better integrated than e-learning in smaller organisations, where there is less potential for in-house development. They furthermore noted that e-learning tends to be impeded by challenges such as connectivity, ready access to computer technology, lack of dedicated e-learning time, and insufficient personnel to support e-learning across all levels, including the management sector of the organisation. The Australian Institute for Social Research (2006) also lists as impediments a lack of industry-specific content and poorly conceived LLN learning activities.

E-learning can be successful when it fits well with work practices (Australian Institute for Social Research, 2006). However, our stakeholders noted that many adults with LLN needs do not work in places that provide access to computers and the web. These adults often have restricted access at home too. In contrast, many large tertiary institutions, such as our case study polytechnic and some training organisations in New Zealand, are relatively mature in their e-learning infrastructure and learning support services (Mitchell, Clayton, Gower, Barr and Bright, 2005).

Some educational organisations, such as open universities and virtual schools overseas, have reconfigured their educational processes to take full advantage of e-learning for distance education. These organisations typically work in partnership with other organisations and unbundle the teaching role into several complementary roles (Davis, 2009). A recent set of guidelines for industry integration of e-learning in Australia and e-learning guidelines in New Zealand provide examples of these developments (Massey University, 2008).

Educational organisations highly dependent on digital technologies continually evolve their practice to make best use of digital technologies, which also constantly change, as evidenced by the community-based Alpha Plus centres in Canada (Eady, 2006; Porter and Sturm, 2006). These organisations bring in staff with needed expertise to accommodate new needs. They also

provide professional development in aspects such as e-learning in general and e-learning design in particular.

Recommendations for tutors and those who support them:

- Recognise that organisations which adopt e-learning must have in place processes and mechanisms that allow them to evolve in line with changing technologies and understanding of e-learning. Technical services and learning support services are particularly important in this regard;

- Intentionally plan e-learning strategies and related professional development that align with a shared vision (among tutors, their managers, and support staff) of that learning;

- Raise leaders' awareness that tutors who work in situations that do not support their efforts to include and develop e-learning have difficulty moving through the maturational stages associated with bedding in e-learning. They may revert to earlier stages if they experience too many difficulties. A supportive climate for tutors includes easy access to e-learning and LLN resources for them and their students.

2.3 E-learning is more effective if it is part of face-to-face training

Most adults with LLN needs are most comfortable with e-learning when it is blended with other learning approaches, including face-to-face tutoring. A recent meta-analysis of international empirical research in higher education and secondary schools, conducted by Means, Toyama, Murphy, Bakia and Jones (2009), provides rigorous evidence that online learning can be more successful than face-to-face learning. The authors also showed that learning which blends face-to-face with online distance learning has the potential for the greatest success, not only because of the increased time available for individualised learning, but also because of the resources that the learners and those teaching them can deploy.

The few adult learners endeavouring to develop their LLN skills and who learn online without tutor support tend to be well organised and to have good access to the needed technology. They also tend to need relatively limited assistance when developing their literacy or numeracy skills, because these skills are typically ones they have lost through lack of use rather than ones they have never developed. Some adult learners who learn online have access to informal tutors, including whānau and workplace colleagues. Additional face-to-face provision can include needs assessment, review and accreditation (Thomas and Ward, 2009).

Those learners with beginning literacy levels need intensive face-to-face support (Davis, Fletcher, and Absalom, 2010; Litster, 2007). For these learners in particular, a learning approach that fits their respective lifestyles can enhance motivation to persist (Litster, 2007). E-learning is particularly accommodating of learners who cannot easily access face-to-face tuition, such as those in rural communities (Nash and Kallenbach, 2009; UNESCO, 2006).

An evaluation of e-learning initiatives undertaken by Careerforce, an ITO that leads training for New Zealand health and disability professionals, found that e-learning must be flexible enough to fit each adult's needs. This flexibility requires careful identification of which LLN skills the person needs to develop, an appreciation of that person's lifestyle, and assessment of his or her e-learning proficiency (Derham-Cole, 2008). In 2004, Careerforce drew on its initial experiences of e-learning to develop a comprehensive programme that included the following characteristics and resources: on-the-job embedded learning and assessment; face-to-face

sessions in the workplace; webcasts and podcasts; performance support; collaboration and community involvement; multimedia archives with CD-Rom; and web-based learning.

Family and whānau can offer the adult learner important motivational support that might include informal tutoring. There is potential to increase the quality of such support, as illustrated in a recent case study of numeracy learners in the concrete industry (Thomas and Ward, 2009). Activities related to everyday life challenges and family can also support e-learning because they provide strong motivational contexts. An example is grandparents now able to read to their grandchildren and to offer these youngsters support as they develop their LLN skills. Mellar et al. (2007) allude to this type of motivation in their description of a promising e-learning course in the UK that focuses, as a means of developing adults' LLN skills, on assisting these adults to support their children's learning.

Learning with support of the church is common in the Pasifika community. One of our stakeholders described a project in which members of a Samoan community had access to computers in a church hall so they could build their LLN skills. A number of studies show that open-access centres are effective in increasing access to education and training, particularly for adults who have been traditionally underserved. Appleby and Bathmaker (2006) and Pannucci and Walmsley (2007) note these benefits, and point out that they often extend beyond the individual. In New Zealand, Benseman and Sutton (2007) found that family literacy partnerships bring clear benefits not only for the adult learners but also for the children in their families.

In Canada, the Alpha Plus organisation provides a valuable set of case studies of outreach centres embedded within their communities, and of the students who are successful there (Porter and Sturm, 2006). Success factors for the learners include the provision of significant mentoring, which includes an in-depth orientation to organise their learning, the development of ICT skills, and career planning that focuses on means of sustaining ongoing (distance) education and e-learning. The global perspective promoted by UNESCO provides many more illustrations of community and outreach centres and initiatives (UNESCO, 2006; Wagner and Kozma, 2005).

Community centres and some homes in New Zealand donate recycled computers to organisations and individuals in order to increase people's access to e-learning. A stakeholder in a literacy centre explained how the centre used recycled computer equipment. Once adults in the centre had gained confidence with reading, they could access a suite of computers, but still relied on mentoring support. When replacing older computers with more recent second-hand equipment, the centre decided to give the surplus older computers to students, because most of them did not have one at home. However, this plan lapsed because the students were unable to access or afford the extensive technical support that is often required for out-of-date computers.

Recommendations for tutors and those who support them:

- Provide a range of delivery modes, including evening courses, workplace learning, whānau/family-oriented programmes and community/church-based programmes;

- Encourage and support supervisors, colleagues and whānau to support e-learning and to incorporate LLN activities in work and family life. Provide guidance for whānau and friends who can support the adult, and position this support so it aligns with the web-based resources the learner is using to develop identified skills. Where relevant, include activities for those adults who are parents or grandparents, so they can develop their LLN at the same time their children or grandchildren are learning these skills;

- Relate LLN to workplace needs and career contexts, and encourage employers to

> provide assistance at all stages, including diagnosis of needs. Provide orientation that includes career counselling;
>
> • Create and support distance learning linked to local support centres. Encourage members of the community to invest in the learning of its members. Investment typically focuses on e-learning infrastructure and e-learning services, and is conducted in a spirit of partnership with the learning centres concerned. Such partnerships are essential for sustaining long-term adult-focused LLN provision.

2.4 Māori approaches to e-learning can be used to build skills and knowledge within the Māori community

Successful programmes for adults with LLN needs address their lifestyle and fit with their aspirations. For Māori these premises are underpinned by kanohi ki te kanohi (face-to-face) interaction and the building of whakawhanaungatanga, which is often described as the centralising influence of whānau on its members (May, 2009, p. 8). For these reasons, Māori prefer courses that are either fully or partly face to face rather than fully online (May, 2009).

This understanding receives support from a study of three successful e-learning programmes for Māori, although these were not designed for adults with LLN needs (New Zealand Council for Educational Research, 2004). Zepke and Leach (2006) found that successful outcomes for distance learning of tutors with a high proportion of Māori and Pasifika students included some use of video or videoconferencing.

Wagner and Kozma (2005, p. 90) describe an initiative that used e-learning to help members of indigenous communities, including native Americans and Bangladeshi, develop the skills and knowledge they needed to make their cultures more visible in the 21st century. These people learned, for example, how to use the web to enlist global resources for local ends. Mellar and colleagues (2007) found that a particularly successful teaching strategy relative to e-learning is engaging learners in projects that encourage them, through role-plays, to practise their language and ICT skills. (According to the authors, directly instructing learners on how to use ICT is the least successful option.) One of these projects saw students producing a small video documentary that was useful to their community. Each student involved in this project had to assume one of the roles needed to accomplish the task, such as that of producer.

The deeply embedded approach to e-learning taken by Te Wānanga o Raukawa (New Zealand's first Māori tertiary institution) is a strong example of pedagogical practice that aligns with the lifestyles and aspirations of Māori learners. The main intent of the wānanga, which was set up in 1981 by a confederation of three main iwi groups (Te Ati Awa, Ngāti Raukawa and Ngāti Toa Rangatira), is to build capacity (the skills and knowledge that help Māori advance their communities) among the people the wānanga serves and those connected to them (Greenwood, Te Aika and Davis, in press). Proficiency with digital technologies and e-learning is at the heart of every programme in the wānanga because the founder, Whatarangi Winiata, wanted to find a way for Māori to be part of the current information and knowledge revolution.

In line with Māori philosophy, the wānanga strives to empower students and then, through the students, their entire whānau and iwi, which include many adults with literacy and numeracy needs. Distance learning on over 20 marae (Māori traditional centres) located throughout New Zealand's two main islands is blended with residential face-to-face courses on the wānanga campus. Kawa (the protocol of teaching, learning and research) is based on Māori cultural tenets that cross physical and spiritual realms to uphold the Māori worldview. As a component of its strategy of making e-learning part of Māori kaupapa (lore), the wānanga introduced computer

skills into its core courses and is incrementally introducing Māori terminology into its computer courses and resources.

> Recommendations for tutors and those who support them:
>
> - Encourage and support Māori-led LLN initiatives and partnerships, including those developed on marae;
>
> - Facilitate and model learning of ICT and other LLN skills by offering learners activities that are relevant to them;
>
> - Recruit Māori tutors and encourage learning activities that build the capacity of Māori to develop and offer their own teaching and e-learning strategies;
>
> - Promote ongoing development of resources that reflect Māori values and aspirations.

2.5 As long as adequate support is in place, e-learning provides a good source of practice and motivation for second-language learners

Second-language learners frequently make good use of e-learning contexts, including the wide range of resources on the web. As Chapelle (2001) reminds us, language tutors have a longer history of e-learning than have tutors in other areas of adult education. Second-language students and their tutors often bring particular strengths to e-learning, such as strong literacy skills in their own languages and well-trained practitioners. Some of them are able to mediate between the immigrant's native culture and language and the indigenous and mainstream cultures and languages of New Zealand. Second-language tutors work more effectively with the support of a resource centre and its staff, as described in our case study (Davis, Fletcher and Absalom, 2010).

Mishan's (2005) textbook for language tutors promotes authenticity in language-learning contexts, and it was one of the most germane we found when considering the relevance of e-learning to second-language learning. The chapter on e-learning stresses the need to fit e-learning and LLN into adult learners' lifestyles. The three main e-learning applications that Mishan describes are the web, email and online discussion forums; corpora (collections of writings of a specific kind or on a specific subject); and concordance (an alphabetical index of all the words in a corpus of texts).

Mishan (2005) positions the web as a valuable learning resource and medium. The tutor's role relative to the resource component, says Mishan, is to steer learners "through the barrage of text from within the web that can be quite daunting at first, especially to lower level learners" (p. 243). The tutor thus acts as a guide and facilitator until such time as the learner can use the web independently. The tutor's main tasks in this respect are coaching learners toward improving their web-access skills and helping them evaluate the information they find through web searching. As a medium, the web provides thousands of websites written specifically for language learning. Most of these provide practice via interactive exercises. However, Mishan cautions, many of these websites are of poor quality and replicate paper-based exercises. She recommends meta-websites because they provide an extensive yet safe location in which to place learners. One such site is Activities for ESL Students, a project of *The Internet Teaching English as A Second Language (TESL) Journal* (http://iteslj.org), which has thousands of contributions from teachers.

Email and related communication modes offer fast and authentic means of communication and can reduce learners' reticence to speak. According to Mishan (2005), email, chat, and online

discussions provide a number of learning possibilities. Examples include tandem learning, where learners teach and learn a language with a partner, discussion lists, and informal web-based community sites. However, Mishan recommends that these opportunities best suit learners with intermediate and higher levels of English proficiency.

Because emails and other digital forms of written communication provide a record of learners' utterances, second-language learners are able to notice idiomatic and colloquial expressions, which they tend to find difficult to pick up in oral communication. The record also facilitates a meta-linguistic discussion on the features of language, a discussion that is centred on the learners' own written communications. Email also encourages the oral skill of turn-taking as well as the opportunity to correct errors without disturbing the flow of conversation. Tutors and learners need, however, to be mindful of the abbreviated forms of English language that people increasingly are using when writing emails, engaging in chat forums, and sending text messages. These forms bend and break linguistic rules. Tutors therefore need to consider carefully which digital mediums to use when assisting learners to develop English-language proficiency.

Today, second-language learners of English also have available to them an increasing number of online distance learning courses, and tools that they can use as self-help resources, although these are more likely to promote successful learning outcomes when blended with tutor support. "U.S.A. Learns" is an example of this type of provision. Our preliminary evaluation of this web resource indicates that it would serve the language-acquisition needs of some second-language learners with an intermediate level of English proficiency where the online activities were blended with tutor support, but it is likely to be problematic for learners with lower levels of English proficiency.

The Australian second-language learning programme "It's Over to You" recently launched an online version of its DVD-enhanced workbooks. These workbooks, which have been offered to immigrant learners for some time, focus on developing migrants' literacy and numeracy skills across increasing levels of difficulty. Harris's (1995, cited in White, 2003) evaluation of the mode of study formerly offered to migrants identified inhibiting factors for language learners that are likely to persist with the web-based version. These included academic difficulties relating to the learning materials and resources on offer and to limited face-to-face assistance from a tutor. The learners with low literacy levels, who are of most interest in this present study, were the learners in Harris's study most likely to identify and comment on these restraints. However, a large proportion of the immigrants who offered comments said they found web-based study without tutor support unsatisfactory, and were generally negative about its relevance and usefulness as a mode of language learning. Practical difficulties included integrating studies into a busy life (many of the commentators were working long hours or were isolated at home with children).

White (2003) provides a comprehensive overview of language learning in distance education, including learning online, although she does not clarify the challenges often experienced by learners with low literacy skills. (As we noted earlier, most of the research in this area is based on students with higher than average literacy skills.) According to White, adult learners are more likely to engage in and benefit from distance learning programmes that offer accessible, high-quality support services and feedback early in the programme and that fit well with each learner's attributes and social/work/family environment and values. Such learners are more likely to see a course through to its end.

White (2003) also describes the stages that learners experience when entering an online learning environment. She explains that learners require a particular type of support, such as counselling, before the course begins. At course entry, the type of support typically needed is that which allows students to interact with one another and to share their experiences (eg through an online

chat-room-type forum). Throughout the course, they need tutor-based support in the form of monitoring and personalised feedback.

In regard to the application of corpora and concordance, Mishan (2005) observes that language learners who have good inductive and deductive reasoning skills, and can thus work with and understand complex language, and who also have good software skills, are well equipped to use the storage facilities of computers to build up a collection of relevant texts (a corpus). They can then use associated concordance software to sort and explore the language features of this material. For example, trainee nurses could use concordance to analyse a corpus of conversations between experienced nurses and their patients. Their aim here would be to identify the terms and phrases (including new ones) typically used in nursing practice contexts and to determine the contexts in which these expressions are appropriately used.

According to Mishan (2005), tutors supporting such learners report that this data-driven language teaching and learning emancipates learners, because they not only develop their language learning through discovery learning but also learn to challenge textbook knowledge. Tutors of learners who do not have the required degree of proficiency to learn in this way can use corpora and concordance to generate highly relevant texts for language exercises.

Although the second-language learning literature contains useful points in relation to the development of specific language-related skills, it also offers ideas for e-based learning activities appropriate for learners with varying degrees of language proficiency (see bulleted list below). A key point made within this particular collection of literature, and a point that we have already alluded to in relation to other literature that we examined for this study, is the need to develop activities and learning contexts based on the learners' current life experiences, vocations and workplaces. The need to develop and share resources was also emphasised by workplace tutors that we spoke to. In addition, Mueller, Wood, Hunt and Laurier's (2009) detailed description of a project that used computers to develop adults' writing illustrates the lengthy individualised support that is usually necessary for any language-learning initiative involving adults with a low level of literacy.

A brief synthesis of research according to the four main aspects of language teaching follows:

- *Writing:* The obvious tool here is the word-processing facility of computers. This facility includes useful language tools such as dictionaries, thesauruses, and spelling and grammar checkers. Having learners incorporate photographs in their texts also supports literacy development, particularly if text and illustrations are drawn from the learner's own life experiences. Using drag and drop to answer online test questions and then receiving immediate feedback increases learners' engagement with the activity and allows them to assess their own progress and needs. Grammar software is best suited to more advanced second-language students. Drill and practice software and computer games can be successful, but only when carefully targeted to address individual needs;

- *Reading:* A variety of glossing formats can be used to improve a learner's understanding of the meaning of words and phrases. A gloss can take the form of a pop-up box containing a text and/or relevant pictures and/or audio. Vocabulary learning can be enhanced by analysing multimedia and specific resources on the web. Embedded audio files are valuable not only for aiding reading skills but also for opening up computer access to learners who are still developing their keyboard skills, or who have not yet developed sufficient English-writing skills. Numeracy activities can also be aided via audio provision;

- *Speaking:* E-learning tools can help learners develop oral presentation skills. For example, learners wanting to improve their pronunciation can use audio analysis software to compare themselves with native speakers. Voice recognition software may be used to turn speech into text, providing the words are clearly articulated. However, in our experience, voice-recognition systems generally recognise less than a quarter of English spoken by non-native

speakers of the language. It therefore remains important to test this tool before using it in learning activities. Carefully structured use of online chat and discussions through email and online discussion forums, as described earlier, is also relevant here;

- *Listening:* Digital voice recordings are widely used by language tutors. The web contains many relevant resources, including radio and television broadcasts with commentaries (see information regarding the web as a medium above). Some computer games, such as Word Shark, include an option that allows the user to replay the audio component.

Recommendations for tutors and those who support them:

- Provide ESOL adults with support from a tutor, particularly at the beginning of their learning, so they can learn how to use e-learning independently and/or with support from whānau;

- Make use of the wide range of e-based language-learning practice resources available to ensure that the diverse range of needs among second-language learners is accommodated;

- Develop resources that can be customised to support adult learners new to New Zealand and/or e-learning. Develop or adapt additional resources and add-on tools for specific populations (eg Mandarin Chinese) to concurrently support the use of their first language and their development of English within the cultural context of New Zealand;

- Integrate and improve e-learning within the professional development of second-language tutors, and support staff in libraries and other appropriate and relevant areas, including workplace assessment. Encourage these people to use their professional networks to share good practice.

2.6 The diverse Pasifika peoples benefit from e-learning that fits their respective cultures and lives and is accompanied by induction activities

The number of second-language learners among Pasifika in New Zealand is high (Ministry of Education, 2007). Surveys of Pasifika adults suggest that they have higher LLN needs than any other ethnic group (see, for example, Ministry of Education, 2007). Higher needs in computer and internet literacy are also evident. At times, these students experience racial stereotyping and comments that adversely affect their learning (Fa'afoi and Fletcher, 2002; Fletcher, Parkhill, Taleni, Fa'afoi and O'Regan, 2009).

Best practice when supporting Pasifika adults to engage in e-learning is that which nurtures Pasifika ways of life. This approach increases learner confidence and willingness to learn (Clayton, Rata-Skudder and Baral, 2004). Characteristics of successful programmes provided by private training establishments for Pasifika adults include flexible course structures and tutors who have knowledge of the diverse Pasifika cultures (New Zealand Qualifications Authority, 2008). Blended e-learning can increase learning options. These then provide the flexibility needed to accommodate learners' individual needs in different environments, including academic, personal, social, whānau and church (Clayton et al., 2004)

Providing Pasifika adult learners with an induction programme is strongly recommended. This should ascertain learning needs and ease the learners into their programme of study and/or skills development. Cultural events that acknowledge students' respective cultures and the provision

of ongoing regular academic and e-learning support by approachable staff are important (Clayton et al., 2004; Fa'afoi and Fletcher, 2002; Fletcher et al., 2009). So, too, are affordable course fees, given that many Pasifika people tend to be over-represented in the lower socioeconomic brackets and to have financial obligations for family in their home islands (Clayton et al., 2004; Fa'afoi and Fletcher, 2002; Ministry of Education, 2007).

Samoans make up the largest proportion of the Pasifika population in New Zealand (Statistics New Zealand, 2007). A workplace tutor told us of his success in using email to motivate and support the literacy proficiency of male Samoan employees who are permanent residents of New Zealand. These men had never touched a computer, despite each having one at home that was used by other people. Their motivation to develop their literacy skills increased dramatically when they had opportunities to engage in e-based activities, such as sending an email to their extended families back home. (Digital infrastructure is improving in a number of Pacific islands.) Their tutor reported, "Their faces just lit up. They can now use a computer, they can type into it, they can send emails. They are getting emails back. They've made Christmas cards for their kids. It's incredible."

Recommendations for tutors and those who support them:

- Encourage and support Pasifika-led initiatives and partnerships in order to facilitate engagement with learning;

- Provide induction programmes that offer needs assessment and targeted development of LLN, including computer skills;

- Use e-learning facilities to build capacity among Pasifika communities, both in New Zealand and in the learners' island-based communities, assuming those communities have sufficient digital infrastructure;

- Ensure teaching and e-support staff are culturally aware, approachable and able to provide consistent, ongoing support for e-learning;

- Recruit tutors with a knowledge of the students' diverse cultures;

- Encourage the development of e-learning resources that celebrate the diverse Pasifika cultures.

2.7 Many of the e-learning strategies used for building reading and writing skills can also be successfully used for and by adults with disabilities that limit their ability to learn and/or access learning

Adults with disabilities that adversely affect their ability to learn and/or to access learning find digital technologies and e-learning that fit their needs highly useful. Adults with LLN needs are more likely to have such disabilities than the rest of the population. Many disabilities are hidden and may not be obvious to the adult, and there has been increasing recognition of the accumulation of deficits from common traumas such as sports injuries and car accidents (Gillon, Davis, Everatt, McNeill and Moran, 2009).

Today, digital technologies offer various types of assistance to adults with disabilities that impede learning. For example, organisers in mobile phones can be used to overcome short-term memory and ordering challenges (Gillon et al., 2009). However, a lack of compatibility between hardware and software and across different types of software (eg the screen reader fails to work after updating of web browser software) can limit or even prevent some of these adults from

using digital technologies (Abbott, 2007; Seale, 2006a). Also, guidance on how best to use certain technologies to good effect in e-learning (and other) contexts is often limited, which makes it difficult for both tutor and learner to benefit from them. For example, books that guide tutors working with dyslexics are widely available but provide little information on using digital technologies in e-learning contexts (see, for example, Townend and Turner, 2000; Yeo, 2003). Both Abbott (2007) and Seale (2006b) strongly recommend e-learning support for adults and their tutors from Learning Support Centres and Computer Centres, plus close liaison between these centres.

Digital technologies specifically designed to ameliorate the learning difficulties experienced by people with various disabilities offer an important means of providing equitable access to learning (Abbott, 2007; Litster, 2007). Voice-controlled software, for example, is becoming increasingly common, and speech input and output can be used to increase the speed and accuracy of reading and writing. These benefits contribute to gains in literacy skills because they tend to favour time on task and exposure to a wider range of vocabulary. Speech input and output also provides a key facility for adults with vision impairment. A stakeholder we interviewed in a literacy centre described how the centre uses computers to enhance learning by members of the deaf community. When teaching, tutors use a large computer screen, set up in front of the class, to display content, and use sign-language specialists to interpret their commentary on what is being displayed. This content typically includes internet sites and particular texts. The centre is also using the online New Zealand deaf sign language dictionary in its programme.

Recommendations for tutors and those who support them:

- Implement e-learning designed to support adults with disabilities that limit their ability to learn and communicate;

- Adapt/modify hardware and software to accommodate each adult's identified skills and abilities, and ensure compatibility across software;

- Provide learning and technology support services, and facilitate cooperation between these services to aid skills development in adults with disabilities that impede their ability to learn;

- Align e-learning tuition for these adults with their individual needs, and ensure that there is adequate tuition (quality and length of time) for them;

- Provide support and professional development for tutors and others who support these learners so that they can embed e-learning tools in their work;

- Improve support for e-learning from centres providing learning services and centres providing computer services, including liaison between them.

2.8 Using mobile digital technologies in e-learning contexts increases the flexibility of LLN provision

Mobile learning refers to learning activities made possible through the use of lightweight hand-held devices, including mobile phones and portable audio and video players and recorders. Mobile learning is a relatively new form of educational provision. It has the potential to extend learning into homes and workplaces, but it can be challenging because the learning takes place outside locations traditionally used for study. Successful mobile learning accordingly involves careful negotiation among designers, instructors, adult learners and collaborating employers.

This collaboration can ensure that expectations relating to LLN development remain realistic and ensures good fit with workplace routines and safety.

Manufacturers increasingly are using mobile devices on the factory floor to guide and monitor processes. Sticht (2001) provides an example in his account of a Canadian car factory, where workers used these tools to help them select and fit components. Pictures, audio, and/or text instructions can be used for tasks in the workplace or at home, thus providing adult learners with opportunity to develop skills through practice. Adults with disabilities that limit their ability to learn can use mobile devices to increase their feelings of control and independence (Smith, 2009).

Clayton and Elliott (2008) describe the increasing use of hand-held devices for e-learning in New Zealand industry, a practice that offers opportunities for just-in-time and just-enough approaches to e-learning. The authors note that graphics, audio and simulations are particularly effective in reducing demand on literacy and numeracy skills. We recommend that employers provide their employees with those applications best able to help develop the LLN skills required in their respective workplaces. The point is perhaps obvious, but employees who receive skills development that closely aligns with the skills needed to do their work are more efficient employees (Noss et al., 2007).

As is evident from innovative developments in the United States Army (Kazmer, 2007), adults who are already proficient in using digital technologies can design their own forms of mobile learning so that these align with the multiple aspects of their life at home and work. Our polytechnic case study of a programme for modern apprentices describes young apprentices, internet savvy and proficient with their mobile phones, successfully gathering evidence in the workplace in order to fulfil the assessment component of their vocational programme (Davis et al., 2010). The use of the mobile phone camera reduced demands on their writing skills. In addition, the tutor texted multiple-choice questions relating to course content to the apprentices' mobile phones, which prompted greater engagement with the theory aspects of their programme. This innovative practice illustrates how digital technology can be used as part of formative assessment in workplaces.

> Recommendations for tutors and those who support them:
>
> - Consider innovative ways to use mobile digital technologies during e-learning in order to increase transfer of learning into workplace and home locations. These technologies must, however, fit the life and work circumstances of the learners in those locations;
>
> - Disseminate to other tutors and providers activities involving mobile digital technologies that have proved successful in respect of adults' LLN learning;
>
> - Promote development of mobile digital technologies that, through their operations, facilitate the development of LLN skills with additional software such as text-to-speech output and relevant instruction, eg tuition on the number line for adults who are unsure of decimal values used in their work.

2.9 Tutors and support staff require specific professional development in e-learning, and organisations need to develop so that they can successfully accommodate this type of learning

The rapid and often innovative development of e-learning and related changes in pedagogy and useful e-based resources illustrated in this report emphasise the need for adult educators to receive ongoing professional development (Davis, 2009; Mitchell et al., 2005; Wagner and

Kozma, 2005). Tutors, leaders and support staff involved in e-learning need targeted professional development to help them through the thinking described in this report, and to implement and integrate the changes that it recommends. Because innovation with e-learning is an evolving process, it takes time to bed in. The stages of adoption and/or rejection that each individual and his or her organisation work through in this respect are related to their particular circumstances (Davis, 2009).

Professional development is also necessary to develop ICT skills and understanding of how both e-learning and LLN can be embedded in the learning process (UNESCO, 2006). The same applies to company training, which needs to include everyone involved in facilitating LLN skills (Smith, 2009). In addition, when leaders in the educational sector participate in professional development alongside their staff, students' achievement tends to improve (Mitchell et al., 2005; Yee, 2001).

The working conditions of tutors in adult foundation education influence the amount and type of change they bring to their practice. In their examination of the factors that encourage teachers to use ICT in their practice or that prevent them from doing so, Drent and Meelissen (2008) note that the number of contacts that the educators maintained to assist their own professional understanding of e-learning had a direct influence on their e-learning attitudes and competence. This outcome, in turn, affected their propensity to innovate with e-learning. In their consideration of adult education in general, Smith, Hofer, Gillespie, Solomon and Roe (2003) identified key factors influencing successful teaching practice. These were sufficient preparation time, access to benefits, including vacations, and having a voice in changes to programmes. The researchers found that individual factors, such as teaching beliefs and attitudes toward innovation, also influenced educators' adoption of e-learning.

Many initiatives around the world, including the New Zealand Ministry of Education's "Laptops for Teachers" project (Cowie, Jones, Harlow, Forret, McGee and Miller, 2008), show that provision of laptop computers and other equipment, such as a digital camera and mobile phones, aids e-learning innovation because they increase educators' ability to access ongoing and relevant professional development. Not surprisingly, given these findings, Hamilton and Hiller (2006), in their critical overview of adult literacy teaching and learning in the UK, identified the constraints on e-learning as follows: insufficient numbers of computers, many of which were old; a lack of suitable teaching areas, often with limited security; and dispersed premises, which meant that tutors had to transport their resources with them. Smith et al. (2003, p. 24) reported similar constraints, as did the tutors we interviewed.

A comprehensive survey of e-learning in New Zealand polytechnics conducted by Mitchell et al. (2005) identified the many challenges that this form of learning poses for tutors' pedagogical practices. In their report, the authors emphasised the need to raise awareness among tutors of the benefits of e-learning and to encourage and support them to explore its potential. The authors found that tutors in larger institutions were more likely to adopt e-learning than were tutors in smaller institutions, partly because the former were more likely to be supported in their endeavours. The authors also found that polytechnic staff encompass the whole spectrum of ICT competence. However, the authors' identification of the varying extent to which these educators had adopted e-learning was somewhat similar to Rogers' (2003) categories: embracers, modifiers, examiners, doubters, and refusers. Mitchell and colleagues furthermore found that neither age nor gender related to the level of adoption. Instead, the level of adoption related to the need for e-learning. Staff teaching off-campus courses and those teaching in programmes with ICT-related industry needs were the staff most likely to have adopted e-learning.

E-learning research in New Zealand tertiary education identifies the need to tightly connect institutional policy, infrastructure and people. As Shephard (2009) points out, leaders can promote development by "providing direction (leading the way), by persuasion (by providing

incentives, reward and recognition) or by coercion (with obligations and penalties)" (p. 3). Although most of the staff that Shephard surveyed considered e-learning important, only one-third had engaged in formal or informal professional development for e-learning. The staff surveyed were involved in many different facets of e-learning and included those working with adults with LLN needs.

According to Shephard (2009), this broad range illustrates just how eclectic the types of professional development on offer need to be to build effective e-learning capacity. However, Shephard did find a number of professional development strategies that were common to all educators. The five top-rated ones were informal: "… sharing knowledge with colleagues; spontaneous learning arising from work or personal activities; learning through informal discussions in the workplace; regular reading of journals and books relevant to a profession; and acquiring knowledge through browsing websites or 'surfing the net'" (p. 3). Our polytechnic case study also illustrated the parts that accredited courses and "champions"—people enthusiastic about and conversant with e-learning pedagogy—play in introducing new approaches to teaching and learning to their colleagues (Davis et al., 2010).

In summary, the perceptions and beliefs of tutors and those who support them influence their uptake of e-learning and the effectiveness of the teaching practices they adopt in that regard. At the present time, adoption trajectories are highly variable; it seems that only a few tutors are at a stage where they can act as influential champions of development in e-learning.

Recommendations for tutors and those who support them:

- Provide support so that tutors can develop the ICT skills and 21st-century knowledge they need to successfully engage in e-learning. Support includes providing educators with sufficient time to gain an effective understanding of the principles and practice of e-teaching and e-learning. It also includes providing them with ongoing access to e-learning-related professional development. Learning mentors are particularly useful here, as they can help tutors prepare for, implement and evaluate the effectiveness of e-learning in their work. Raising tutors' awareness of relevant e-learning, e-assessment and related resources is also an important ingredient;

- Acknowledge that time is needed to mature knowledge and skills;

- Ensure that ongoing professional development of teaching staff is informed by research: tutors need to know why they are using ICT and how they can best use these tools to accomplish their teaching aims. Having staff conduct their own action research relative to their growing understanding and use of e-learning is also a valuable strategy;

- Provide a range of professional development opportunities that not only include accredited certificate and degree programmes but also encourage less formal networking that allows educators, tutors and agencies to share successful e-learning innovations;

- Encourage the appointment and active engagement of people who champion e-learning and the development of LLN skills. By partnering with tutors and other relevant staff, these practitioners can offer the support tutors need to build confidence in and develop their use of ICT in literacy and numeracy learning contexts;

- Showcase and cascade at national conferences and locally accounts of relevant initiatives and research projects conducted both individually and collaboratively. Model hands-on ICT and e-learning.

2.10 Communities of practice can provide a means of professional development for tutors engaged in e-learning and can lead to the development of relevant resource banks

Communities of practice made up of vocational staff, including workplace assessors, LLN specialists and others who support adults with LLN needs, can be an important supplementary aspect of professional development of e-learning tutors (Davis, 2009; Davis et al., 2010; Mitchell et al., 2005). Used well, online learning enhances this type of professional development. It also provides educators with opportunities to create and access useful resources, such as those developed by Workbase (see http://www.workbase.org.nz/) and by the recently established national hub for adult literacy and numeracy at the University of Waikato.

The Teachers for Teachers for Tertiary (T4T4T) action research programme evaluated by CORE Education (Ministry of Education, n. d.) demonstrates just how successfully community-based approaches to e-learning can be integrated into professional development programmes accommodating diverse learners. The programme involved tertiary staff working within four Canterbury tertiary institutions. Trained mentors supported and guided small groups as they developed an action-based and reflective approach to accredited professional development online. The tutors and support staff advanced their use of e-learning with the support of the online community and occasional face-to-face meetings. Mentoring both online and in the face-to-face meetings was an important success factor.

Mackey's (2009) extensive research into similar programmes for tutors in all sectors of education in New Zealand indicates that complementary e-learning communities of practice can develop online and in the workplace during formal professional development. Moreover, as Davis, Preston and Sahin (2009) found, national professional development initiatives that fit with tutors' lifestyles not only facilitate the tutors' professional learning but also encourage development and sharing of relevant e-learning resources across organisations and geographic boundaries. Online mentoring and accreditation of professional development are likely to be essential to the formation of a strong community of practice (Selwyn, 2000).

Drawing on their research into e-learning initiatives focused on developing numeracy skills in the workplace, Thomas and Ward (2009) recommend the establishment of a bank of appropriate activities that a large number of tutors and learners can then use. They note that quality online learning activities cover the required content, use cognitively demanding tasks, provide immediate feedback and guidance and are accessible to adults. They also state that each resource included in the bank should be accompanied by specification of the required skills and the potential learning outcomes.

Having considered research on large-scale e-learning professional development for tutors in England, Davis and colleagues (2009) concluded that synergistic links with ongoing professional development has the potential to increase and refine banks of resources to fit many more adults' needs. The researchers also noted that online communities of tutors supported by champions, mentors and leaders tend to lead to an increase in the number and range of resources and their uptake. Block courses were blended with professional practice supported by colleagues and online tutors. The online tutors continued to develop banks of resources that teachers could draw upon and adapt for their learners.

Coben et al. (2007) recommend that commercial developers of educational resources produce and trial materials for use with adults wanting to improve their numeracy skills. The researchers also urge tutors to create and adapt their own resources and versions of existing materials. However, they caution that the success of this work rests on tutors' receiving suitable professional development. Coben and colleagues furthermore note that open source software

and "creative commons" licensing readily allow practitioners to share resources and activities and to adapt these to accommodate the needs of other learners.

After evaluating a wide range of easily accessible digital technologies implemented by tutors engaged in teaching numeracy skills to adults, Coben and colleagues (2007) cited the following technology-based initiatives as the most successful:

- An audio file embedded into a web-based worksheet for ESOL students;
- Web quests with embedded web links, including online numeracy tasks, such as buying a ticket;
- Mind-mapping software;
- Blogs that provide details of activities and shared progress;
- Simple spreadsheets to make numeracy more meaningful and attractive to learners.

In New Zealand, professional development communities are also emerging within particular vocational areas. For example, one of the stakeholders we interviewed told us of an online community of practice where tutors ask colleagues for material that not only suits their particular vocational purposes, for example, teaching learners how to mix fertilisers, but also develops the learners' numeracy and literacy skills. The company that this stakeholder represented said access to downloadable resources and exercises had opened the company's eyes to the potential for providers and practitioners to work together to develop and share supplementary learning materials contained in a databank-type facility, and offering links to other websites. Recognition was also given to the need to structure these resources so that tutors and learners were not left determining the best order in which to access them.

Recommendations for tutors and those who support them:

- Purposefully develop communities of practice that include LLN tutors. This form of professional development should both supplement and complement professional development work carried out by existing local, regional and national networks as well as by workplace communities;

- Promote use of e-learning in professional development programmes for tutors of adults with LLN needs and those who support them, such as administrators;

- Improve support for e-learning from centres providing learning services and centres providing computer services, including liaison between them and national hubs;

- Offer online modes of professional development blended with intensive block courses that also model good e-learning practice. Some tutors and support staff may need an induction programme designed to develop their e-learning skills;

- Link the development of banks of e-learning resources to communities of practice initiated through online professional development.

3   E-LEARNING IN A POLYTECHNIC

This section presents a brief description of our polytechnic case study, provided here to illustrate the variety of e-learning opportunities and the complex evolution of this form of learning. The full case study can be found at http://www.educationcounts.govt.nz/publications/tertiary_education.

The polytechnic we studied is a large urban polytechnic that has been using e-learning with adults with LLN needs over a number of years. The polytechnic strives to serve adults with diverse literacy and numeracy needs, and its leaders recognise that this provision has to be an ongoing development. The polytechnic's leaders are highly qualified people. Most of them have, or are studying towards, postgraduate degrees, and all are active promoters of professional development for their staff and their students. This latter provision includes an e-learning course within the polytechnic's certificate programme for adult educators.

E-learning policy development is inclusive. Meetings of senior managers include presentations from e-learning champions, who typically are people undertaking postgraduate study. These people also tend to be members of national communities of e-learning practice. Senior and middle managers work collaboratively and strategically to develop a range of teaching and learning initiatives needed to accommodate their diverse learners. They also work together to develop principles of good practice in regard to e-learning and to embed literacy and numeracy into foundation and trades courses.

The development of e-learning in the polytechnic reflects not only the maturation of e-learning support services within the institution but also the professional development trajectory of individual tutors adopting this form of learning. The polytechnic's e-learning coordinator outlined for us the stages of professional development in e-learning that he considered most relevant and that he therefore supported.

- *Learner stage:* Talk about e-learning. What is it? What are your attitudes to it?;
- *Adopter stage:* Exposure to new technologies, with time to "play". Embedding skills into a learning activity, rather than teaching ICT skills separately;
- *Leader stage:* Having on board someone with a passion for e-learning or ability in some aspect of it, and who can successfully convey that passion and experience to staff, so that they gain requisite skills. (The coordinator told us that one such person had recently led a workshop session on e-learning under the auspices of the Certificate in Adult Teaching.)

During our study, we carefully considered all programmes within the polytechnic that had adopted one or more forms of e-learning in order to improve learners' LLN skills. We identified, as a result of this work, the following successful and innovative learning applications.

- *Online distance learning designed to develop and refresh numeracy skills:* Presented in modular form, and autonomously accessed by learners, this provision is accessed through the polytechnic's learning management system. This initiative was established 10 years earlier with the aim of increasing adults' access to careers in health-related fields. The programme is most successful with adults who have all of the following: some numeracy skills, an intermediate or higher level of language literacy, good study skills, and access to the internet at home or on the polytechnic campus. The programme has also proved particularly successful for adults who have lost skills through lack of practice;
- *Using mobile phones to enhance the learning of apprentices in their workplaces:* An innovative tutor who was an early adopter of new technologies led this innovation in partnership with the e-learning coordinator. The mobile phone component was part of a

continuing innovation with e-learning. On finding that her student apprentices were not accessing the polytechnic's learning management system when off campus, the tutor applied for and won a grant to use mobile phones as part of her teaching and learning strategy. She asked her students to go back to using workbooks, and sent them a daily quiz via text messages. She also had the apprentices use the camera feature of their phones to photograph their workplace achievements. This initiative led to an improved form of work-based assessment and an increase in the students' general literacy skills;

- *A library resource centre designed to support second-language international students and migrants:* The centre had evolved to a point where it had successfully incorporated a range of digital technologies and e-learning resources. Centre staff are committed to encouraging e-resource-based learning because, as they told us, it increases adults' self-access to English-language learning. However, they stressed that this provision must include collaboration among centre staff, second-language tutors and members of other relevant support units. They also emphasised that student access to the resources needs to be guided by the second-language tutors and other support staff;

- *The creation and ready availability of a wide range of e-learning resources:* These had been developed by several tutors of trades who saw the value of ongoing use of ICT to create materials (including numerous images) deemed relevant for adults with low-level literacy and numeracy skills. Among the many innovations we observed were test questions (accessed through the polytechnic's online learning management system) complete with drag and drop answers developed with the aim of increasing feedback for students, numeracy and literacy support for foundation and trades students (provision that had increased student retention), and an innovative computer simulation of the complicated task of laying out a building site. The simulation readily drew in young male learners, who were highly engaged by its game-like interface;

- *An evening class set up to support adults with particularly low levels of literacy skills:* This class illustrated for us the challenge that such adults have in terms of accessing e-learning support. As we emphasise elsewhere in this report, such adults need support to develop their LLN skills so that they can gain maximum benefit from e-learning. However, the evening class showed us that digital technologies can still be brought in at an early stage of this development. With support from their tutors, the students attending the night class were using software designed for dyslexics. According to the class tutors, the class helps adults develop computer skills, including those needed to use email, and also facilitates student recruitment.

4 CONCLUSIONS AND MAIN RECOMMENDATIONS

There is no doubt that introducing and integrating digital technologies into educational provision is a complex process. Many factors have to come together to ensure that e-learning programmes are successful for adults with LLN needs. Our findings from our review of the literature, online seminars, stakeholder interviews and case study emphasise that success occurs when the e-learning fits:

- The adult's lifestyle;
- The tutor's pedagogic goals;
- The tutor's e-learning proficiency;
- The purpose and culture of the education and/or training organisation;
- All other locations where learning takes place, including the home.

Good fit with individual learners' lifestyles is the overarching success characteristic that we identified through our research. This fit is not easy to achieve. It requires ongoing monitoring and development as the teaching, learning, organisational and digital ecologies continue to evolve.

We consider that the success or otherwise of programmes that use e-learning to support adults wanting to develop their LLN skills can best be predicted by considering these ecologies from within an evolutionary framework (Davis, 2009). Davis describes ecologies of people in and around the classroom who all contribute to the success of learning. The e-learning that takes place is supported by four tiers: bureaucratic entities, such as the Tertiary Education Commission; commercial interests, including telecom companies; professionals in tutor-training organisations and professional societies; and political agents at all levels of society, from the local community to the international stage. Amidst this framework, tutors are the key players: they are the essential individuals who keep the edifice functioning.

This evolutionary framework recognises that ecologies change as people adapt their behaviour, whether individually or in groups, in accordance with new understandings and ways of doing things. Such change leads to changes in organisational structures and procedures, and those changes, in turn, lead to more change among the individuals who work within the organisation or access its learning provisions. And so the process continues. In short, the process is an ongoing, dynamic one, and it also has to be an integrated one, in which all ecologies work well together. Tutors provide an example of this process in action. They and those who support them can help or hinder development of the ecologies that work to make an educational organisation or environment e-learning "friendly".

E-learning also has the benefit of opening up greater interaction between learners' study, work, home and community environments, simply because the learning environment can be extended into those places. These extensions of the locations where learning takes place stretch out the opportunities and time that adults have available to develop their LLN skills. (The time needed to develop such skills can take hundreds of hours, yet this factor is often underestimated.) Mobile learning that encompasses digital technologies continues to expand the options for LLN, but this facility also increases the complexity of e-learning development within and across organisations.

The often intensive and challenging nature of developing adults' LLN skills explains the need for organisational development and commensurate professional development for staff. Resource development is also vital. However, e-learning can also be used to support these developments at both local and national levels, while digital technologies provide educators with opportunities

to share ideas and resources through partnerships and learning communities, and across geographic boundaries.

With these considerations in mind, we recommend that leaders at all levels of educational provision apply Davis' (2009) evolutionary framework and its underlying models to support the development of human behaviour that is likely to result in successful e-learning for adults with LLN needs. Relevant leaders include employers, ITOs, tutor educators, e-learning coordinators, chief executives, vendors of e-learning products and services, and policymakers.

As we stated at the beginning of this report, the government knows that the tertiary sector is likely to be challenged in its efforts to provide sufficient education for all adults wanting to develop their LLN skills. Blending face-to-face training with e-learning for individuals and groups has the greatest chance of addressing this need, but these types of provision must be accompanied by professional and organisational development within and across organisations. We therefore conclude our report with nine recommendations for action at the regional, national and international levels. Although some of these recommendations may appear generic, they can all be conceptualised within LLN contexts.

MAIN RECOMMENDATIONS

1. Provide e-learning-related professional development for tutor educators and workplace assessors who work in adult education.

2. Ensure that the quality assurance measures used in relation to LLN programmes include regular assessment and updating of e-learning provisions.

3. Partnerships between and among key stakeholders are essential for the effective development and integration of sustained e-learning opportunities. These partnerships should include web-based facilities that offer access to e-learning content, tutors and professional development.

4. Increase the capacity for e-learning in all New Zealand contexts, including e-learning on marae in collaboration with Māori institutions and communities.

5. Research and develop e-learning in partnership with rural and remote communities. Immigrants' home countries can be party to this provision, but only if the e-learning infrastructure in these places is sufficiently developed to provide immigrant and transient populations with the opportunity to develop their LLN skills.

6. Establish banks of appropriate activities and resources for use by tutors and assessors, and support these people in a way that allows them to help develop and update those banks as part of their professional development activities. The scale of need in New Zealand suggests this approach could be a cost-effective one. However, achieving this aim would need centralised coordination (a national hub).

7. Support projects designed to investigate the potential that more recent digital technologies might offer learners with LLN needs. This potential could include, within workplaces, for example, mobile learning via mobile phones, simulations with game-like interfaces, and e-learning on hand-held computers.

8. Encourage continuing research in e-learning that is sufficiently complex to aid the evolution of pedagogical practice. How digital technologies can be used to advance learning and how the e-learning professional development needs of professionals and organisations can best be served are issues particularly in need of sustained research.

9. Collaborate internationally to continue to review research and development

worldwide, and to disseminate the findings of this research to the New Zealand tertiary sector.

REFERENCES

Abbott, C. (2007). *E-inclusion: Learning difficulties and computer-related technologies*. Futurelab Report 15. Bristol: Future Lab, University of Bristol. Retrieved April 24, 2009, from http://www.futurelab.org.uk/litreviews.

Alton-Lee, A. (2003). *Quality teaching for diverse students in schooling: Best evidence synthesis*. Wellington: Ministry of Education.

Appleby, Y. & Bathmaker, A. (2006). The new skills agenda: Increased lifelong learning or new sites of inequality? *British Educational Research Journal*, *32*(5), 703−717.

Australian Institute for Social Research. (2006). *The digital divide: Barriers to e-learning*. Adelaide, SA: University of Adelaide. Retrieved March 4, 2009, from http://www.community.ca/docs/convergence_situating.pdf.

British Educational Communications and Technology Agency (BECTA). (2008). *Harnessing technology review 2008*: *The role of technology and its impact on education. Full report*. Coventry: Author. Retrieved August 4, 2009, from http://publications.becta.org.uk/.

Benseman, J. & Sutton, A. (2007). *A synthesis of foundation learning evaluation and research in New Zealand since 2003*. Retrieved February 28, 2009, from http://www.dol.govt.nz/publications/research/learning/learning-evaluation_08.asp.

Chapelle, C. (2001). *Computer applications in second language acquisition: Foundations for teaching, testing, and research*. Cambridge UK: Cambridge University Press.

Clayton, J. & Elliott, R. (2008). *E-learning in industry: A summary of activities*. Wellington: Emerging Technologies Centre, Wintec.

Clayton, J. F., Rata-Skudder, N. & Baral, H. P. (2004). *Pasifika communities online: Issues and implications*. Paper presented at the third Pan-Commonwealth Forum on Open Learning, Dunedin, New Zealand.

Coben, D., Crowther, J., Kambouri, M., Mellar, H., Mogey, N., Morrison, S. & Stevenson, I. (2007). *Greater than the sum ... report of the action research project: The use of ICT in adult numeracy teaching in Scotland, phase 2*. London: National Research and Development Centre. Retrieved February 15, 2009, from http://www.nrdc.org.uk/uploads/documents/doc_3698.pdf.

Cowie, B., Jones, A. & Harlow, A., with Forret, M., McGee, C. & Miller, T. (2008). *TELA: Laptops for Teachers evaluation. Final report, Years 7 & 8.* Wellington: Ministry of Education. Retrieved February 28, 2009, from http://www.educationcounts.govt.nz/publications/ict/27369/25188.

Crump, S., Twyford, K. & Littler, M. (2008). Interactive distance e-learning for isolated communities: The policy footprint. *Education in Rural Australia*, *18*(2), 39−52.

Davis, N. E. (2010). Global interdisciplinary research into the diffusion of information technology innovations in education. In A. McDougall, J. Murnane, J. Jones & N. Reynolds (Eds.), *Researching I.T. in education: Theory, practice and future directions* (pp. 142–149). London: Routledge.

Davis, N. E., Fletcher, J. & Absalom, I. (2010). *E-learning for adult literacy, language and numeracy. A case study of a polytechnic.* Wellington: Ministry of Education.

Davis, N. E., Preston, C. & Sahin, I. (2009). Training teachers to use new technologies impacts multiple ecologies: Evidence from a national initiative. *British Journal of Educational Technology*, *40*(5), 861–878.

Derham-Cole, C. (2008). *Careerforce: A framework for e-learning delivery*. Retrieved January 22, 2009, from http://elg.massey.ac.nz/index.php?title=Careerforce.

Drent, M. & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Journal of Computers & Education*, *58*(1), 187–199.

Eady, M. (2006). *Literacy learning at a distance: A new approach*. Retrieved March 4, 2009, from http://www.resources.alpharoute.org/articles.asp.

Earle, D. (2009). *The effect of first language and education on literacy, employment and income: An analysis from the Adult Literacy and Life Skills survey.* Wellington: Ministry of Education. Retrieved September 24, 2009, from http://www.educationcounts.govt.nz/publications/tertiary_education/55973/1.

Fa'afoi, A. & Fletcher, J. (2002). Na hakahita ki tagata Pahefika I te akoga haka haiakoga: Identifying barriers for Pacific Island student teachers. *Many Voices*, *19*, 24–31.

Fletcher, J., Parkhill, F., Taleni, T., Fa'afoi, A. & O'Regan, B. (2009). Pasifika students: Teachers and parents voice their perceptions of what impacts on Pasifika students' achievement in literacy, language and learning. *Teaching and Teacher Education: An International Journal of Research Studies*, *25*, 24–33.

Fletcher, J. & Williams, J. (2008). Motivating adult learners to improve their literacy skills: Barriers and supports. *New Zealand Journal of Adult Learning*, *36*(2), 20–39.

Gillon, G., Davis, N. E., Everatt, J., McNeill, B. & Moran, H. (2009). *Supporting adults with dyslexia: A resource for adult literacy programmes.* Wellington: Tertiary Education Commission.

Greenwood, J., Te Aika, L. H. & Davis, N. E. (2010 in press). Creating virtual marae – an examination of how digital technologies have been adopted by Māori in Aotearoa New Zealand. In P. R. Leigh (Ed.), International Explorations of Technology Equity and the Digital Divide: Critical, Historical and Social Perspectives. Hershey, PA: IGI Global.

Hamilton, M. & Hiller, Y. (2006). *Changing faces of adult literacy, language and numeracy: A critical history*. Stoke-on-Trent: Trentham Books.

Industry Training Federation. (2009). *ITO Literacy and Numeracy Good Practice Project: Interim report, April 2009.* Wellington: Author.

Kazmer, M. M. (2007). Community-embedded learning. In R. Andrews & C. Haythornthwaite (Eds.), *The Sage handbook of e-learning research* (pp. 311–327). London & New York: Sage.

Litster J. (2007). *Stick with it! Literature review: Final report to the Quality Improvement Agency.* Retrieved September 7, 2008, from http://excellence.qia.org.uk/165471.

Mackey, J. (2009). Virtual learning and real communities: Online professional development for teachers. In E. Stacey & P. Gerbic (Eds.), *Effective blended learning practices: Evidence-based perspectives in ICT-facilitated education.* Hershey, PA: Information Science Reference.

Massey University. (2008). *E-learning guidelines for New Zealand*. Palmerston North: Training Development Unit, Massey University. Retrieved April 7, 2009, from http://elg.massey.ac.nz.

May, S. (2009). *Hangaia te mātāpuna o te mōhio: Learning foundations for Māori adults.* Wellington: Ministry of Education. Retrieved September 24, 2009, from http://www.educationcounts.govt.nz/publications/tertiary_education/55461/1.

Means, B., Toyama, T., Murphy, R., Bakia, M. & Jones, K. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies.* Washington, DC: US Department of Education.

Mellar, H., Kambouri, M., Logan, K., Betts, S., Nance, B. & Moriarty, V. (2007). *Effective teaching and learning using ICT.* London: NRDC/ALN. Retrieved August 7, 2009, from http://www.nrdc.org.uk/publications_details.asp?ID=87#.

Ministry of Education. (n.d.). *Teachers for Teachers for Tertiary (T4T4T)*. Retrieved September 29, 2009, from http://cms.steo.govt.nz/eLearning/Projects/Teachers+for+Teachers+for+Tertiary+(T4T4T).htm.

Ministry of Education. (2007). *Pasifika Education Plan.* Wellington: Author.

Mishan, F. (2005). *Designing authenticity into language learning materials.* London: Intellect.

Mitchell, D., Clayton, J., Gower, B., Barr, H. & Bright, S. (2005). *E-learning in New Zealand institutes of technology/polytechnics: Final report.* Wellington: Ministry of Education.

Mueller, J., Wood, E., Hunt, J. & Laurier, W. (2009). Assessing adult student reactions to assistive technology in writing instruction. *Adult Basic Education and Literacy Journal*, *3*(1), 13–23.

Nash, A. & Kallenbach, S. (2009). *Making it worth the stay: Findings from the New England Adult Learner Persistence Project.* Boston, MA: New England Literacy Resource Center.

New Zealand Council for Educational Research. (2004). *Critical success factors and effective pedagogy for e-learning in tertiary education: Background paper for ITP New Zealand*. Wellington: Author.

New Zealand Qualifications Authority. (2008). *Te rau awhina: The guiding leaf.* Wellington: Author.

Noss, R., Bakker, A., Hoyles, C. & Kent, P. (2007). Situating graphs as workplace knowledge. *Educational Studies in Mathematics*, *63*(3), 367–384.

Osborne, M., Gallacher, J. & Crossan, E. (Eds.). (2004). *Researching widening access to lifelong learning: Issues and approaches in international research.* London: Routledge.

Pannucci, L. & Walmsley, S. (2007). Supporting learning-disabled adults in literacy. *Journal of Adolescent and Adult Literacy*, *50*(7), 540–546.

Porter, P. & Sturm, M. (2006). *Crossing the great divides: Distance learning and flexible delivery in adult basic education: Research report for Ontario's literacy and basic skills*

program. Retrieved February 28, 2009, from http://www.nzliteracyportal.org.nz/imsdirector.php?resid=2943&ruid=15.

Rogers, E. (2003). *The diffusion of innovations* (5th ed.). New York: The Free Press.

Seale, J. (2006a). A contextualised model of accessible e-learning practice in higher education institutions. *Australasian Journal of Educational Technology*, *22*(2), 268–288.

Seale, J. (2006b). *E-learning and disability in higher education: Accessibility research and practice*. London: Routledge.

Selwyn, N. (2000). Creating a 'connected' community? Teachers' use of an electronic discussion group. *Teachers College Record*, *102*(4), 750–778.

Shephard, M. (2009). *Part C Massey literature review: Professional development for e-learning: Adoption, implementation and improvement.* Palmerston North: Massey University. Retrieved August 10, 2009, from http://cms.steo.govt.nz/NR/ rdonlyres/ 212E102F-F736-486B-A1FD-FA4B0BEE9690/0/Shephard PartCMasseyliteraturereviewFinal2.pdf p C5.

Simmons, J. (2002). *Researching key skills co-ordinators: A report for the Learning and Skills Development Agency*. London: Learning and Skills Development Agency.

Smith, C. (2009). *Industry integration of e-learning: Guidelines for supporting learners using e-learning in workplaces.* Canberra, ACT: Commonwealth of Learning. Retrieved March 24, 2009, from http://industry.flexiblelearning.net.au.

Smith, C., Hofer, J., Gillespie, M., Solomon, M. & Roe, K. (2003). *How teachers change: A study of professional development in adult education*. Boston, MA: National Center for the Study of Adult Learning and Literacy in the USA.

Statistics New Zealand. (2007). *QuickStats about culture and identity.* Retrieved August 6, 2007, from http://www.stats.govt.nz/census/2006-census-data/quickstats-about-culture-identity/ quickstats-about-culture-and identity.htm?page=para016Master.

Sticht, T. G. (2001). *Reforming adult literacy education: Transforming local programs into national systems in Canada, the United Kingdom and the United States*. Retrieved May 5, 2008, from http://www.nald.ca/FULLTEXT/sticht/ reformin/cover.htm.

Thomas, G. & Ward, J. (2009). *Numeracy for adults: Latest findings from teaching and learning research.* Wellington: Ministry of Education. Retrieved September 24, 2009, from http://www.educationcounts.govt.nz/publications/ tertiary_education/51931/1.

Townend, J. & Turner, M. (Eds.). (2000). *Dyslexia in practice*. New York: Kluwer Academic/Plenum Publishers.

UNESCO. (2006). *Using ICT to develop literacy.* Bangkok: Author. Retrieved July 17, 2009, from http://www.unescobkk.org/fileadmin/user_upload/ict/e-ooks/Literacy/Using_ICT_to_ Develop_Literacy.pdf.

Wagner, D. A. & Kozma, R. B. (2005). *New technologies for literacy and adult education: A global perspective.* Paris: UNESCO Publishing.

White, C. (2003). *Language learning in distance education.* Cambridge, UK: Cambridge University Press.

Yee, D. (2001). The many faces of ICT leadership. In B. Barrell (Ed.), *Technology, teaching and learning: Issues in the integration of technology* (pp. 223–238). Calgary, AB: Detselig.

Yeo, D. (2003). *Dyslexia, dyspraxia and mathematics*. London: Whurr Publishing.

Zepke, N. & Leach, L. (2006). Improving learner outcomes in lifelong education: formal pedagogies in non-formal learning contexts? *International Journal of Lifelong Education, 25*(5), 507–518.