



MINISTRY OF EDUCATION

*Te Tāhuhu o te Mātauranga*

E-learning for adult literacy,  
language and numeracy  
*A case study of a polytechnic*

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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# 1 SUMMARY

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Few descriptive accounts exist of the many recent innovations in e-learning for adults with literacy, language and numeracy (LLN) needs underway in New Zealand. This case study presents one such account.

The case study institution at the heart of this report is a large urban polytechnic, known for its innovative effort to provide quality education for second-chance learners, including blending of ICT. The polytechnic has successfully embedded literacy and numeracy in many of its programmes, in line with the recommendations of the Tertiary Education Commission (TEC) and with reference to the TEC learning progressions for adult literacy and numeracy. Online and distance education is not a main priority for the polytechnic, and it does not have a distance education unit. Instead, e-learning coordination and support are part of the polytechnic's Learning Services division.

E-learning initiatives across the polytechnic include those associated with coordinating e-learning provision throughout the institution, embedding e-learning in polytechnic courses, and (from our particular interest point) making e-learning part of activities aimed at enhancing adults' LLN skills.

During our investigation, we endeavoured to understand what had contributed to and detracted from the success of the polytechnic's specific and polytechnic-wide e-learning initiatives, especially those aligned with LLN learning. We identified five major factors that led to sustained innovations involving e-learning and embedding of LLN:

- The importance of leading from the top;
- Learning Services support;
- Professional and curriculum development (including professional development in e-learning);
- E-learning development and maturity;
- Initiatives for Māori.

We studied three of the five colleges of the polytechnic that had taken aboard the need to advance, through professional development and other measures, the e-learning (and embedded LLN) trajectory of individual tutors and organisational units. From our observations, we concluded that the polytechnic is generally managing to meet the many needs of adults with LLN needs and that it is taking a realistic approach to this work, especially in recognising that this development is an ongoing one that needs careful periodic review and adaptation.

During our investigation, we took a close look at five polytechnic programmes that have adopted one or more forms of e-learning in order to improve adults' access to learning and/or the curriculum at foundation level. A brief summary of each programme follows.

1. *Provision of online distance learning to support remedial study of numeracy:* Presented in modules accessed online through the polytechnic's learning management system, the content of this provision is designed to help adults access careers in health-related fields. The online study has been successful for some adults, but not as many as the programme developers envisaged. Overall, online study works best for students with some initial numeracy.
2. *Use of mobile phones as part of trades courses for apprentices:* An innovative tutor who was an early adopter of new technologies in the polytechnic developed and leads this initiative. She carries out this work in partnership with the polytechnic's e-

learning coordinator. The tutor implemented m-learning (mobile learning), which is part of an ongoing innovation with e-learning within this course, after finding her student apprentices were not using the course's learning management system when in their workplaces. Her aim in having her students use mobile phones was to engage them in their learning via a technology with which they were familiar. She also decided to use the phones to provide a more effective means of work-based assessment and to develop her students' literacy skills.

3. *A digital resource centre within the polytechnic's library:* The centre, which has developed over time within the library, contains and supports a range of digital technologies that encourage resource-based learning and increase adults' self-access to English-language learning. This latter provision has been particularly welcomed by international students and migrants learning English at the polytechnic.
4. *Computer-based simulation of practices, such as preparing a building site:* The simulation approach has been well received by foundations and trades students. Additional online provision includes quizzes with drag and drop answers that increase students' access to language and are delivered through the polytechnic's online learning management system.
5. *Evening class providing literacy support for adults:* The class provides strong evidence of why adults with particularly low levels of literacy skill need intensive support, not only to improve their level of skill but also to access literacy learning through e-learning. Adults with low levels of literacy skill are also likely to have poor ICT skills. The support therefore needs to simultaneously accommodate both areas of need.

To understand the processes underpinning the evolution of e-learning implementation and practice in the polytechnic, we undertook a further analysis using change models. Our case study ends with a brief description of the outcomes of this analysis against each of the findings of our comprehensive review of the international literature on e-learning for adults with LLN needs (Davis, Fletcher, Everatt, Mackey, Morrow, Brooker and Gillon, 2010).

## 2 INTRODUCTION

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This case study is one of the few descriptions of the many recent innovations with e-learning for adults with literacy, language and numeracy (LLN) needs underway in New Zealand. This research informed the accompanying final report (Davis and Fletcher, 2010) and literature review (Davis, Fletcher, Everatt, Mackey, Morrow, Brooker and Gillon, 2010) (available online at [http://www.educationcounts.govt.nz/publications/tertiary\\_education](http://www.educationcounts.govt.nz/publications/tertiary_education)).

The 2006 Adult Literacy and Life Skills 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). In this case study we use the Adult Literacy and Life Skills survey levels of literacy, particularly Level 2 of the ALLS. In this review we refer to this level as an *intermediate* level of literacy, which often appears to be a threshold for becoming less dependent on a tutor.

In this case study, "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. E-learning offers educators new ways to structure and support the learning of their students. Activities that draw on these technologies not only aid access to learning but can also be made relevant to everyday life and work contexts, where literacy and numeracy skills are becoming more important, as shown in our summary report (Davis and Fletcher, 2010).

Our consultation with the Ministry of Education and stakeholders made us aware of how little e-learning has been employed with adults with LLN needs. It became apparent to us that the polytechnic is probably the only tertiary organisation in New Zealand to have been using e-learning in this way for a sustained period of time (just over nine years). We therefore selected it as the focus of this case study.

The study is part of a larger body of research (commissioned by the Ministry of Education) on the applicability of e-learning for adults with LLN needs. The other components of the research include the aforementioned literature review, online seminars conducted by international experts in the area of LLN, and stakeholder interviews on the same topic (Davis and Fletcher, 2010).

The institution at the heart of this present report is a large urban polytechnic, known for its innovative efforts to provide quality education for second-chance learners, including blending of ICT. The case study describes the polytechnic in 2008. Over time, the polytechnic has successfully embedded literacy and numeracy in many of its programmes, in line with the recommendations of the Tertiary Education Commission (TEC) and with reference to the TEC numeracy and literacy progressions. Online and distance education are not a main priority for the polytechnic, and it does not have a distance education unit. Instead, e-learning coordination and support are part of the institution's Learning Services division.

The polytechnic is one of the largest tertiary institutions in New Zealand. It educates over 15,000 students per annum and employs around 2,000 staff. Applied learning is emphasised on the polytechnic's public website, which details offerings in many qualifications, some of which are local and some of which are national and which range from foundation programmes through to degree and graduate qualifications. A job advertisement issued by the polytechnic states that

its “staff profile encompasses foci on students, learning and teaching, innovation, flexibility and continual learning, research, biculturalism, internationalisation, disability awareness, environmental awareness and sustainability, health and safety and [ICT] literacy”. All the polytechnic leaders we interviewed during the study agreed with the following statement made by the institution’s chief executive officer during our interview with him: “This institution sees itself as having a key role in providing second-chance opportunities for adults to achieve their vocational objectives, and one of the things that they need to do that is a certain level of literacy, numeracy and study skills.”

The use of e-learning within the polytechnic is most prevalent in courses for international students and at higher levels of learning. However, we identified five of the polytechnic’s programmes as particularly pertinent to our investigation because they provide e-learning-based activities for adults seeking to improve their LLN skills at foundation level. The features of these programmes that we thought merited close examination included the use of computers in classrooms, distance learning, and mixed mode (ie some learning activities carried out in the workplace or at home, but most situated in the polytechnic). We also endeavoured to describe the range of initiatives underpinning the development and delivery of these programmes so that we could better understand how e-learning can be used to embed LLN within programmes for second-chance learners.

We begin our report by describing the characteristics of the five programmes. This section is followed by a description of the wide range of initiatives that support the polytechnic’s sustained development of e-learning. To understand the processes that resulted in implementation of e-learning practice, we conducted another analysis, using change models. Our case study ends with a brief description of the outcomes of this analysis against each of the findings of our comprehensive review of the international literature on e-learning for adults with LLN needs (Davis et al., 2010).

We describe, in Appendix A, the approach we took when conducting the case study. Appendix B contains a brief description of the innovation models that we used as a reference point when conducting our investigation.



## 3 E-LEARNING IN FIVE PROGRAMMES

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We selected these programmes for close examination because they address adults' LLN needs and incorporate at least one aspect of e-learning. We discuss each one in turn. The order in which we present them runs from the programme that is most dependent on e-learning—an online numeracy class—to the programme that is least dependent—a literacy evening class with only a few ICT enhancements.

- Online distance learning (numeracy);
- Blended m-learning (apprentices);
- A digital resource centre (ESOL resource centre);
- Trades course involving some ICT use;
- Literacy class involving some ICT use.

### 3.1 Online distance learning (numeracy)

In 2008, the year we conducted our study, this programme was a rare instance in New Zealand of a course that had made long-term use (since around 2000) of online distance learning for adults with numeracy needs.

#### **Context**

This course is designed for adults whose goal is a health-related career, such as nursing, but whose numeracy holds them back from completing the necessary foundation work. More specifically, the course aims to equip students with the “basic arithmetic and graph-drawing skills” they will need to complete further study in health-related courses.

Most adults choose the face-to-face mode rather than the online form of the course. The few students who typically elect to study online choose this mode so they can fit in study time and study location with their employment and/or child care commitments. The course tutor told us that the adults who are most successful at studying online are those who already have some of the numeracy skills covered in the course and/or need to revise some of those skills. Adults who need to learn all topics tend to drop out or join the campus class while continuing their learning online. We were also told of one student who, having failed the course on campus, was guided into studying the topics online. She passed after completing this further self-paced study. Across the two course modes, students studying online are more likely than the students studying face to face to gain the top grades.

In addition to interviewing tutors and observing the online course materials, we interviewed four students (all women). All four said they valued this provision because the self-paced learning allowed them to fit the timing and duration of study around their personal lives. They also valued the course because their numeracy errors and lack of understanding remained private. “A computer doesn't laugh at you,” said one. Past classroom-based experience of numeracy learning had left them embarrassed whenever they held up the rest of the class because they needed extra help or practice.

#### **LLN targeted**

Material advertising the programme states that it will “start at the very beginning with addition and subtraction and take you through to percentages and ratios”. Topics covered include addition, subtraction, multiplication and division on whole numbers, decimals, fractions, order-of-operations rule, rounding numbers, estimation, graphs, powers, standard form, percentages, rates, ratios, proportion, metric conversions, calculators and word problems. The course is not tailored to individual needs, and it is up to the learners to choose which topics to study. Each topic begins with an introduction (eg Introduction to Metrics).

## **Place of learning**

Many of the adults who opt to study online prefer to do so at home via the internet. Help desk support is available online, by phone, or by visiting the polytechnic's Maths Help centre located within Learning Services. Adults without a computer at home can choose to study on polytechnic computers in the Maths Help centre or in an outreach centre nearer their home. One woman had done so successfully, but she noted that other people in the room distracted her. Another woman preferred the face-to-face contact of the classroom and supplemented her learning there with the learning provided online.

Most of the students we spoke to, especially those in work, found time and organisation constraints challenging. As one of them said, adults often find it difficult to discipline themselves "to sit down and study online".

## **Form(s) of e-learning**

Around 50 hours of self-paced individual learning is delivered in structured online units that adults learning at a distance access through the polytechnic's course management system, Moodle. The printed workbook that complements the online resources reinforces each learner's skills and achievements. Online access to the course is provided 24/7 for as long as each student requires access. Students complete the course by taking an examination at the polytechnic or at an approved assessment centre.

The computer requirements are clarified in the programme's advertising materials. Potential students can also use the programme's website to test if they can access the course material through their own computer and to determine if the software they have on that computer allows them to browse the internet. The website also provides a link to an online "tour" that features the introductions to several topics. The design of the programme assumes that students have the basic skills needed to operate a computer, access the internet, and learn through a learning management system.

Each unit takes a tutorial approach to learning a specific topic and starts with an introduction to important concepts. Occasionally, the units include interactive elements, such as that illustrated in the screen shot in Figure 1 below. All units contain a range of exercises with immediate feedback. When a learner has worked through a problem and entered the answer, he or she finds feedback on the next screen. An incorrect answer prompts the computer to offer the student different ways (short and long methods) of working out the problem.

When we asked students which features of the online programme they considered best aided their learning, they identified the following:

- Clear and colourful tuition;
- The ability to choose how long to stay on the computer;
- Presentation of several different ways of solving each maths problem;
- Practice exercises, including a mixture of easy and harder problems, with immediate feedback;
- The opportunity to repeatedly access material ("as much as you want") before moving on to the next question or stage.

The learners also valued clear instructions. One woman, who was currently working in a supermarket, said, "When you do exponents or fractions, ... [the computer tells you] what keys to press." The "very good" Help section in the online course was also appreciated.

Figure 1: Example of an interactive exercise in the online numeracy course

Example 1 continued Metrics: topic 3 of 3

M	•	•	k	h	da	m	d	c	m	•	•	μ
Mega			kilo	hecto	deca	l	deci	centi	milli			micro
1000000			1000	100	10	g	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$			$\frac{1}{1000000}$

This is three steps to the left.

So move the decimal point three places to the left.

1400 ml = 1400.ml = 1.400 litres = 1.4 litres

Navigation: Previous | Go to Topic 1: Metrics Introduction | Show this again | Next

One of the four women we interviewed in relation to the numeracy course had printed out all of the online material so that she could study on paper. She said she found it easier to study through this medium than via a computer screen. She also said she was worried about using wireless internet at home and so “got off it as soon as possible”. Her reason for doing this may have been a misconception about a health risk, or it may have related to the cost of the internet connection.

All four women suggested that additional exercises and an online video clip of someone teaching or explaining the maths would aid their learning. One woman had written as additional practice for herself some extra exercises based on those in the workbook. Another woman, who told us that “sometimes you just need a little more”, had borrowed a book (on maths for nurses) from the library. The women also wanted practice exercises at a more basic level than those currently provided. Another learner felt that the examples in the first unit went from easy to very hard in too few steps: “I’m all right doing the work on the computer, but it when it comes to doing the homework in the book, it’s like missing steps.” Additional formats for use at home, including a DVD, were proposed because “not everyone has internet or broadband access”. The women also proposed individual face-to-face tutorials, perhaps for an hour at a time, once or twice a term, on request.

The four women thought that a free, public online maths programme was a good idea, but only two said they would definitely use it, probably from home. They also said that they would want the resource to fit their specific needs and that success could also depend on “phone calls to ask questions, or face-to-face time with a tutor”. Accompanying face-to-face workshops or tutorials were also deemed useful.

We also asked the four women to identify barriers to their and other students’ online learning. All recognised the following as common problems:

- Lack of basic computer skills;
- Not having one’s own computer;
- Not having home-based internet or broadband access;
- Having to enter answers on the computer rather than write them on paper.

## **Programme origination and development**

This programme began in 1998 as a result of a polytechnic-funded initiative aimed at improving teaching and learning. Programme development was led by a tutor who has now become head of department. The funding allowed this numeracy expert to reduce her teaching load so that she could lead construction of the original web pages. While she enjoyed using software to create the web pages, she considered it prudent to call on support from an instructional designer.

The web pages were published on the polytechnic website so that any polytechnic student who wanted to develop his or her numeracy skills could do so. The department head had expected that most students would be able to use them successfully, but it soon became clear to her that self-paced online learning was only successful for students who already had some numeracy, and that this form of learning was particularly successful for students wanting to refresh numeracy skills that they had not used for some years.

Although the institution was ready in 2008 to offer this provision collaboratively with other organisations, it decided to move the pages to the polytechnic's learning management system, which was initially Blackboard and is now Moodle. The web pages have thus become part of the content offered online. These and other changes in computer platforms caused technical problems, so ongoing maintenance is required. However, changes to the content and design of the web pages have been minimal because the content of the topics covered has remained static. The department head said that her increasing role in the polytechnic leadership over subsequent years had probably contributed to the ongoing support needed to successfully sustain this innovation.

## **3.2 Blended m-learning (apprentices)**

This programme, which employs mobile technologies (eg mobile phones) to facilitate learning, is the only one of those we investigated in 2008 that encompassed work-based study. Apprentices' learning involves course books blended with a learning management system and the use of mobile phones.

### **Context**

The context for this course is a modern apprenticeship programme that links apprentices with employers. Apprentices' workplace learning is complemented by a series of two-week block courses involving theory and practice and offered each year during the three years of apprenticeship learning at the polytechnic. Apprentices sign up for these courses through their industry training organisation (ITO).

The theory-based courses are part of a national certificate (Level 3) programme and follow industry unit standards. These topics are covered in printed workbooks and online through the course management system, Moodle. Course topics include legislative requirements, vocational science and technology, management, making processes, and plant and products. Summative assessment is linked to completion of unit standards during block courses on campus. However, the apprentices are also required to gather evidence of learning from their workplaces.

### **LLN targeted**

The course as a whole contains a strong embedded literacy component, but this case study focuses on the m-learning component. Apprentices commonly have literacy and numeracy needs. They tend, therefore, to find gathering evidence for formative and summative assessment challenging.

### **Place of learning**

Cohorts of around 10 apprentices learn in workplaces scattered across New Zealand. Each year, the apprentices also attend a two-week block-learning course on the polytechnic's main campus. Some of their learning also occurs at home.

Ensuring that apprentices complete their training continues to be a struggle because employers are often too busy to provide the required experiences and to sign off their apprentices' learning records of skills and unit standards acquired. The tutor said that some employers were keen for the polytechnic to take over this role.

### **Form(s) of e-learning**

Since 2000, apprentices have been able to access learning resources for 10 unit standards through the polytechnic's learning management system, Moodle. However, the apprentices rarely have online access in their workplaces, so they generally use Moodle only when on campus. According to one of the programme's tutors, many first-year apprentices are not computer literate or they have limited keyboard skills at the start of the programme. This situation applies even to those who are skilled on game consoles. However, due to the apprentices' lack of access, while out in the workplace, to an internet-connected computer, the online resources have also been redeveloped into paper-based workbooks.

The learning management system provides an e-portfolio for the apprentices to aggregate formative and summative assessment of their work relative to the unit standards. The e-portfolio gives apprentices opportunity to develop their ICT skills because they have to upload evidence of their achievements. They also use this facility to find out what improvements their peers and tutors think they need to make to their submitted work. The learning management system allows tutors to view and assess all apprentices' work. It also provides them with tools with which to build and distribute additional learning activities.

Tutors and most of the apprentices use mobile phones extensively as part of the learning context. The polytechnic purchases mobile phones for the tutors and has in place routines that allow for an easy interface between the phones and the learning management system. All apprentices use their own mobile phones, but the polytechnic gives them vouchers that support the cost of using the phones for three purposes:

- Responding to a tutor's text message to arrange meetings at the student's workplace. The success of texting for this purpose stimulated the second purpose;
- Formative evaluation of the theory contained in the workbooks, prompted by the tutor sending a text of a different multiple-choice question up to four times per day to all the apprentices. The tutor uses a mass text system called eTXT. Each multiple-choice question uses up to the 160 characters permitted in a text message;
- Photographs and video evidence of workplace-based learning captured by the apprentice on his or her phone in the workplace so that the tutor can assess this work against unit standards. Apprentices upload this material into their personal journals in Moodle. When doing this, they often use an interim web-based repository compatible with mobile phones, such as Flickr, to store photographs, or YouTube, for video. A few apprentices have explored the use of social networking sites, such as Bebo, which can be linked to their Moodle page. However, it was evident that apprentices rarely want to mix their working life with their leisure activities.

During the block courses, each apprentice collects all of this evidence together into his or her e-portfolio. Their tutors encourage the apprentices to choose software that is appropriate for presenting this work. Some apprentices use PowerPoint presentation software. Others experiment with web tools, such as Comiq, to show a work process. Comiq allows users to present a series of photos with captions in balloons (as is done in comic strips).

Apprentices, tutors and the polytechnic's ICT coordinator have together learned the capabilities of the mobile phones. As they have become more sophisticated users of their own mobile technology, apprentices have helped their tutors develop the ICT skills needed to operate m-learning effectively. Before the phones were used for this purpose, only a few apprentices had used their phones for surfing the web, videoing and/or photographing. Since using the phones as part of the learning context, apprentices have gained confidence in using a variety of mobile phone applications for a variety of purposes. Tutors are continuing to learn from their students

how best to “maximise the system”: having several different phones and payment plans is just one recently developed option.

The tutors told us that they had purposefully decided to use a digital tool that their apprentices were familiar with (ie the mobile phone) and to combine it with web-based applications that are freely available. To date, the most successful outcome of this approach has been the apprentices’ documentation in the e-portfolio of their workplace-based competencies, skills and knowledge. Each e-portfolio website is hosted by or linked to a Moodle course so that the apprentices can readily access their individual areas, and their tutors can easily see all of the apprentices’ work.

The tutors also told us of several unexpected benefits of the m-learning approach. Apprentices, they said, have taken greater ownership of their learning, especially as they near the end of their apprenticeships. They have become smarter at gathering evidence for their portfolios, and they are “more attuned to what they are doing at work”. They have also “become more assessment smart” in terms of determining the best work evidence to collect and present. Previously, apprentices’ assessment focus had been on “getting the employer to sign them off”. The apprentices, furthermore, are giving more thought as to what they are actually being taught in the workplace, and they have a greater awareness of the range of products they need to work with in order to achieve all their unit standards.

### **Programme origination and development**

The innovative use of e-learning in this programme was instigated and led by a tutor who has been and remains an early adopter of innovations (see Rogers, 2003, for a description of adopter categories). She works closely with an innovative ICT coordinator; both receive strong support from their managers.

The initiative had been stimulated in part by the polytechnic winning a series of grants received from the government that were designed to encourage the development of innovative teaching and learning practice. The first innovation within the e-learning programme was the implementation of online learning. However, when it became apparent that the apprentices were not comfortable using the course learning management system as part of their workplace learning, their tutors redesigned the e-learning context to encompass mobile technology so that it would support the apprentices’ learning in the workplace. This redevelopment constituted the second innovation – the texting of multiple-choice questions. The third innovation, which was still being developed at the time of our investigation in 2008, is the requirement for apprentices to gather evidence of their accomplishments while in the workplace and then to present it online.

The ICT coordinator noted that he and the team of tutors were continually evaluating different phone-accessible websites in an effort to find which best suits the programme’s aims and needs. The ICT coordinator also told us that a long-range goal of the programme is to have apprentices and tutors make as much use as possible of mobile phones to collect and collate (in the e-portfolio) evidence of learning. An even longer-term aim is to obtain funding to extend the project to a range of other trades and students, in order to determine the effectiveness of this approach in other workplace contexts. As the coordinator pointed out, trades such as building and plumbing, where students move around between sites, seem particularly well suited to the mobile-phone approach. He also observed that mobile communication networks offer increasingly practical opportunities for m-learning.

### **3.3 A digital resource centre (ESOL)**

The polytechnic’s ESOL centre is the driver behind the integration of self-study into programmes for adults wanting to learn English as a second or other language (ESOL). Digital technologies are an increasingly natural part of the centre and its e-learning extensions.

## Context

The ESOL centre serves migrants, international students and refugees, and their tutors. Most of these students enrol in English classes, full or part time; others drop in according to need. Our investigation focused on permanent students, who often have work or other commitments.

Tutors teach the English language directly in their classroom or team up with tutors in the trades and professional programmes. They also help adults in their classes to use resources in the polytechnic's computer labs and ESOL centre. All classes have, per week, one hour scheduled in the computer suite and one hour in the language centre. Adults can drop in at any time, including after class up to 7.00 p.m., or during the weekends from 12.00 noon to 4.00 p.m.

The ESOL centre's close relationship with tutors throughout the polytechnic has resulted in a successful student support system. At the beginning of the year, and at other times as necessary, centre staff give tutors an introduction to or an update on centre resources. This information includes material on a range of useful resources and strategies that tutors can match to the level and discipline of their students.

## LLN targeted

Within the ESOL programme, the course for beginners in the English language includes those adults with the highest level of LLN needs. At the time of our investigation, there were about 40 such adults, spread across three classes. Of these 40, about 15 had no English whatsoever, so were absolute beginners. In addition, the centre was accommodating about 200 adults with an intermediate level of English-language proficiency, and about 100 students at the upper-intermediate and above levels. To move from one level to the next, students take a test at the end of the term. Some adults stay at the same level for more than one term.

## Place of learning

The ESOL centre is located in a large room on a floor of the central library adjacent to racks of English-language-related material and two computer rooms overseen by the centre manager. The centre's display stands of books and media include video and audio materials in several formats, including DVD. A whole section features New Zealand-based materials. Other racks, shelves and stands display plastic bags containing the following: recorded items, tasks and transcripts; beginning and elementary teaching items for listening, reading and vocabulary; books on English for specific purposes (eg business English, English for science); and multimedia assessment tools with sound tracks on CDs to prepare for test such as International English Language Testing System (IELTS). The latter include transcripts and answers. Near the enquiry desk is a wide range of colour-coded one-page guides on strategies for successful language learning. Figure 2 provides an extract from a student guide to computer-based resources.

Figure 2: Extract from a student guide available in the polytechnic's ESOL centre

### Would you like to use the computer to help you with ...

Your spelling? Try...

- Interactive Picture Dictionary
- That's Life
- Issues in English 1 & 2 (dictation)

Or on the Internet:

- [http://esl.about.com/library/listening/bls\\_beg\\_spelling.htm](http://esl.about.com/library/listening/bls_beg_spelling.htm)
- <http://www.sentex.net/~mmcadams/spelling.html>
- <http://owl.english.purdue.edu/handouts/grammar/>
- <http://www.bbc.co.uk/skillswise/words/spelling>

Your writing skills? Try...

Before beginning their learning, students tour the centre, during which they receive information on what they can do in the centre and how to access resources. At the end of the tour, they complete a simple quiz on paper. The quiz is designed to assess their needs and to encourage them to start to take responsibility for their own learning. Students are free to walk around and look closely at the resources. Centre activities and information sheets cater for different levels of English proficiency. Vocabulary and layout (eg font size) differ according to student need. Vocabulary relevant to different contexts (eg business, science, nursing, and everyday situations, such as a visit to the doctor) is also on offer.

Although centre staff and tutors sometimes directly refer students to specific resources likely to help their language development, they also guide, advise and encourage students towards thinking about and evaluating what they might do. The aim is not to tell students to do things in certain ways but, as is the case with the above-mentioned quiz, to help them take ownership of their learning. ESOL centre desk staff accordingly encourage and support students to use a plan for their resource-based learning. The plan has the particular advantage of scaffolding each student's learning in a manner that allows him or her to develop autonomy in language learning.

Students begin their plan by noting demographic information, including home language. From there, tutors help the adults to analyse why they are learning English and which aspects of that learning are important to them. This step is advanced by having the students tick items, listed under four columns (reading, writing, listening, and speaking), that they want to develop. They then provide a short statement describing their goals or needs related to English-language learning. The tutor then comments on their lists and statements. The final page of the plan provides space for a log of resources used and notes on each resource's helpfulness. A 1 to 3 scale also allows the students to rate that helpfulness.

In addition to a full-time manager, the ESOL centre has a part-time technical support assistant and a resource coordinator. The centre also employs peer students for evenings and on weekends. Criteria for selection relate to having a male/female balance and a range of ethnicities. Open-mindedness and helpfulness are also important selection criteria.

### **Forms of e-learning**

In addition to its traditional resources, the centre has many forms of e-learning at hand. To allow for this provision, the polytechnic remodelled the room that accommodates the centre and changed the centre's furnishings. The centre thus contains digital equipment and appropriate seating, and its resources are grouped into four well-labelled skills areas: reading, writing, listening, and speaking. Many of the published resources in the ESOL centre are digital. These are carefully collected, coded and placed, along with other resources, in clearly marked repositories. The other resources include:

- Audio and video books;
- Music recordings;
- Interactive software packages and guides to their use;
- Information sheets containing useful websites (refer to Figure 2);
- Multimedia assessment tools (eg IELTS and OET tests), with sound tracks on CDs and including transcripts and answers;
- Podcasts, blogs and online resources, linked through the polytechnic's learning management system.

The polytechnic carefully designed the ESOL centre to minimise disturbance from students involved in different activities. For example, students who want to listen to and record speech can use booths. On one occasion, we observed six students who were part of an ESOL class engaged in a variety of activities employing digital technologies. Between them, the students were:

- Working on a computer-generated exercise to identify errors in written English sentences;
- Conducting research via the internet;



- Taking down notes for an essay through what appeared to be a hand-held personal digital assistant (PDA);
- Watching a TV3 news item on a screen set at the back of the room and listening to the item through headphones so as not to distract other students in the centre.

One of the adjacent computer rooms is a digitalised language lab that is frequently used by tutors and students. Tutors introduce their students to software in this lab, which includes the very popular software series *Issues in English* (see <http://www.englishsoftware.com.au/esl/issues.htm>). (The resource is available both at the centre and on the polytechnic computer network for use in the dedicated computer suite.) Tutors also help students use software to record, listen to and edit their own speech in English and to compare it with other samples. The centre manager noted that a challenge is explaining how the software works to students with low levels of English-language proficiency.

The two ESOL literacy students we interviewed had learned English in their respective countries, but were unable to understand or speak the language with confidence, even though both had Kiwi spouses and had been in New Zealand for two and five years respectively. Although the European man used English when helping his children with their homework, the Asian woman expressed fear at trying to communicate in English in daily life, as she could not understand what people were saying.

Both students wanted to improve their English so they could obtain work or undertake study. However, both said the main barrier to study was lack of time because of work and/or family commitments. The adult from Asia had worked in the ICT industry and planned to return to that field of work in New Zealand once she had gained sufficient English proficiency.

Both students also noted their need for support during computer-based learning. They said they had experienced difficulties using the computers and had needed staff help to resolve those problems. Individual support was essential in the early stages of learning to use computer software, as were opportunities for repeated practice. The two students appreciated centre staff directing them to activities on the internet, such as stories they could listen to and read.

The adult from Europe, who had an intermediate level of English ability when he first came to the centre, said he had been able to actively search the polytechnic's library and the internet for reading materials that would enable him to consolidate his learning. However, the other student, whose English was not as strong, had been frustrated in her attempts to access the library and the internet when first at the polytechnic. She felt that no one had explained that such access required her to load funds onto her student card, let alone explain the process for doing this. (In 2009, the polytechnic ceased this charging approach.)

Both students gave particular praise to the resource *Issues in English*, introduced to them by their class tutor. Their praise centred on these features:

- Inclusion of different aspects of English, such as dictation, listening and writing;
- Allowance for repeated practice;
- Activities graded into levels of difficulty;
- Opportunity for students to move up and down the difficulty levels as desired.

The two students suggested that a free online resource for literacy, accessible from home, would be an especially useful aid for ESOL learners. The aspects they wanted to see included in this resource were structured material, as in *Issues in English*, as well as activities for listening to and speaking English. The adult from Europe said he was already using the internet to help his children learn his language and that he would be happy to have access to or guidance on where to find resources for this purpose.

### **Programme origination and development**

The ESOL centre, which had begun about 15 years previously, had experienced particularly strong growth in the six years since the appointment of the current manager. She had been

particularly instrumental in increasing the range of e-learning facilities, with support from the ICT coordinator and colleagues. At the time of our investigation, she had just redesigned the main resource room; this refurbishment was completed soon after the end of our investigation.

In order to develop resources, the manager reads extensively and uses the web. Other sources include conferences and websites of professional associations, such as the International Association of Teachers of English as a Foreign Language and publishers' catalogues. The manager said that talking to tutors and students about what they want is also helpful in terms of bringing in new resources. She told us that centre staff often adapt new resources to accommodate the proficiency levels of the students, and/or split the resources into units so that more students can use them at any one time. The manager deemed careful cataloguing of resources an essential component of resource accessibility.

The centre manager also told us that the centre holds a group meeting each month to provide polytechnic tutors and other staff with "advice, professional development and inspiration". This "special interest group" frequently discusses the suitability of resources for ESOL purposes. The manager described these meetings as one of the "cornerstones" of the centre's success.

The manager is also engaged in research into best practices for teaching language. As part of her professional development, she is studying towards a masters degree in language learning and technology. She made particular mention of her research into and development of guided individual learning. This work, she said, has the added benefit of providing a means of evaluating and improving the centre's current practice.

It was clear to us that the centre's manager is an agent of change in the polytechnic. In addition to developing and facilitating the activities described, she plans ongoing professional development for e-learning, which includes providing polytechnic staff with hands-on experience of the facilities in the ESOL centre and its language lab. To date, staff had been given, among other opportunities, experience in deploying the language learning management system, using digital recorders, and trying out the audio-editing software that students use to improve their spoken English.

### 3.4 Trades course involving some use of ICT

This full-time programme of study for students engaged in or wanting to enter a trade leads to national certification. In order to develop, where needed, students' LLN skills, programme staff had embedded into the programme's learning materials strategies associated with the Tertiary Education Commission's Literacy, Language and Numeracy Action Plan.

#### **Context**

Programme tutors are well aware that adults learning trades learn best if their learning is set within their chosen vocational context. The programme and its courses have therefore been designed so that the majority of students' early study is authentic and practical. Theory is introduced gradually, but becomes an increasingly important part of each course as the programme progresses. Each course gives over its afternoons to simulated work projects, such as building foundations for a transformer. In essence, tutors manage their classes in a way that prepares their students for the workplace. For example, students must call in if sick or unable to attend class, and they are held responsible for their own progress. Older students with trade experience are encouraged to mentor younger or less experienced students.

During our investigation, we observed a full-time group of students during a "theory" class conducted as part of a 36-week foundation-level trades course and involving a computer simulation of a trade activity. The course had begun about seven weeks earlier, and the students we observed ranged in age from 15 to 48. The 15-year-old had been allowed to leave school because of his acceptance on to the course. Two of the men in the class identified as Māori; one of them was older and the other was the 15-year-old. The older man told us that he sometimes answered questions on behalf of and provided orientation for the younger Māori student.

The trades tutor had qualified initially as a primary school teacher and was studying towards the polytechnic's Certificate in Adult Teaching (see section on professional development below). On Friday afternoons, this tutor voluntarily set aside an hour outside class time so that he could give extra tuition to those needing it. Seven or eight students had attended his most recent session. Some had retaken an open book examination; others had caught up on work they had missed, or come to pick up notes, or simply ask for help. The tutor told us that ESOL students sometimes came along for help with English related to their courses. One of the Māori students we interviewed said he valued this additional opportunity for one-to-one face-to-face time with his tutor. The tutor, in turn, told us that he often consulted the older Māori student in his class to ensure that his (the tutor's) teaching was culturally appropriate for Māori.

### **LLN targeted**

The course tutors told us that although their students' LLN needs vary from individual to individual, many of the students have extensive skills needs, most often in relation to writing and reading. The literacy levels certainly varied widely in the class we observed, as did students' trades-related skills; some students had very little practical experience while others had a considerable amount. Other needs also required consideration. One of the students, for example, was a diagnosed dyslexic; another had Asperger's Syndrome and another had ADHD (an attention deficit disorder).

Where necessary, tutors in this and the other courses in the programme refer their students to Learning Services for extra help with numeracy and/or literacy and to access assistive technologies such as digital recorders. The tutor of the course we observed told us that lessons within the programme's courses are sometimes co-taught by the vocational tutor and a tutor from Learning Services. Each tutor teaches the same topic, such as trigonometry, from his or her complementary perspective. A particular advantage of this approach is that the vocational tutor is able to learn additional teaching strategies.

### **Place of learning**

For most of the students enrolled in the trades programme, learning takes place entirely on the polytechnic campus. For adults not in work, the polytechnic simulates a workplace and engages the students in authentic projects. Theory classes occur in traditional classrooms that are well equipped from an e-learning perspective. This high level of resourcing is especially evident in the computer lab, where we observed a lesson. Tutors and other polytechnic staff encourage students to drop in and use the computer labs whenever they are not being used for formal classes.

### **Forms of e-learning**

The trades programme is continuing to build up a rich e-learning environment that in future will include video links to the existing simulated trade workplaces. Three approaches to e-learning are notably present within the programme; each enables the adult learners to revisit their learning and to build their LLN skills as they work through their courses.

The first approach that we noted concerned the tutor of the class we observed. This tutor was making extensive use of presentation software, word-processing and digital photos in his teaching sessions and in his learning-support materials. He told us that he liked to source many of his teaching materials, such as how to build a straw-bale house, online. After showing these video clips and animations to his class, he encouraged discussion about the processes involved. At the time we spoke with him, he was writing a computer-based assessment on making a deck after referring to several relevant websites. The tutor also reported that he encouraged his students to use other polytechnic e-learning facilities, such as a numeracy unit accessible through the polytechnic's learning management system (see Section 3.4 above).

The tutor had found mixing pictures with words a particularly helpful teaching and learning device. Taking photos of building sites and then placing these in PowerPoint presentations allowed him to present authentic images. These not only reminded the students of the processes but also increased their learning engagement, and even more so when the tutor added the

elements of humour and surprise to his presentations. The tutor said he reused the PowerPoint slides as handouts, which, as we later learned, were greatly appreciated by one adult whose reading and writing skills were very limited.

The second approach that we documented was the provision of e-assessment within the learning management system. According to a senior tutor within the trades programme, many of the adults enrolled in its courses benefit from alternatives to pen and paper tests of terminology. Quiz questions, with drag and drop answers, available within each course in the learning management system (Moodle), prove particularly beneficial for adults with LLN needs early in their study, he said. This is because the opportunity to recognise key terms by sight, rather than to write them down or verbalise them, helps these adults overcome their weak grasp of written terminology early in their programme. This approach, the tutor went on, also improves these students' ability to remember this terminology in the long term. Moreover, by the end of the course, after extensive theory and practical work, they are able to speak and write these new words without difficulty.

The third approach we observed was a computer simulation developed by the trades faculty to teach and reinforce the processes of laying out a building site. This activity involves a complicated set of skills that all students in the programme need to acquire. The tutor told us he uses one class meeting to introduce the simulation and he then encourages the students to return to it as needed during class or study time. The session during which we watched the simulation involved a group of students gathered together in a computer suite with 21 computers, a large display screen featuring the tutor's computer screen, and an interactive whiteboard. The display screen initially showed a bare section of grass, with the tools for the job set out in a tool bar on the right-hand side of the screen. Step-by-step written instructions appeared at the bottom of the screen. A site plan was in a separate window. Each stage of the simulation included different set-up exercises, for example, accurately measuring and setting out the markers that later guide construction according to the architect's plan. Students also had the option of viewing a real-life video clip showing the simulated processes.

The tutor also told us that students helped one another with the simulation activity, and we witnessed this. Some of the students were able to start work straight away with minimal explanation. The second wave of students waited until the first had started work, watched them for a minute or two until they felt confident to try on their own, and then got to work. The approach taken by this second set of students suggests that peer-to-peer support can be more effective in some situations than tutor input, although it should not replace formal tuition. The final wave of students waited for someone they knew to finish or waited for the tutor to have time to help them on a one-to-one basis. During this time, they were frequently off task, and as a result were not learning and were at risk of distracting others. Once a classmate had finished and was prepared to help them, these students allowed themselves to be guided through the process step by step, often pausing for answers and additional help from the tutor.

The tutor roved around the room, observing and commenting on the students' progress; those needing help raised their hands. When the task was finished, students were allowed to access the internet, as long as they did so quietly. The two students who particularly needed both peer and tutor support were the youngest learner and the oldest learner. The oldest learner was unable to use the software because of his lack of ICT skills and his inability to read the instructions. He thought that he did not need this content because he had considerable experience of the building trade, although he may have benefited from the embedded numeracy. These two students continued to require one-to-one support to use this software throughout the time we observed this course.

We noted that the simulation had a competitive component. The most obvious such element from the outset was the self-marking nature of the resources. Once a student had completed the simulation, the software sounded a bell, and after a few students had finished, they immediately compared their scores. The second competitive aspect was the time (shown on the computer screen) that each student took to complete the task. The students who participated in these

competitive aspects of the exercises obviously enjoyed what they were doing and were highly focused on their work and its outcomes.

We also noted a particular challenge for some of the adults with LLN needs. Adults seeking entry to the course had to be formally accepted onto it before their course funding could come through. This process, we learned, tended to be delayed if applicants had personal (often LLN-related) challenges or lacked initial commitment to the particular trade. Because these adults could not receive a computer ID until they paid the course fees, they could not access the self-study resources without tutor support, a situation that often put them behind their peers, limited their enjoyment of the course and hindered their motivation to fully engage with and/or continue the course.

### **Programme origination and development**

According to the trades tutors, when they first introduced the task of setting out a building site (the task was not, at this time, presented in simulation form), up to one half of any one class of students needed to do extra work and receive tutor encouragement and reinforcement in order to complete it. The task includes many procedures, calculations and tools, all of which have to be used and considered sequentially, according to the architect's plan.

Given the difficulty experienced by so many students, the tutors, led by the current head of the department, took advantage of an internal grant to build the simulation. They decided to use a game-like interface whereby students could progressively set up the building site. Smaller (software interface) windows, set into the main window, providing instructions, a tools menu, and a plan for the building site, can be opened by clicking a mouse. The tutor of the class we observed said that the simulation had been inspired to some extent by tutors' observations of their students. The tutors noted that students who needed to conceptualise angles and calculations in later activities returned to the model of a roof they had built out of cardboard in an early session.

We consider it likely that this and other e-learning innovations in the department had been sustained in part by the leadership and increasing authority and respect afforded to the head of school. This person also assisted the leader of his faculty in relation to e-learning innovations. The dean's vision for the library and the faculty's learning centre, which was under construction at the time of our investigation, was "that there will be books there, but [only] as one of the modes for learning. Most of the notes will be on Moodle [the online learning management system], whereas in the past there had been a tendency to use workbooks, and the tutor would say, 'Turn to Page 1 and go down through the questions.' Now they're getting very much into project learning, which is proving to be particularly effective." The dean went on to explain that project-based learning requires increased support for individual and group learning. A learning management system, she said, can aid organisation of that support and act as an assessment tool.

## **3.5 Literacy class involving some use of ICT**

The traditional adult literacy courses offered at the polytechnic use various elements of e-learning. This provision includes use of software designed to aid learners with dyslexia.

### **Context**

The polytechnic's adult literacy course is a free programme that is offered part-time on campus as well as in outreach centres across the city. It is also offered as a one-year full-time course. The course follows a traditional approach, but also, as the description on the polytechnic website claims, allows for individualisation of learning: "An individual programme will be developed to suit your needs so you can improve skills in reading, writing, spelling and mathematics with a group of people with similar needs. Communicating in groups and basic computer skills are also part of the programme. You will be equipped for further education, training or employment."

We learned that lack of confidence is a major inhibiting factor for all adult literacy learners. According to one of the tutors we spoke to, the adult literacy class is almost therapeutic because it is a place where students can be open about what they cannot do: “We try to create an atmosphere where everybody is accepted.” Most students, the tutor explained, have not had good learning experiences in the past. All have been humiliated for making mistakes, and some have been hit for doing so. Any learning pressure could therefore cause the old feelings and fear to return.

The students that we spoke to told us that, in addition to learning to read and write, they were inspired by the accepting ethos of the class. This, they said, aided their learning: “It’s just like one big, happy family,” said one. The tutors “are unbelievable. They don’t make you feel like you’re stupid”, said another. Students highly valued individual work with a tutor. This was especially true of students who found it hard to ask questions in a group, and particularly if that question concerned a specific point related to a student’s own work. The students welcomed teaching that occurred in “baby steps”, followed by “putting it all together”.

For most of the students we observed and interviewed, coming to a literacy class was a major challenge because of unhappy memories of school. However, the need to learn to read and write to a satisfactory level had spurred them on to face this hurdle. One student expressed his joy at being able to write an email by himself for the first time as a result of what he had learned. Another said, “Academically, I have always looked down on myself, and it’s lifted me, coming here. It’s really boosted my confidence. I remember, the first day I came here, I cried my eyes out because it was something that I knew I needed, for a long time.”

Except for two students—a member of the Pasifika community who had never attended school, and an Asian—the students in an evening class we observed were from English-speaking backgrounds. All of these students were motivated by the need to improve their literacy skills in order to secure or retain employment. Some wanted to find a higher-level job; others wanted to do their current job better. One student working in a professional capacity wanted to improve her skills so that she could meet the demands of her current job and thereby keep it. Until coming to the class, this adult had struggled with her professional studies and had needed a proof-reader to check her documents at work. Other reasons that the adults gave for enhancing their literacy skills included the desire to read to their grandchildren, to help their children with reading difficulties, and to read and write in their native language as well as in English. Most students recognised the additional benefits of boosting self-esteem and confidence.

### **LLN targeted**

The course’s targeted LLN skills are reading and writing. The course is open to all adults, no matter what their level of English-language proficiency. Some of the adult students we encountered during our investigation had very few reading and writing skills.

In the evening class we observed, the group of students with the lowest level of literacy competency comprised five males, four of them in full-time work. One of these men was a confident reader, but had considerable difficulty with writing. Two of the students in the class had been sent to the course by their employers. Two more said their family members (spouse, children, or member of their extended family) sometimes helped them with reading or writing, but they wanted to become independent of them. Several adults said they had come to the course because they wanted to read to their grandchildren.

On the evening that we attended the class, the tutor began the session with individual time and reading, with each student reading a (usually) self-chosen story to the tutor. The tutor reminded students of, and guided them towards, the skills needed to decode meaning. The rest of the session was given over to the students working on activities commensurate with their levels of literacy proficiency. For example, the tutor’s aim for the group of students with the lowest level of proficiency was for them to revisit activities and revise learning that had occurred during the term. Activity for the evening for this group therefore included a spelling test (the students had a week to prepare for it); discussion about the spelling of words, such as phonic aspects and alphabetical order; revision of nouns, verbs and homonyms; and advice on how to write a

sentence. Two of the four adults in the group of students with a medium level of proficiency were preparing to study for a tertiary qualification. Their main focus at this time was spelling, grammar and writing skills (eg paragraphing).

### **Place of learning**

The evening class we observed took place during Week 10 of the 17-week course. The course offers three-hour evening sessions twice a week and its emphasis is on reading, writing and verbal literacy, not numeracy. It is team-taught by two tutors in a temporary building on the campus. Three adjoining classrooms in this building are available for the course. At the time we visited the campus, one of these classrooms had a cluster of six desktop computers. The tutors also teach in the outreach centres, where, they said, the adults typically have a higher level of literacy than those adults attending the course on campus.

The tutors told us they separate their classes into two groups—one with low literacy-skill proficiency (pre-TEC progressions) and the other with a medium level of proficiency. The two tutors also sub-group these two groups, so that students with commensurate skill levels can work in pairs or trios. Students, we were told, tend to progress through their learning activities at different rates; some work ahead of the others, and some want to redo some of their activities in order to consolidate their learning. Only spelling had been successful as homework. We heard of one student who, when sick, had asked his tutor, by email, to email some spelling words to him.

Both tutors were using word-processing to tailor worksheets to the needs of small groups of adults. The tutors told us they generally introduce these words to the groups around the middle of each class session.

### **Form(s) of e-learning**

When using computers for a particular activity, the literacy programme tutors use software recommended by a local firm specialising in software for dyslexics. A third member of the literacy team, who has the most expertise with software, provides support for her colleagues. The tutors said they generally manage the pace at which their students engage with this software and they actively encourage its use. Both of the tutors we interviewed told us that these adults need considerable support. “These people,” said one of them, “need a lot of support and encouragement. The relationship [with them] is more important, almost, than what’s on the screen.”

It was apparent to us during our visit that the extent to which tutors and students use computers during the course increases as the students gain greater literacy proficiency. The overall level of literacy in the class we observed was lower than that in the outreach centre we visited during our investigation. We noted, on arriving at class, that the more competent adults with at least intermediate-level English (Level 2 of the Adult Literacy and Life Skills (ALL) survey) and some ICT skills got straight onto the computers, before the class started, and into activities that included spelling and word-processing. We also observed that the students attending the outreach centres often helped their peers, and were more likely to do so than the campus-based students. Course tutors directed these more competent students to online websites, such as BBC Skillswise (see <http://www.bbc.co.uk/skillswise>), so they could practise the skills introduced by the tutor. The tutor of the low-level group of students attending the campus class guided the students into using software such as Word Shark (see <http://www.wordshark.co.uk/>). However, we observed this tutor keeping a careful eye on the students’ progress and sometimes adding in, for further practice, activities such as a downloaded printout of a crossword. She left these supplementary activities on a table for students to access during their individual study time.

We saw that some of the students with the lower level of literacy proficiency in the class were unable to use Word Shark because they could not read what was on the screen, including menu items and what to do. Some could not enter their name and password without assistance. All of the adults attending the course had limited ICT skills. This was particularly true of the older students in the class. Not surprisingly, they found any work involving a computer interface

challenging. The tutor worked with these students on a one-to-one basis, sitting alongside them at the computer and encouraging them “to have a go”. We watched the tutor working with one such student. When the student made errors, the tutor encouraged him to try again. If the student found the task relatively easy to complete, the tutor decreased the time available to repeat it, or gave him a game to play as a reward. All programme tutors prompted the adults to review and reflect on what they had learned. “Often,” said one tutor, “I’ll ask, ‘How did you feel about that? What do you think you did well? Do you think it was helpful or a waste of time?’”

Word Shark, according to the tutors, is one of the more popular items of software for the students. The students confirmed this comment. They said they enjoyed using it to support their spelling learning. They also said it taught them “a lot”, that the person providing the voiceover content had an acceptable accent (unlike the Read Rapid software for children; see <http://www.pearsonschoolsandfecolleges.co.uk/Primary/Literacy/SpecialNeeds/RapidFamily/RapidFamily.aspx>), that it offered opportunity for repeated practice, and that it complemented the in-class work. Word Shark also allowed the students to listen and hear differences in word endings, a feature that the two ESOL adults noted as a particularly useful attribute. One of these adults illustrated her difficulty by referring to the auditory similarity of “my” and “mine”.

Because of their limited ICT skills, many of the adults attending the literacy courses receive a high level of support from family members when using digital technologies at home. Three of the four adults in the medium-level group we observed had access to a computer at home. Two of them were using their internet-connected computers to research topics or engage in activities online, such as locating recipes. A third was using her laptop for email and games but did not feel competent enough to use the computers in the polytechnic resource centre.

When we asked these four students if they would find a free online learning resource helpful, three of them identified the following potential benefits: learning at home, learning independently, and no time limit on computer use. The fourth student, an adult with ESOL learning requirements and the only one of the four to have had experience of learning online, told us that she found learning by distance difficult because she needed to have someone she could consult with and bounce ideas off. The class, she said, provided this support. She also told us that she struggled with reading and writing on the computer, preferring to print out material and then highlight it. She said if she had no other option, she would probably access a distance learning course from her home, but she would still need someone to explain the material to her. She highly valued face-to-face engagement with the course tutor and her classmates.

In addition to emphasising the challenges just mentioned for adults learning online, the tutors identified the following difficulties:

- Many adults with LLN needs lack basic computer skills and do not know how to use the internet;
- Many adults find online material too hard to learn independently and therefore need personal support. One tutor said: “You ... need someone there to help you sound it out”;
- Many adults and their families and whānau are unable to evaluate whether a website is useful and appropriate, let alone accurate.

### **Programme origination and development**

Two of the tutors we spoke to said that a third tutor had led the development of e-learning within the literacy programme. She was also the tutor who, as we mentioned earlier, had liaised with a local firm specialising in software for dyslexics. The tutors said they had good support from the e-learning coordinator and from other services necessary to maintain their cluster of computers and internet connections.



## 4 E-LEARNING INITIATIVES WITHIN THE POLYTECHNIC

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During our investigation, we worked to gain understanding of what contributed to and detracted from the success of the polytechnic's e-learning initiatives, especially those aligned with LLN learning. These initiatives are evident across all learning and stage levels of the polytechnic. They relate to the activities involved in coordinating e-learning provision throughout the polytechnic, embedding e-learning in the polytechnic's courses, and (from our particular interest point) making e-learning part of activities aimed at enhancing adults' LLN skills.

### 4.1 The importance of leading from the top

It was evident to us from both the polytechnic's documentation and the commentary of the institution's leaders that the polytechnic's managers are well aware of the responsibility they hold for leading activity required to fulfil the polytechnic's mission. Polytechnic leaders also acknowledge that this role involves close collaboration with institution stakeholders and partnerships with other providers of education. During our interview with him, the chief executive officer (CEO) articulated these responsibilities as follows:

We are one of the larger institutions of this type in the country, and we see that we need to take on the responsibility for developing and trialling new approaches and learning from these to share good practice. ... Due to its size, [the polytechnic] ... is more likely to have a critical mass of staff with student experience to enable them to develop good practice and a community of practice. ... While this also happens in smaller organisations, such as [private training organisations], with employers and in wānanga, they are likely to find it more challenging.

We also noted, as a result of our consideration of the polytechnic's documents and commentary from polytechnic leaders, support staff, tutors, and learners, that the polytechnic clearly recognises the need for everyone involved in the institution to take ownership of change processes. The relevant literature confirms that across-the-board ownership of change is necessary for successful change (see Finding 6A below).

The provision of foundation education is one of the polytechnic's strategic priorities for 2008 to 2010. Early in 2008, the institution set out a strategy for developing its foundation studies programmes in response to the TEC's *Literacy, Language and Numeracy Action Plan* (TEC, 2008). During our time at the polytechnic, it was evident that staff had successfully embedded LLN provision within a wide range of vocational programmes. Part of this success could be attributed to the requirement that tutors of these courses undertake professional development. One component of this development requires a literacy or numeracy tutor to work with course tutors to develop and integrate this provision in their teaching and learning plans.

The polytechnic's embedded approach to LLN began in 2007, when the polytechnic leadership, led by the CEO, renewed its strategic vision in line with changes to its charter. Today, this approach is practised by all staff involved in the institution's foundation courses (Levels 1 to 3 of the New Zealand Qualifications Framework, and occasionally above), including those courses that are part of diploma programmes.

The trades course that we documented in Section 3.4 of this report was one of the first courses to adopt the embedded approach. The trades programme overall has lent itself well to this approach, in part because the programme underwent revision and restructuring in 2003. One outcome of this process was the appointment of a dean with considerable knowledge of teaching and professional development. "The restructuring," the dean told us, "permitted a focus on improving foundation-level studies, giving trades more status and better resources." She continued:

An entrepreneurial approach was encouraged, and the Trades Faculty went for Partnerships for Excellence funding that allowed them to enhance facilities with thirteen million dollars, including matched funding from employers in building and other industries, with in-kind products such as plumbing equipment. ... [Investment has included the construction of] a library and learning centre with a wide range of innovative ICT and relatively few book stacks, with links to other locations, including trades workshops, via video.

We also learned that the polytechnic leadership had set up a strategic group within the last few years to “cross fertilise” (as one person put it) innovations in learning and teaching. The leaders considered this development necessary because successful innovations in certain sectors or courses within the polytechnic had not spread to other sectors and courses. One of the initiatives set in place by the strategic group involved faculty deans choosing presenters from the diverse programmes who could effectively share their innovations with leaders, including deans and their staff. These presentations took place at what the dean termed “communication meetings”, held every second month. According to the members of the deans’ strategic group, this approach had achieved the desired result—innovations were spreading. We were given several examples of this development, one of which concerned an online numeracy unit that had been developed five years earlier for use in a trades course (see Section 3.4). Interest in using this unit elsewhere in the polytechnic had arisen only after a presentation on it during one of the communication meetings.

## 4.2 Learning Services support

The components of the polytechnic’s Learning Services division (including the library, e-learning service, maths and ESOL resource centres, and Disabilities Support Services) are located alongside one another in the institution’s central building. The three services work closely together. According to the Dean of Learning Services, the need to embed LLN provision in courses and support programmes is now strongly articulated throughout the polytechnic. The philosophy behind this development, said the dean, called for “a lot of loop closing ... [and had established] a mandate for everyone to be partnering for the whole experience”. Liaison librarians had accordingly made considerably more effort to work alongside tutors by informing or reminding them of the services the library could offer them, suggesting better resources, and letting staff know the areas in which they had seen students in need of LLN help. Learning Services advisors were also working with programme staff. Their particular focus was professional development. The Learning Services dean told us that they were successfully using “an embedded model for staff development”. One message that she said Learning Services was pushing in regard to students’ LLN needs was that online learning for learners with low levels of LLN (including ICT) proficiency is unlikely to be successful unless it is accompanied by tutor support.

When a tutor or advisor refers a student to Learning Services, staff in the division use formal tests to assess that student’s LLN needs. Should the tests confirm the need for assistance, staff work to identify if a specific difficulty, such as dyslexia, underlies this need. Staff then put in place appropriate support, such as provision of a digital recorder or a reader/writer aid. (One of the adults in the trades course that we considered as part of our case study was using an audio-recorder supplied by Learning Services to support his learning.) Learning Services continues to monitor such students and to provide other support should additional needs be identified.

The Dean of Learning Services led development of the polytechnic’s outreach centres, set up as part of the institution’s Computing for Free initiative established some years earlier. The centres cater to adults living in outlying suburbs of the city, or nearby rural towns. Classes typically take place in the evening, and the courses offer additional learning support in the form of online material. Occasionally, the centres hold events such as a careers evening. They also help people decide which courses to attend and assess which level of provision they can manage/need. The centres also act as a recruitment agency for the polytechnic. According to the dean, the centres “help broker that first step of coming to an institution”.

At the time we visited the polytechnic, a working group was trying to revise the goal for these centres, so that they could act as an “umbrella” agency for the polytechnic. The idea is that the centres will not only offer flexible delivery of polytechnic programmes but also act as an intermediary between community and industry needs by “taking learning to the learner” and providing a pathway into the polytechnic. Some trialling of these aims had already taken place through free opportunities for adults to develop their reading and writing skills and the provision of a fee-paying business software course (Mind Your Own Business). The approach taken in these instances was the same as that used for the earlier Computing for Free initiative, that is, some initial sessions followed by self-paced learning. Polytechnic staff told us that, in time, learning support tutors might go out to the centres to offer a greater level of face-to-face tuition and assistance. Alternatively, video-conferencing might be used. Diversification of centre types, including partnering with other organisations, was also being considered.

### 4.3 Professional and curriculum development

#### **Professional development for embedding LLN**

Many of the polytechnic’s teaching and administrative staff are highly qualified, particularly in the field of education, but, where needed, a good number are undertaking additional graduate study. Many of the polytechnic’s managers have extensive experience of professional development in both the school and tertiary sectors of education.

Tutors in higher education in New Zealand are not required to have a teaching qualification. However, since 2004, the polytechnic has required new staff to study for the Certificate in Adult Teaching, which the polytechnic offers. New staff also have to complete a two-year probationary period, during which their teaching load (about 600 hours a year) is lower than the teaching load (825 hours) for longer-term staff. Although the full teaching load leaves little time for study, many staff who have been at the polytechnic for two years or more also study for the certificate; others sign up for a particular course on the basis of need or interest.

The Dean of Learning Services identified her role as ensuring coherent services across the polytechnic and reducing staff stress at key points. She mentioned, in particular, the stress expressed by programme coordinators, such as the e-learning coordinator. “Many layers of services delivery that we are responsible for,” the dean explained, “have many, many touch points with other things. So it’s absolutely critical that the educational support services are integrally connected with the ones that have been in faculties.” She further stressed the need for support when alluding to the “proliferation of projects across the institution” brought about through the TEC’s LLN Action Plan. One outcome of efforts to provide coherent service and relieve stress had been the recent appointment of an LLN coordinator, who now facilitates the embedding of literacy and numeracy into study programmes.

The Dean of the Trades and Engineering programme said that the TEC’s LLN Action Plan had been “particularly powerful” because the developers had worked with the tutors rather than “imposing it on them and having someone come in to work with the students”. According to the dean, some of the teaching staff sought out involvement and others were “semi-directed” to become involved. She said that it was very exciting to see people become enthused about what they were doing. “You could see this sort of cognitive apprenticeship where they started off listening to what they were being told by the literacy and numeracy expert, and then trying to put it in place ... [and then] that balance gradually changing towards them initiating what should be put in place, with a bit of input from the literacy and numeracy expert.”

It was clear the process had worked particularly well, she went on, “when you heard those people who you knew were pretty entrenched—‘no-one can tell me anything more about teaching apprentices’—actually arguing about methodology and the best approach ... and pulling other people into the argument, and them starting to think, ‘There’s something good happening here; I want to be involved.’” She considered that the polytechnic workforce had become “more engaged” as a result of seeing the LLN provision working successfully with the students and that a good many tutors had become re-enthused about their teaching.

The dean furthermore reported that staff involved in the project had subsequently become involved in other projects because they had seen the benefits for both the students and themselves. “I would say we’ve got some people here now who would be quite able to go out and evangelise about what they’ve been doing and why ... What has also worked well is that it hasn’t been a quick fix. It has been ongoing, and therefore there has been time for people to feel confident in what they’re doing, so the resourcing of it has been important.”

The staff who participated in the initial project had been given release time to undertake the necessary professional development. Although some funding was available to pay for replacement tutors in the classroom, finding people with trades experience willing to work as part-time interim tutors had been difficult. Existing staff had therefore worked above load to take classes for their colleagues. The released staff returned enthusiastic, and the worth of the project became obvious. The staff who had taken on extra work showed no apparent resentment at having to take on colleagues’ work because those who attended the course passed on what they had learned to their team of tutors.

According to the dean, once staff had experienced the value of embedding LLN (“It has turned tutors’ thinking around”), members of the trades and engineering faculty were able to enter a new and integrated approach to curriculum, programme organisation and staff development. During the time we were at the polytechnic, programme staff were writing a new course for a particular trade, and were designing it with embedded literacy and numeracy in mind. In the past, the dean told us, teaching in the trades had generally been based on assessment, which was prescribed to some extent by the unit standards. However, staff were now prepared to design holistically in line with the programme’s aims, and they were also paying close attention to the most appropriate ways of delivering courses. The need to incorporate LLN and e-learning was very much to the fore. Also, said the dean, staff were developing means of accommodating the prescribed assessment by using the unit standards as a means of checking that student learning was on target rather than as a means of constraining that learning.

### **E-learning professional development**

Polytechnic staff wanting or needing to gain a greater understanding of e-learning and how they could use it in their teaching have available to them various types of support, including one-to-one programmes, school-based workshops, and specific project-related work. “The philosophy is the independence model,” said the Dean of Learning Services, “and that means working alongside them [tutors]. Just in time help, and so on.” Sometimes, she said, all staff within a programme or course need help with a particular area, or a staff member will “get a step up by having that ‘just now’ individualised [support].”

Although teaching at the polytechnic is still predominantly face to face, more and more courses are blending this traditional mode of teaching with e-learning measures. We learned that all tutors within the polytechnic had or were taking aboard e-learning, but were not implementing it in their courses until they felt confident to do so. Some tutors were undertaking this development alone; others were working in groups. Tutors, we were told, are most likely to embrace e-learning after completing the ICT course within the Certificate in Adult Teaching. “That usually starts to give them not only ideas but also confidence,” said the Dean of Trades and Engineering. “I think so often it’s the confidence factor that makes the difference.” The ICT component of the certificate, which is taught by the polytechnic’s ICT coordinator, is available not only to polytechnic staff but also to industry-based trainers. The number of tutors attending the ICT course is usually 20 to 25.

When we spoke to the e-learning coordinator, he reminded us that completing the ICT course and the Certificate in Adult Teaching is only part of the “bedding in e-learning” process. “Building a community of practice is important, with people helping and supporting each other. The germ of an idea can be sown that participants can take away, adapt and use in their own context. You can show and model, but even then it takes time for people to make the connections and have the internal dialogue to make that shift for themselves.” All polytechnic staff working to make e-learning an integrated part of their tuition have access to ongoing instructional design and professional development. This and other measures, such as the

requirement to attain the Certificate in Adult Teaching, have resulted, said the ICT coordinator, “in a rapid increase of courses using e-learning, with hundreds of courses and very active staff development”.

#### 4.4 E-learning development and maturity

As noted earlier, staff in Learning Services, including those responsible for digital library-supported resources, work together to provide polytechnic staff and students with e-based teaching and learning initiatives and activities. The polytechnic decided to place its unit for e-learning (originally set up in 2000 under the polytechnic’s former Information Technology Services) under the joint oversight of Learning Services, because of the need to closely integrate ICT resources and their platforms with e-learning-related organisational and professional development.

The e-learning coordinator told us that he, on behalf of the polytechnic, had contributed to Massey University’s study of e-maturity in tertiary institutions (Marshall, 2006; Massey University, 2008; see also Appendix B). He provided us with a brief summary of the findings of this study relevant to polytechnics. “All polytechnics,” he said, “are strong in the delivery dimension, such as making sure the infrastructure is in place to support the students and tutors; for example, the provision of Help Desk support and pedagogical support for tutors. However, there are gaps in other dimensions, for example, in the processes surrounding the evaluation and quality control of e-learning through its entire cycle.” He described his own polytechnic as one that is building upon solid foundations, but “it will take time, as people don’t change overnight”.

We asked several leaders at the polytechnic to indicate the institution’s stage of e-maturity according to a simple schema (see Table 1 below and the e-maturity model in Appendix B). As is the case with most institutions not set up to offer e-learning (Davis, 2010), the polytechnic had reached maturity Stages 2 and 3 by 2008, which means that e-learning is embedded within the institution. Although several of the polytechnic’s externally funded innovative projects include e-learning projects that involve joint development of materials and teaching in partnership with external agencies, including other polytechnics, e-learning within the polytechnic has yet to reach the stage where it can be offered in partnership with such agencies. Table 1 sets out the detail of this situation in relation to e-learning in general and e-based LLN support in particular at the polytechnic.

Table 1: Extent of maturity of e-learning and e-embedded LLN at the case study polytechnic, as of 2008

Stage of maturation	Characteristics	Examples of maturity	
		e-learning	e-embedded LLN
Localised	Innovator(s) adopt the innovation and use it in their classrooms or other individual contexts	Several innovations still in development E-learning numeracy in pre-med course 10 years ago	Several innovations still in development TEC projects started three years ago
Internal integration	Coordinator is appointed to manage, across the organisation, applications and resources relating to the innovation	E-learning coordinator appointed in 2000	Foundation coordinator appointed in 2008
Transformative	Faculty or polytechnic changes internal routines and activities to take advantage of the innovation	ESOL centre Trades programmes M-learning Numeracy online	ESOL centre Trades foundation programmes Numeracy online
Embedded with other organisations	Faculty or polytechnic uses networks with other organisations in relation to this innovation, while keeping within its existing scope	Pasifika project * Nursing project*	Diversification of outreach centres*
Innovative	Faculty or polytechnic reviews and changes its scope and activities to take full advantage of the innovation	None	None

Note: \* Under development or proposed.

The e-learning coordinator told us that, from his perspective, the process the polytechnic's tutors use to make changes necessary to accommodate e-based innovations is similar to the professional development model espoused by Sherry and Gibson (2002) (see Appendix B). He set out the e-innovation process as follows:

- *Learner stage*: Talk about technology—what is it? What are the tutor's attitudes to it?;
- *Adopter stage*: Expose the tutor to new technologies—"Have a bit of a play." Guide him or her towards embedding ICT skills in a learning activity, rather than teaching the skills separately;
- *Leader stage*: Invite tutors who show a passion or an ability in an aspect of the use of e-learning in teaching and learning to lead a workshop and/or speak during a Certificate in Adult Teaching session.

## 4.5 Māori- and Pasifika-related initiatives

The polytechnic perceives that it has relatively few Māori (indigenous people of New Zealand) and Pasifika (people living in New Zealand who have migrated from the Pacific Islands or who identify with the Pacific Islands because of ancestry or heritage) students. Māori make up 7 percent of students and Pasifika 2 percent. The staff we interviewed noted that most students from these groups in the locality prefer to attend the local wānanga (a tertiary institution that caters for Māori learning needs). Those Māori and Pasifika students who do study at the polytechnic are mostly involved in the Māori degree programme, Te Reo (Māori language).

The literature on e-learning and LLN recognises that Māori and Pasifika learners may require specific consideration. The Dean of Māori and Pasifika, whose role is to provide programmes and initiatives to support Māori and Pasifika students, told us that the polytechnic does not have a teaching model specific to these learners. However, she said all programmes strive to offer elements of provision known to motivate these learners. The staff of these programmes therefore worked to:

- Inculcate in students "a sense of belonging to the institution, a sense of comfort";
- Have culturally appropriate and relevant exemplars within the content;
- Guide learners to consider, understand and appreciate their own legacies of literacy;
- Help learners develop a sense of appreciation of the personal benefits of increasing their literacy skills;
- Support Māori and Pasifika students to "own" literacy—to take aboard the attitude that literacy is something that is theirs and that "they're not just 'doing English'".

We talked for some time with the Dean of Māori and Pasifika about her belief that, across time, Māori have developed the misconception that they are not academic, or essentially literate, but are an oral people. "We ended up not just inheriting the negative expectation; we ended up living up to it," she said. "This has become almost endemic within our society. It was fed by the European assimilation strategies and governments' prescribed expectations of Māori within the education system, from as early as the first Native Education Act, back in the 1800s, where the expectations were clearly set that Māori weren't to be academic and that Māori were to be pretty much manual workers."

The dean went on to explain that teaching academic subjects and the classics was prohibited in Māori Native Schools. "After one and a half generations of success ... [that strategy] wiped out any [Māori] success for the next 70 years. ... Helping Māori to own literacy requires learning to deconstruct those perceptions and present bits of our [Māori] literary past, which is exceptional. From the 1850s to early 1900s, we had 47 Māori newspapers written in Māori, and Māori debating topics from Shakespeare to animal husbandry in Argentina."

The polytechnic's Te Reo degree programme begins with a foundation course called Preparation for Academic Study, which helps determine if students need assistance with the basic literacy requirements, including ICT skills, required to study successfully within the institution. The polytechnic soon found that this foundation class for Māori students did not work well if students lacked confidence with general literacy, let alone computer literacy. The tutors

involved in the course, said the dean, came to realise that students could not progress because of the classroom set-up. Students, she said, are “almost on display when they can’t cope, so that will become known. It’s not like you can hide away or deal with it at your own pace. Therefore, in such a class, there is a level of whakamā or embarrassment that can be quite intimidating for some”. She said tutors had found that successful literacy skills development, including e-literacy, was more likely to occur in a community of learners, such as that developed with the apprentices using m-learning to produce and present e-portfolios of their achievements.

According to the dean, modes of e-learning particular to the needs of Māori students were “on the radar”. Anticipated provision included content in Māori dialects and blended learning for groups of students dispersed geographically but able to learn about their culture using online methods. We also learned, from the polytechnic’s CEO, of a course for Māori kaumātua (elders), conducted in their own dialect and through which they had developed e-learning skills and produced a book of Māori stories and culture.

When we asked the CEO if the polytechnic offered particular support for Pasifika, he told us that the polytechnic had joined with other partners, including the local wānanga, to develop a proposal for funding an initiative aimed at developing e-learning programmes for Pasifika in the city and on their home islands. One of the partners would have the specific role of providing the e-learning platform and helping the polytechnic work through the instructional design stage of the e-learning content.

## 5 THE EVOLUTION OF THE E-LEARNING PROGRAMMES

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We now turn to the theoretical models that we used to identify and analyse the characteristics of LLN-related e-learning at all levels of the polytechnic. The models that we present in this section have each been simplified to include only five aspects.

The three models that we used were the Attributes of Innovation Model (Rogers, 2003), the Learning Trajectory Model of professional development (Sherry and Gibson, 2002), and the Organisational Maturity Model (Learning and Skills Network, 2008). The development and the components of each of these models are outlined in Appendix B.

### 5.1 The Attributes of Innovation Model

The attributes of an innovation that affect the speed and uptake of innovations are relative advantage, compatibility, complexity, trialability, and observability. Reference to these attributes allows institutions to predict if the uptake of an innovation will be sustained and helps tutors and managers increase the likelihood of success.

The m-learning initiative that we documented earlier in Section 3.2 provides an example in which the attributes of the innovation had different effects on the adults involved in it.

- *Relative advantage:* For the tutor, the advantage was student retention. The project was fun for the students and so increased their motivation to continue their study. The provision of external funding for the innovation gave credence not only to the tutor's teaching approach but also to her leadership in employing m-learning. For the employers, the innovation reduced their responsibility for monitoring and assessing the apprentices' progress. For the students, the innovation reduced their need to write and maintain records while on their employers' premises;
- *Compatibility:* Students did not have to access computers but instead could use their own mobile phones, a technology that nearly all students of today are likely to own or be familiar with. Having students use vouchers to pay for texting and uploading pictures is also compatible with the everyday life experience of students;
- *Complexity:* Complexity retards adoption of innovations. The tutor's decision to text four quiz questions a day to the students in order to stimulate them to use their paper-based workbooks was an innovation that the students found simple to use. The students also found taking pictures and uploading them to websites easy, given that they already knew how to do this from engaging in similar activities in their leisure time. The tutor, having gained support and advice from the e-learning coordinator, also found the innovation a straightforward one;
- *Observability:* During block courses, and informally outside of class, students and staff had opportunity to observe more expert users of mobile phones and other technologies for learning trades skills;
- *Trialability:* Before implementing the use of mobile phones as an m-learning tool, the tutor trialled, with intensive support from the e-learning coordinator, all the m-learning activities. The coordinator also set up the Moodle learning management platform for the tutor and advised on the purchase of mobile phones and other associated equipment and software. The use of a mobile phone was not compulsory, so some students were able to trial the innovation by using a peer's mobile phone. The external funding made it economically feasible to conduct the trials.

### 5.2 The Learning Trajectory Model

The learning trajectory that an educator is likely to pass through during adoption of a teaching and learning innovation is learner, adopter, co-adopter, re-affirmer or rejecter, and leader (Sherry and Gibson, 2002). Our case study of the polytechnic provided several examples of staff



who had led e-learning and LLN innovations and had gone on to become heads of their respective departments. One important common characteristic of each of these people was their ability to provide their colleagues with the right mix of professional development activities and support over a sustained period of time.

The Dean of Learning Services, the Dean of Trades and Engineering and the e-learning coordinator all observed that the tutors with whom they were working were at different stages of the learning trajectory in relation to the innovations we studied. For example, the Dean of Learning Services noted that, at any one time, a whole school might need help in a particular area or a tutor will “get a step up by having that ‘just now’ individualised [support]”. She reminded us that the types of support offered by her service included one-to-one, programme- and school-based workshops, and specific project-related work. The philosophy that Learning Services uses with all forms of support, she said, “is the independence model ... and that means working alongside them. Just-in-time help, and so on”. The dean said that while most tutors soon get to grips with e-learning, few of them become leaders in this area. The e-learning coordinator gave us a particularly useful outline, from his perspective, of tutors’ ability to engage with e-learning across time. This process followed that outlined towards the end of Section 4.4 of this report.

### 5.3 The Organisational Maturity Model

Under this model, the stages of maturity that organisations are likely to pass through when adopting an innovation are termed localised, internal integration, transformative, embedded, and innovative (Davis, 2010). E-learning is a pervasive innovation that tends to stimulate further change, and so the adoption overall of this form of learning is one that constantly moves through these stages. In short, it is an ever-evolving process.

In Table 1 (Section 4.4), we provided an overview of the stages of maturity relating to the two complex innovations specifically targeted by our case study (advancing e-learning and embedding LLN into it). During our investigation, it was clear to us from plotting these developments as a whole, or in part, against the model, that both are in a state of flux. The intertwined nature of the innovations contributes to this situation: sometimes, the two aspects enhance each other; sometimes they disrupt or prevent each other from progressing. This complexity helps explain why time and careful management are needed to bed in innovations—to bring them to an appropriate stage of maturity.

We consider, from our observations, that the polytechnic is likely to remain at the transformative stage relative to its e-learning and embedded LLN initiatives, a situation that is appropriate to its mission. To date, these initiatives have prompted—through the development of the polytechnic’s central services and increased collaboration across its programmes and various support services—transformation of the institution’s internal routines. The polytechnic has not reached a stage of forming (and informing) partnerships with other organisations and external agencies that have a stake in developing e-learning and/or addressing the LLN needs of adults, but this has not been called for. The polytechnic is unlikely to move to the later stages (embedded and innovative) of e-maturity until such outcomes and partnerships become central to its mission.

## 6 CASE STUDY FIT WITH THE FINDINGS OF THE PROJECT'S LITERATURE REVIEW

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We now present an overview of our case study findings, using the structure developed for the review of literature (Davis et al., 2010). The following six sets of findings not only outline the characteristics of the polytechnic programmes that were successfully using e-learning to support adults wanting to improve their LLN skills but also point to areas in need of further research. In summary, our findings encompass these matters.

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

### 6.1 Lack of research evidence directly related to the question

#### **Finding 1A: More research is needed**

This case study, through its description of a variety of e-learning initiatives at an urban polytechnic, provides research evidence that e-learning can be used to raise adults' literacy and numeracy skills and/or their second-language acquisition. The case study also provides evidence that adult learners generally welcome opportunity to learn, and that they and their tutors can adopt e-learning provision that successfully addresses these learners' LLN needs. However, because the range of e-learning initiatives and opportunities relative to LLN support for adults in New Zealand and beyond remains challenging to map, these conclusions are tentative and more research is needed to verify them.

### 6.2 Characteristics related to learning (overarching)

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

Adults with LLN needs vary in their ability to use e-learning effectively. Most of the adult learners observed and interviewed during the case study investigation appeared to be best served by e-learning blended with other approaches, including face-to-face tutoring and ongoing support from staff. The few adults who had chosen to learn numeracy online autonomously, due to work or home commitments (see Section 3.1), asked for individual tuition to support their e-learning. Adults with very low levels of literacy (see Section 3.5) continued to need intensive support when using computers. This support included direct help to log in and to choose the right option to click. Adults with little exposure to computers tended to be fearful of e-learning until they had developed a certain measure of ICT skill and confidence.

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

The adults observed at the polytechnic were participating in LLN courses for a variety of reasons, although the majority of these courses have employment-related goals. The polytechnic's recruitment, retention and completion goals have led to a range of strategies relevant to adult learners' home and work contexts. ICT skill development is embedded, in most programmes, in activities designed to advance 21st-century study skills, and ICT is used as an

enrolment incentive. The online numeracy course has improved the programme's completion rate, and the goal of the m-learning innovation is retention (see Section 3.2).

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

The participants emphasised that activities related to employment and career-related training are more effective than generic LLN training and e-learning.

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

It was apparent that families and whānau play a critical role in adult learners' LLN development. Family and whānau not only aid learners in terms of motivation but also provide them with a context (particularly one involving children and grandchildren) within which to practise simple literacy and numeracy skills. Family members can also assist learners to use e-learning. According to the case study observations, this support was most evident for the adults attending the evening class. These adults were also the learners who had the lowest level of LLN proficiency amongst the adult learners observed (see Section 3.5).

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

Computer games can provide a non-threatening, enjoyable means of re-engaging younger adults with LLN. The simulation within one polytechnic course of a building site that had a game-like interface was providing apprentices and their tutors with an informal means of assessing these apprentices' LLN needs (see Section 3.4).

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

Care was necessary to effectively blend m-learning within the polytechnic's e-learning provision. The apprentices and tutors we interviewed valued the mobile phone as a teaching and learning tool within workplace contexts. The texting and photography features of the phones were particularly useful in this regard, and the students appreciated the polytechnic's decision to provide them with vouchers to subsidise the cost of using their mobile phones. Particular attention was being given to making mobile phone use an integrated part of the polytechnic's learning management system. The apprentices using e-portfolios as a means of assessing their work against unit standards had enhanced their ICT skills and increased their autonomy as learners (see Section 3.2).

## 6.3 Characteristics related to learning (specific)

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

The polytechnic has identified the factors that act as barriers or supports for Māori adults wanting to improve their LLN skills. A strong support factor, for example, is a nurturing learning environment. In 2008, the polytechnic was at an early stage of development in terms of addressing these barriers and supports, but it had already begun the important process of working with elders to consider these matters and to build up a bank of Māori-related learning resources (see Section 4.5).

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

The polytechnic, having realised that these adults vary widely in terms of their literacy and language needs, has in place a range of activities designed to address those needs and to help the adults become autonomous language learners. All such adults observed during the case study investigation required tutor support to use e-learning. Their tutors had brought additional strengths to these adults' learning, including activities involving ICT in collaboration with the ESOL resource centre. The polytechnic's exemplary ESOL resource centre, with its carefully embedded digital technologies and the digital language learning lab nearby, is a particularly valuable component of provision for this group of learners (see Section 3.3).

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

Little data on the learning of and support for Pasifika adults with LLN needs emerged from our case study investigation. However, a collaborative initiative designed to support e-learning of such adults by connecting them, through ICT, with family and friends back in their island homes was noted as having potential (see Section 4.5).

**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 their ability to learn and/or access learning**

Those adults with learning disabilities attending polytechnic courses found the polytechnic's information technology resources highly useful, but only if they directly fitted their needs. Examples included handouts with digital images and use of a digital recorder by a student in the trades course (see Section 3.4) and software designed for dyslexics in use for the adult literacy course (see Section 3.5), where tutors noted that most students showed some form of dyslexia.

## 6.4 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**

It was apparent from our case study that the tutors most effective in supporting adults to engage with ICT and e-learning opportunities were those well practised in the use of these technologies and who were thus able to provide adult learners with intensive support from the time they entered their courses. Because this approach strongly favours early success for the learners, learners quickly develop the confidence and skills required to use resources specific to their needs. Team teaching involving literacy and numeracy tutors, librarians and vocational tutors was observed as another effective means of developing e-learning measures suitable for adult learners with LLN needs. Partnerships between the polytechnic's e-learning coordinator and tutors also aided successful blending of e-learning and LLN support (see Sections 3.4 and 4.3).

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

The polytechnic's tutors and support staff understand that adults with LLN difficulties need a range of interventions. This understanding was practically demonstrated in all courses observed.

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

The polytechnic's tutors and support staff encourage learners with LLN needs to discuss and debate different types of text in order to enhance their literacy skills. In addition to providing conventional texts, the polytechnic also offers a wide range of digital media, such as interactive multimedia, websites, digital video, and television (see Sections 3.3 and 3.4).

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

Polytechnic tutors and support staff use ICT to modify and create materials and provide relevant learning contexts. They also use ICT as tools for literacy and numeracy learning. It was evident that this approach increases the relevance and meaningfulness of learning provision for adults with LLN needs. It was furthermore apparent that this approach enhances these learners' awareness of the need to have sound literacy and numeracy skills in order to live, work and study successfully in the 21st century (see Section 3.4).

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

Polytechnic tutors use specialised assessment software to diagnose adult learners' LLN needs on a limited basis only. In contrast tutors were developing formative assessment and e-portfolio processes. For example, at the time of the case study investigation, drag and drop quizzes (within the learning management system) and e-portfolios along with mobile phones were

providing students and their tutors with a means of assessing student work against unit standards with the apprentices and trades course (see Sections 3.2 and 3.4). The online numeracy course included formative assessment and self-testing (see Section 3.1).

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

Adults wanting to improve their LLN skills, especially those with the highest needs, greatly valued the supportive, collaborative learning environment that tutors had provided. Within this collaborative context, another mark of an effective tutor is when he or she can use ICT and e-learning skills to good effect pedagogically, can impart ICT-related skills to learners, and can encourage learners to share their own such skills with one another. One of the courses observed involved apprentices teaching their peers how to use e-portfolios and mobile phones for assessment purposes (see Section 3.2).

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

As was the case with developing adult learners' language and literacy skills, tutors at the polytechnic were drawing on a range of strategies to meet the needs of each adult learner intent on enhancing his or her numeracy skills. E-learning had opened the range of strategies available to these tutors. For example, tutors were able to give their learners opportunity to repeat learning activities and to reinforce their earlier learning. These activities were particularly valued by students who were unlikely to complete their programme of study without this form of support (see Sections 3.1 and 3.4).

## 6.5 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**

Tutors, support staff and their leaders were actively engaged in professional development relating to their content area, to ICT skills, and to both blending e-learning and embedding LLN in the learning process. The polytechnic's strong programme of professional development included workshops and just-in-time support for staff requesting it, plus a reduced timetable for newly recruited tutors, and a Certificate in Adult Teaching, with at least one e-learning course (see Section 4.3). To improve use of its facilities the learning resource centre included professional development for tutors within its liaison activities.

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

The polytechnic has a policy of providing professional development that is informed by the individual's concerns and which acknowledges that such concerns change over time. Professional development for staff is also directed at each staff member's learning trajectory in relation to e-learning. A tutor who reaches the final stage of this trajectory—known as “teacher as leader”—is able to support colleagues to adopt the types of e-learning innovations with which he or she has been engaged. Such tutor leaders do this by example and through invitations to talk about their innovations in e-learning (see Section 4.3).

**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**

Within the polytechnic, the implementation of e-learning led to the unbundling of some tutors' roles. This process has enabled the polytechnic to determine need for additional staff, such as teaching assistants in the ESOL resource and maths support centres and the polytechnic's outreach centres (see Sections 3.3 and 4.2). It has also led, on occasion, to students teaching their peers (see Section 3.2).

### **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 has brought particular challenges to the members of the polytechnic's staff involved with creating, developing and maintaining the institution's e-learning-related resources and services. However, it was obvious that these individuals had addressed, and were continuing to address, these challenges, and that they were committed to applying sound, universal design principles to e-learning systems, website construction and maintenance, and related services. The same approach was being taken to managing the various projects associated with this work across the polytechnic.

## **6.6 Findings relating to organisation and society**

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

The polytechnic, aware that adoption of innovations, especially e-learning, occurs in stages, was conducting its implementation and integration of e-learning and LLN support with this knowledge in mind. Leaders were managing these developments in accordance with known stages of organisation maturity and the staged implementation of innovations (see Section 4.4).

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

The polytechnic, having recognised that study skills include ICT and e-learning, has successfully embedded these features within its foundation courses. The polytechnic also acknowledges that successful development of adult literacy is closely linked to ICT competence and success in securing and retaining employment. These principles are evident in an innovative programme in the polytechnic which introduces students to a range of trades and which is committed to find work placements and jobs for Māori students once they successfully complete their programme (see Section 4.5).

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

The urban polytechnic is unusual in New Zealand in having five programmes, one of which began in 1998, that use e-learning to support adults with LLN needs. These programmes cater mainly for city-based students. In addition, the polytechnic plans in future to implement partnerships to serve rural and dispersed communities with innovative e-learning projects designed to address adults' LLN needs within the polytechnic's courses (see Section 4.5).

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

Open-access learning provision in the polytechnic and its outreach centres has increased the ease and comfort with which adult learners can access LLN support. This support includes considerable use of e-learning in association with appropriate tutor support and partnerships with other agents and agencies engaged in facilitating adult learning. The ESOL centre within the polytechnic is exemplary in its practice in this regard (see Section 3.3).

## 7 CONCLUSION

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This case study research of a large urban polytechnic in New Zealand provides a rich description of a tertiary educational institution intent on using e-learning in ways that successfully support adults needing to develop their literacy, language and numeracy (LLN) skills. Our accounts of the initiatives the polytechnic has taken thus far to achieve this aim show senior and middle managers working strategically and collaboratively to embed LLN provision, via e-learning activities, into the polytechnic's foundation and trades courses.

More specifically, the study illustrates the challenges and benefits of e-learning for adults seeking to develop their LLN skills and/or proficiency in English as a second or other language (ESOL). Nested within the story of the polytechnic are descriptions of how five programmes use information and communication technologies for LLN and ESOL purposes. The study also includes accounts of how the polytechnic has developed its learning support services to accommodate these programme advances and of the professional development that staff receive to help them use these technologies for LLN and ESOL teaching and learning.

Finally, the case study illustrates and often supports the findings of this project's literature review (Davis et al., 2010). A synthesis of these findings and the findings of all other components of our research can be read in our summary report (Davis and Fletcher, 2010, available online at [http://www.educationcounts.govt.nz/publications/tertiary\\_education](http://www.educationcounts.govt.nz/publications/tertiary_education)).

## APPENDIX A METHODOLOGY

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### A.1 Approach

The research methodology was adapted from the success case method (Brinkerhoff, 2003, 2005). While our reporting of the research focused on success, we also noted unexpected outcomes and failures. For example, in the m-learning example, we noted an unsuccessful innovation. In order to gather data relating to the polytechnic's adoption of innovations and commensurate systemic change, we asked polytechnic leaders questions based on the three change models described in Appendix B.

The urban polytechnic at the centre of this case study is becoming increasingly known for its innovative endeavours in the provision of quality education. Initial informal requests for exploratory discussions were made to staff known to be including e-learning or mixed media learning as part of their programmes.

These meetings confirmed that the polytechnic was a good site for a case study of a tertiary institution that had, for some years, been successfully using e-learning to promote the literacy, language and numeracy (LLN) skills of adults. The Ministry of Education agreed with this conclusion and told us that the polytechnic uses the Tertiary Education Commission Learning Progressions. Further details of the selection process are provided under procedures.

We began our investigation by seeking initial permission from the polytechnic's chief executive officer to proceed with the study. He advised us on procedures for gaining approval from the institution's ethics committee. We also sought permission from the University of Canterbury College of Education ethics committee. (Further details of the ethical considerations are provided under the procedures section below.) We then put in our applications for ethical approval, which were granted. The polytechnic's Dean of Research announced the research project to staff.

### A.2 Criteria used to select case study organisation and programmes

The selection criteria we used to select the polytechnic for our case study, and the criteria we used to select programmes and courses for sub-case studies, included as many of the aspects of good practice as possible that we identified in the literature available at the time the research was proposed (Ministry of Education, 2005). We accordingly looked for an institution and for programmes and courses that had a range of the following attributes:

- Includes e-learning;
- Has been in place for at least two years and has documented evidence of outcomes;
- Targets students from groups of people who are either in work or about to begin work;
- Has staff with relevant qualifications and expertise in adult education, elementary education, community education, and/or educational administration;
- Offers teaching based on sound principles of adult learning;
- Connects its curriculum to students' needs and interests;
- Provides (to some extent) content in collaboration with a range of relevant agencies such as schools, employment agencies and educational groups;
- Has explicit and clearly structured modes of teaching literacy and/or numeracy and provides individualised tuition;
- Uses individual learning plans;
- Has high expectations of students;
- Provides students with formal credit and accreditation for their study.



## A.3 Participants

Our research team consisted of two researchers and a research assistant. Together, we conducted interviews with staff and undertook observations in all areas of the polytechnic where e-learning or mixed media learning were being used or developed at the time of our investigation. We also covered those areas of the polytechnic with programmes or initiatives directed at New Zealand adults with LLN needs. These areas were:

- The ESOL centre in the library (including one day class);
- Trades faculty (including two trades classes);
- Food and hospitality faculty (including one programme for apprentices);
- Māori and Pasifika faculty (including the dean);
- Adult literacy (including one evening class);
- Applied sciences and health faculty (including one pre-health course).

### Interviewees

We formally interviewed 34 people:

- Ten leaders, some of whom were also managers and tutors. The leaders included the CEO, three deans, two heads of schools, three unit managers, and the e-learning coordinator and designer;
- Six tutors (two literacy, two ESOL, two numeracy/trades);
- Eighteen students (seven adult literacy, four ESOL literacy, four maths, three trades).

The students represented a range of backgrounds, skills and needs, including ESOL, low literacy, behavioural and physical disabilities, and various ethnicities (including Māori, Pasifika, Asian, and European), ages (late teens to 50s) and subject areas (from trades to professional). More females than males volunteered to participate in our research; approximately two-thirds of our respondent students were female.

## A.4 Procedures

### Interviews with staff

The interviews were conducted by one or more of the three researchers. Face-to-face staff interviews occurred in a variety of situations, including interviewees' own offices, classrooms, a café and labs. On a small number of occasions, other people were present, or the interview was conducted by phone.

Potential questions covered several areas, including (but not restricted to) the nature of good practice in e-learning, work-based learning, success factors for e-learning, impacts on learners, motivation of learners, barriers to learning, and the value of a free, online site for developing LLN skills, etc. Our interview of leaders included questions on the three change models described in Appendix B.

Interviews were semi-structured, allowing for flexibility to follow new leads or ideas raised by the interviewees. All interviews were transcribed. Each interviewee received a copy of his or her transcript for checking and amendment.

### Interviews with students

These interviews, which were semi-structured, were conducted by one of the two researchers or by the research assistant. We interviewed students either by phone (after they had told their tutors that they wanted to participate in the study) or face to face in their labs or classrooms. Most student interviews were done on a one-to-one basis. However, we conducted two group interviews in the adult literacy class and one in the ESOL centre.

The questions we asked sought students' reasons for wanting to improve their LLN skills. The questions also focused on employment aspirations, current or past use of e-learning, and whether or not the student would use a free, public online LLN site.

All student interviews were transcribed, but it was not possible to have students check their transcripts because of their literacy limitations. In most cases, we considered that it would be unreasonable to ask these students to read and amend their respective transcripts.

## **Observations**

We observed the members of three classes as they worked to develop their literacy or numeracy skills. Each observation was made by one of the two researchers and the research assistant. We did not take photographs during class sessions but did some sketches at these times. We also took some photographs of classroom layout and resources. During each observation, we wrote field notes and asked for and received handouts and copies of teaching materials. We also had access to the polytechnic's online e-learning environments, including its learning management system, Moodle.

We used the polytechnic's web pages as a briefing tool before interviews, and to enrich our descriptions as we analysed and wrote up the case study. Some of our interviewees gave us documents, papers and teaching materials, and we also used this material for illustrative purposes.

## **Ethical considerations**

Both the University of Canterbury College of Education and the polytechnic's ethics committees reviewed and approved the project. Interviewees all participated voluntarily after an initial approach from us. None of the tutors was asked to recruit students. Students who appeared embarrassed or very busy were not asked to participate. No staff members declined the chance to participate. All participants received a copy of information about the project.

We told the students they could withdraw from the study at any time, and we gave them consent forms to sign. We took considerable care to ensure that the students were not stressed by the research and that their identities remained anonymous. We used pseudonyms and changed any characteristics that could identify a participant. We consider that the group interviews within the adult literacy class worked particularly well because the group setting allowed the students to contribute to the discussion as and when they felt comfortable.

We produced modified versions of the staff information and consent forms for students. We also had at hand other simplified versions of these forms for those students with low literacy skills. These forms were read aloud to these students. Students and their tutors expressed their appreciation of this approach.

## **A.5 Analysis and reporting**

Our study involved five stages of analysis. The case study and its analysis were led by the project's principal investigator and first author. The analysis and reporting process progressed as follows.

- We began by reviewing the complete data set, initially briefly and then in depth, to create the various perspectives one by one. We used this material to draft the full report. We then analysed the data against the change models;
- We used this material to write a first full draft report of our study and its findings. We then carefully considered this report, and also gave it to polytechnic staff in December 2008 for their feedback and corrections;
- Some months elapsed before we completed the accompanying literature review. The report was then revised again against this material, and also to improve coherence and remove

items that might identify the polytechnic. We sent the revised report to the polytechnic's Dean of Research for approval;

- On receiving and incorporating into the report the polytechnic's feedback and further corrections, we asked external experts to carefully consider what we had written. This process resulted in further revision and edits in order to increase the contextualisation and clarity of the findings for tutors in the field;
- The outputs were reviewed by national experts, international experts and the Ministry of Education;
- Following amendment and editing to improve communication, the outputs became public.

## APPENDIX B MODELS OF INNOVATION

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The focus of our study was identifying characteristics that influence the success of two innovations presently changing pedagogical practice in adult education. The first is the application, through use of information and communication technologies (ICT), of e-learning. The second is embedding, within that learning, content designed to enhance the language, literacy and numeracy (LLN) skills of adults. Both innovations can be viewed as practices that give adults with low levels of literacy and/or numeracy the opportunity to improve their chances of success in employment and society.

The study, set in a tertiary education institution, was underpinned by a perspective which recognises that e-learning innovations within educational settings take time to bed in and that this process is influenced by the nature of the institution. The institution, in turn, is influenced by the success of the innovation. In other words, innovation and institution co-evolve (Andrews and Haythornthwaite, 2007; Davis, 2010).

We selected, as a means of analysing our data, three models of change brought about by ICT-based innovation in education. During analysis, we found that these models had strong applicability to the processes involved in embedding LLN within e-learning.

In the following section, we briefly describe and explain the elements of each model.

### B.1 Attributes of Innovation Model

Rogers' (2003) seminal research into the diffusion of innovations within an organisation concluded that innovations 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).

Ferster (2006) provided verification of these attributes after conducting an extensive literature review and garnering opinion from experts. He compiled from this work an extensive list of factors that he then tested (using neural network analysis) in relation to six ICT-related innovations. His systematic analysis confirmed that Rogers (2003) had selected those attributes of innovations most likely to predict the success of an innovation; the predictive accuracy of each attribute was above 90 percent.

We recommend that developers of ICT for education maximise these characteristics, but that they also interpret their applicability in relation to the other two models presented here and the findings of our study.

*Key point:* The attributes of an innovation that affect the speed and uptake of innovations are relative advantage, compatibility, complexity, trialability, and observability.

### B.2 Learning Trajectory Model

This model articulates the stages by which individuals adopt or reject an innovation or elements of it. The researchers in the seminal longitudinal study of the innovative Apple Classroom of Tomorrow (ACOT) identified five stages of "instructional evolution" that teachers move through when using ICT as a teaching and learning tool in well-resourced classrooms and receiving commensurate ongoing professional development (Sandholtz, Ringstaff and Dwyer, 1997). The stages are entry, adoption, adaptation, appropriation, and invention. Students of innovative ACOT tutors demonstrated high levels of skill with ICT and ability to learn on their own, to problem-solve, and to work more collaboratively with their classmates.

Hall and Hord's (1987) Concerns Based Adoption Model (CBAM) of innovation emphasises that individuals (in the case of the 1987 study, teachers) are more likely to adopt an innovation if they think it addresses their personal concerns.

Sherry, Billig, Tavlin and Gibson (2000) enhanced the work of the above researchers when they published a model setting out the stages they consider teachers and tutors move through when working with an ICT-based innovation. The stages are teacher as learner, teacher as adopter, teacher as co-adopter, teacher as re-affirmer or rejecter, and teacher as leader (Sherry and Gibson, 2002). The last two stages (the last in particular) extend adoption beyond the individual to the group because a tutor who has become "teacher as leader" advocates for ICT and supports others who decide to integrate the innovation into their own practice. Because, from an ecological perspective, the tutor as leader has co-evolved with ICT, he or she is able to provide informed, practical support for other tutors taking on board ICT innovations. Such support has a cascading effect throughout the organisation and thereby hastens evolution of the innovation.

The above literature suggests that a tutor in the leader stage will be a person previously positioned in the innovator and early adopter categories. Rogers (2003) uses five categories of innovativeness to group people in a social system: innovators, early adopters, early majority, late majority, and laggards. Because, according to Rogers, adoption of an innovation in any one system follows an S curve when plotted over time, the categories with the lowest proportions of people are innovators and laggards. Only a few tutors, therefore, are likely to reach Sherry et al.'s (2000) leader stage.

*Key point:* The learning trajectory that an individual is likely to pass through during adoption of an innovation is learner, adopter, co-adopter, re-affirmer or rejecter, and leader. Only a few tutors become leaders of e-learning and LLN.

### B.3 Organisational Maturity Model

The ongoing maturational process that occurs in an organisation as it implements and integrates ICT into its teaching and administrative structures is linked to the fact that these digital technologies are not passive but dynamic innovations: organisations that adopt one or more e-learning-related innovations tend to experience further changes stimulated by previous adoptions of ICT. For example, once e-learning becomes an integral part of the approach taken by several tutors to teaching and learning, it typically stimulates further collaborative ICT-based activities between tutors and departments.

Rogers' (2003) terminology for the five stages of organisational change in this respect is agenda-setting, matching, redefining/restructuring, clarifying, and routinising. The last two stages are rarely static because the introduction of each new innovation disrupts the clarifying and routinising processes.

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. This process is displayed in Table A1 below. Here we can see that the e-maturity sequence starts with localised exploitation when one or more tutors adopt one or more ICT innovations. As the number of tutors and students using ICT increases and activity proliferates, the increasing demand for resources stimulates management to appoint an ICT specialist to manage demand and coordinate internal integration. The range of innovations continues to expand and become further embedded into the organisation through the work of the ICT coordinator and users, who work together to redesign their curricula and educational practices.

The next stage involves redesigning the school's external digital networks to better accommodate use of ICT, a development that can lead to further embedding of ICT within and

across like organisations, such as partner colleges and educational authorities that require information from the organisation on the one hand and provide support to it on the other. Few tertiary organisations reach the innovative stage where they redefine their scope, as has been seen in other sectors, including commerce (eg the banking sector) (Natriello, 2005).

Table 2: The stages that ICT-related innovations move through in educational organisations

Stage of maturation	Characteristics
Localised	Innovator(s) adopt the innovation and use it in their classroom or other individual context
Internal integration	Coordinator is appointed to manage, across the organisation, applications and resources relating to the innovation
Transformative	Polytechnic or training company changes internal routines and activities to take advantage of the innovation
Embedded	Polytechnic or training company uses networks with other organisations in relation to this innovation, while keeping within its existing scope
Innovative	Polytechnic or training company reviews and changes its scope and activities to take full advantage of the innovation

Note: Derived from Davis (2010) and Learning and Skills Network (2008).

The conflicting pressures exerted by authorities beyond the education and training organisations are one of the factors that tend to make this process of organisational maturation much more chaotic and uncertain. It appears that most of the educational organisations established in the 20th century move from localised exploitation to the second stage of internal integration with an e-learning coordinator and occasionally back again. They also move to the transformative stage to take greater advantage of e-learning in activities, and they establish new routines to do this. However, further maturation of the kind that leads to redesigning educational processes so that they align with provision and facilities offered by external networks appears to be rare (Davis, 2010).

In general, at this time, the only educational organisations that appear to be truly at the embedded stage of e-maturity are those set up from their inception to use digital technologies to deliver education. Such organisations include virtual universities and virtual schools, and they rely on partnerships between organisations (Natriello, 2005). Two examples of such organisations are the Open University in the UK and the Virtual High School in the USA.

*Key point:* The stages of maturity that organisations are likely to pass through when adopting an innovation involving ICT are localised, internal integration, transformative, embedded, and innovative.

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