MINISTRY OF EDUCATION

Te Tāhuhu o te Mātauranga

E-learning for adult literacy, language and numeracy

A review of the literature

New Zealand Government

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.

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SUMMARY

This research aims to provide readers with a greater understanding of the potential of e-learning for adult literacy, language and numeracy (LLN). 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. In this literature review, we outline the nature of the extant literature pertinent to our research question. We also describe and discuss the key success characteristics that emerged from our review in relation to engaging adults in e-learning designed to develop their LLN skills. We set this material out in six sets of research-based findings (1–6).

1. Lack of research evidence directly related to the question.
2. Characteristics relating to learning (overarching).
3. Characteristics relating to learning (specific).
4. Strategies effective tutors use.
5. Staff and e-learning resource development.
6. Characteristics relating to educational organisation and society.

An overarching message to emerge from our research is that e-learning is relevant to and useful for most adults with literacy, language and/or numeracy needs, providing the programme is carefully designed to fit with each person's needs, lifestyle, and proficiency with digital technologies and literacy. Realising the potential of e-learning also depends on ongoing professional development for tutors and others who support learners, and may require changes to programmes and resources within the relevant organisations, such as colleges and private training providers. Moreover, for adult learners, ease of access to training in the workplace and at home requires development of infrastructure and support from employers and whānau.

Distance e-learning can provide a cost-effective way of extending the development of LLN skills of learners currently at Level 2 of the Adult Literacy and Life Skills survey. In this review, we refer to this level as an *intermediate* level of literacy. Longer-term learning pathways often include e-learning (National Center for the Study of Adult Learning and Literacy in the USA (NCSALL), cited in Litster, 2007, p. 17).

The recommendations set out below each finding are directed at a range of groups: practitioners including tutors, LLN course developers, resource and game developers, tertiary education organisations and private training providers, companies and industry organisations (including industry training organisations (ITOs)), public services including libraries, policy makers including government departments and agencies, e-learning service providers including telecommunications companies and community organisations including iwi and churches.

1. Lack of research evidence directly related to the question

FINDING 1A: MORE RESEARCH IS NEEDED

We found no *direct* research evidence in the research literature to show that e-learning enhances adult literacy and numeracy skills and second-language acquisition. However, we did find indirect evidence of gains in studies with other populations, including adults. Recent syntheses of e-learning literature express concerns about the rigour of some studies and the

challenges of locating and mapping relevant studies.

Recommendations:

- Encourage continuing research in this field. Such research should clearly articulate its terminology and offer theoretical underpinnings that are sufficiently complex to aid the evolution of pedagogical practice that draws on digital technologies. At times this will involve multiple and competing frameworks. How new 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;
- Collaborate internationally to review research and development worldwide, and disseminate the findings of this research to the New Zealand tertiary sector.

2. Characteristics related to learning (overarching)

FINDING 2A: E-LEARNING IS MORE EFFECTIVE IF IT IS PART OF FACE-TO-FACE TRAINING

Most adults are best suited to e-learning that is blended with other learning approaches, including face-to-face tutoring and other staff support. Some adult learners become autonomous users of ICT when learning. However, most continue to benefit from blended e-learning, and some continue to need intensive support. Adults with LLN needs who have had little exposure to computers tend to fear e-learning until they develop some ICT skills and confidence.

Recommendations:

- Provide guidance on web-based opportunities for adults and those who support them, and provide a means of assessing whether the adult is prepared for e-learning, and the level of support he or she will need;
- Recognise that the resources and strategies that allow the development of the ICT skills and literacy necessary for e-learning are valuable but can be challenging to develop and use because of the widely varying situations in which they are typically employed;
- Disseminate information about web resources throughout the adult education sector, particularly in regard to LLN and bridging programmes, along with resources that give ITOs, mentors and tutors methods of blending these resources into their work with adults who have LLN needs;
- Encourage and support research and development of web-based resources that fit the needs of New Zealand adults.

FINDING 2B: APPROPRIATE RECRUITMENT, RETENTION AND COMPLETION PRACTICES INCLUDE E-LEARNING

Adults participate in LLN courses for various reasons. Encouraging adults not only to enter courses but to stay on and complete them calls for deployment of a wide range of different strategies to ensure relevance to each adult's circumstances and needs, including e-learning.

Encouraging adults to participate in LLN courses requires deployment of a wide range of strategies. Successful strategies include:

- Recruitment where updating ICT skills acts as both a relevant context and a cover to reduce embarrassment that is often associated with LLN needs;

- Marketing the courses in a way that attracts students from diverse backgrounds and with different reasons for wanting to undertake study;
- Increasing the flexibility of course delivery with e-learning;
- Advertising courses in a range of positive ways, including the web and word of mouth from past students;
- Providing students with optional e-learning opportunities, such as online learning activities or e-based activities that draw on and link the learners into their communities;
- Blending e-learning with distance learning from support centres in the locality, such as libraries (see also Finding 6D).

FINDING 2C: LLN ACTIVITIES ARE MORE EFFECTIVE WHEN THERE IS A STRONG EMPLOYMENT AND CAREER FOCUS

Activities related to employment- and career-related training are more effective than generic LLN training and e-learning, but only if they are tailored to vocational and local contexts.

Recommendations:

- Relate LLN to workplace needs, career contexts and other life roles;
- Encourage employers to provide assistance at all stages, including early diagnosis and e-learning extensions to programmes;
- Provide orientation that includes career counselling;
- Ensure that ICT skills and workforce updating using e-learning are designed to address LLN needs as well as other employment-related skills.

FINDING 2D: FAMILIES, WHĀNAU AND COMMUNITIES PLAY AN IMPORTANT ROLE

Adults are more likely to succeed in their literacy and numeracy learning when the learning environment acknowledges and respects their values and cultural backgrounds. Families, whānau and communities have a critical place in literacy development, often adding motivation and a context within which learners can practise simple literacy and numeracy. They may also assist learners to use e-learning. Life roles such as parenting and community service also provide relevant contexts to develop LLN.

Recommendations:

- Provide a learning environment that acknowledges the different cultural backgrounds of their students;
- Provide a range of ways of delivering adult learning opportunities in order to accommodate the diverse needs of LLN learners who have family, whānau, community and workplace commitments;
- Relate LLN to life roles such as parenting and community service;
- Consider a range of delivery modes, among them evening courses, workplace training, whānau-/family-oriented programmes and community-/church-based programmes;
- Use e-learning and digital media to support activities in culturally relevant ways;
- Provide web-based guidance for whānau and friends wanting to support the adult learner to use e-learning.

FINDING 2E: COMPUTER GAMES CAN RE-ENGAGE YOUNGER ADULTS

Computer games often provide a non-threatening, enjoyable means of re-engaging younger

adults with LLN, providing the LLN requirements are clearly identified for the learners and they have opportunity to reflect on what is required and what they need to do. These games also provide both learner and tutor with an informal means of assessing learning needs.

Recommendations:

- Set design standards and develop support materials that allow players to integrate the games into adult LLN contexts, including those that occur at home;
- Provide professional development for tutors in the use of games on computers, the web and mobile devices;
- Encourage peer interaction so as to leverage the learning advantages of collaboration;
- Encourage learners to discuss their game-playing experiences and to debrief.

FINDING 2F: MOBILE LEARNING OFFERS NEW WAYS TO BLEND WORK AND LEARNING

Mobile learning offers new ways to blend work and learning and increase access to LLN. Careful embedding is necessary to ensure the LLN activities fit well within the workplace and educational organisations.

Recommendations:

- Consider innovative ways of using mobile digital technologies during e-learning in order to increase transfer of learning between education, 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. 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), may be required.

3. Characteristics related to learning (specific)

FINDING 3A: MĀORI APPROACHES TO E-LEARNING CAN BE USED TO BUILD SKILLS AND KNOWLEDGE WITHIN THE MĀORI COMMUNITY

Māori people have a history of adaptation to new technologies. E-learning can support the development and maintenance of Māori language and culture. Computers are an identified strategy to make the delivery more flexible and to increase learner control, as well as to build capacity within Māori people.

Recommendations:

- Encourage development of e-learning resources suited to Māori;
- Partner with Māori leaders and communities to develop the capacity (including acquisition of LLN and e-learning skills) of Māori students;
- Celebrate stories of embedding e-learning and LLN in Māori educational contexts and consider how these initiatives can be used to improve western-style practice;
- Adopt Māori educational philosophy (kaupapa Māori), especially in terms of supporting peers, whānau, iwi, and intergenerational learning;

- Provide academic mentoring during recruitment as well as detailed orientation and follow-on;
- Develop transition programmes, including those involving e-learning skills, to encourage prospective adult students to attend tertiary education and to introduce new students to their educational institution;
- Ensure staff and peers are culturally aware, approachable and consistent;
- Celebrate the cultural capital that Māori students bring to the educational context, by marking appropriate cultural events, incorporating Māori culture within pedagogical practice, and using an expanding range of media, including e-learning, as part of these initiatives;
- Research which e-learning principles and practice best support ongoing skills development for Māori adult LLN students.

FINDING 3B: AS LONG AS ADEQUATE SUPPORT IS IN PLACE, E-LEARNING PROVIDES A GOOD SOURCE OF PRACTICE AND MOTIVATION FOR SECOND-LANGUAGE (ESOL) LEARNERS

Although ESOL students and their tutors bring certain strengths to e-learning, these students have a wide variety of needs. Many ESOL students become autonomous learners, but all require tutor support in order to use e-learning successfully.

Recommendations:

- Provide ESOL adults with support from a tutor, particularly at the beginning of their course, so they can learn how to use e-learning independently and/or with support from whānau;
- Use the wide range of e-based language-learning practice resources available to ensure that the diverse range of needs evident among second-language learners is accommodated;
- Develop customisable resources to support adult learners new to New Zealand and/or e-learning;
- Develop and/or adapt additional resources and add-on tools that enhance writing, reading, speaking and listening for specific populations (eg Samoan) 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 locations, including the workplace. Encourage these people to use their professional networks to share good practice.

FINDING 3C: THE DIVERSE PASIFIKA PEOPLES BENEFIT FROM E-LEARNING THAT FITS THEIR RESPECTIVE CULTURES AND LIVES AND IS ACCOMPANIED BY INDUCTION ACTIVITIES

When supporting Pasifika adults to build their LLN skills, providers and tutors need to take account of particular barriers to and supports for their learning. Providers and tutors need, amongst other considerations, to provide course content that has connections with the learners' cultures and to provide a nurturing learning environment. E-learning makes course delivery more flexible for these learners and gives them a measure of control over the nature and pace of their learning.

Recommendations:

- Recognise the diversity of cultures and experiences of Pasifika people;
- Encourage the development of e-learning resources suited to Pasifika;

- Partner with Pasifika leaders and their communities to develop the capacity, including LLN and e-learning skills, of these communities;
- Provide academic mentoring when recruiting Pasifika adults into educational courses, and then ensure they receive detailed orientation and follow-on;
- Develop transition or induction programmes, including those involving e-learning skills, to encourage prospective students to attend tertiary education and to introduce new students to their place of study;
- Ensure that staff and peers are culturally aware, approachable and consistent;
- Celebrate the cultural capital that Pasifika students bring to the educational context by providing them with appropriate cultural events, incorporating their culture into pedagogical practice, and using an expanding range of media, including e-learning, as part of these initiatives;
- Research which e-learning principles and practice best support ongoing skills development of Pasifika adult LLN students.

FINDING 3D: MANY OF THE E-LEARNING STRATEGIES USED FOR BUILDING READING AND WRITING SKILLS CAN ALSO BE SUCCESSFULLY USED FOR AND BY ADULTS WHO HAVE DISABILITIES THAT LIMIT THEIR ABILITY TO LEARN AND/OR ACCESS LEARNING

Most adults, including adults with learning disabilities (LD), find the information and communication technologies (ICT) provisions that fit their needs are highly useful and can reduce exclusion. However, lack of compatibility between systems and software can lead to the exclusion of some learners, including those who use technology for communication.

Recommendations:

- 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;
- Favour the use of generic software, where possible;
- Provide both learning and technology support services, and facilitate cooperation between these services to aid skills development of adults with disabilities that impede ability to learn;
- Align e-learning tuition for these adults with their individual needs, and ensure there is adequate tuition (quality and length of time) for their needs;
- Provide support and professional development for tutors and others who support these learners so that they can assist these adults to embed relevant e-learning tools in their lives.

4. Strategies used by effective tutors

FINDING 4A: EFFECTIVE TUTORS ARE WELL ABLE TO APPLY WHAT THEY HAVE LEARNED THROUGH PROFESSIONAL DEVELOPMENT IN E-LEARNING AND PEDAGOGY

Tutors need professional development to support changes in content delivery, such as e-learning. Although a few early adopters self-manage this professional development, a systematic approach is necessary to develop the ICT skills of all tutors and their understanding of how both e-learning and LLN can be embedded in the learning process. The same applies to company training, which should include provision for all those involved in facilitating and assessing LLN skills.

Recommendations:

- Seek opportunities to develop the ICT skills and 21st-century knowledge they need to be effective practitioners of e-learning (with embedded LLN tuition where necessary);
- Acknowledge that time is needed to mature tutors' 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 achieve their teaching aims;
- Provide a range of professional development opportunities, including informal networking (so that educators can share successful e-learning innovations) and formal, accredited programmes. Having staff conduct their own action research relative to their growing understanding and use of e-learning is a valuable professional development strategy;
- Encourage the appointment and active engagement of e-learning and LLN champions (leaders outstanding in their field). By partnering with tutors, champions can offer the support that tutors and other relevant staff need to build their confidence in their ability to use ICT in LLN learning contexts;
- Showcase and encourage the uptake of the work of relevant action research projects at national conferences and locally;
- Model hands-on use of ICT in learning contexts as well as the principles and practice of e-learning in general;
- Plan e-learning strategies and related accredited professional development that aligns with the vision that tutors, their managers and support staff have collectively developed in relation to e-learning for adults with LLN needs.

FINDING 4B: EFFECTIVE TUTORS HAVE AT HAND A RANGE OF STRATEGIES

Effective literacy learning for adult learners relies on tutors acquiring and/or having access to a wide range of literacy learning strategies appropriate to the needs of these learners. Tutors need to understand that adult students with literacy learning difficulties benefit from access to a range of interventions, including e-learning opportunities and support.

Recommendations:

- Understand that adult students experiencing literacy learning difficulties require a range of interventions, among them the following:
  - Assessment of adults' LLN learning needs;
  - Follow-on, with formative and summative assessment, including e-assessment suited to each adult's level of proficiency and learning context;
  - Tutor-developed resources and activities that meet the specific needs of each adult;
- Remember that well-embedded interventions can help increase literacy development;
- Research and collaboratively develop interventions and resources suited to adults' LLN needs, including e-learning resources.

FINDING 4C: LEARNERS BENEFIT FROM ENGAGING WITH AND DEBATING THE CHARACTERISTICS AND USEFULNESS OF DIFFERENT TYPES OF LITERACY MEDIA

Learners who are given opportunity to engage with and discuss the merits of different types of text enhance their literacy skills. Along with opportunity to use conventional texts, learners should be able to access a wide range of digital media, such as interactive multimedia, websites, and video, including television.

Recommendations:

- Encourage learners to engage with and discuss with one another different types of conventional text as well as the wide range of digital media available, such as interactive multimedia, websites, and digital video, including television;
- Develop case studies of good practice in engaging with and debating different media;
- Research and develop promising interventions with digital text, including video/movies with subtitles for underserved groups, such as Māori and Pasifika, as well as strategies for using these resources.

FINDING 4D: TUTORS CAN USE ICT TO CREATE AND MODIFY LLN MATERIALS, RESOURCES AND LEARNING CONTEXTS

Tutors can use ICT to modify and create materials that provide adult learners with engaging LLN learning resources and a meaningful and relevant learning milieu. ICT-based resources help adult learners gain awareness and appreciation of the need to have good literacy and numeracy skills in the 21st century, including technology-related skills.

Recommendations:

- Support LLN tutors and collaborating staff by providing them with their own laptop computers and a range of productivity software, including common office applications, multimedia tools and e-learning resources;
- Share tutor and ITO materials online in a format that encourages tutors to customise and further develop them, eg using a creative commons licence;
- Purposefully develop communities of practice for LLN tutors that not only include online opportunities for collaboration embedded within training courses but also complement existing local, regional and national networks.

FINDING 4E: DIAGNOSTIC AND FORMATIVE E-ASSESSMENT CAN BE DEVELOPED AND USED MORE WIDELY

While e-assessment is currently being applied successfully in relation to LLN pedagogy for diagnosis and formative assessment, its use for summative assessment may be limited. For some learners, e-assessment could support individual training that employs integrated learning systems (ILS), but only if these are blended with other teaching strategies. Attaining such objectives is likely to be challenging.

Recommendations:

- Ensure that implementation of e-assessment is accompanied by adequate guidance on collecting and interpreting resultant data;
- Consider the limitations that e-assessment may have on the types of assessments that can be used;
- Provide coherent organisational and professional development relating to e-assessment for practitioners across all relevant parts of tertiary education, including the course providers and the assessment/examining authorities;
- Recognise that large-scale e-assessment is challenging, especially in terms of ensuring robust interlinked web-based systems for this time-critical application that involved data that should remain confidential and secure. Ongoing development of testing centres and their infrastructure is required;
- Continue research and development into e-assessment, including ongoing overview of research and development in other countries;

- Encourage those people developing and implementing e-assessment and ILS in New Zealand to join the growing international community of practice in this area.

FINDING 4F: LEARNING IS ENHANCED WHEN TUTORS AND THEIR ADULT STUDENTS WORK COLLABORATIVELY, THUS DEVELOPING LEARNER AUTONOMY

Tutors need to provide a supportive and collaborative learning environment for adult students if they are to succeed in improving the LLN skills of these students. ICT-related and e-learning skills can be added to the factors that characterise effective LLN tutors.

Recommendations:

- Create a positive and supportive learning environment, including collaborative activities to help LLN learners realise that they are not alone;
- Develop learner autonomy through collaborative, authentic activities, including e-learning, with other learners and/or their tutor;
- Draw on learners' diverse backgrounds, contexts and LLN strengths with diverse resources and activities that include ICT skills.

FINDING 4G: EFFECTIVE DEVELOPMENT OF NUMERACY SKILLS REQUIRES A RANGE OF STRATEGIES

LLN programmes that encourage adult learners and their tutors to collaboratively seek out and consider the range of strategies that will best facilitate each learner's numeracy learning not only enhance that learning but also give these adults greater awareness of the increasing place and importance of numeracy and ICT-related numeracy skills in the 21st century.

Recommendations:

- Relate numeracy learning, including ICT-related numeracy learning, to the everyday numeracy experiences of their adult learners;
- Use learners' diverse home, work and community experiences in a manner that allows learners to make connections between these experiences and mathematical concepts;
- Allow learners to explore relationships in quantities, space and data by using concrete examples where possible;
- Support tutors and others who facilitate numeracy development, such as employers and ITOs, to develop learning activities relevant to workplace contexts;
- Raise the profile of numeracy in the everyday environment, including the workplace;
- Encourage further research that investigates numeracy acquisition by adult students with LLN needs, including e-learning.

5. Staff and e-learning resource development

FINDING 5A: STAFF INVOLVED IN E-LEARNING NEED PROFESSIONAL DEVELOPMENT IN HOW TO EMBED BOTH E-LEARNING AND LLN IN THEIR TEACHING PROGRAMMES

Providers of training and e-learning need to ensure their staff are involved in professional development that focuses on their content area, on ICT use and on how both e-learning and LLN can be embedded in the learning process. There needs to be systematic professional development for adequate organisational development.

Recommendations:

- Facilitate ongoing professional development for their teaching staff, using research-informed strategies in a variety of formats;
- Encourage the appointment of ICT/e-learning, literacy and numeracy experts to promote tutors' confidence;
- Promote partnerships between staff members that allow them to develop their use of ICT in numeracy and literacy;
- Realise that partnerships can be conducted remotely through email, telephone and other forms of e-communication, such as free desktop video-conferencing services (eg Skype);
- Showcase and encourage the uptake of the work of relevant professional development action research projects, including work involving hands-on learning and e-learning, at national literacy conferences, as well as locally through partnerships;
- Acknowledge that teaching staff need to know why they are using e-learning and match its use to their learning and teaching aims.

FINDING 5B: STAFF PROFESSIONAL DEVELOPMENT PROGRESSES OVER TIME IN ORDER TO ADDRESS THE DEVELOPING AND CHANGING CONCERNS OF THE INDIVIDUALS INVOLVED

Staff development is informed by individual concerns, which change over time. Once individuals reach the final stage of development, "tutor as leader", they are fully able to support adoption of similar innovations by the staff with whom they network. Successful staff development over time also involves continuing access to and engagement with emerging resources and procuring support from within professional organisations.

Recommendations:

- Recognise that professional development is a work in progress because tutors, along with teacher educators, grow into a community of practice that supports tutors as they endeavour to bed in LLN and e-learning;
- Celebrate the stages of development that tutors and teacher educators move through, especially the most mature stage, "tutor as leader", because it is at this stage that teachers are most likely to enhance the growth of the whole community;
- Raise leaders' awareness that tutors who do not work in a supportive climate (ie one that gives them and their students easy access to e-learning and LLN support) will have difficulty moving through the stages and may revert to earlier stages if the climate becomes more challenging;
- Encourage tutors comfortable with the web to engage in computer-networked professional development in order to support the growth of both local and national communities of practice;
- Appreciate that a computer-networked professional development approach is not suitable for tutors involved in the early stages of tutor professional development for e-learning.

FINDING 5C: "UNBUNDLING" THE ROLES PLAYED BY E-LEARNING TUTORS FACILITATES TARGETED PROFESSIONAL DEVELOPMENT AND UNDERSTANDING OF HOW TUTORS CAN BETTER SERVE THE NEEDS OF THEIR STUDENTS

E-learning permits and stimulates an "unbundling" of the tutor's role, a process that makes explicit the need for professional development for a wider range of staff, including the e-tutor (who teaches via e-learning), the m-tutor (who coaches and advocates for the student), the d-tutor (who designs resources used online), and all the leaders who work with them.

Recommendations:

- Recognise the usefulness for professional development, administration, e-learning, in general, and distance learning, in particular, of breaking down (unbundling) the roles that tutors typically play;
- Appreciate that while these diverse roles can be the province of one member of staff, e-learning is likely to be better served when several members of staff take up these roles;
- Provide ongoing professional development and support targeted to the needs of each type of tutor;
- Encourage managers and leaders to promote, establish and participate in e-learning professional development that includes preparation of relevant materials, such as case studies.

FINDING 5D: E-LEARNING RESOURCES FOR ADULTS ENGAGED IN LLN PROGRAMMES ARE MORE EFFECTIVE WHEN DESIGNED WELL

Designing e-learning for adults with LLN needs brings additional challenges to those creating, developing and maintaining e-learning websites, e-assessment and related resources and services. The individuals carrying out this work need guidance on the principles of universal design as well as on what constitutes best practice regarding the design of e-learning, in general, and of websites, related services and project management, in particular.

Recommendations:

- Remember that effective e-learning rests on the application of sound e-design and universal design principles, relating not only to all elements of the e-learning provision, but also to its particular features, such as websites, related services and related project management;
- Ensure that design and testing work and ongoing support lead to reliable and robust systems so that the user interface and technical issues do not undermine adults' (often) fragile confidence to develop their LLN;
- Note, in this regard, that adults with a low level of literacy skill benefit from very simple interfaces with few distractions and options, that audio, images, simulations, and multimedia are beneficial, and that formative assessment can be used to good effect to minimise distractions, guide options and inform the learner's plans;
- Recognise that ICT skills will remain highly variable. For example, while some learners have excellent gaming skills, the ability to read a screen or use a mouse cannot be assumed. This caution is especially in respect of older adults;
- Recognise that LLN learners' access to computers and the internet will remain lower than the average population. Some of these adults only have access to old computers and/or have dial-up internet access. In addition, reliance on a continuous internet link and/or broadband is not advised;
- Promote e-learning design that enables many sub-packages and versions to be made for hundreds of employment and community contexts, while also responding to software updates and the variety of computer systems;
- Encourage and support open-source initiatives to serve these diverse vocational and cultural needs and the needs of the distributed communities of New Zealand and the wider Pacific region;
- Remember that mobile learning (m-learning) is increasing, so versioning for mobile devices is a highly relevant option;
- Plan to embed tutor and mentor support. This support should include resources that will help the learner continue learning while away from their tutor or organisation.

6. Characteristics relating to educational organisations and society

FINDING 6A: ORGANISATIONS MATURE WITH RESPECT TO E-LEARNING AND EMBEDDING OF LLN

Organisations mature in their ability to adopt innovations, including e-learning and LLN. Leaders can use known stages of maturity and characteristics of innovations to ensure that the work they put into designing e-learning platforms and bedding in LLN occurs smoothly across time.

Recommendations:

- Encourage the active support of a senior manager when bringing in an e-learning innovation because this support is essential for embedding e-learning and LLN. At times, conflicts arise in situations involving multiple innovations. This situation arises partly because multiple innovations compete for resources, such as the time that the e-learning coordinator has available to deal with difficulties and conflicts. Such situations require resolution by an organisation's leaders;
- Ensure buy-in from middle managers, as these people can facilitate or block developments. These people also need to be encouraged to work closely when developing organisational strategy;
- Encourage leaders, coordinators and developers to apply Rogers' (2003) characteristics of innovation (relative advantage, compatibility, complexity, trialability and observability) to improve the coherence of multiple innovations with the institutional vision and available resources.

FINDING 6B: SUCCESSFUL DEVELOPMENT OF ADULT LITERACY IS CLOSELY LINKED TO ICT COMPETENCE AND EMPLOYMENT-BASED EXPERIENCE

Adults who do not have LLN and ICT skills tend to be excluded from the labour market and society, and increasingly so in the 21st century, where all forms of literacy are vital for effective participation in these milieu. This consideration is even more cogent in times of economic recession.

Recommendations:

- Develop a combination of provisions to raise adults' literacy skills, ICT competence and employment opportunities in order to give them a sound chance of securing and retaining employment;
- Encourage employers to provide both tutors and adults intent on developing their LLN skills with access to relevant ICT systems so they can develop training materials and the requisite skills;
- Recognise that LLN in the 21st century must include the "new literacies" associated with ICT and e-learning;
- Address the LLN needs (including, as necessary, development of the new literacies) for adults with LLN needs who plan to return to work after a break.

FINDING 6C: E-LEARNING PROJECTS TARGETING RURAL AND DISPERSED COMMUNITIES ARE AT A VERY EARLY STAGE

Although innovative projects on e-learning for LLN in rural and dispersed communities are evident in New Zealand, these are still at a very early stage of development or

implementation. They are consequently not at a point that would allow researchers to scrutinise them in order to provide quality research evidence and/or determine critical success factors.

Recommendations:

- Continue research and development in e-learning that includes long-term partnerships with rural and dispersed communities;
- Recognise that these innovations are in the early stage of development and that those responsible for them will need to maintain or improve their attributes if the innovations are to be sustainable.

FINDING 6D: OPEN-ACCESS CENTRES, INCLUDING LIBRARIES, INCREASE ACCESS TO E-LEARNING

Open-access learning centres in the community, including libraries and facilities on employers' premises, can increase access to e-learning. However, they can only do this with appropriate support and opportunity to develop and engage in partnerships.

Recommendations:

- Bear in mind that learning centres in the community, such as libraries and those on employers' premises, can increase adults' access to e-learning;
- Remember that the success of such access for learners depends not only on these learners receiving appropriate support but also on the centres operating in partnership with other individuals and organisations involved in the learning programme;
- Encourage ongoing investment from the community served, as this support is essential for sustaining the e-learning infrastructure and e-learning services;
- Recognise that robust and reliable IT-based infrastructure is critical;
- Ensure that adults' first experiences with e-learning are successful in terms of building these learners' confidence in and appreciation of the use and relevance of e-learning;
- Prepare staff, procedures and resources that align with the learners' cultures and backgrounds and link with other aspects of their lives;
- Encourage libraries to increase privacy and duration of internet access to benefit adults with LLN needs;
- Encourage and support mentoring that spreads into the communities served, and that draws in adults who have successfully developed their LLN and e-learning;
- Investigate the potential of emerging technologies (including mobile learning on PDAs and phones) as well as software applications, open-access centres and community support to reach underserved populations of adults and their communities.

1 INTRODUCTION

1.1 Research rationale and purpose

The 2006 Adult Literacy and Life Skills (ALL) survey showed that over a million adult New Zealanders are missing some of the skills they need to successfully accomplish the literacy and numeracy tasks common in today's society and economy. Many of these adults are people who speak English as a second language (Satherley, Lawes and Sok, 2008). Lack of literacy and numeracy skills can adversely affect adults' chances of being employed, earning a good income and helping their children succeed in education (Earle, 2009). Similar reports have been published elsewhere, including Canada (Statistics Canada, 2008).

The government has created a national infrastructure for adult literacy, language and numeracy (LLN). Its aim in doing this is to bring together the diverse parts of the adult learning sector by way of a common language for identifying, teaching and assessing LLN skills. The work involved in developing and maintaining the infrastructure includes the creation of shared resources, such as an online assessment tool and adult literacy and numeracy programmes.

The research set out in this and accompanying documents was conducted by members of the University of Canterbury E-Learning Lab. The research brief required the researchers to investigate how e-learning fits into learning programmes and courses directed toward adults wanting to improve their LLN skills, and to consider how such provision can be used to reach greater numbers of such learners and better meet their respective needs. In short, the research explores the role that e-learning does and can play in improving the LLN skills of adults.

The primary question guiding both this literature review and our full research project was this:

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

We decided to draw together two bodies of literature and to analyse them to draw out the key success characteristics. The two bodies of literature were:

- Literature on adult literacy and numeracy;
- Literature on e-learning, including blended learning, across all phases of education and training, including distance, with a particular focus on those situations in which information and communication technologies (ICT) are used to enhance classroom-based practice.

The project report and our case study of a polytechnic are available at http://www.educationcounts.govt.nz/publications/tertiary_education/.

1.2 Terminology and underlying concepts

In this report, we use the Adult Literacy and Life Skills (ALL) survey levels of literacy, particularly Level 2 of the ALL. Throughout the review, we refer to this level as an *intermediate* level of literacy—a level that often appears to be the threshold at which learners become less dependent on a tutor. Earle (2009) provides more information on the ALL survey and the New Zealand data.

In this report, "e-learning" refers to the use of digital technologies to support learning and teaching. E-learning is an ever-evolving process because it emerges from the possibilities afforded by continually developing digital technologies. These technologies can be in the hands

of tutors, learners and those who support them. These individuals create and recreate e-learning applications and resources through evolving behaviour as individuals and across groups and society.

Tertiary programmes often harmoniously blend digital technologies into activities designed to enhance learning. Sometimes the blending involves the presence of a tutor (as with the use of a digital tool in a classroom setting) and sometimes not (as in distance learning via a computer). Blended application of digital technologies can also be designed to fit with activities in the workplace and at home. For example, distance learning in New Zealand workplaces commonly includes workbooks, with periodic visits by assessors. This mode of workplace learning may be extended with e-learning in a number of ways, including directed use of web-based resources at home with support of whānau (immediate and extended family members).

Our approach to literacy is based on current theories of (and is supported by research on) literacy development. Because literacy develops from within a social context, it is viewed as a socio-cultural phenomenon. We align with Vygotsky's (1978) perspective on literacy learning. This perspective focuses on what is termed "the zone of proximal development", wherein explicit teaching and collaboration with and by peers and tutors are an essential means of developing new understandings among learners. Cullen (2002) extended this notion of collective learning by exploring, within what she defines as the post-Vygotskian era, the values and expectations of the broader community. Her definitions of thinking and learning as social constructions permit a favouring of socio-cultural and critical approaches to literacy acquisition. These constructions also have relevance for numeracy development.

1.3 Reservations

Our intention when conducting the literature review was that it would be up to date as of April 2009 and include an examination of recent approaches to LLN in New Zealand and internationally, including Australia, Canada, Ireland, the United Kingdom and the United States. We also sought to include some later findings published by the Ministry of Education from research conducted as part of parallel projects. However, as we got underway with our search, we developed important reservations regarding the quality of literature available to review. We could find no studies that directly researched the question central to our investigation (see above). The paucity of research on LLN (numeracy in particular) in adult education means that the findings of research conducted in the school sector continue to be applied to adults (see, for example, the review titled *Lighting the Way*, Ministry of Education, 2005), and this was the approach we had to adopt in this review when considering e-learning relative to adults' LLN learning.

We also bring to readers' attention the notion that the e-learning and ICT literature has not been conducted from a neutral perspective but mainly according to a capitalistic and often industrial or technocentric viewpoint (Ministry of Education, 2008a; Selwyn, 2004). Both Dutton (2004) and Rogers (2003) warn of the capitalist tendency to view technological innovations as beneficial rather than to carefully weigh both the positive and the negative effects that the implementation or addition of information and communication technologies (ICT, also known as IT) might have on educational practice. Critics of ICT in education (eg Cuban, 2001; Oppenheimer, 2003) cite evidence in support of their claim that ICT is "oversold and underused". They ask if ICT is as cost-effective as other interventions, such as smaller class size, and they note the obsolescence of computers and the ongoing costs of upgrading both hardware and software.

We furthermore draw attention to the recent recognition that ICT and education co-evolve (see, for example, Andrews and Haythornthwaite, 2007; Davis, 2010). Another recent development is

use of an ecological metaphor to improve understanding of the complexity of educational policy (Weaver-Hightower, 2008). In our study, co-evolution relates to the embedding of e-learning and LLN in learning programmes and courses. Researchers who fail to recognise this co-evolution and complexity are those likely to present oversimplified findings and to draw erroneous conclusions.

1.4 Structure of this review and key findings

In this literature review, we outline the nature of the extant literature pertinent to our research question. We also describe and discuss the key success characteristics that emerged from our review in relation to engaging adults in e-learning designed to develop their literacy, language and numeracy (LLN) skills. We set this material out in six sets of research-based findings (1–6).

1. Lack of research evidence directly related to the question.
2. Characteristics relating to learning (overarching).
3. Characteristics relating to learning (specific).
4. Strategies effective tutors use.
5. Staff and e-learning resource development.
6. Characteristics relating to educational organisation and society.

In the summary section of this report, we simply list each finding and its implications for policy and practice. Here, we repeat each of the findings and its implications. We also analyse, and include brief reference citations for, the literature reviewed. We provide full bibliographic citations in the reference section and describe in Appendix 1 the method that we used to conduct the literature review.

The overarching message to emerge from our research is that e-learning is relevant to and useful for most adults with literacy, language and/or numeracy needs. However, these benefits rely on a learning programme that is carefully designed to fit with each person's needs and lifestyle, his or her proficiency with digital technologies, and his or her level of reading literacy.

Another important message is that realising the potential of e-learning depends on ongoing professional development for tutors and others who support learners, and may require changes to programmes and resources within faculties of the relevant organisations, such as colleges and private training providers. For adult learners, ease of access to training in the workplace and at home requires development of infrastructure and support from employers and whānau.

Two further important messages to emerge from our review relate to cost and time. First, distance e-learning can provide a cost-effective way of extending the development of LLN skills of learners currently at Level 2 of the ALL survey. As noted earlier, we refer, in this report, to this level as an *intermediate* level of literacy.

Second, ensuring that adult learning programmes offer learners sufficient time for their study is important because some research indicates that these learners typically need a minimum of 100 hours of study to increase their LLN skills by one level (Litster, 2007, p. 15). These longer-term learning pathways often include e-learning ((National Center for the Study of Adult Learning and Literacy in the USA (NCSALL), cited in Litster, 2007, p. 17).

2 FULL LITERATURE REVIEW

The literature review is part of a study for the Ministry of Education. It is complemented by other outcomes as described in the introduction. The primary question guiding this study is:

> 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?

It is important to note that e-learning is not a separate mode of learning but an embedded mode of learning. It is just one of the tools that tutors and learners have at hand, as suggested by the International Reading Association (2009). The New Zealand Interim Tertiary e-Learning Framework (Ministry of Education, 2004) suggests that e-learning will probably become a redundant term because nowadays a great many learning experiences have elements of digital content incorporated within them or use digital technologies in some way.

This review is structured into six sets of findings (2.1–2.6) relating to key success characteristics. Within each set, each finding and its implications (presented in summary form) are expanded with a section presenting the research analysed. Appendix A describes the methodology used to conduct the review. A full listing of the references cited in the text is provided at the end.

2.1 Lack of research evidence directly related to the question

Finding 1A: More research is needed

There was no *direct* research evidence in the research literature to show that e-learning enhances adult literacy and numeracy skills and second-language acquisition. However, there was indirect evidence from studies with other populations, including adults. Recent syntheses of e-learning literature express concerns about the rigour of some studies and the challenges of locating and mapping relevant studies.

Relevant research

Earlier efforts directed at exploring quality research on adult literacy and numeracy programmes within New Zealand showed a paucity of research linking these programmes with improvements in adult literacy skills.

An extensive review conducted by Benseman, Sutton and Lander (2005) and a subsequent synthesis undertaken by Benseman and Sutton (2007) for the Ministry of Education "sought original research studies [involving e-learning] that reliably relate specific aspects of teaching practice and programmes' operations to learning outcomes—especially demonstrable changes in the literacy skills of learners" (Benseman and Sutton, p. 7). The researchers found that the lack of such research in the New Zealand context was similar to the lack in the international context, where coverage was only marginally better.

Similar concerns have been expressed about the *rigour* of research on online learning (Lewin et al., 2008), although a recent meta-analysis of empirical research in higher education and secondary schools led by Barbara Means (Means, Toyama, Murphy, Bakia and Jones, 2009) provides robust evidence that e-learning can be more successful than the learning that occurs in face-to-face courses. In addition, Means and her colleagues concluded from their findings that online distance learning which blends this form of educational provision with face-to-face tuition has the most potential for successful learning outcomes because of the increased time

and resources deployed by the learners and those who teach them (Means et al., 2009). Both sets of researchers found no studies of online learning by adults with literacy and/or numeracy needs.

To add to these concerns, we, as researchers, note a varying use of terminology in both the literacy, language and numeracy (LLN) literature and the e-learning literature. The reason for this variation may be because this multidisciplinary body of literature is spread across many journals and other print and online sources.

In a recent report, the British Education and Communication Technologies Agency (BECTA), a UK-based organisation that promotes the use of ICT in teaching and learning, noted that, despite e-learning being widespread throughout the workplace in the UK, there is a low level of LLN provision at the basic-skills level (BECTA, 2008). BECTA also noted a decreasing use of Learn Direct courses within work-based learning in the UK, a finding supported by a study carried out by the Mackinnon Partnership (2008). While 40 percent of the organisations that the Mackinnon Partnership surveyed said they were providing their students with an online learning space, three-quarters of them were offering this provision in only some of their courses. The online provision included use of electronic learning materials, e-portfolios and online tests.

According to another UK-based study (Overton, Hills and Dixon, 2007), e-learning incorporated in work-based learning appears to aid the delivery of a range of skills, such as communication, leadership and management, and foreign language acquisition. This process also appears to allow for a wide range of company-specific programmes. However, the researchers observed that the extent to which the employment sector is using e-learning programmes is hard to estimate because only about one-third of work-based learning providers appears to be e-enabled while the remaining two-thirds may be unaware of the full benefits of technology-supported learning.

Our efforts to locate sustained and robust research studies on LLN learning for adult students at the functional levels, where elements of e-learning were being used to enhance learning outcomes, proved challenging. We found no direct evidence from published studies that e-learning benefits adults with LLN needs. There is also a more general lack of evidence in the literature on adult literacy that learning gained through e-learning transfers to the workplace (Taylor, Ayala and Pinsent-Johnson, 2009).

The lack of research, both quantitative and qualitative, specifically focused on the nature and benefits of incorporating e-learning into LLN courses or teaching programmes for adult learners at the functional levels led us to reassess our goals. On the recommendation of the research team's principal investigator, and after consultation with her international and national colleagues within the wider field of e-learning, we decided to include only that research which related to areas surrounding our specific focus.

However, the stakeholder interviews (presented in the case study report of our research) that we conducted during this project not only allowed us to identify a range of current relevant initiatives but also to detect research presently underway in New Zealand. We expect that a range of evidence of the kind we initially sought from our review may emerge in the near future (see Davis, Fletcher and Absalom, 2010, in this regard).

Implications of these research findings for practice

Recommendations:

- Encourage continuing research in this field. Such research should employ consistent use of terminology and offer theoretical underpinnings that are sufficiently complex to aid the

evolution of pedagogical practice that draws on digital technologies. How new 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;
- Collaborate internationally to review research and development worldwide, and disseminate the findings of this research to the New Zealand tertiary sector.

2.2 Characteristics related to learning (overarching)

Finding 2A: E-learning is more effective if it is part of face-to-face training

Most adults are best suited to e-learning that is blended with other learning approaches, including face-to-face tutoring and other staff support. Some adult learners become autonomous users of ICT when learning. However, most continue to benefit from blended e-learning, and some continue to need intensive support. Adults with LLN needs who have had little exposure to computers tend to fear e-learning until they develop some ICT skills and confidence.

Relevant research

Many adults do not have access at work to computers, and some of those who do have such access have had little exposure to these machines. This situation is especially true for older adults and those who have been out of the workforce for some time. They fear that they will break the computer; they are scared to touch it in case they "damage" it or make it "crash". But although fearful, these adults generally appreciate the need to develop ICT literacy. Providing these adults with intensive support directed at familiarising them with ICT before they undertake LLN learning via e-learning is imperative (Davis et al., 2010; Wagner & Kozma, 2005).

Ability to use computer systems requires what have been coined 21st-century literacy skills. Several studies (Askov, Johnston, Petty and Young, 2003; Benseman and Sutton, 2007; Dofs, 2007; Litster, 2007) suggest that the adult learners most likely to become autonomous users of e-learning tools and to gain maximum benefit from these are people with the following characteristics and opportunities:

- Comfortable, ongoing access to a computer with internet access and the skills to use it;
- Literacy skills sufficient to give them the confidence to get started and make immediate progress;
- Clear goals that give them strong motivation to succeed;
- Access to support from whānau and/or employers as needed;
- A good induction to e-learning resource(s);
- No technical issues likely to block access.

They are also people who tend to:

- Be well organised and/or able to recruit others to support them;
- Engage in learning activities that have direct relevance to their everyday lives;
- Receive regular feedback on their learning;
- Be able to recognise their cultures in the design and pedagogy of their e-learning, and in the support they receive during that learning.

The studies also suggest that the adults with LLN needs who might most readily become autonomous users of e-learning focused on enhancing literacy and/or numeracy skills are likely to be confident second-language learners of English (ESOL) and to have a first language that has commonalities with English. E-learning tools encompassing this premise currently available in New Zealand include BBC Skillswise (http://www.bbc.co.uk/skillswise/words/spelling) and USA Learns (Sacramento County Office of Education, n.d.).

According to Askov et al. (2003), adults with LLN needs that fall below the mid level of the Tertiary Education Commission (TEC) progressions can successfully use e-learning tools if these tools are blended with other resources and support from a tutor in a class or some other individual able to provide appropriate support. Nash and Kallenbach (2009) found that e-learning tools can enhance adults' motivation to continue learning and can also be used to increase outreach into rural communities, providing factors described in Finding 6D are addressed.

While adults with needs below the TEC progressions are likely to need intensive support, many are often unaware that they do. As our case study within a polytechnic illustrates, this support includes not only the generalised support needed to maintain motivation but also specific tuition, such as a mentor identifying where to look on a computer screen and showing the learner how to click or type to choose levels and tasks (Davis et al., 2010). The case study also shows that advice and assistance from whānau and peers can successfully complement tutor support.

As studies by Derham-Cole (2008) and Milne, Gilbert and Barr (2005) remind us, the blending of e-learning must be flexible enough to fit with each adult's needs, including the skills he or she wants to develop and his or her ability to access ICT. Both of these studies focused on the ITO Careerforce, which leads training for New Zealand health and disability professionals. In her study, Derham-Cole (2008) looked at a specific e-learning project undertaken by Careerforce. The project involved outsourcing the production of an e-book on literacy. This move led, during the 2006/2007 teaching year, to a CD-Rom intended for use with PC computers and alongside the workbooks that Careerforce was already using. Unfortunately, the e-book approach was unsuccessful because:

- Some students had difficulty accessing the CD-Rom;
- Although the ITO identified additional content and other platforms, including the web, as relevant e-resources for many of its students, these resources could not be updated or re-versioned by anyone other than the contractor;
- Despite initial support and a contract that included provision of training along with workplace assessment, the employers saw time spent on the e-books as generic literacy training that was not directly relevant to their workplace.

Derham-Cole's (2008) example suggests that any organisation intending to implement an e-learning innovation should carefully think through its development and inception.

According to Derham-Cole (2008), in 2004 Careerforce drew on its initial experience with e-learning to plan a large-scale e-learning initiative that would include a range of characteristics, such as on-the-job embedded learning and assessment, face-to-face sessions in the workplace, webcasts and podcasts, performance support, collaboration and community, multimedia archives with CD-Rom, and web-based learning. We did not find an evaluation of the outcomes of this plan.

Implications of these research findings for practice

Recommendations:

- Provide guidance on web-based opportunities for adults and those who support them, and to provide a means of assessing if the adult is prepared for e-learning and the level of support he or she will need;
- Recognise that the resources and strategies that allow the development of the ICT skills and literacy necessary for e-learning are valuable but can be challenging to develop and use because of the widely varying situations in which they are typically employed;
- Disseminate information about web resources throughout the adult education sector, particularly in regard to LLN and bridging programmes, along with resources that give ITOs,

mentors and tutors methods of blending these resources into their work with adults who have LLN needs;
- Encourage and support research and development of web-based resources that fit the needs of New Zealand adults.

Finding 2B: Appropriate recruitment, retention and completion practices include e-learning

Adults participate in LLN courses for various reasons. Encouraging adults to enter courses and to stay on and complete them calls for deployment of a wide range of different strategies to ensure relevance to each adult's circumstances and needs, including e-learning.

Relevant research

A wide range of personal factors influence each individual's decision to enhance his or her literacy and numeracy skills. A study by the Basic Skills Agency of the United Kingdom found that the main reasons the research participants gave for wanting to improve their literacy skills were to feel better about themselves and to be better at everyday tasks (Sticht, 2001). In their qualitative research into the experiences of adults returning to formal literacy learning in the New Zealand environment, Boyd, Cates, Hellyer, Leverton, Robinson and Tobias (2002) observed that the backgrounds and experiences of the participants were diverse and their motivations to learn were complex and dynamic. The reasons given included the desire to be a good parent, to motivate and help their children to learn to read and write, and to put prior negative schooling experiences behind them by returning to formal learning as an adult student. These reasons align with those given by adult learners in another recent New Zealand-based study conducted by White (2009).

A well-established body of research literature documents not only the challenges and barriers involved in improving the literacy skills of adults but also the expected benefits, which extend beyond those that affect only the individual (Appleby and Bathmaker, 2006; Pannucci and Walmsley, 2007; Prins, 2007). Barriers include the shame that individuals often feel if they have poor literacy skills in a largely literate society (a level of embarrassment that can lead some to "hide" their problems) and the resulting difficulty of raising these issues publicly (Bartlett, 2007; Burnside, 2005; "Canada's Shame", 2006; Wolf, Williams, Parker, Parikh, Nowlan and Baker, 2007).

In their study of adult students undertaking a literacy skills course in New Zealand, Fletcher and Williams (2008) said the students frequently stated that fear of attending and completing a literacy course would be diminished if prospective students knew the course offered a positive and non-threatening learning environment. They suggested that those offering the course should set in place an advertising campaign that stressed the comfortable learning environment and used prior students' comments about how they had overcome fears such as self-doubt and discomfort. They also said that this message could be made more widely available to the target audience by advertising in venues such as doctors' waiting rooms, Plunket rooms (Plunket is a major provider of child health care in New Zealand) and working men's clubs, and on community notice boards. More flexible course times would help students to accommodate time constraints; an extra option could be a weekend block session.

Nash and Kallenbach's (2009) review of an adult learner persistence project in New England, USA, noted programme providers endeavouring to meet challenges and attitudes among their learners similar to those expressed by the adults in Fletcher and William's (2008) study. Three of the 18 programmes involved in the project had chosen computer-based strategies to expand learning options for their students. The strategies included distance learning through drop-in centres in libraries, a learning management system (Moodle), multimedia content on DVD (English for All) and paper-based learning linked to e-games and other e-learning resources

commonly available to ESOL adults. In addition to extending recruitment through outreach and having measures in place to improve retention, tutors actively helped the students become less dependent and more autonomous learners so that they could continue learning on their own after class.

Although Nash and Kallenbach (2009) found that these initiatives produced learning gains for the students, the gains were not as robust as they could have been because of constraints relating to programme organisation and staff professional development. For example, the students' access to e-learning was variable and significant technical problems tended to occur during start-up phases. Other literature also warns of the adverse effects of poor access to e-learning for those already disadvantaged by their LLN needs and lack of social capital (see, for example, Grabill, 1998; Osborne, Gallacher and Crossan, 2004; Thompson, Putthoff and Figueroa 2006).

Programmes offering ICT use as a means of either enhancing or complementing literacy and numeracy skills tend to attract and retain students, especially if what they provide is seen as relevant to workplace skills. ICT, as this research shows, can be an effective way of drawing people in New Zealand (Davis and Fletcher, 2010) and abroad (Aldridge and Tuckett, 2008; Simmons, 2002) into foundation provision (also known as basic skills provision). Aldridge and Tuckett's exploratory survey of the courses most popular among adult learners found that these courses were those that involved computer skills, information technology (IT) and the internet. This provision not only encouraged learners into the programmes but also encouraged their participation in other learning programmes.

ICT provision and acumen is a central feature of 21st-century literacy and numeracy programmes, as the New Zealand Curriculum attests. In addition, studies of work-based numeracy, such as that by Noss, Bakker, Hoyles and Kent (2007), tell us that while ICT can reduce the need for certain skills (such as computation), gains in workplace productivity still require a workforce with a firm grasp of numeracy concepts, even when the members of that workforce already have good ICT skills.

Implications of these research findings for practice

Encouraging adults to participate in LLN courses requires deployment of a wide range of strategies. Successful strategies include:

- Recruitment where updating ICT skills acts as both a relevant context and a cover to reduce embarrassment that is often associated with LLN needs;
- Marketing the courses in a way that attracts students from diverse backgrounds and with different reasons for wanting to undertake study;
- Increasing the flexibility of course delivery with e-learning;
- Advertising courses in a range of positive ways, including the web and word of mouth from past students;
- Providing students with optional e-learning opportunities, such as online learning activities or e-based activities that draw on and link the learners into their communities;
- Blending e-learning with distance learning linked to support centres in the locality, such as libraries (see also Finding 6D).

Finding 2C: LLN activities are more effective when there is a strong employment or career focus

Activities related to employment- and career-related training are more effective than generic LLN training and e-learning, but only if they are tailored to vocational and local contexts.

Relevant research

A 2008 New Zealand skills and training survey of 536 employers, conducted by Gerritsen (2008) on behalf of Business NZ and the Industry Training Federation, found literacy and numeracy the third most important skill area cited. Thirty-five percent of the respondents noted that some of their employees had problems with literacy and numeracy. Although 50 percent of the respondents noted these skills as important, only 9 percent offered their employees up-skilling in this area. Of those employers prepared to offer their employees assistance, nearly all cited problems with finding training providers.

In Australia, a survey of e-learning programmes supported by public funds (Smith, 2009) led to the development of guidelines for Australian industries wanting to integrate e-learning into their work-based professional development. When asked about the design features of effective e-learning programmes, all of those surveyed stressed the presence of work-relevant tasks; 95 percent noted contextualised content. Most respondents cited LLN needs as a reason for using facilitated e-learning. Just under 40 percent said they checked literacy and numeracy levels when assessing learner readiness.

Several studies show that unemployed people are less likely than those in employment to attempt to improve their skills, including literacy, even though improvement would advance their employment prospects. Appleby and Bathmaker (2006), Pannucci and Walmsley (2007) and Prins (2007), among others, stress that the need for good literacy skills is very much to the fore these days, given that more and more jobs require such skills, and given that well-performing and productive workplaces offer societies the benefits of economic competitiveness on both the national and the international stage.

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 two researchers noted that most of the learners they surveyed valued learning relevant ICT skills, and that these learners played an important part in attracting other students to the courses. These students furthermore provided valuable role models for family and community members, and some went on to mentor peers. Also in Canada, Taylor et al.'s (2009) study of the transfer of learning to the workplace from four different employment preparation programmes sheds light on the socio-cultural learning that develops and the importance of the tri-partnership of the instructor, trainee and workplace supervisor. Although skills profiles described career-related needs, the authors noted that such segmentation of curriculum disrupted appropriate embedding of learning into relevant contexts. Learning occurred best through various life roles, including a role as a parent or Canadian citizen.

Other, more general, reviews of research (eg Stites, 2003) and a study from the USA on improving retention (Smith, 2009) also note the advantages of providing careful support for learners. However, the authors caution that such care will not be effective unless the programme in question offers its students appropriate and easy access to e-learning.

Implications of these findings for practice

Recommendations:

- Relate LLN to workplace needs, career contexts and other life roles;
- Encourage employers to provide assistance at all stages, including early diagnosis and e-learning extensions to programmes;
- Provide orientation that includes career counselling;

- Ensure that ICT skills and workforce updating using e-learning are designed to address LLN needs as well as other employment-related skills.

Finding 2D: Families, whānau and communities play an important role

Adults are more likely to succeed in their literacy and numeracy learning when the learning environment acknowledges and respects their values and cultural backgrounds. Families, whānau and communities have a critical place in literacy development, often providing learners with motivation and a context within which they can practise simple literacy and numeracy. They may also assist learners to use e-learning. Life roles such as parenting and community service also provide relevant contexts to develop LLN.

Relevant research

The community is interested in improved levels of literacy amongst its members because literate people contribute more to the greater good of the community, in both economic and social terms (Benseman, 2006; Biddulph, Biddulph and Biddulph, 2003). Low levels of literacy seriously impede the development of skilled workforces (Satherley, Lawes and Sok, 2008).

Literacy is culturally bound; the notion of cultural capital holds that students' academic achievements are shaped by the family and the school's social and cultural resources (Bourdieu and Passerson, 1977). Language, as a medium of culture, is a central element of society. Bourdieu's (1984) theory of cultural capital holds that students whose values and attitudes accord with those of their educational provider are more likely to succeed at school and beyond than are those whose cultural dispositions differ from those of the provider. In New Zealand, and in other countries, the poor scholastic performance of members of some minority cultures can be explained by their alienation in institutions dominated by the mainstream culture (Nechyba, McEwan and Older-Aguila, 1999).

The achievement gap between students from lower and higher socioeconomic status (SES) backgrounds and with (generally) concomitant levels of cultural capital can be seen as early as school entry, and the gap tends to widen as students progress through the education system. Students from low-SES backgrounds tend to perform at the lower range of achievement on standardised tests and other measures of literacy competency (Au, 2002; Elley, 1992; Farstrup, 2002; Flockton and Crooks, 2003, 2005).

A large body of literature now exists to show SES and ethnicity as correlating factors in literacy achievement (Au, 2002; Biddulph et al., 2003; Gaine & George, 1999; Wylie and Hodgen, 2007). Sectors of the population that fall outside the "mainstream" are generally those most vulnerable to the intergenerational effects of poverty and unemployment (Biddulph et al., 2003).

Family, whānau and community understanding of and support for sound literacy development is thus critical. Successful literacy instruction builds on the knowledge and understandings that students bring to the learning environment from their diverse cultural and language backgrounds (Alton-Lee, 2003; Au and Raphael, 2000; Biddulph et al., 2003). Partnerships developed between family, whānau and the educator facilitate effective instruction (Gee, 1990).

Improving the literacy of parents with poor literacy skills has a positive impact on children's achievement (Biddulph et al., 2003). Improving the literacy levels of adults in general also has positive impacts on the literacy acquisition of the next generation. Longitudinal research conducted by Biddulph et al. (2003), Wylie (2005) and Wylie and Hodgen (2007) found that mothers' literacy abilities and attitudes have a long-term impact (whether positive or negative) on their children's scholastic achievement.

Benseman (2006) observed in 2006 that, in New Zealand, the government then funded not only traditional modes of literacy development for adults (such as evening and workplace-based courses) but also family-oriented adult literacy programmes. This funding, Benseman explained was built on the premise that engaging parents and children together in literacy activities enhances the literacy levels of both and establishes learning communities around schools.

The Manukau family literacy programme PACTT (Parent And Child Time Together) provides a useful New Zealand-based example (Benseman, 2006). In place for several years now, PACTT uses three different but complementary strategies to deliver its provision. First, adult learners can spend daily time in the classroom with their children. Second, each month, they can engage in a class session involving the sharing of literacy expertise. The session takes place during school/early childhood centre time. And, third, they can participate in a family or whānau session that includes food and focuses on a literacy "event", such as a quiz evening, guest speaker (eg a children's book author), or a play written by the adults and presented to their children. The adults who are part of this programme can study for a university-accredited Certificate in Introduction to Early Childhood Education. According to the City of Manukau Education Trust (2008), just over 90 percent of these adults acquire the qualification.

Teen parent units and their attached early learning centres, first established in New Zealand in the 1990s, provide another useful example of how parents and children can successfully engage with one another in literacy activities. One teen parent unit, Karanga Mai Young Parents College, endeavours to enhance the literacy levels of the students and their children through the following means:

- Encouraging the young adult learners to read daily to their children (the children attend the onsite early learning centre);
- Timetabling the young adults to engage once a week in a learning activity with their children in the early learning centre;
- Having the classroom and early childhood teachers regularly model and encourage reading to the children.

According to J. Hinden-Miller (founding principal of the college, personal communication, 12 June 2009), this type of dual focus is successfully breaking down intergenerational patterns of educational deprivation. She considers that developing the literacy of young parents and children in group settings, as occurs at Karanga Mai, is a particularly effective strategy to use with young people disengaged from education and characterised by educational underachievement.

A report documenting events and practice at another New Zealand teen parent unit, Te Whare Whai Hua, examines the role that ICT can play in assisting teen parents with literacy difficulties, learning gaps and negative attitudes to learning. The author of the report (Charteris, 2005) found that ICT offered many ways of helping these young people feel comfortable within the learning environment. She noted, from her observations, that learning using ICT, assuming adequate access, provided the parents with a portal for learning, supported their learner-centred activities, linked them with providers, experts and other community members, and helped them learn about their children's development. Digital images and use of computers to write learning narratives, in concert with the early childhood staff, appeared to be particularly effective ICT-based learning strategies.

Family and whānau can offer adult learners important motivation and support that might include tutoring. All of the adults in a literacy class in our case study of an urban polytechnic who were using e-learning or other ICT outside that classroom were supported by one or more whānau (Davis et al., 2010). Some of these adults said they were motivated by their children and grandchildren to develop their literacy; engagement with these youngsters provided a context

for their practice. 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 & Ward, 2009). Activities related to everyday life challenges and family can also support e-learning by providing strong motivational contexts.

Grandparents now able to read to their grandchildren and offer these youngsters support as they develop their LLN skills is an example. Mellar, Kambouri, Logan, Betts, Nance and Moriarty (2007) allude to this type of motivation in their description of a promising e-learning course in the UK designed to help adults support children's learning as a means of also developing their (the adults') LLN skills. Greenwood, Te Aika and Davis (2010) also note this motivation for adults learning through the wānanga (see Finding 3A).

Implications of these findings for practice

Recommendations:

- Provide a learning environment that acknowledges the different cultural backgrounds of their students;
- Provide a range of ways of delivering adult learning opportunities in order to accommodate the diverse needs of LLN learners who have family, whānau, community and workplace commitments;
- Relate LLN to life roles such as parenting and community service;
- Consider a range of delivery modes, among them evening courses, workplace training, whānau/family-oriented programmes and community/church-based programmes;
- Use e-learning and digital media to support activities in culturally relevant ways;
- Provide web-based guidance for whānau and friends wanting to support the adult learner to use e-learning.

Finding 2E: Computer games can re-engage younger adults

Computer games often provide a non-threatening, enjoyable means of re-engaging younger adults with LLN needs, providing LLN-related requirements are clearly identified for the learners and they have opportunity to reflect on what is required and what they need to do. These games also provide both learner and tutor with an informal means of assessing learning needs.

Relevant research

In learning contexts, the intention behind games is to interest and motivate learners by creating compelling and immersive learning situations and to imbue an educational activity with the benefits that technology has to offer (Bynner, Reder, Parsons and Strawn, 2009; Kambouri, Schott, Thomas, Pavlou and Mellar, 2003; Garris, Ahlers and Driskell, 2002; Gee, 2003; McFarlane, 2007; Prensky, 2001; Sefton-Green, 2003).

Kambouri et al. (2003) documented and evaluated two computer games used to stimulate and provide learning opportunities for adult LLN learners in outreach centres associated with the Learn Direct initiative in the UK. The two games were played on desktop computers, using the local area network or a CD-Rom. The authors found that the games offered a non-threatening recruitment aid for younger adult males (16 to 36 years of age), a group that is typically hard to reach in educational terms, and were influential in engaging the participation of females and second-language learners. The games furthermore provided both learners and tutors with a means of informally evaluating learning needs.

The students who used ICT to discuss the games and support their performance benefited from increased literacy practice and reflection on their performance. Use was more effective when learners appreciated relevant LLN outcomes. Because the tutors tended to let students play without their support, Kambouri and colleagues (2003) recommended the provision of

guidelines and support materials for tutors, and in so doing signalled the importance of staff development. The researchers also developed a framework that enabled use of m-learning on hand-held devices in both individual and community contexts. (M-learning involves use of mobile information and communication tools; see Finding 2F.)

However, those adults who were not game players did not find the games engaging; the time they spent developing the skills needed to operate both hardware and software distracted them from LLN activities. According to several other researchers, successful game learning relies on learners communicating with their tutors about what they are learning and how they are learning (and prefer to learn). Game learning is particularly successful when those learners who enjoy gaming can control aspects of the game, test out ideas, collaborate with other people and interact with peers (Klopfer and Squire, 2008; Sharples, Corlett and Westmancott, 2002; Sim City, 2002). Providing learners with feedback (both positive and negative) empowers them to delve deeper into the game and their learning (Garris et al., 2002).

Traditional "edutainment" titles presented in repetitive drill form are still being produced and marketed to schools and parents. While the drill and practice embedded within some games is a proven principle of education and learning (McFarlane, 1999), we need to seriously question if such activities should occupy a significant part of such resources, especially given the ready access these days to more relevant and demanding learning tasks (McFarlane, 1999).

The tutor or mediator is often as important as the game itself in promoting useful learning. The learning "coach", claim Kirriemuir and McFarlane (2007), has many assets and roles, including understanding of the game, keeping the students "on track", and troubleshooting. The two authors therefore recommend the provision of background/help/training materials for both the tutor/motivator and for the students, and they stress that these resources must include curriculum-relevant tasks and content, allow users to save their work at regular intervals, and offer home versions that are compatible with the original "full" versions, so that the students can continue the game at home.

Implications of these research findings for practice

Recommendations:

- Set design standards and develop supporting materials that allow players to integrate the games into adult LLN contexts, including those that occur at home;
- Provide professional development for tutors in the use of games on computers, the web and mobile devices;
- Encourage peer interaction so as to leverage the learning advantages of collaboration;
- Encourage learners to discuss their game-playing experiences and to debrief.

Finding 2F: Mobile learning offers new ways to blend work and learning

Mobile learning offers new ways to blend work and learning and increase access to LLN. Careful embedding is necessary to ensure the LLN activities fit well within the workplace and educational organisations.

Relevant research

Mobile learning, often shortened to m-learning, refers to learning activities made possible through use of lightweight hand-held devices. These devices continue to be at the forefront of technological development and so change rapidly. They include mobile phones/smart phones, portable audio/multimedia players and digital voice/video recorders. Because m-learning research is so recent, it is mainly descriptive. More robust research is urgently required.

The range of innovative projects using this technology includes applications designed to extend study on the job and the development of just-in-time skills. Hand-held devices are increasingly

being used on the factory floor to guide and monitor processes, such as in a Canadian car factory where workers use these tools to facilitate the selection and fitting of components (Sticht, 2001). Multimedia audio, images and video can be used to enhance communication and increase personalisation for learning-disabled students. Use of hand-held devices may increase a sense of control and independence (Smith, 2009). When carefully embedded into the LLN plan and adults' learning activities, m-learning tends to motivate these learners and boost their morale. As Smith (2009) points out, podcasts and vodcasts, which are becoming increasingly common in educational contexts, allow tutors and students to produce additional materials that support adults' LLN skills. Such materials might include a picture/audio/text dictionary or instructions for a set of skills that the adult is developing through practice.

Simple, brief communication using mobile phones to send text messages has also been successful for LLN learning. This activity might involve learners texting questions to their tutor, or a tutor texting quick multiple-choice questions to learners to maintain their learning activity and increase retention (Davis et al., 2010). Tutors might also decide to send multiple texts to a class of adults using an online service and to integrate this facility within a learning management system, such as Moodle. Chan and Ford (2007) provide an example of just this in their research and development of a New Zealand bakery programme. They, along with Smith (2009), also highlight the possibility of encouraging adults to gather evidence of their achievements at work by using images collected on a mobile phone. As our case study demonstrated, this approach may require the polytechnic to give vouchers to students that allow them to pay their mobile phone costs.

A UK Futurelab literature review provides guidance for those designing m-learning. The authors of the review (Naismith, Lonsdale, Vavoula and Sharples, 2004) note that the design approach must take account of the learning context and the other activities that are part of the study programme. They set out these recommendations:

- Investigate a cost model for infrastructure, technology and services;
- Study the requirements of all those involved in the use of the technology (learners, tutors, content creators) to ensure it is usable and acceptable;
- Assess that the technology is suited to the learning task and examine advantages and disadvantages of each technology before making a decision on which one to use;
- Assign the necessary roles for initiating and thereafter supporting mobile learning;
- Develop procedures and strategies for the management of equipment when it is provided by the institution;
- Provide training and (ongoing) technical support to the tutors to enable them to use mobile technologies to enhance current, and to enable new, instructional activities;
- Consider the use of mobile technologies for student administration tasks;
- Consider the use of mobile technologies to support collaborative and group learning;
- Discover and adopt suitable applications that match the needs of your specific classroom and map directly to your curriculum needs;
- Ensure security and privacy for the end users (Naismith et al., 2004, p. 4).

As Kazmer (2007) reminds us, challenges for tutors include designing such resources and receiving suitable professional development and support. Kazmer's commentary suggests that even though development of resources and activities, including learning objects, is at an early stage, it offers considerable promise educationally. Therefore, we can expect a rapid evolution of m-learning devices and software and ongoing development of affiliated learning resources, pedagogy and organisations. However, Kazmer cautions that this rapid development, and the

likelihood that instructors and designers will have difficulty predicting how students will personalise their e-learning spaces, makes it important to recognise the impact of the variety of contexts in which students learn and will use such resources.

Kazmer (2007) illustrates this very concern by describing the successful development of m-learning at post-secondary level of the US Army's project EArmyU. Instead of having adult learners engaged in one traditional classroom, the army supports these adults to develop their learning within several different networked social worlds. This approach, says Kazmer, has implications for the set-up phase of any such programme. At this point, careful negotiation is needed among the designers, instructors, adult learners and collaborating employers in order to facilitate reasonable expectations for LLN development and to fit this development, on an ongoing basis, into workplace routines and safety considerations.

Implications of these research findings for practice

Recommendations:

- Consider innovative ways to use mobile digital technologies during e-learning in order to increase transfer of learning between education, 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. 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) may be required.

2.3 Characteristics related to learning (specific)

Finding 3A: Māori approaches to e-learning can be used to build skills and knowledge within the Māori community

Māori have a history of adaption to new technologies. E-learning can be used to support the development and maintenance of Māori language and culture. Computers are an identified strategy to make the delivery more flexible and to increase learner control, as well as to build capacity within Māori people.

Relevant research

In New Zealand, many Māori students have been underachieving in literacy and exhibiting disengagement from and alienation at school (Alton-Lee, 2003; Flockton and Crooks, 2005; Ministry of Education, 2009a; Organisation for Economic Co-operation and Development, 2001; Wylie and Hodgen, 2007). Macfarlane (2007) emphasises that in order to support Māori students, educators need to improve the contexts in which these students learn, by striving to connect with their culture. This approach means educators need to use teaching and learning practices that are culturally responsive. More specifically, Macfarlane stresses that educators need to design instruction that builds on what the students already know, to form and maintain positive and effective relationships with the students, and to develop a nurturing environment. In addition, when students or tutors choose to work with Māori content, then it is important to protect that content from misuse by keeping it within a secure site (Campbell and Hawkesworth, 1999; Hond, 2004; New Zealand Council for Educational Research, 2004).

According to May (2009, p. 8), successful programmes for adults with LLN needs address their respective lifestyles 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. For these reasons, Māori prefer courses that are either fully or partly face to face rather than fully online (May, 2009).

Zepke and Leach's (2002) description of preferred Māori approaches to learning is useful because it provides information on the key success characteristics of these approaches. Metge (2001) and Ministry of Education (2009b) gives us a picture of preferred Māori approaches to learning. Māori generally like working in groups and they prefer a holistic approach to learning incorporating all four dimensions of the person—wairua (spiritual), hinengaro (intellectual), tinana (physical), and whatumanawa (emotional). They also like face-to-face contact and discussion, and they prefer their learning to be related to real-life tasks (Zepke and Leach, 2002, p. 316)

A recent analysis of three research projects, focused on adult Māori learners undertaking study in foundation learning programmes taught by Māori tutors, used kaupapa Māori research approaches, with the key feature being the prominence of the Māori participants' voices (May, 2009). The students reported that their current study contrasted starkly with the negative experiences many of them had encountered in their prior learning, including foundation programmes, where there had been a disconnection from Māori contexts. All three studies found that a critical success factor was acknowledging that Māori are not homogeneous but bring unique and diverse experiences to their learning. The students reported significant economic barriers, lack of support with childcare and, for some, homelessness. Key findings were the need for te reo Māori to be used as a primary vehicle of tikanga (custom) and learning and for learning to take place on a marae (Māori traditional centre) setting in order to provide a safe and accessible context for learning and reinforcing Māori identity.

Mlcek et al. (2009) explored foundation learning opportunities in marae-based settings. The authors concluded that foundational learning programmes embedded in marae-based programmes improve the capacity and capabilities of Māori learners by providing a learning environment that is safe yet also challenges and takes people out of their comfort zones. Here, learners are able to improve their reading, writing and oral language skills in te reo Māori or English or a combination of both. Mlecek and colleagues noted that many of the students in these wānanga experiences were "late learners, adult learners" and that they reported getting back their mana and wairua, experiencing deep emotion, and improving their te reo levels. The presence of tupuna (ancestors) and kaumatua (elders) enhanced the foundation learning. Teachers who were confident and expert in te reo Māori and tikanga supported learning overall.

In 2004, the New Zealand Council for Educational Research published a study of three courses that successfully engaged Māori learners. On the basis of their findings, and in line with May's (2009) findings (above), the council recommended blended courses that incorporate kanohi ki te kanohi (face-to-face) interaction and recognition, and they stressed that the building of whakawhanaungatanga (relationships) is more likely to be achieved through this approach than through fully online courses. However, because the courses did not include students with significant LLN needs, these recommendations need to be considered cautiously in relation to Māori adults with LLN needs.

In an investigation carried out by Zepke and Leach (2002, 2006), leaders of professional development courses for tutors in ITOs with a high proportion of Māori and Pasifika described their reasons for using a structured video to provide a storyline for their course materials and activities for trainers. The leaders considered some video or videoconferencing an essential part of their courses, and their decision not to use internet-based e-learning was mainly due to access issues in New Zealand at that time.

Although internet access has increased since the 2002 study, poor access and low ICT skill levels remain ongoing in many rural locations and homes with lower incomes (see Finding 6B). Satellite technologies hold potential for these communities, however, as evident from an initiative involving interactive distance e-learning in Australia's New South Wales and Northern Territory. According to Crump, Twyford and Littler (2008), the initiative has been widely and rapidly implemented and has particularly benefited indigenous adults and school-age children in the remote areas of these two parts of Australia.

A study of 13 Māori and three Pasifika private training establishments (PTEs) conducted by the New Zealand Qualifications Authority (NZQA, 2008) in order to identify successful teaching and learning practices found that the most commonly mentioned techniques for delivery of course content included the use of technology such as computers (noted by 12 of the 16 PTEs). The PTEs said that computers were playing an increasingly large part in their range of delivery options. Computers, they said, made the delivery system more effective, which resulted in learners taking increasing control of their learning (NZQA, 2008, p. 36). Culturally relevant philosophy/kaupapa practice was also cited in the report's key findings.

> The three key components to creating a holistic, good-practice Māori/Pasifika Private Training Establishment (PTE) were: adopting the surrogate whānau/aiga concept; creating a sense of belonging; and creating a sense of greater humanity. The third theme closely resembles the Māori theme of inclusivity.
>
> Tutors play a pivotal role in influencing the attitudes and efforts of learners. Good-practice tutors were seen as being flexible, committed, having a passion for teaching, being focused on the learners, and able to motivate them.
>
> The needs of students were generally paramount in driving the development of the PTEs. Student needs included academic, personal, social, and whānau needs.
>
> To meet student needs, the PTEs adopted flexible course structures and timings. They also developed individualised learning plans, and used one-on-one learning. They also encouraged student reflection and feedback.
>
> The four key organisational characteristics of good-practice PTEs were: the characteristics of managers; having a robust quality management system; recruiting, developing, and supporting high-quality tutors; and maintaining good external relations. (p. 62)

Greenwood and Te Aika's (2009) research study investigated an alternative, deeply embedded approach for e-learning developed by Te Wānanga o Raukawa, which was the first of the Māori tertiary institutions. A confederation of three main iwi groups (Te Ati Awa, Ngāti Raukawa and Ngāti Toa Rangatira) set up the wānanga in 1981 in order to build capacity among their people and those connected to them. Making computer competence and e-learning a core part of every programme was a result of the vision of the founder of the wānanga, Whatarangi Winiata, who wanted to find a way for Māori to be part of the current knowledge revolution. In line with Māori philosophy, the goal is that the technology will empower not only the students but the whole whānau and iwi.

The adults attending the wānanga include many with literacy and numeracy needs. Distance learning on over 20 marae located in New Zealand's two largest islands has been made possible via e-learning, which provides access to tuition for over half of the students. The students attend intensive face-to-face residential courses situated in a Māori cultural context. Before and after the residential component, they undertake self-directed study and research through a programme that includes blended e-learning. The students are supported in a manner that allows them to view the world through Māori eyes and to behave according to the core philosophy (kaupapa).

In a later publication, Greenwood and colleagues further described the teaching approach of the wānanga:

> In Māori terms the goals of education are the development of communities as well as individuals and engage spiritual and interactional as well as intellectual domains. To ensure that it is possible to present learning through Māori eyes, all courses are placed in a context that is guided by customary behavioural protocols and values. Such a context is provided on the grounds of the Wānanga itself, on various marae around the country where it has agreed to develop courses, and in the interactions with students on-line and through the help centre. … Decisions about pedagogy are also made on the basis of Māori protocols and values. (Greenwood et al., 2010)

The programme offers two core courses that blend e-learning and develop rorohiko (computer skills) and related capacity among the students' Māori community. The wānanga is committed to Māori development, including computer literacy, not only for the students but also their whānau, hapū and iwi. Because the courses require students to have a laptop and printer and internet connections at home, the wānanga has negotiated cost-effective packages to help the students procure quality equipment and set up an internet connection. Students can add some of these costs to their course fees or student loan.

The wānanga has also developed a programme designed to teach basic computer skills on campus and in block courses for the distance students. A number of the students enrolled in the programme are kuia and kaumātua who want to support their future generations. Acceptance and respect are demonstrated within a kaumātua group, so that those students with a higher level of computer proficiency do not offend those who need more support.

During the six years the programmes have been offered, the Māori-designed course materials and computer interface have advanced the embedding of e-learning into Māori culture. For example, there has been an incremental use of Māori terms for computer parts as a strategy for making e-learning part of a Māori kaupapa rather than something alien.

In addition to conducting the wānanga case study, Greenwood et al. (2010) analysed case studies of informal learning of a Māori dialect. They also looked at an initiative involving learning through Māori TV. The researchers' analyses illustrated ways in which e-learning conducted within and across communities can support Māori diaspora. The researchers identified, from their work, four key success characteristics for Māori learning:

- Supporting learning through use of digital resources (particularly effective in respect of a resurgence of Māori language and culture);
- Visionary leadership;
- Community-based constructions of education;
- Presence of a virtual marae.

As noted earlier, Māori students appreciate a learning environment where they are able to live as Māori and that acknowledges their spiritual, physical and emotional needs (May, 2009). Māori prefer to meet, learn and debate in settings that embrace Māori culture and beliefs. Educational providers wanting to assimilate digital technologies into Māori learning frameworks must be informed by Māori aspiration and kaupapa. Virtual marae need to be created in ways that allow them to blend with the physical marae. As the younger generation incorporates participative web tools in their learning, as they meet and share cultural constructions in learning environments, they will develop exciting possibilities for the local and global futures of all Māori (Greenwood et al., 2010).

Implications of these research findings for practice

Recommendations:

- Encourage development of e-learning resources suited to Māori;
- Partner with Māori leaders and communities to develop the capacity, including LLN and e-learning skills, of Māori students;
- Celebrate stories of embedding e-learning and LLN in Māori educational contexts and consider how these initiatives can be used to improve western-style practice;
- Adopt Māori educational philosophy (kaupapa Māori), especially in terms of supporting peers, whānau, iwi, and intergenerational learning;
- Provide academic mentoring during recruitment as well as detailed orientation and follow-on;
- Develop transition programmes, including those involving e-learning skills, to encourage prospective adult students to attend tertiary education and to introduce new students to their educational institution;
- Ensure staff and peers are culturally aware, approachable and consistent;
- Celebrate the cultural capital that Māori students bring to the educational context, by marking appropriate cultural events, incorporating Māori culture within pedagogical practice, and using an expanding range of media, including e-learning, as part of these initiatives;
- Research which e-learning principles and practice best support ongoing skills development for Māori adult LLN students.

Finding 3B: As long as adequate support is in place, e-learning provides a good source of practice and motivation for second-language (ESOL) learners

Although ESOL students and their tutors bring certain strengths to e-learning, these students have a wide variety of needs. Many ESOL students become autonomous learners, but all require tutor support in order to use e-learning successfully.

Relevant research

Second-language learners of English frequently make good use of e-learning, including the wide range of relevant resources available on the web. These ESOL students and their tutors often bring particular strengths to e-learning, including strong literacy in the learners' native language and a high level of training (the tutors). Some tutors are able to mediate between the learners' native cultures and languages and one or both of the main languages and cultures of New Zealand. UNESCO (2006) provides a straightforward guide, *Using ICT to Develop Literacy*, that is appropriate for all ages and cultures and emphasises the importance of working toward greater equity of access to e-learning.

In her textbook for language tutors, Mishan (2005) promotes the need for authenticity in language learning. When considering e-learning, she focuses on applications that fit learners' lifestyles. The three main e-learning applications that she considers are the web, email and online discussions, and corpora and concordance. The web, Mishan says, is a valuable learning resource and medium. Tutors using the web as a pedagogical tool assume the role of guide. They coach learners toward becoming autonomous users and searchers of the web, steering them "through the barrage of text from within the web that can be quite daunting at first, especially to lower level learners" (Mishan, 2005, p. 243), and thereby helping them develop this foundation skill of the 21st century. Particularly importantly, these tutors help learners evaluate the veracity and usefulness of the information they find when web searching. The web, says Mishan, also provides access to thousands of websites written specifically for language learning. While many of these offer practice via interactive exercises, a good many are of poor quality and replicate paper-based exercises. Mishan accordingly recommends web meta-sites

(eg TESL-J). These, she says, provide a safe yet extensively resourced location in which to place learners.

Email and related communication modes offer fast and authentic means of communication. 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 restricting these opportunities to learners who have intermediate and higher levels of English proficiency.

Because emails and other digital forms of written communication provide a permanent record of learners' utterances, ESOL learners are better able to notice frequently heard idiomatic or colloquial expressions, which they normally find difficult to hear during spoken communication. Email also encourages the oral skill of turn-taking as well as the ability to correct errors without disturbing the flow of conversation. The record furthermore facilitates a meta-linguistic discussion on the features of language, a discussion that is tailored to the learners' own communications. However, teachers and learners need to be mindful of the forms of English language increasingly being used in emails, chat forums and text messaging. Because these forms tend to bend and break linguistic rules, tutors need to carefully structure learning via these tools for their ESOL students (Kung, cited in Mishan, 2005).

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. However, as noted earlier, these are more likely to be successful when blended with tutor support. U.S.A. Learns is an example of this provision. This website has two culturally sensitive interfaces—one in English and the other in the most common first language in the USA, namely Spanish. A preliminary evaluation of this project that we (the authors of this literature review) conducted indicated that its learning content could prove useful for some ESOL learners with an intermediate level of English proficiency but only if blended with tutor support (Davis and Fletcher, 2010).

The Australian second-language learning programme "It's Over to You" recently launched an online version of its DVD-enhanced workbooks. These have been offered to immigrant learners for some time, and they focus on a range of skills levels relevant to both literacy and numeracy. Harris's evaluation (cited in Mishan, 2005) of the mode of study traditionally used by migrants identified three types of inhibiting factors for these learners that are likely to persist with the web-based and DVD versions. The immigrants experienced academic difficulties with materials and found it hard to proceed in the absence of face-to-face assistance from a tutor. This situation was particularly evident for learners with low levels of literacy proficiency—the learners who are of most interest in this present study. Practical difficulties included integrating studies into a busy life: many of the immigrants surveyed in the evaluation were working long hours or were isolated at home with children. The third inhibitor identified was negativity arising out of the learners' unsatisfactory experience of studying.

White (2003) provides a comprehensive overview of language learning in distance education, including learning online, although she does not clarify the overwhelming challenges often experienced by learners with limited literacy. (As we noted earlier, most of the research in this area is based on students who have higher than average literacy skills.) According to White, adult learners are more likely to engage in, benefit from and complete distance learning programmes that offer accessible high-quality support services. This need varies, however, according to the stage of the programme the learner is at. The most effective programme is one that fits well with each learner's disposition, ICT skills and his or her social/work/family environment and values. Also important is feedback on learning early in the programme from an online tutor. White also describes the stages that learners experience when entering a learning

environment. She explains that learners need dedicated support, such as counselling, before the course begins. On entering the course, these learners typically require face-to-face support from tutors that encourages them to interact with their fellow learners and share experiences. Throughout the course, the learners need monitoring and personalised feedback online from their tutor.

In regard to her third e-learning application—corpora and concordance—Mishan (2005) identifies learner attributes that particularly favour language skills development among second-language learners studying online. Learners, says Mishan, whose inductive and deductive reasoning skills are such that they can manage dense language and who are able to use different software applications can 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 that material. According to Mishan, 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. Teachers of learners who do not have the needed degree of proficiency to learn in this way, Mishan continues, can use a concordance to generate highly relevant texts for language exercises.

The ESOL learning literature contains not only useful points in relation to the development of specific language-related skills, but also ideas for e-based learning activities suitable for adult learners with an intermediate level of English-language proficiency. These activities typically draw on English-language usage gathered from and applicable to each learner's current lifestyle, vocational focus and workplace. However, Mueller, Wood, Hunt and Laurier's (2009) detailed description of a second-language learning project based in a community centre provides a note of caution. The project, which used computers to develop the writing skills of adult ESOL learners with a low level of literacy, showed the lengthy individualised support necessary for these learners to achieve success.

We conclude this section with a brief synthesis of research on the four main aspects of language teaching.

- *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, are 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. An exciting new development features simulated robots that allow ESOL students to practise their spoken English on a computer. These robots (or similar agents) continue to produce increasingly natural English language and actions, such as those used by the Artificial Intelligence Foundation that developed the ALICE robot simulation (see Alicebot, n. d). From his evaluation of four such robots in conversational practice with ESOL students of English, Coniam (2008a, 2008b) concluded that the robots' ability to provide some corrections and make some suggestions is promising, but that further development is required before the full potential of these robots can be realised.

Implications of these research findings for practice

Recommendations:

- Provide ESOL adults with support from a tutor, particularly at the beginning of their course, so they can learn how to use e-learning independently and/or with support from whānau;
- Use the wide range of e-based language-learning practice resources available to ensure that the diverse range of needs evident among second-language learners is accommodated;
- Develop customisable resources to support adult learners new to New Zealand and/or e-learning;
- Develop and/or adapt additional resources and add-on tools that enhance writing, reading, speaking and listening for specific populations (eg Samoan) 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 locations, including the workplace. Encourage these people to use their professional networks to share good practice.

Finding 3C: The diverse Pasifika peoples benefit from e-learning that fits their respective cultures and lives and is accompanied with induction activities

When supporting Pasifika adults to build their LLN skills, providers and tutors need to take account of particular barriers to and supports for their learning. Providers and tutors need, amongst other considerations, to provide course content that has connections with the learners' cultures and to provide a nurturing learning environment. E-learning makes course delivery more flexible for these learners and gives them a measure of control over the nature and pace of their learning.

Relevant research

The Pasifika population in New Zealand is growing. In 1991, Pasifika peoples made up 5 percent of the New Zealand population. By 2006, they constituted just under 7 percent of the population (Statistics New Zealand, 2007). Samoans make up the largest proportion of Pasifika peoples in New Zealand (49 percent). They are followed by Cook Island Māori (22 percent), Tongans (19 percent), Niueans (8 percent), Fijians (4 percent), Tokelauans (3 percent) and Tuvaluans (1 percent) (Statistics New Zealand, 2008).

Pasifika children tend to be marginalised in the New Zealand classroom and to exhibit disengagement from and alienation at school (Alton-Lee, 2003; Flockton and Crooks, 2003,

2005, 2006; Organisation for Economic Co-operation and Development, 2001). Wylie and Hodgen's (2007) longitudinal research on competent learners over a 12-year period showed that Pasifika learners tended to be in the lower quartile groups at the onset of the study and that they generally were still in that band of achievement at age 16.

Twenty-two percent of Pasifika school leavers in 2008 did not gain a qualification (Ministry of Education, 2009c). Pasifika underachievement has halved, but school leavers from Decile[1] 1 or 2 schools had 19 percent of their students leave school with little or no formal attainment (Ministry of Education, 2007b). National Certificate of Educational Achievement data for 2007 show that 15 percent of Pasifika students gained three qualifications during their secondary schooling whereas 34 percent of non-Pasifika students gained this number of qualifications. Also, Pasifika students often take three years instead of the two that most other students take to gain two qualifications (Ministry of Education, 2009c). The Ministry of Education has measures in place designed to reduce the disparity in achievement for Pasifika students. The Ministry (2007a) reports progress in this regard, but is mindful that a high percentage of Pasifika students are still not achieving to their potential.

The authors of the *Pasifika Education Plan Monitoring Report* (Ministry of Education, 2006b) and the *Pasifika Education Plan* (Ministry of Education, 2007a) recognise the significant role that families and communities play in relation to the achievement of Pasifika young people at school and, from there, their ability to enter and remain in the workforce. Because underachievement among Pasifika students has been an ongoing situation in New Zealand, the country now has many Pasifika adults whose level of education is problematic. The authors of the *Pasifika Education Plan* (Ministry of Education, 2007a) cite recent surveys of Pasifika adults which show that these adults generally have lower levels of LLN skills than any other ethnic group in New Zealand. One response to this has been the establishment of the Pacific Islands School Community Parent Liaison (PISCPL). The aim of this project is to forge closer relationships between schools and their Pasifika communities in order to improve student achievement (Gorinski, 2005).

Because of the high number of second-language learners among Pasifika peoples in New Zealand, language needs to be a particular focus of remedial educational provision (Ministry of Education, 2007a). When Pasifika students' first language is recognised in their education, it appears to play a key role in building their confidence because the students feel that their tutors really care about their language and culture (Fletcher, Parkhill, Taleni, Fa'afoi and O'Regan, 2009; Taleni, Parkhill, Fa'afoi and Fletcher, 2007). In support of this notion, Tuafuti and McCaffery (2005) claim that raising Pasifika students' self-esteem, self-discipline and self-identity requires the inclusion of Pasifika language and cultural considerations in all aspects of these students' education. Moreover, in line with Vaioleti's (2003) assertion that learning is for the purpose of cultural continuity, educational providers need to recognise that Pasifika students require access to their own language when learning (Fletcher et al., 2009).

Work by Clayton, Rata-Skudder and Baral (2004) on best practices to support Pasifika adult students in online learning supports this claim. The authors investigated the perceptions of Pasifika adults (who typically have limited access to technology) enrolled in an e-learning environment at one of New Zealand's largest providers of education for Pasifika. Clayton and colleagues found that a learning environment that nurtures the Pasifika way of life gives learners greater confidence and a greater willingness to try. They observed that the students began their study with limited academic skills, but that these deficits were successfully addressed by the provision of a three-week induction programme.

[1] Schools in New Zealand are ranked from 1 to 10 as a measure of the socio-economic status of the school community, with Decile 1 being the lowest and 10 the highest.

The authors concluded from their findings that educators need to be aware of the diversity of cultures and experiences within Pasifika rather than treating Pasifika as a homogeneous group. They furthermore recommended that hardware and software costs should be included in the course fees and that institutions delivering education to Pasifika should explore e-learning blended with tutor (preferably face-to-face) support, because this approach is likely to encourage Pasifika adults to enter and complete tertiary education. Finally, Clayton and her colleagues stated that Pasifika students need to have ongoing and regular academic support and that educators need to ensure these learners feel comfortable in the learning environment.

The findings and recommendations of the New Zealand Qualifications Authority study of 13 Māori and three Pasifika training organisations described and discussed under Finding 3A (PTEs) are also relevant to our discussion relative to Pasifika adult learners. So, too, is the work by Zepke and Leach (2002, 2006) outlined under Finding 3A.

Although the above researchers and commentators call on educators to provide Pasifika adult students with culturally sensitive learning practices, content and environments, the reality is that most Pasifika in New Zealand develop their LLN skills in predominantly western-style contexts. For that reason, we return to research studies in New Zealand that have identified the factors and practices that act as barriers or enablers for Pasifika adult students. Our bulleted list below draws on work by, amongst others, Airini, Rakena, Curtis, Su'a-Huirua, Townsend, Savage et al. (2008), Clayton et al. (2004), Dickie (2000), Fa'afoi & Fletcher (2002), the Ministry of Education (1998) and the New Zealand Qualifications Authority (2008).

Barriers

- Cost of fees;
- Lack of pastoral and collegial support;
- Difficulty approaching the tutor/lecturer and actively participating in class due to different cultural perceptions about behaviour;
- Difficulty understanding English (this barrier also applies to some students for whom English is their first language, as they have difficulty understanding terminology);
- Difficulty finding time to study because of family and church commitments;
- Racist comments made by fellow students;
- Stereotyping by the tutors/lecturers;
- Feeling pressured to keep up with the achievement of other students, including that associated with e-learning.

Enablers

- Provision of academic support for Pasifika students of a kind that encourages them to pursue their study and mentors them toward adopting good study habits and relevant skills for e-learning;
- Teaching methods that focus on integrating cultural activities within curricula, including using various forms of learning media, providing resources appropriate to the learners' learning and cultural needs, setting up and facilitating study groups, and offering tutorial-style teaching (ie small groups of learners engaging with a tutor);
- A positive learning environment that includes cultural events, tutors who are approachable, consistent in their manner of teaching and interaction with students and readily available to students, ready and comfortable access to library staff and ICT staff, and pre-entry and/or preparation/induction courses.

Implications of these research findings for practice

Recommendations:

- Recognise the diversity of cultures and experiences of Pasifika people;
- Encourage the development of e-learning resources suited to Pasifika;

- Partner with Pasifika leaders and their communities to develop the capacity, including LLN and e-learning skills, of these communities;
- Provide academic mentoring when recruiting Pasifika adults into educational courses, and then ensure they receive detailed orientation and follow-on;
- Develop transition or induction programmes, including those involving e-learning skills, to encourage prospective students to attend tertiary education and to introduce new students to their place of study;
- Ensure that staff and peers are culturally aware, approachable and consistent;
- Celebrate the cultural capital that Pasifika students bring to the educational context by providing them with appropriate cultural events, incorporating their culture into pedagogical practice and using an expanding range of media, including e-learning, as part of these initiatives;
- Research which e-learning principles and practice best support the ongoing skills development of Pasifika adult LLN students.

Finding 3D: 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 these adults' ability to learn and/or access learning.

Most adults, including adults with learning disabilities (LD), find the information and communication technologies (ICT) provisions that fit their needs are highly useful and can reduce exclusion. However, lack of compatibility between systems and software can lead to the exclusion of some learners, including those who use technology for communication.

Relevant research

Adults with disabilities that adversely affect their ability to learn and/or to access learning find computer-related 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).

Although use of digital technologies in mainstream education has had mixed success, various studies identify these tools as a major resource within special education (Abbott, 2007; Singleton, 1994; Wise, Olson and Ring, 1997), including adult literacy contexts (Stites, 2003). These tools provide practitioners with the means not only to develop indicators of engaged learning but also to establish principles and practices relevant to the development and evaluation of multimedia materials in adult literacy (Wrigley, 2001).

Today, computer-related technologies present various types of assistance to adults with disabilities that impede learning. Computer-related 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. Abbott (2007) notes that professional development on how such learners can best use these tools is essential for tutors and support staff.

However, a lack of compatibility between hardware and software and across different types of software (eg the screen reader failing 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. Although both Abbott (2007) and Seale (2006b) strongly recommend e-learning support for adults and their tutors from learning support centres and computer centres, as well as close liaison between these centres, such centres are uncommon in New Zealand. In the USA, the Americans with Disabilities Act of 1990 (including amendments of 1997), and similar legislation in Europe, has led to stronger provision than that linked with New Zealand's Disability Strategy 2003 (Ministry of Health, 2001).

Our literature search located only one publication that described e-learning practice with adults with LLN needs and special needs in New Zealand. Curzon, Selby and Ryba (2000) illustrate three roles for digital technologies for these learners: as a means of overcoming barriers to participation, as a learning partner, and as a tool to develop social skills. The authors also noted that adults may need collegial support to use assistive technologies. In support of this claim, they cited the following quote from an adult whose sight had been impaired from an early age. She said that she had been able to overcome this difficulty when reading and writing through use of text-enlarging software and good lighting conditions: "A collaborative environment and trusting partnership with colleagues is essential for me to feel comfortable enough to use my specialised equipment. … [because] I want to be valued for my skills" (Curzon et al., 2000, p. 20).

In their review of Murray and Aspinall's (2006) book about using information technology to empower people with communication difficulties, Selby and Ryba (2002, p. 214) note that "the mastery of software in general use is more likely to generate respect whereas the very nature of adaptive software emphasises the difference and restive disability of those who use it". The authors accordingly recommend the use of generic software, where applicable, to improve inclusion. They also note the importance of finding a good reason to start applying an aspect of information technology to address an individual learner's needs, and the role of carers in the needs analysis and later adoption process.

A range of assistive technologies and e-learning is also valuable for adults with a wide range of learning disabilities. For example purposes, we consider in detail in this section some of the ICT applications that are commonly used with students with dyslexia. We focus on these students because of the many resources produced for this group, perhaps with good reason, given that they comprise a large proportion of students with special needs in typical literacy classrooms, and because ICT may serve them particularly well.

The main feature of dyslexia is difficulty learning literacy (reading and writing). This difficulty can also influence ability to learn numeracy, in which case it is called dyscalculia. Dyspraxia, although a different disorder linked with motor impairment, also relates to the production of literacy and numeracy. For individuals with literacy difficulties, the computer, with its speech-recognition and speech-production facilities, represents a compelling learning resource. Computers and other digital tools can enable individuals who find it difficult to process written language to access and produce information in a form that avoids many of the difficulties associated with written (or typed) formats. Tutors have available to them a range of books designed to guide them in catering for students with such difficulties; most include limited guidance on the use of computers and e-learning (see, for example, Townend and Turner, 2000; Yeo, 2003).

ICT thus provides tutors of such students with an alternative medium through which to promote their literacy acquisition and production. And while such technology can be used instead of the medium of written text, there is also the view in the field of dyslexia research and remediation that written communication skills can be supported through efficient ICT tools such as text-to-voice software, word-processing with spell-checkers, and voice-activated software (Singleton, 1994; Yeo, 2003).

Additionally, and perhaps somewhat surprisingly, many dyslexics find the web a useful learning resource (Seale, 2006a). For example, the interactive nature of the web allows such individuals to search for word meanings when learning text material, a facility that may overcome some of the problems associated with weak vocabulary due to poor literacy experience (see, in this regard, Stanovich, 1986). The web also allows these learners to seek out and present key concepts in written and non-written forms. And unlike the situation often evident in formal learning settings, the informal nature of typed material on the web may motivate dyslexics and people with related conditions to produce material. This supposition aligns with the learning-related motivation that texting on mobile phones brings to some individuals (Seale, 2006a).

Computer-based technology is also being used to help identify individuals who need specific literacy-related support. Again taking dyslexia as an example, we noted in the literature mention of various computer-based screening tools being used at all levels of education, from primary to higher (eg Singleton, Thomas and Horne, 2000; Weeks, Everatt and Brooks, 2006). These tools also appear useful in identifying appropriate forms of learning support for people with learning disabilities (see, for example, Fawcett, Singleton and Peer, 1998). However, as is the case with many of the technologies covered in this review, the literature stipulates that educators use these tools in a manner that fits each adult's specific needs.

Implications of this research for practice

Recommendations:

- 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;
- Favour the use of generic software, where possible;
- Provide and improve both learning and technology support services, and facilitate cooperation between these services to aid LLN development of adults with disabilities that impede 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 their needs;
- Provide support and professional development for tutors and others who support these learners so that they can assist these adults to embed relevant e-learning tools in their lives.

2.4 Strategies used by effective tutors

Finding 4A: Effective tutors are well able to apply what they have learned through professional development on e-learning and pedagogy

Tutors need professional development to support changes in content delivery, such as e-learning. Although a few early adopters self-manage this professional development, a systematic approach is necessary to develop the ICT skills of all tutors and their understanding of how both e-learning and LLN can be embedded in the learning process. The same applies to company training, which should include provision for all those involved in facilitating and assessing LLN skills.

Relevant research

Tutors, leaders, and support staff involved in e-learning need targeted professional development so that they can ably support the changes in course delivery and thinking described in this report. The rapid and often innovative development of ICT, e-pedagogy and useful e-based resources illustrated in our polytechnic case study (Davis et al., 2010) further clarifies the need for tutors to receive ongoing professional development and the need for tutors, vocational staff and workplace assessors, including those working with adults with LLN needs, to form

communities of practice. Support includes providing educators and support staff with sufficient time to gain an effective understanding of the principles and practice of e-pedagogy. 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, 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.

Innovation involving e-learning takes time to bed in, and the stages of adoption and/or rejection are mediated by both the individual and the organisation in which he or she works (Davis, 2008). Professional development is also necessary to help practitioners develop ICT skills and understand how both e-learning and LLN can be embedded in the learning process. The same considerations apply to tutors providing learning support to workplace staff and to everyone involved in facilitating adults' LLN skills (Smith, 2009). Also, as Alton-Lee (2007) found, effective leaders in the educational sector who participate in professional development with their staff have a positive influence on the achievement outcomes of their institutions' students.

The working conditions of tutors in adult foundation education influence the amount and type of change these educators make to their practice, including their LLN pedagogy. Drent and Meelissen (2008) found that the number of contacts tertiary educators maintained to assist their own professional understanding of e-learning had a direct influence on their innovative use of e-learning. Number of contacts also influenced the educators' e-learning attitudes and their competence, which in turn affected their propensity to innovate with e-learning. Smith, Hofer, Gillespie, Solomon and Roe (2003) identified other key factors influencing amount and type of change among educators, including those educators involved in e-learning and LLN development. These factors were access to preparation time, provision of benefits, including vacations, and having a voice (along with colleagues) in proposed changes to learning programmes. Individual factors, such as beliefs about teaching and attitudes toward innovation, also influence educators' adoption of e-learning.

Many initiatives around the world, including the New Zealand Ministry of Education laptops for teachers project (Cowie, Jones, Harlow, Forret, McGee and Miller, 2008), show that providing educators with laptop computers and other equipment, such as a digital camera and mobile phones, increases e-learning innovation because increased personal access provides opportunities for ongoing relevant professional development.

However, Hamilton and Hillier's (2006) critical overview of adult literacy teaching and learning in the UK identified constraints on e-learning in foundation learning due to poor facilities. These included an insufficient number of computers, and, of the computers available, many were old. Poor facilities also included 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. Some of the stakeholders we interviewed during our project (Davis and Fletcher, 2010) reported similar constraints on the e-learning of students in New Zealand workplaces.

A comprehensive New Zealand study conducted by Mitchell, Clayton, Gower, Barr and Bright (2005) identified the same challenges as those just cited. The authors stressed the need to raise awareness of the benefits of e-learning among tertiary educators and to encourage and support them to explore the potential of this form of teaching and learning while recognising the challenges that e-learning poses to tutors' pedagogical practices. Mitchell and his colleagues also surveyed the ICT competence of tutors and other staff in New Zealand polytechnics. Their findings showed that staff ranged across the whole spectrum of ICT proficiency. Tutors in larger institutions were more likely to adopt e-learning and to receive needed support than were tutors in the smaller institutions. The authors furthermore identified varying levels of adoption for e-learning that were somewhat similar to Rogers' (2003) categories: embracers, modifiers,

examiners, doubters, and refusers. In the study by Mitchell et al., neither age nor gender influenced tutors' adoption of e-learning. However, the extent to which e-learning was needed within an institution did influence level of adoption. Tutors teaching off-campus courses and those teaching in programmes with ICT-related industry needs were the tutors most likely to adopt e-learning. While embracers ("early adopters" in the terminology of Rogers, 2003) can self-manage their own professional development, Sherry, Billig, Tavlin and Gibson (2000) found that a systematic approach is the one that best favours their becoming lead learners.

Various projects in Australia, Canada, the UK and the USA have developed some form of e-learning directed at helping adults increase their LLN proficiency. Most of these ventures are or have been innovations created and developed by the tutors themselves, with some support from state or federal initiatives. One impetus for their development has been the desire to extend the reach of adult education into rural areas. Most instructive for this literature review are the Alpha Plus centres in rural Canada (Porter and Sturm, 2006), Pennsylvania's Workplace Essential Skills (WES) project (Askov et al., 2003), the California Distance Learning Project (Askov et al., 2003), and national and state-wide vocational education and training (VET) initiatives in Australia, including case studies of foundation-level courses (Australian National Training Authority, 2000/2003).

All of these projects stress the need for professional development of educators and support staff. They also emphasise the importance of carefully constructed student induction in order to meet each student's individual needs. Most of these projects experienced student recruitment difficulties in their early stages, but these problems lessened when the programme operators later recruited successful students as mentors, advocates or (at least) recruiters. Essentially, the innovations had to embed themselves into the ecologies of the students, including adults with LLN needs, and one of the most successful means of doing this was through what might be termed "e-learning champions", many of whom were successful students able and willing to provide mentoring as well as role models within their communities.

Implications of these research findings for practice

Recommendations:

- Seek opportunities to develop the ICT skills and 21st-century knowledge they need to be effective practitioners of e-learning (with embedded LLN tuition where necessary);
- Acknowledge that time is needed to mature tutors' 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 achieve their teaching aims;
- Provide a range of professional development opportunities, including informal networking (so that educators can share successful e-learning innovations) and formal accredited programmes. Having staff conduct their own action research relative to their growing understanding and use of e-learning is a valuable professional development strategy;
- Encourage the appointment and active engagement of e-learning and LLN champions (leaders outstanding in their field). By partnering with tutors, champions can offer the support that tutors and other relevant staff need to build their confidence in their ability to use ICT in LLN learning contexts;
- Showcase and encourage the uptake of the work of relevant action research projects at national conferences and locally;
- Model hands-on use of ICT in learning contexts as well as the principles and practice of e-learning in general;
- Plan e-learning strategies and related accredited professional development that aligns with the vision that tutors, their managers and support staff have collectively developed in relation to e-learning for adults with LLN needs.

Finding 4B: Effective tutors have at hand a range of strategies

Effective literacy learning for adult learners relies on tutors acquiring and/or having access to a wide range of LLN learning strategies appropriate to the needs of these learners. Tutors need to understand that adult students with literacy learning difficulties benefit from access to a range of interventions, including e-learning opportunities and support.

Relevant research

As we noted in the introduction to this review, our understanding of what constitutes effective literacy learning is based on current theories of literacy acquisition (see below) and is supported by research on literacy development (Allington, 2003; Ministry of Education, 2006a; Pressley, 2002). Numerous theorists, among them Lankshear and Knobel (2003), Leu, Kinzer, Coiro and Cammack (2004), the New London Group (2000), and Unsworth (2002), emphasise that effective literacy pedagogy relies on the development of critical literacy strategies where adults learn to critique what they read, on setting teaching and learning within culturally relevant contexts, and on having at hand appropriate learning resources and tasks. These researchers and theorists posit that literacy develops from within a social context and can accordingly be viewed as a socio-cultural phenomenon.

Students need to have strong foundations in word meanings and word recognition to ensure that later reading development and comprehension do not suffer (Hirsch, 2003). Word-level fluency is a precursor to confident fluent reading and to understanding and thinking about the ideas in a text (Pressley, Gaskins and Fingeret, 2006). Several studies provide strong empirical support that struggling readers make positive progress if they receive systematic decoding instruction (see, for example, Gillon, 2007; National Institute of Child Health and Human Development, 2000; Tunmer and Chapman, 2002). The research literature (for a review, see Gillon, 2004) also clearly establishes the critical importance of oral language, in particular, phonological processing ability, for successful literacy acquisition.

Individuals who experience difficulty in these areas as children are likely to show persistent difficulties in reading and spelling through into adulthood. As many as 70 percent of children with language impairment may demonstrate underachievement in literacy and/or language as adults (see Gillon, Moriarty and Schwarz, 2006, for a review). However, relatively short periods of well-structured intervention (eg 20 hours for phonological awareness) have proved significantly effective in improving the reading accuracy, reading comprehension and spelling of adolescents and children struggling with their literacy development (Gillon, 2000; Gillon and Dodd, 1995, 1997). However, Pressley (2006) cautions educators that there is disturbingly little intervention research work in improving reading in the later years of schooling and beyond and encourages more research in this area.

Silver-Pacuilla (2007) points out that these opportunities, in general, and the development of vocabulary and comprehension, in particular, can be enhanced through use of computer-assisted instruction employing a variety of software. The authors of the Moser Report (Department for Further Education and Employment, 1999) lend support to her view. They state, "At the heart of improved quality in delivery and materials must be increased use of Information and Communication Technologies (ICT) to improve basic skills" (paragraph 9.26). The authors also claim that:

- ICT is a powerful means of raising literacy and numeracy skill levels;
- Computers and multimedia software provide attractive ways of learning;
- The web gives students and their teachers access to some of the best materials available and the most exciting learning opportunities;
- ICT offers a new start for adults returning to learning;
- Internet and digital TV technology extend learning opportunities because they reach into homes;

- Learners who use ICT for foundation skills double the value of their study time by acquiring two sets of skills at the same time.

Silver-Pacuilla (2007) concluded that instruction, including that involving e-learning, which is designed to enhance foundation competencies in literacy and language learning for adults with low literacy levels, must be carefully examined. She also observed that interventions proven successful for adolescents struggling in literacy need to be adapted and trialled for use with adult learners.

Implications of these research findings for practice

Recommendations:

- Understand that adult students experiencing literacy learning difficulties require a range of interventions, among them the following:
  - Assessment of adults' LLN learning needs;
  - Follow-on, with formative and summative assessment, including e-assessment suited to each adult's level of proficiency and learning context;
  - Tutor-developed resources and activities that meet the specific needs of each adult;
- Remember that well-embedded interventions can help increase literacy development;
- Research and collaborative development of interventions and resources suited to adults' LLN needs, including e-learning resources.

Finding 4C: Learners benefit from engaging with and debating the characteristics and usefulness of different types of literacy media

Learners who are given opportunity to engage with and discuss the merits of different types of text enhance their literacy skills. Along with opportunity to use conventional texts, learners should be able to access a wide range of digital media, such as interactive multimedia, websites, and video, including television.

Relevant research

Learning is a social act because it takes place when people interact (Fisher and Frey, 2007). Learners' understanding of different types of text and information and their desire to continue engaging with texts are enhanced through learning approaches that use rich and authentic texts and encourage the learners to discuss these resources with one another. Tutors need to facilitate this process, however, by encouraging students to consider the authors' writing intentions and styles, to debate the concepts and ideas within the texts and to use their knowledge of how the world works rather than rely solely on authoritative sources of knowledge (Baker, 2001). Creating opportunities for students to look at how text and images are constructed provides situations where critical conversations and authentic dialogue about text can occur (Vasquez, 2003).

According to Kobayashi (2008), the factors that affect students' ability to engage in successful learning via interactive digital television are social presence, instructor effectiveness, sense of community, facilitators in the learners' location, and technical support. These factors also apply to other forms of e-learning. Educational television, featuring popular soap operas, for example, has successfully built a sense of community and following that also can assist large numbers of adults to practise foundation literacy skills. For example, one current Māori Television language programme involves a soap opera. The reason for this approach is to widen the appeal of this learning opportunity and add to the feeling of social presence. However, the authors of the report documenting this initiative note that it has involved challenge in terms of addressing learners' diverse needs (Durgunoglu and Kuscul, 2008).

Implications of these research findings for practice

Recommendations:

- Encourage learners to engage with and discuss with one another different types of conventional text as well as the wide range of digital media available, such as interactive multimedia, websites, and digital video, including television;
- Develop case studies of good practice in engaging with and debating different media;
- Research and develop promising interventions with digital text, including video/movies with subtitles for underserved groups, such as Māori and Pasifika, as well as strategies for using these resources.

Finding 4D: Tutors can use ICT to create and modify LLN materials, resources and learning contexts

Tutors can use ICT to modify and create materials that provide adult learners with engaging LLN learning resources and a meaningful and relevant learning milieu. ICT-based resources help adult learners gain awareness and appreciation of the need to have good literacy and numeracy skills in the 21st century, including technology-related skills.

Relevant research

Tutors and media producers often successfully use e-learning to localise and continually adapt LLN materials, and then make them available via e-learning over the long term. Resources can be accessed informally through radio, TV and online, and also more formally in classes. A blend of these modes is most successful to introduce and engage adults with a range of complementary relevant resources and to encourage further informal practice (UNESCO, 2006). These resources may be accessed in a number of ways. For example, in situations where students have access to a learning management system, this facility can be used to align the resources with other course materials (Nash and Kallenbach, 2009).

In relation to numeracy, workers are frequently required to use ICT-enabled devices. These often disguise the underlying mathematical concepts and practices, a situation that results in surface and rote learning, with resultant losses in efficiency and an increase in errors (Noss et al., 2007). E-based activities, including the use of simple spreadsheets and role playing relevant work-related activities, can help learners identify and understand the underlying computations (such as those related to decimals and percentages) and thereby gain the skills to carry out these computations themselves (Noss et al., 2007). Coben et al. (2007) recommend that commercial developers of educational resources produce and trial materials that can be used by adults wanting to improve their numeracy skills. They also urge tutors to create and adapt their own resources and versions of existing materials, but note that the success of this work rests on tutors receiving suitable professional development. Coben and colleagues note that open-source software and creative commons licensing readily allow practitioners to share resources.

At a more specific level, Coben et al. (2007) considered a wide range of ICT applications implemented by tutors engaged in teaching numeracy skills to adults as part of an innovative project conducted in Scotland. The applications and resources that the researchers deemed most successful were the following:

- Sound files attached to a worksheet set out as a web page for ESOL students;
- Webquests 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;
- Productivity software (word-processing and spreadsheets) to make numeracy more meaningful and attractive to learners;
- Digital photography that provoked reflective and critical discussion within the learners' contexts;
- Personal flash drives for learners so they could store and share ideas.

UNESCO's (2006) consideration of using ICT to enhance literacy learning includes a number of examples of relevant resources. Silver-Pacuilla (2007) brings another resource to mind in her description of a successful application of video-conferencing for ESOL learners. Coben et al. (2007) also found that providing adult learners involved in distance learning with opportunity to engage in video-conference sessions successfully extended their access to numeracy learning. However, the tutors blended this approach with extensive use of emailed worksheets, including embedded assessments, and ensured that phones provided a backup means of communication.

Word-processing activities have a not unexpected role to play in relation to literacy learning. According to the work-based tutors that we interviewed during our case study investigation of a polytechnic, simply introducing students to the thesaurus tool of word-processing programmes assists literacy learners with their spelling and vocabulary development (Davis et al., 2010). The aforementioned New England project reviewed by Nash and Kallenbach (2009) encouraged tutors to use the Moodle learning management system to develop self-study materials for their adult learners and to create web pages and blended learning resources.

In respect of resource development, and especially when LLN is embedded within other content areas, such as vocational courses, it is important, observes Shulman (1987), to respect tutors' pedagogical content knowledge. However, in the 21st century, what is also important, according to Mishra and Kohler (2007), is developing, by way of pre- and in-service professional development, tutors' technological pedagogical content knowledge.

Tutors have successfully embedded e-learning into students' everyday learning experience in simple ways. For example, Malthus, Holmes and Major (2005) identified from their analysis of conversations (in English) between nurse and patient the benefit to nurses of developing skilful conversations, only 40 percent of which were specific to the medical treatment. The researchers used these conversations as the basis of authentic learning materials for nurses during their first year of study so that they could learn to identify model practice, including intercultural communication, which, according to Malthus and colleagues, is essential in many professions. Malthus and colleagues then embedded these conversations within online activities so that the ESOL nurses could develop not only their ability to converse with the patients they were treating but also their own e-skills. The online component had yet another advantage, that of further enhancing the nurses' vocabulary acquisition as well as their general oracy.

Implications of these research findings for practice

Recommendations:

- Support LLN tutors and collaborating staff by providing them with their own laptop computers and a range of productivity software, including common office applications, multimedia tools and e-learning resources;
- Share tutor and ITO materials online in a format that encourages tutors to customise and further develop them, eg use of creative commons licensing;
- Purposefully develop communities of practice for LLN tutors that not only include online opportunities for collaboration embedded within training courses but also complement existing local, regional and national networks.

Finding 4E: Diagnostic and formative e-assessment can be developed and widely used

While e-assessment is currently being applied successfully in relation to LLN pedagogy for diagnosis and formative assessment, its use for summative assessment may be limited. For some learners, e-assessment could support individual training that employs integrated learning systems (ILS), but only if these are blended with other teaching strategies. Attaining such objectives is likely to be challenging.

Relevant research

New Zealand readily recognises the importance of using purposeful assessment to assist the learning of adults with LLN needs (New Zealand Council for Educational Research, 2006). Computer-based tools offer a number of advantages over equivalent paper-based instruments for checking skills in literacy, numeracy and ICT, and high-quality systems have been successfully used to provide initial assessments. For example, Basic Key Skills Building (BKSB) software is used by around 80 percent of colleges of further education in the UK to assess LLN and foundation ICT skills (H. Mellar, personal communication, email, September 10, 2008). These tools systems (according to the sources just cited plus others where necessary) can offer advantages, among them the following.

- Some learners find computer-based tests less threatening not only because they can take an adaptive approach to the questions posed but also because mistakes and poor performance are not open to the view of others. In addition, whereas learners often associate paper-based tests with bad experience of examinations, they tend to associate computers with computer games and adult tasks;
- Questions asked can be adapted to learner performance, thus maintaining the appropriate level of challenge, but the questions must fit the needs and learning stage of each individual being tested;
- The computer can mark closed questions automatically to provide immediate results for formative or summative assessment. Computer marking can be used to produce a detailed profile of a learner's performance, which is then available for immediate review. The outcomes of this review can then inform and be integrated into the next round of electronic learning planning activities. Each activity can be stored for later use by an individual or organisation;
- Designers can use rich, authentic media content—images, newsprint, maps, forms, articles. This content, in turn, can include colour, sound, moving images, animation and video. Audio files and learning objects can be added to provide explanations or to add drills in specific content. When such tuition is added, the system becomes both an e-assessment and an integrated learning system (see below).
  - Online resources can include onscreen embedded tools, such as a calculator and a glossary;
  - ICT tools provide specialist support for people with certain disabilities (eg large print size and use of audio at the touch of a button for visually impaired candidates; use of "colour buttons" and audio for dyslexics; pointing devices and key operations for physically disabled learners). However, these features are likely to be distracting for other learners with different special needs. Another disadvantage is that software updates become more complex over time (see Finding 3D);
  - Marking is 100 percent accurate every time, provided the marking scheme is correct and the student understands both the questions and the alternative answers;
  - Computers can be centrally networked and accessed within an organisation or over the internet, provided security is adequate. However, because scalability is an issue for internet based-systems, and given the critical and sensitive nature of testing, commentators do not recommend use of public networks (see, for example, Future Skills Academy, 2004);
  - Updates and versioning can be relatively efficient once the prototype has been developed and the "engine" to drive the software system has been produced and refined in practice. The versioning facility means that the systems can be adapted to different vocational and cultural contexts, but this approach can be challenging to maintain technically (Future Skills Academy, 2004);
  - Because computer technology allows extensive reporting of results, test data can be collected and efficiently analysed for trialling purposes as well as for ongoing monitoring of the performance of individual students, groups and organisations. However, care must

be taken when interpreting these data, because they are likely to be limited by the scope of the software.

As a good number of researchers and commentators remind us, and as we have stressed elsewhere, learners need a considerable amount of support to first engage with and then continue using these ICT tools, whether they are using them for assessment or for other purposes. For example, adults with literacy needs may need assistance to read numeracy test questions and log in. As we noted earlier, an intermediate level of literacy is likely to be necessary. The technology, moreover, does not replace the need for face-to-face or individualised interactions for this group of learners (Hansen, Nicholls, Williams, Monk and Baker, 2008; Porter and Sturm, 2006; Sweet and Wagner, 2006).

Some e-assessment systems incorporate integrated learning systems (ILS). ILS software was first developed to automate drill and practice activities, and the activity presented was informed by the assessment of individual students' progress on previous questions (Underwood and Brown, 1997). Independent research evidence on the efficacy of ILS relative to LLN has been problematic partly because of the ease that ILS affords data collection. Such data can obscure the evidence of transfer of literacy and numeracy skills beyond the specific ILS researched. A New Zealand review of the literature conducted by Parr and Fung (2000) for the Ministry of Education cautions schools on the cost-effectiveness of ILS; similar cautions doubtless apply to adult education.

Implications of these research findings for practice

Recommendations:

- Ensure that implementation of e-assessment is accompanied with adequate guidance on collecting and interpreting resultant data;
- Consider the limitations that e-assessment may have on the types of assessments that can be used;
- Provide coherent organisational and professional development relating to e-assessment for practitioners across all relevant parts of tertiary education, including the course providers and the assessment/examining authorities;
- Recognise that large-scale e-assessment is challenging, especially in terms of ensuring robust interlinked web-based systems for this time-critical activity involving data that should remain confidential and secure;
- Ensure ongoing development of testing centres, their technical infrastructure and staff;
- Continue research and development into e-assessment, including ongoing overview of research and development in other countries;
- Encourage those people developing and implementing e-assessment and ILS in New Zealand to join the growing international community of practice in this area.

Finding 4F: Learning is enhanced when tutors and their adult students work collaboratively, thus developing learner autonomy

Tutors need to provide a supportive and collaborative learning environment for adult students if they are to succeed in improving the LLN skills of these students. ICT-related and e-learning skills can be added to the factors that characterise effective LLN tutors.

Relevant research

As a study by Fletcher and Williams (2008) attests, adult literacy courses need to take place within a non-threatening and positive learning environment. Comments from adult literacy learners led Fletcher and Williams to conclude that tutors and mentors of adults seeking to improve their LLN must be aware of the emotional risk that students take on entering a literacy class. They also recommended that tutors and mentors maintain a positive and supportive

attitude toward students and that they use praise and encouragement to alleviate the anxiety that adults typically experience when they have to admit they do not have certain skills. Teaching approaches should include group tasks, as these help students know they are not alone in having literacy-related difficulties. Airini et al. (2008) and the Ministry of Education (2005) urge tutors and mentors to celebrate and acknowledge, through the resources and materials they use and discuss during class, the diverse backgrounds of their students and their prior knowledge of literacy and numeracy.

Fletcher and Williams (2008), along with Nash and Kallenbach (2009), give further guidance when they suggest that tutors also need to support their learners by helping set realistic long-term goals that provide a balance between challenge and building on existing knowledge. Handouts and other resources should be available for students who miss a session, and tutors need to be accessible to students outside lecture/class times so they can provide them with individual support.

Information gleaned from the studies cited here, indicate that effective LLN tutors are those who:

- Have a positive attitude toward their learners;
- Are approachable and able to build on students' strengths and experiences;
- Can create a positive and supportive learning environment;
- Have a genuine interest in and passion for their subject;
- Have recognised expertise in that subject;
- Use their learners' experiences in their teaching;
- Have links to industry;
- Are aware of and manage critical periods in the programmes (when learners are susceptible to failure and/or withdrawal) and are thus supportive in times of crisis.

Implications of these research findings for practice

Recommendations:

- Create a positive and supportive learning environment, including collaborative activities to help LLN learners realise they are not alone;
- Develop learner autonomy through collaborative, authentic activities, including e-learning, with other learners and/or their tutor;
- Draw on learners' diverse backgrounds, contexts and LLN strengths with diverse resources and activities that include ICT skills.

Finding 4G: Effective development of numeracy skills requires a range of strategies

LLN programmes that encourage adult learners and their tutors to collaboratively seek out and consider the range of strategies that will best facilitate each learner's numeracy learning not only enhance that learning but also give these adults greater awareness of the increasing place and importance of numeracy and ICT-related numeracy skills in the 21st century.

Relevant research

The ability to read and interpret mathematical and numeric information has a substantial influence on how individuals interact with the world around them. Strong numeracy skills enhance creativity, critical and logical thinking, strategic planning, and economic understanding and participation (Holton, Ahmed, Williams and Hill, 2001; Walters, 2004). The now commonplace presence of ICT in most businesses means that employees must have, amongst other ICT-related skills, broad-based general problem-solving skills and the ability to use ICT for mathematics-related activities (Coben, 2005; Thomas and Ward, 2009).

Despite acknowledgement in the literature of the importance of numeracy in many aspects of business and daily life, there is no consensually determined definition of numeracy. Coben (2003, p. 21) interprets the term numeracy to mean "an aspect of lifelong mathematics education", which is consistent with the objectives of our review. For purposes of instruction, Coben observes that course developers and tutors need to identify the content areas of numeracy. Benseman et al. (2005) do just this. Having summarised Glass and Wallace's (2001) review of numeracy frameworks in Australia, Canada, the UK and the USA, the three authors set down the four common types of content to emerge from that work:

- Quantity and number, that is, whole numbers, money, fractions, decimals, percentages and ratios, and skills such as computation, using calculators, estimation;
- Dimension and shape, that is, geometry (length, width, perimeter, area, volume, angles);
- Pattern and relationships, that is, inter-relationships of variables, algebra;
- Data and probability, that is, sampling, prediction, data analysis, likelihood and chance, reading of charts and graphs.

Benseman et al. (2005) also note that this content is taught in relation to these processes:

- Communicating mathematical information;
- Reasoning and decision-making;
- Being able to apply mathematical knowledge and skills to solve problems;
- Interpreting results and other forms of understanding mathematical information.

While there is considerable agreement on the importance of the content and processes outlined above, there is little understanding of how these can be effectively taught to adults. As Coben (2003, p. 21) points out, "evidence on the impact of adult numeracy tuition is sparse and unreliable". This view is echoed by Benseman et al. (2005, p. 88), who emphasise the "consistent, strong calls across the reviews for the development of initial training and professional development of tutors in numeracy—both in their understanding of the subject and their skills in teaching it". Despite the concerns of these commentators, some research directed at addressing this lack of understanding is beginning to emerge. An example is Thomas and Ward's (2009) case study of an innovative project that included e-learning and was designed to enhance the numeracy skills of apprentices in the building industry.

Thomas and Ward's (2009) work also highlights the importance of mathematics educators engaging learners by using students' everyday experiences and individual interests as occasions for learning (see Alton-Lee, 2003, in this regard). Successful mathematics educators acknowledge that diverse home and community experiences provide particularly rich mathematical opportunities (Anthony and Walshaw, 2007; Biddulph et al., 2003; Sheldon and Epstein, 2005).

Implications of these research findings for practice

Recommendations:

- Relate numeracy learning, including ICT-related numeracy learning, to the everyday numeracy experiences of learners;
- Use learners' diverse home, work and community experiences in a manner that allows them to make connections between these experiences and mathematical concepts;
- Allow learners to explore relationships in quantities, space and data by using concrete examples where possible;
- Support tutors and others who facilitate numeracy development, such as employers and ITOs, to develop learning activities relevant to workplace contexts;
- Raise the profile of numeracy in the everyday environment, including the workplace;
- Encourage further research that investigates numeracy acquisition by adult students with LLN needs, including e-learning.

2.5 Staff and e-learning resource development

Finding 5A: Staff involved in e-learning need professional development in how to embed both e-learning and LLN in their teaching programmes

Providers of training and e-learning need to ensure their staff are involved in professional development that focuses on their content area, on ICT use and how on both e-learning and LLN can be embedded in the learning process. There needs to be systematic professional development for adequate organisational development.

Relevant research

Professional development is a complex matter. A recent best evidence synthesis of tutor professional development (Timperley, Wilson, Barrar and Fung, 2007) identified six elements in the professional learning context as important contributors to a range of student outcomes. These elements call for tutors to do the following: provide sufficient time for learning activities and to use that time effectively; draw on external expertise; engage in the learning process; challenge problematic discourses; to interact in a community of professionals; employ research-based practices consistent with wider trends and policy; and engage in and model active leadership.

When tutors collectively believe it is possible to improve student achievement, they are more likely to tackle difficult situations and persevere in raising achievement, and when tutors strive to update their skills and their knowledge of content and pedagogy, including the use of e-learning, they are more likely to enhance their teaching (Goddard, Hoy and Hoy, 2000). ICT use and e-learning are important facets of effective tutors' pedagogical repertoire because these features help them, as the International Reading Association (2009) argues, successfully address the foundation skills needs of adult learners. According to the association, the reason for this success is threefold. First, digital technologies provide exciting and effective educational possibilities. Second, digital technologies provide tutors with a way to connect with communities of learners excluded by traditional education provision (eg because of geographical factors). And, third, digital technologies call for a new set of foundation skills, the acquisition of which has become necessary for living and working in the 21st century.

E-learning research in New Zealand tertiary education indicates that successful e-learning courses rely on strong interconnections between institutional policy, infrastructure, staff and students. Shephard (2009), for example, found from his review of the professional development provision on offer to tertiary practitioners using e-learning that institutional leaders can promote successful such learning "by providing direction (leading the way), by persuasion (by providing incentives, rewards and recognition) or by coercion (with obligations and penalties)" (p. 3). Shephard also found that of the tertiary staff involved in e-learning (including those concerned with developing adult learners' LLN needs), one-third had not engaged in formal or informal professional development for e-learning. Shephard's review also illustrates the eclectic range of professional development on offer nationwide to help tutors build e-learning capacity. The five most common activities 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).

The challenge in all of this for educators is how they can best employ e-learning to enhance or transform their teaching practices in ways that offer students flexible, accessible, relevant and high-quality learning experiences. However, as the study by Coben et al. (2007) that we discussed earlier suggests, educators will not be able to fulfil this promise unless they themselves have the requisite ICT skills. According to Coben and colleagues, adult numeracy tutors involved in an action research and staff development project (the focus of which was

using ICT to teach adults numeracy) required complex professional development in order to develop their ICT-related knowledge and skills. They also needed considerable support to develop e-based content and pedagogy.

Despite the difficulties, the project led to tutors (and their students) gaining a far greater and more useful appreciation of the technology in the world around them. For example:

> WebQuests were very helpful in encouraging learners to go on to the internet and skim, scan and search for information and then analyse and manipulate it appropriately. This was particularly effective when the activity was real, e.g., organising travel on the internet, managing a budget wisely, or trying to find the best deal as a consumer of utilities. (Coben et al., 2007, p. 30)

Before the research intervention, the tutors had varying levels of ICT competency and confidence and had received little training on how to teach such skills to others. After the intervention, all exhibited improved practice and had gained new insights into how to deliver course content, including not having to work to a fixed curriculum. An online community learning session involving a course management system (WebCT) also proved successful. However, because the intervention involved only seven days of relatively limited professional development, it is not surprising that, post-intervention, the tutors mainly used ICT to extend existing approaches to their teaching, as has been noted in trials and evaluations of similar professional development interventions. Ruthven and Hennessy (2002) provide an example. They had tutors use ICT in ways that allowed them to adapt to the very diverse contexts of their learners, a process that we have already noted as essential for adult learning (see, in particular, Coben et al., 2007).

In order to develop the types of changes in delivery and thinking described in this review, educational providers/leaders need to facilitate and monitor the outcomes of ongoing professional development for their tutors. Effective leaders in the educational sector who participate in professional development with their staff promote the achievement outcomes of their students (Alton-Lee, 2007; Smith and Gillespie, 2007). The same consideration applies to workplace training and includes all those involved in facilitation of LLN skills (Smith, 2009).

Taken together, the body of work considered in this section indicates that, during professional development, those involved should have opportunity to:

- Interact with external professionals in their field of expertise;
- Have their manager/leader involved in the professional development so that outcomes and changes can be explored collaboratively and so that there is a joint understanding of best practice;
- Explore research-based practices;
- Have sufficient time and space and a positive learning environment within which to reflect on the professional development;
- Discuss and debate problems.

Implications of these research findings for practice

Recommendations:

- Facilitate ongoing professional development for their teaching staff, using research-informed strategies in a variety of formats;
- Encourage the appointment of ICT/e-learning, literacy and numeracy experts to promote tutors' confidence;
- Promote partnerships between staff members that allow them to develop their use of ICT in numeracy and literacy;
- Realise that partnerships can be conducted remotely through email, telephone and other forms of e-communication, such as free desktop video-conferencing services (eg Skype);

- Showcase and encourage the uptake of the work of relevant professional development action research projects, including work involving hands-on learning and e-learning, at national literacy conferences, as well as locally through partnerships;
- Acknowledge that tutors need to know why they are using e-learning and match its use to their learning and teaching aims.

Finding 5B: Staff professional development progress over time in order to address the developing and changing concerns of the individuals involved

Staff development is informed by individual concerns, which change over time. Once individuals reach the final stage of development, "tutor as leader", they are fully able to support adoption of similar innovations by the staff with whom they network. Successful staff development over time also involves continuing access to and engagement with emerging resources, and procuring support from within professional organisations.

Relevant research

Implementation and bedding-in of innovation takes time, and the points at which the innovation is adopted and/or rejected will be determined by the individual's current beliefs, attitudes and work as well as by the beliefs, attitudes and work of the community, or communities, in which he or she works (Davis, 2010). Hall and Hord's (1987) experience in developing and implementing a Concerns-Based Adoption Model (CBAM) of innovation showed that tutors are more likely to adopt an innovation if it addresses the particular concerns and needs the tutors have at the time.

An influential longitudinal study of the innovative Apple Classroom of Tomorrow (ACOT) (Dwyer, 1994; Sandholtz, Ringstaff and Dwyer, 1997) identified five stages of "instructional evolution" for tutors using e-learning in (albeit well-resourced) classrooms and having ready access to ongoing professional development. The stages were entry, adoption, adaptation, appropriation, and invention. Students of inventive ACOT school teachers demonstrated high levels of IT skills and ability to learn on their own, to problem-solve, and to move toward more collaborative work patterns.

Sherry et al. (2000) adapted previous models of CBAM and ACOT to include an additional stage in their Learning/Adoption Trajectory model. The stages were (with the last the new one): teacher as learner, teacher as adopter, teacher as co-adopter, teacher as re-affirmer or rejecter, and teacher as leader. All stages have the potential to promote further adoption, and this is especially true of the final stage because, in the context of e-learning, a teacher as leader is likely to advocate e-learning and to encourage and support other tutors to use it (Sherry, 2002; Sherry et al., 2000). According to Becker and Riel (2008), even among school teachers who are accomplished users of e-learning, only about 10 percent are likely to be classified as leaders. However, the authors state that these teachers can be very influential within an organisation. This is because, from an ecological perspective, the teacher as leader who has co-evolved with e-learning has a strong influence on their colleagues' adoption of e-learning or on developing their use of this form of learning (see also the cases compared in Davis and Niederhauser, 2005).

Sherry (2002) and Sherry and Gibson (2002) argue that, from a systems theory point of view, three interacting key factors determine the extent to which tutors embrace and successfully use e-learning:

- *Convergence*: There must be a sufficient number and type of e-learning resources at the classroom level to make use of such resources a practical part of classroom programmes;
- *Mutuality*: Both the user of these resources and the administrators responsible for funding and providing them must see that benefit will accrue from their use;

- *Extensiveness*: There must be a high density of technology throughout the school building to enable both broader administrative support and backup expertise, especially given the likelihood of technology leaders taking their expertise with them when enticed away by new career opportunities.

As noted in Finding 4A, the level of adoption of e-learning by tutors in New Zealand is 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 adopt or make greater use of e-learning (Mitchell et al., 2005). Drent and Meelissen (2008) found that personal entrepreneurship has a significant influence on innovative use of e-learning in tertiary tutors' own instructional practices. Also, research on e-learning in New Zealand tertiary education provision identifies the need to connect institutional policy, infrastructure and people (Shephard et al., 2009). In summary, the perceptions and beliefs of tutors and those who support them influence practice and the uptake of e-learning. Learning trajectories are highly variable with only a few tutors becoming influential champions of e-learning development.

The stages of development also apply to learning communities, and to the professional development of teacher educators, who prepare tertiary tutors. Correia and Davis (2008) reiterate the importance, relative to professional development, of tutors developing communities of practice at the course level and the teacher educator level, as well as at their intersection. Davis, Preston and Sahin's (2009) study considers, within the context of educating tutors to use new technologies, the importance and possibility of tutors forming collaborative learning networks. They observe, not surprisingly, that a national professional development network built on e-technology is unlikely to work if the tutors concerned do not have the requisite ICT skills.

Implications of these research findings for practice

Recommendations:

- Recognise that professional development is a work in progress because tutors, along with teacher educators, grow into a community of practice that supports tutors as they endeavour to bed in LLN and e-learning;
- Celebrate the stages of development that tutors and teacher educators move through, especially the most mature stage, "tutor" as leader", because it is at this stage that teachers are most likely to enhance the growth of the whole community;
- Raise leaders' awareness that tutors who do not work in a supportive climate (ie one that gives them and their students easy access to e-learning and LLN support) will have difficulty moving through the stages and may revert to earlier stages if the climate becomes more challenging;
- Encourage tutors comfortable with the web to engage in computer-networked professional development in order to support the growth of both local and national communities of practice;
- Appreciate that a computer-networked professional development approach is not suitable for tutors involved in the early stages of tutor professional development in e-learning.

Finding 5C: "Unbundling" the roles played by e-learning tutors facilitates targeted professional development and understanding of how tutors can better serve the needs of their students

E-learning permits and stimulates an "unbundling" of the tutor's role, a process that makes explicit the need for professional development for a wider range of staff, including the e-tutor (who teaches via e-learning), the m-tutor (who coaches and advocates for the student), the d-tutor (who designs resources used online), and all the leaders who work with them.

Relevant research

Worldwide, various educational organisations, such as open universities and virtual schools, have reconfigured their modes of delivery to take full advantage of ICT. In addition, these organisations have examined the teaching role within this provision and "unbundled" it into several complementary roles that may or may not be played out by just one tutor or (more usefully) across several tutors and support staff (Davis, 2008; Natriello, 2005).

Because tutors and other educators involved in distance learning commonly undertake a variety of roles and responsibilities in relation to e-learning, gaining a clearer picture of just what these roles and responsibilities are and how they can be categorised is a useful exercise, particularly in terms of making sure that the professional development meets each tutor's needs (Compton, Davis and Mackey, 2009; Davis, 2008; Harms, Niederhauser, Davis, Roblyer and Gilbert, 2006). Although the detail of this unbundling of roles derives from university and school education, it has direct relevance for adults receiving e-based LLN and study skills tuition.

The literature (see especially Davis and Rose, 2006; Harms et al., 2007; Smith, 2009) identifies three e-teaching roles:

- *E-tutor*: The virtual classroom tutor who develops the classroom community and its day-to-day tasks, including orientation and assessment;
- *M-tutor*: The facilitator who provides study support for online distance students and liaises between the e-tutor and other tutors, and who is the proctor of summative assessment;
- *D-tutor*: The instructional designer who designs and publishes content in a learning management system or other format.

The components of the role of the tutor engaged in distance internet-based learning include a strong approach to and emphasis on innovation, an approach and emphasis that differs from that typically taken by tutors in a traditional classroom setting (for one contrast, see Davis and Niederhauser, 2005). The types of e-learning that develop, and the roles that the tutors play in that development, also tend to be differentiated according to where, when, how and why each type begins; an example is that of community-based e-learning exemplified by the Alpha Plus centres in Canada (Eady, 2006; Porter and Sturm, 2006).

The research literature emphasises the importance of providing professional development for all three roles and also for leaders, collaborating colleges, training providers and schools (see, for example, Davis and Rose, 2007; Lai, 2001). Hannum, Irvin, Lei and Farmer (2008) conducted a rigorous study of the impact of an online course designed to teach m-tutors nationally recognised principles underpinning effective distance education for learners. The course had a statistically significant impact on student achievement, namely, increased retention and grades.

Implications of these research findings for practice

Recommendations:

- Recognise the usefulness for professional development, administration, e-learning, in general, and distance learning, in particular, of breaking down (unbundling) the roles that tutors typically play;
- Appreciate that while these diverse roles can be the province of one member of staff, e-learning is likely to be better served when several members of staff take up these roles;
- Provide ongoing professional development and support targeted to the needs of each type of tutor;
- Encourage managers and leaders to promote, establish and participate in e-learning professional development that includes preparation of relevant materials, such as case studies.

Finding 5D: E-learning resources for adults engaged in LLN programmes are more effective when designed well

Designing e-learning for adults with LLN needs brings additional challenges to those creating, developing and maintaining e-learning websites, e-assessment, and related resources and services. The individuals carrying out this work need guidance on the principles of universal design as well as on what constitutes best practice regarding the design of e-learning, in general, and of websites, related services and project management, in particular.

Relevant research

Although adults with LLN needs are enormously diverse, it is clear from the literature reviewed (see, for example, Biddulph et al., 2003) that these adults include many who live in challenging circumstances, including limited or no access to the internet. Most LLN learners have low literacy skills, at least in English, and many have reduced computer literacy and related skills (Davis et al., 2010). Some have physical and/or intellectual disabilities. Those designing the e-learning platforms have to tailor them to these limitations. They also have to appreciate that some learners will use mobile interfaces and other learners will use computer interfaces.

Advice on designing web-based resources that can accommodate a diversity of learners and learning situations (with particular attention drawn to access issues and the needs of people with disabilities) is available from several internet sources, including the US Center for Applied Special Technology (the CAST website is http://www.cast.org) and the Ministry of Education website (http://www.minedu.govt.nz, using the term assistive technology). Another source that is aimed at ICT professionals is the Australian Computer Society (1997). Their website documents three areas of consideration for those involved in website design:

1. *Computer organisation and architecture*: High-volume websites test the limits of available server hardware. Careful study of the operating components of a computer system allows development of a design optimal to meet performance requirements. Mobile and web appliances have limited capacity, requiring an appreciation of how the hardware will affect the development of web systems;
2. *Data communications and networks*: Large websites impose significant loads on a network. A large site may need to be spread geographically to balance load; the different characteristics of internal LAN and wide area networks must also be considered. The security requirements of the website need to mesh with those of the underlying network;
3. *Ethics/social implications/professional practice*: Website design involves legal, social and ethical issues of a magnitude not seen before in relation to IT use. The newness of the internet and the public visibility of websites create major problems for website design. Whereas these issues might arise only a few times during an IT professional's career, they will occur during almost every web-based project.

The society's website discusses, in relation to the third area, requirements for designing websites used by people with disabilities. The discussion features links to web accessibility tools that can be used to check for compliance with laws relating to discrimination. M-learning brings particular design challenges relating to small screen formats and finding alternatives to full keyboard and mouse, inability to predict the conditions under which the e-learning will be used, and acceptable practice at work (Smith, 2009; see Findings 2F and 3D for more explanation).

In New Zealand, guidelines for developing effective e-learning environments have the implicit expectation that well-designed e-learning can support learners across all sectors of New Zealand society. Guidelines produced by the New Zealand Council for Educational Research (2004) and for the Ministry of Education by Milne and Dimock (2006) include the following:

- Activities need to be grounded in an understanding of how students learn and are informed by research on effective e-learning;

- Good e-learning design takes into consideration prior learning and provides formative assessment within the e-learning environment;
- Well-designed e-learning provides a scaffold of learning experiences;
- Learners are able to work from a variety of perspectives and can choose the resources they use and the learning activities in which they engage.

In respect of e-learning environments, the literature advises paying particular heed during the design stage to the ease with which tutors and students can access these environments. More specifically, the literature suggests these approaches:

- *Providing flexibility, particularly in respect of opportunities for users to turn features on and off*: This facility gives students opportunity to customise their learning environment by including, for example, vocabulary support, links to background information, graphic organisers and semantic support (Dolan, 2000);
- *Making available alternative representations of content*: This provision gives students access to information in a multimodal format, such as captioned video resources with a built-in option to view transcripts, a text transcript option for audio resources, alternative graphic presentations of instructional content and opportunity for the learner to hear the material read out loud (Bohman, 2003);
- *Ensuring appropriate and easy-to-use course and web-page navigation, including the option for alternative navigation controls*: Navigation should include easily identified access to moving forwards and backwards, repetition of video, audio, and/or animated content, printing facilities and access to help (Alessi and Trollip, 2001);
- *Having a screen design that is straightforward and uncluttered and provides access to content and navigation without undue distraction*: Suitable design features include plain, solid backgrounds, division of large blocks of text into manageable units, and clear headings that let learners quickly see how the content is organised. Blinking, flickering or flashing objects should be minimised, as should graphics that serve no purpose other than as "eye-candy" (Grabinger, Aplin and Ponnappa-Brenner, 2008; Hassell, 2005);
- *Evaluating web resources outside the class environment specifically for accessibility* (Rose and Blomeyer, 2007).

All e-learning accessible to the public should be made accessible to students with disabilities and ideally should be underpinned by universal design for learning (UDL) principles (Rose and Blomeyer, 2007). UDL principles provide a framework for designing curricula that enable all individuals to gain knowledge, skills and enthusiasm for learning. The UDL focus on using multiple means of representation, multiple means of expression and multiple means of engagement supports learning and enhances ease of access to the curriculum while maintaining high achievement standards for all (see, for example, Center for Applied Special Technology, 2009). However, Vanderheiden (cited in Seale, 2006b) cautions that designing e-learning that offers universal access is a challenging process.

The majority of proponents, however, agree that designing for the majority of people is a more realistic approach than trying to design for everyone (see, in this regard, Bohman, 2003; Witt and McDermott, 2002). Vanderheiden (cited in Seale, 2006b), for example, argues that it is not possible to create a product that can be used by everyone or under all circumstances. The commentators who feel uncomfortable with the principle of universal design argue that it relieves educators of the responsibility of addressing individual student needs. Kelly, Phipps and Swift (2004), for example, claim that because accessibility is primarily about people and not about technologies, it is inappropriate to seek a universal solution. They go on to say that rather than providing an e-learning resource which is accessible to everyone, resource developers and tutors can find it advantageous to provide materials tailored to each student's particular needs.

These provisos, along with the other understandings gained from this literature review, make obvious this adage: e-learning projects for adults with LLN deficiencies need to clearly identify just which learners will be using the particular form of e-learning and then to design learning content so that it fits with their needs. Learners with LLN needs typically include dyslexics, and there is a considerable body of literature on their requirements (eg Rainger, 2003; Stites, 2003; Wrigley, 2001; see also Finding 3D). Finally, the design must also accommodate the needs of all involved in supporting the adult learners, but their needs are unlikely to be as significant (see Finding 2E).

Implications of these research findings for practice

Recommendations:

- Remember that effective e-learning rests on the application of sound e-design and universal design principles, relating not only to all elements of the e-learning provision, but also to its particular features such as websites, related services and related project management;
- Ensure that design and testing work and ongoing support lead to reliable and robust systems so that the user interface and technical issues do not undermine adults' (often) fragile confidence to develop their LLN;
- Note, in this regard, that adults with a low level of literacy skill benefit from very simple interfaces with few distractions and options, that audio, images, simulations and multimedia are beneficial, and that formative assessment can be used to good effect to minimise distractions, guide options and inform the learner's plans;
- Recognise that LLN learners' ICT skills will remain highly variable. For example, while some learners have excellent gaming skills, the ability to read a screen or use a mouse cannot be assumed. This caution is especially necessary in respect of older adults;
- Recognise that LLN learners' access to computers and the internet will remain highly variable. Adults with LLN needs are more likely to only have access to old computers and/or dial-up internet access. Reliance on continuous internet connections is also not advised;
- Promote e-learning design that enables many sub-packages and versions to be made for hundreds of employment and community contexts, while also responding to software updates and the variety of computer systems;
- Encourage and support open-source initiatives to serve these diverse vocational and cultural needs and the needs of the distributed communities of New Zealand and the wider Pacific region;
- Remember that mobile learning (m-learning) is increasing, so versioning for mobile devices is a highly relevant option;
- Plan to embed tutor and mentor support. This support should include resources that will help the learner continue learning while away from the tutor or their organisation.

2.6 Key characteristics relating to organisations and society

Finding 6A: Organisations mature with respect to e-learning and embedding of LLN

Organisations mature in their ability to adopt innovations, including e-learning and LLN. Leaders can use known stages of maturity and characteristics of innovations to ensure that the work they put into designing e-learning platforms and bedding in LLN occurs smoothly across time.

Relevant research

Organisations catering to the learning needs of adults (whether college, ITO, training centre or workplace) evolve in line with the success or otherwise of their educational programmes and what they learn from that experience; naturally, all modes of teaching and learning, such as e-learning, within that organisation evolve too (Andrews and Haythornthwaite, 2007; Davis,

2010). Because e-learning is a particular innovation embedded within traditional forms of training and education, a change in one will mean a change in the other, thereby producing a process of co-evolution.

Organisations move through stages in the adoption (and/or rejection) of innovations. The terminology that Rogers (2003, p. 420) uses to label his five stages of organisational change is agenda-setting, matching, redefining/restructuring, clarifying, and routinising. However, because e-learning is an innovation that stimulates further changes, organisations that adopt one or more technologies tend towards further changes stimulated by the adoption of earlier innovations. Golden, McCrone, Walker and Rudd (2006) use the term "e-maturity" to denote the development and embedding of the e-learning infrastructure and processes that they observed in further education in the UK. Each stage of the maturation process stimulates further change (see Table 1 for a simple representation of this process). Not only is there permeation of initiatives into the central operations of each organisation but also advancement of collaborative activities with external organisations. E-learning is particularly well suited to these processes because of the advantages of networked technologies and because educators and support staff appreciate these (Davis, 2010).

Table 1: The stages of organisational maturity with innovations in education

Stage of maturation	Characteristics
Localised	Innovator(s) adopts the innovation and uses it in his or her pedagogical context
Internal integration	Coordinator is appointed to manage, across the organisation, applications and resources relating to the innovation
Transformative	Organisation changes internal routines and activities to take advantage of the innovation
Embedded	Organisation uses networks with other organisations in relation to this innovation, while keeping within its existing scope (enterprise)
Innovative	Organisation reviews and changes its scope (enterprise) and activities to take full advantage of the innovation

Note: This model applies equally well to innovations associated with e-learning and to innovations associated with LLN.
Source: Davis (2009).

The sequence depicted in Table 1 starts with localised exploitation by one or more adopters of one or more innovations. As the number of users of the innovation(s) increases and activity proliferates and clusters, the increasing demand for resources stimulates management to appoint an e-learning and LLN coordinator to manage the demand and to coordinate internal integration of the innovation. Once e-learning has been widely adopted within and across organisations, including those offering LLN, a new role typically emerges, that of the coordinator (Bradley, 1992; Davis, 2002; Lai 2001). This person can move developments forwards even more, because his or her dedicated role usually comes with the time and resources needed to liaise with and direct the activity of everyone concerned in the training or educational initiative.

The range of innovations continues to expand and becomes further embedded into the organisation through the work of the coordinators and users, who collaborate to redesign (transform) their curriculum and educational practice. The next stage sees the organisation forming external networks, a process that further embeds the innovations into the fabric of the organisation. The networks draw in partners and communities that require information and/or provide support. Few educational organisations reach the innovative stage, where they redefine their scope, as is seen in other sectors, such as banking.

It appears that established schools and colleges often move from localised exploitation to the second stage of internal integration with an IT coordinator, but further "maturation" to the point of redesigning educational processes or developing external networks is rare (Passey and

Ridgway, 1994). When combined with the conflicting pressures of authorities (such as government) beyond the organisation, the "loosely coupled" nature of educational organisations that work together yet also compete with one another (Weik, 1976) tends to make this process of organisational maturation much more chaotic and uncertain than is the case in various other sectors of society and enterprise (Davis, 2010).

In New Zealand, most vocational training providers are involved in a much more complex mapping process for e-maturity than that depicted in Table 1. Industry frameworks in common use today require careful guidance to inform further development and use (see, for example, http://elg.massey.ac.nz/; Milne, Gilbert and Barr, 2005). Similar guides are available elsewhere. BECTA, in the UK, for example, uses a matrix to plot and support institutional planning (see BECTA, 2009).

Although organisations can reach the innovative stage, both they and/or the individuals within them may reject innovation after having earlier adopted it (Davis, 2010). The reasons for this vary. Contextual factors change in line with the normal rhythms of personal and organisational lives, such as the academic year. They also change as a result of external shocks, such as imposed reforms and weather-related disasters. Rogers (2003) cites educational expenditure per student as a predictor of the success of an innovation: organisations with more resources are likely to have more success with innovations. This cost factor is evident in relation to a report prepared by the Commonwealth of Australia (2008). The authors of the report describe the proliferation of e-learning in workforce training, and they observe, on the basis of National Centre for Vocational Education Research statistics for the years 2003 to 2008, that less than 20 percent of the manufacturing firms surveyed had inter-firm cooperative training arrangements. However, the authors expected this percentage to rise given that those organisations already in partnerships said collaboration resulted in higher-quality training at reduced costs.

Engaged leadership at all levels of an organisation is a critical success factor for adoption of e-learning. Ely (1990), for example, stresses that "two-pronged leadership" is necessary by (a) the executive officer of the organisation and (b) the project leader, who is more closely involved in day-to-day activities. A closer look at the importance of this type of coordinated and shared leadership across multiple levels of an educational institution to the success of e-learning initiatives comes from a study carried out by Tong and Trinidad (2005) in a Hong Kong college. They used a model that identified the influences and feedback loops that drive educational change.

The model made clear that the college's chief executive and its innovation coordinator(s), curriculum coordinators and individual tutors shared leadership relating to e-learning initiatives. The model also allowed Tong and Trinidad to examine how this shared leadership manifested at strategic, departmental, and tutor levels. Leadership was most effective when its holders brought a common vision and practice to all departments of the college and to all discipline-specific and level-specific groupings, and when it was flexible enough to allow tutors to work within more than one department. As Tong and Trinidad observed, coordinated leadership can sometimes block or slow development in order to increase its coherence across a part or the whole of the organisation and its programmes; sometimes this form of leadership can also inadvertently impede that process.

Rogers (2003) reached a similar conclusion in his seminal research on the diffusion of innovations through an organisation. "Innovations," he said, "have attributes that influence the speed of their adoption and/or rejection in particular contexts as follows: relative advantage, compatibility, complexity, trialability, and observability" (p. 223). Leaders, coordinators and developers, he continued, may apply these characteristics to speed or retard innovations and improve coherence with the institutional vision, while also recognising that individuals take time to move through the stages of adopting innovations. Work by Ferster (2006) shows the

applicability of these attributes to IT in education. His systematic analysis of 43 IT-related innovations confirmed that Rogers (2003) had selected the most influential attributes of innovations.

Implications of these research findings for practice

Recommendations:

- Encourage the active support of a senior manager when bringing in an e-learning innovation because this support is essential for embedding e-learning and LLN. At times, conflicts arise in situations involving multiple innovations. This situation arises partly because multiple innovations compete for resources, such as the time that the e-learning coordinator has available to deal with difficulties and conflicts. Such situations require resolution by an organisation's leaders.
- Ensure buy-in from middle managers, as these people can facilitate or block developments. These people also need to be encouraged to work closely when developing organisational strategy.
- Encourage leaders, coordinators and developers to apply Rogers' (2003) characteristics of innovation (relative advantage, compatibility, complexity, trialability, and observability) to improve the coherence of multiple innovations with the institutional vision and available resources.

Finding 6B: Successful development of adult literacy is closely linked to ICT competence and employment-based experience

Adults who do not have LLN and ICT skills tend to be excluded from the labour market and society, and increasingly so in the 21st century, where all forms of literacy are vital for effective participation in these milieu. This consideration is even more cogent in times of economic recession.

Relevant research

Many writers describe literacies in the 21st century as "new literacies" that include ICT and e-learning (see, for example, Andrews and Haythornthwaite, 2007). A recent study that used statistical modelling to compare longitudinal data on adult populations in Oregon (USA) and Britain identified relationships between adult literacy (traditional literacy), ICT skills (new literacy) and employment (Bynner et al., 2009). The researchers concluded, "… boosting literacy is unlikely to reverse the labour market exclusion process on its own. A combination of provision that raises ICT competence and the creation of employment opportunities will raise literacy and so is more likely to convert the vicious circle into a virtuous one" (p. 69).

Bynner et al. (2009) also emphasise the importance of ICT in the types of literacy and numeracy that people need to function effectively in 21st-century society and workplaces. They furthermore show reciprocal relationships between the three "divides"—their term for LLN, ICT, and workplace experience. They argue that adults without literacy skills, and/or ICT skills, and/or employment experience often enter a vicious cycle of exclusion that makes success less and less likely.

The authors found interesting contrasts between the US sample and the British sample because at the time of the study the USA was in recession, a situation that showed the aforementioned vicious cycle in action. In contrast, the members of the British sample were "operating" in a buoyant labour market. However, there the vicious cycle was still in evidence, but it manifested as less opportunity for career progression. Thus, access to ICT for training and employment opportunities (which vary according to economic fortunes) both have an impact. And, when put together, they have a double-loop impact on the development of LLN skills.

Other studies also link the need to provide a combination of opportunities for adults with LLN deficits, including acquisition of ICT skills and experience in employment settings (Department of Further Education and Employment, 1999; Mellar, Kambouri, Sanderson and Pavlou, 2004). Selwyn's (2003) critique for an international round table provides an extensive discussion of challenges, including the narrowing of LLN provision for adults due to the perceived availability of online resources.

Many adults face additional challenges when using e-learning to update skills before returning to work after a break. Common causes of breaks in employment are immigration, illness, recession and childrearing. These forms of break have a greater impact on women, who also tend to have fewer ICT skills than men (Bynner et al., 2009). The findings of an analysis of the ALL survey data for New Zealand also fit with this picture (Earle, 2009).

Implications of these research findings for practice

Recommendations:

- Develop a combination of provisions to raise adults' literacy skills, ICT competence and employment opportunities in order to give them a sound chance of securing and retaining employment;
- Encourage employers to provide both tutors and adults intent on developing their LLN skills with access to relevant ICT systems so they can develop training materials and the requisite skills;
- Recognise that LLN in the 21st century must include the "new literacies" associated with ICT and e-learning;
- Address the LLN needs (including, as necessary, development of the new literacies) for adults with LLN needs who plan to return to work after a break.

Finding 6C: E-learning projects targeting rural and dispersed communities are at a very early stage

Although innovative projects on e-learning for LLN in rural and dispersed communities are evident in New Zealand, these are still at a very early stage of development or implementation. They are consequently not at a point that would allow researchers to scrutinise them in order to provide quality research evidence and/or determine critical success factors.

Relevant research

E-learning has the advantage of including distant members of a community, including those on Pacific islands, where digital access is improving. It can also be used to tailor interfaces, resources and communication to the culture(s) and languages concerned (McCain, 2002). However, such initiatives are still in the design phase or in the early stages of operation in New Zealand. UNESCO (2006) describes some examples; one of the most interesting is a Mexican/USA project that provides adults working to complete their schooling with access to web-based courses.

Indications of effective approaches in New Zealand e-based distance learning come from initiatives such as Lifeworks, Mahi Ora, and Kiwi Ora, which have successfully recruited Māori and Pasifika and other non-traditional learners. The E-Māori and E-Pacific sections of the ITP New Zealand e-learning website provide examples (see Institutes of Technology and Polytechnics of New Zealand, 2006). Māori communities are actively considering how to adapt e-learning to their needs and culture as part of the New Zealand Tertiary Education Commission's e-learning strategy (Institutes of Technology and Polytechnics of New Zealand, 2006), as are Pasifika (Koloto, Katoanga and Tatila, 2006). In addition, with the right support, Māori and Pasifika have successfully taken up e-learning (Ham and Wenmoth, 2007; see also Finding 3A).

As mentioned elsewhere in this review, in Canada, the Alpha Plus organisation has provided a valuable set of case studies of their outreach learning centres and of the students who are successful there (Porter and Sturm, 2006). Each centre is embedded within its targeted community. The tutor's initial role is to provide students with significant mentoring in the outreach centre. This support includes in-depth orientation so that students can organise their learning, determine the e-learning skills they need and determine and map out their goals relative to work and careers. Once the centre successfully traverses this phase, their distance education and e-learning provision become sustained.

After the longish period of time needed to establish learner and community trust in these new modes of learning, ongoing student recruitment occurs mainly by word of mouth. Some students undertake mentoring of peers and family who are not formally enrolled in the programme, thus spreading the benefits of their learning and increasing longer-term recruitment. Tutors and outreach centre staff need ongoing professional development, however, and the skills that they use are significantly different from those that tutors use in traditional classrooms.

These outreach centres identified from their beginning the need to support students so they had early success with e-learning and developed a goal or plan for their ongoing learning. For example, the centres developed intensive face-to-face induction linked to career counselling and preparation of a learning plan, within which LLN needs were addressed (Porter and Sturm, 2006). In Pennsylvania, developers of the WES project created a test to screen students for their suitability for e-learning, as well as a course to help students develop the ICT skills necessary for e-learning. In California, however, the Distance Learning Project, which uses news broadcasts to develop literacy, had a much lower rate of success among its adult students than planned (Askov et al., 2003). One reason for this may have been that 95 percent of their students spoke English as an additional language.

The benefits accruing from the Alpha Plus outreach centres are confirmed by studies of similar services in the USA and Australia. (For a review, see Askov et al., 2003.) The key success characteristics that the authors identified as necessary from the set-up phase on were financial support, time to grow, encouragement of experimentation, freedom from accountability, and ongoing support (p. 41). We also noted that the services offered in the USA and Australia informed the recently launched U.S.A. Learns online learning tool (see http://www.U.S.A.Learns.org and also Finding 3B).

Implications of these research findings for practice

Recommendations:

- Continue research and development of e-learning that includes long-term partnerships with rural and dispersed communities;
- Recognise that these innovations are in the early stage of development and that those responsible for them will need to maintain or improve their attributes if the innovations are to be sustainable.

Finding 6D: Open-access centres, including libraries, increase access to e-learning

Open-access learning centres in the community, including libraries and facilities on employers' premises, can increase access to e-learning. However, they can only do this with appropriate support and opportunity to develop and engage in partnerships.

Relevant research

Open-access centres have been shown to be effective in increasing access to education and training, particularly for adults who have been traditionally underserved. The expected benefits

extend beyond those that affect only the individual and often relate to the partnerships involved (Appleby and Bathmaker, 2006; Pannucci and Walmsley, 2007; Prins, 2007). For example, family literacy partnerships bring clear benefits for children as well as adults in New Zealand (Benseman, 2006).

Luger and Maynard (2007) identified benefits for urban regeneration when the organisations concerned developed strategic partnerships at multiple levels in the USA. The authors conducted case studies of centres focused on developing foundation life and literacy skills (including those associated with ICT use) among people from low SES backgrounds. The forming of partnerships between the centres, community members and leaders, the e-learning service providers (eg phone and internet) and commercial enterprises in the area was led by an advocate working out of the centre. This strategic development was complemented by the fostering of close partnerships among staff and the adults they served. The authors considered these partnerships, stimulated by the advocates working as change agents, an important mechanism for developing and sustaining these innovative centres within their respective communities.

UNESCO (2006) illustrates successful use of centres in remote communities and those with tutor shortages. The Alpha Plus centres in rural areas researched by Porter and Sturm (2006) again provide a useful source of reference. As we noted in relation to Finding 6C in this review, Porter and Sturm identified from their case studies of these centres a number of characteristics that contributed to the successful setting up and sustaining of these centres. Porter and Sturm's key success factors are similar to those that Askov and colleagues (2003) identified in relation to the rural centres of Pennsylvania's WES initiative. Both sets of authors stressed the importance of planning for e-learning as a vital success factor. And both sets of authors found that the success factors changed as the innovations matured—the early technical difficulties were reduced, and activities to improve retention increased. Kambouri et al.'s (2003) evaluation of UK Learn Direct Centres noted a similar range of issues and the need for ongoing development and support.

In New Zealand, a study of e-learning in industry, conducted by Clayton and Elliott (2008), identified the growth of e-learning and also three levels of characteristics critical to the success of e-learning: organisational, training, and learning. The authors also observed that the stages of maturity for e-learning in large organisations differ from those for smaller organisations where there is less potential for in-house development. They furthermore noted that e-learning growth is impeded if the learners are on the wrong side of the "digital divide". The particular challenges in this regard were connectivity/access to e-learning and the capacity of personnel to support e-learning within existing modes of management and training. The authors finally identified lack of industry-specific content and limited opportunity to access LLN provision because of the e-learning being embedded within the sector and because of constraints exercised by company-specific practices and language. The Australian Institute for Social Research (2006) reported the same problem concerning LLN in their examination of barriers to e-learning. The institute paid particular attention to problems associated with the digital divide, and their commentary in this regard highlights the particular challenges faced by women, indigenous people, disabled adults and people with two or more of these characteristics.

Sawyer's (2004) research in Australia on e-learning directed at enhancing literacy and vocational outcomes for indigenous people draws attention to another success factor. Sawyer found that video-conferencing provided a critical aid to the learning process because it offered oral and visual communication and because it provided a face-to-face learning exchange. Text-based e-resources, he noted, are often inappropriate because of their reliance on English literacy and because of the unfamiliar cultural contexts of the scenarios in the resources. These resources also assumed that learners had requisite computer skills. Sawyer advised significant

customisation of resources (including digital stories), but emphasised that this process needed to be conducted with reference to and in collaboration with the challenged adults.

Several studies report the promise of emerging technologies and mobile learning. For example, Askov et al. (2003) describe "chatterbots", which use artificial intelligence to guide learners, with delivery occurring through personal digital assistants (PDAs). According to Coniam (2008a, 2008b), these devices still have "some way to go" before they will truly support the learning of ESOL adults. Clayton and Elliott (2008) describe increasing use of PDAs for e-learning in New Zealand industry, and maintain that these could bring increased opportunities for just-in-time and just-enough approaches to e-learning. In particular, they say, the use of graphics, audio and simulations could reduce demands on literacy. Additional applications could also be developed to address literacy and numeracy needs. However, we could find no studies to support this supposition in the LLN research literature, and the benefits or otherwise of these new devices have yet to be explored.

Implications of these research findings for practice

Recommendations:

- Bear in mind that learning centres in the community, such as libraries and those on employers' premises, can increase adults' access to e-learning;
- Remember that the success of such access for learners depends not only on these learners receiving appropriate support but also on the centres operating in partnership with other individuals and organisations involved in the learning programme;
- Encourage ongoing investment from the community served, as this support is essential for sustaining the e-learning infrastructure and e-learning services;
- Recognise that robust and reliable IT-based infrastructure is critical (hardware, software and computer networks including web access);
- Ensure that adults' first experiences with e-learning are successful in terms of building these learners' confidence in and appreciation of the use and relevance of e-learning;
- Prepare staff, procedures and resources that align with the learners' cultures and backgrounds and link with other aspects of their lives;
- Encourage libraries to increase privacy and duration of internet access to benefit adults with LLN needs;
- Encourage and support mentoring that spreads into the communities served, and that draws in adults who have successfully developed their LLN and e-learning;
- Investigate the potential of emerging technologies (including mobile learning on PDAs and phones) as well as software applications, open-access centres and community support to reach underserved populations of adults and their communities.

APPENDIX A LITERATURE REVIEW METHODOLOGY

A.1 Introduction

The initial methodology for this literature review took into account the current characteristics of LLN and e-learning research, in keeping with Alton-Lee's (2003) and Galvan's (2006) views that the method underpinning a research synthesis should be an iterative process. We agree with Benseman, Sutton and Lander (2005) that a literature review should include an appropriate scrutiny of evidence-based practice (de-emphasising the value of particular research methodologies) and should view the process as an integration of professional wisdom with the best empirical research available.

This broader interpretation enables the findings from research based on rigorous methodology to be combined with action research, observations and analyses, case studies and/or more detailed explorations of "learning events" or local experience to provide rich data from which to draw observations and conclusions. Small-scale, well-organised, in-depth studies in the literature can illustrate good practice and provide useful insights into teaching and learning. For us, the approach to our literature review was discursive because the research on the topic that we examined comes from a number of disciplines, cultures and contexts and has only rarely been undertaken systematically.

During our review of the literature, we used the access that our team's principal investigator (Davis) had to various important sources of information. These sources included leading libraries in the United Kingdom (the Institute of Education, University of London, which is a copyright library and was identified as the leading educational research university in the UK in December 2008) and the USA (specifically Iowa State University). Together, as a team, we were able to complement the collections of the University of Canterbury library (our "home" library) with material accessed through the Triangle Research Libraries Network (North Carolina Central University, Duke University, University of North Carolina, and North Carolina State University). Furthermore, Davis was able to use her fellowship with the Oxford Internet Institute to access libraries at the University of Oxford, including the institute's own collection. We also widely searched New Zealand sources, including the Ministry of Education Iterative Best Evidence Synthesis Programme and the New Zealand Educational Theses Database, as well as avenues and items suggested by Ministry of Education staff.

During our first stage of searching, we relied on support from experienced database researchers and librarians in New Zealand, the UK and the USA. The search criteria used at this time related to the research question and sub-questions. We also used backward referencing to provide additional sources. We took particular care, by using a combination of keywords, to include the multiple ways of expressing both LLN and e-learning. We furthermore sought to locate high-quality research studies that incorporated e-learning as part of the delivery of LLN courses, and/or teaching and/or citations. Each of us fed in recommendations, as did our national and international collaborators and the contributors to our project's website.

Each of us was delegated specific areas to search further. These areas were typically ones that related to our individual expertise relative to the e-learning project. We placed our findings on a "Delicious" web bookmark database so that each of us could swiftly and readily access this material. We furthermore established a web-situated project area where we could share pdf and other electronic versions of key resources and documents, as well as database files compatible with Endnote software. Among the other material that we sought were recently published books and web-based texts. We also combed the reference sections of selected items and used Google to identify relevant articles. We screened this large collection of literature according to

additional factors, such as whether the research appeared to be congruent with New Zealand contexts and the reputation of the organisation or researcher conducting the study.

During the second stage of our research, we independently read the abstracts and/or full texts of the identified articles and reports and evaluated each one using criteria appropriate to the type of study concerned. Davis and Fletcher met frequently during the sustained literature review search to discuss and analyse articles. The second stage saw us eliminating many of the initial lists for various reasons, including inadequate reporting of outcomes, interventions not specified, and poor data collection. The remaining items formed the data-set for our analysis of the literature and were collected into the project's archive and database for further analysis.

We found a dearth of research, including both quantitative and/or qualitative, specifically focused on incorporating e-learning as part of the delivery of LLN opportunities, training, courses and/or teaching programmes for adult learners at the foundation levels. On Davis's recommendation, in part a product of her consultation with her international and national colleagues within the wider field of e-learning, we decided to include research that related to areas surrounding the specific focus on e-learning supporting adult LLN students at the foundation level. During this further analysis, we continued to seek themes for our literature review and to frame those themes according to our multilayered ecological perspective (Davis, 2008).

We then shared drafts of the literature with critical scholars as friends, including our national and international experts (eg Emeritus Professor Bridget Somekh), the members of the project's advisory board, and the New Zealand Ministry of Education. We also drew on those people associated with our two parallel research studies (conducted as part of this project) for their input.

These processes ultimately led to a literature review that provides information on the typologies of LLN and e-learning and a set of hypotheses predicated on the key success characteristics of e-learning for adults wanting to develop LLN competence. We initially grouped our findings under five themes, but later rationalised these into six themes, a process that informed the development of the observation and interview schedules for stakeholder interviews and the case study (see below).

During the second half of the literature review, from October 2008 to April 2009, the literature could not help but be informed by our parallel activities—the stakeholder interviews and the case study. We describe each of these in the remaining sections of this appendix.

A.2 Stakeholder interviews

In consultation with the project's advisory board and the findings from our research team's search for providers of e-learning within LLN contexts, we contacted all suggested possible stakeholders to ascertain whether their experience and work related to the specific needs of the research project. The criteria for inclusion related to these questions:

- Did the potential stakeholders have a role in implementing or contact with adult learning programmes focused on literacy, language, and/or numeracy and involving use of e-learning?
- Were the potential stakeholders considering or in the process of developing such programmes for adult LLN learners, particularly at the foundation level?

On completing this initial wide search, we invited the selected stakeholders to participate in either a phone or a face-to-face interview with a researcher, either the two lead researchers (Davis and Fletcher) or the lead research assistant (Absalom). Key stakeholders included the

following: Ministry of Education adult literacy, numeracy, and language experts; literacy development officers, including those working in ESOL and with Māori; ITOs; workplace human resources managers; and LLN tutors.

A.3 Case study

From the data that we gathered during the initial search for stakeholders to interview, we identified one tertiary organisation that had embedded LLN and e-learning. This organisation met the criteria of being a provider offering courses targeted at students at the foundation level in literacy, language, and/or numeracy, and which were taught within the context of workplace scenarios. Another criterion was that the courses include an element of technology or e-learning to support adults with LLN needs.

Our aim was to undertake a complex multilevel case study informed by ecological perspectives. We therefore gathered data about the whole organisation. We also ensured that the information collected provided detailed evidence about the evolution of embedding LLN and e-learning within the units in the organisation supporting adults with LLN needs, such as the ESOL resource centres. We also looked for and documented examples, spread across the organisation's three colleges, of five courses that included e-learning and/or ICT enhanced teaching.

For further details of this process, see the published report of the case study (Davis, Fletcher and Absalom, 2010).

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