Adult literacy mobile learning: A smartphone app proposal to aid adult learners to practise their literacy skills

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Attestation of authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

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Leonie Williams

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Ethics Approval

This research obtained ethical approval 13/290 from the Auckland University of Technology Ethics Committee on 4 November 2013.

Abstract

The aim of this thesis is to explore how adult learners with low literacy may use smartphones to practise their literacy skills. The study was guided by these research questions: *How do adults with low literacy engage with smartphones, if at all? Can specialised smartphone applications be developed that provide a way for adults with low literacy to practise their skills? Can m-learning be used to enhance and reinforce traditional learning styles?*

The study answered the research questions in succession using heuristic inquiry, mixed-methods quantitative and qualitative research, and practice-based research. The study uncovers smartphone ownership levels amongst adults with low literacy, how they use smartphones and applications (apps), and identifies their learning preferences. Recommendations for practising literacy skills using smartphones ("m-learning") are established from the literature review and the results of the survey and interviews. These recommendations are then applied to a proof of concept smartphone app designed to help adults with low literacy practise their literacy skills.

The results showed promise that adult learners with low literacy can be supported with a smartphone app that will help with practising their literacy skills. The study did not seek to complete a fully functional app, instead only creating a proof of concept. This saw the app go untested and is a potential area for future research.

The knowledge gained by implementing the recommendations from the development of the proof of concept app is fully documented in this thesis. This documentation may help others in the field who wish to further investigate the development of smartphone apps in this area.

Smartphone App Download

The research produced a smartphone app and is available for both Android and iOS platforms. It is called My Skills Workout and is available to download for free on the Google Play and iTunes stores:

Google Play

https://play.google.com/store/apps/details?id=com.leoniewilliams.masters_app

iTunes

https://itunes.apple.com/us/app/my-skills-workout/id971376957?mt=8

1. Introduction, Purpose, and Objectives of the Research

1.1 Introduction

This research was initially undertaken based on a perceived need to explore the potential opportunities for using mobile smartphone learning ("m-learning") for adults with low literacy in New Zealand. Currently working in the learning and development industry, with a particular focus on adult learning programmes with embedded literacy, the researcher was aware of a significant lack of m-learning resources available in this area. Combined with a scarcity of available research on this topic specific to New Zealand, there is potentially a significant gap in this area that needs researching.

Due to the timeframe of a Master's thesis this research's practical outcome is limited to a smartphone app proof of concept, prior to the next logical step of user testing. The proof of concept aims to explore how the data from surveying and interviewing adults with low literacy can be incorporated with applicable learning theories and pedagogical models to develop an app that allows the practice of literacy skills and an improvement in skill level as a result.

1.2 Chapter overviews

This research is broken down into eight chapters. This chapter states the problems associated with low levels of literacy in adults in New Zealand, the background and need for this research and presents the research questions of this study.

Chapter 2 reviews the available literature in the field of adult literacy, the impact of English as an Other Language (ESOL) on literacy, learning and teaching pedagogical models that may address this issue, and how technology is being used to enhance learning.

Chapter 3 outlines the methodological framework and design of the research.

Chapter 4 presents the survey results and Chapter 5 the interview results.

Chapter 6 details recommendations for the app.

Chapter 7 outlines the creative synthesis/practice-based research and presents the proof of concept. This includes documentation captured from the development of the app and discusses the creation of the app.

Chapter 8 presents key findings of the research, obstacles, implications for the field of adult literacy and future research ideas.

1.3 Statement of the problem

Low levels of literacy in adults is a very real issue for New Zealand with 40% of employed people at the two lowest levels of the International Adult Literacy Survey (IALS) scale (see Table 1), these being level 1 and level 2 (Department of Labour, 2010). Literacy level 3 is regarded as being the minimum required for individuals to meet the complex demands of everyday life and work in the emerging knowledge society (Felligi & Alexander, 1997).

For immigrants living in New Zealand, having English as a second or other language (ESOL) is a significant barrier to literacy. Based on the Adult Learning and Life Skills (ALL) Survey results (Department of Labour, 2010), as at 2006 immigrants with ESOL made up 38% of those with both literacy and numeracy skills at IALS level 1.

The Adult Learning and Life Skills (ALL) Survey results (Department of Labour, 2010) show that those with low literacy skills are predominantly employed in low paid jobs. The average hourly rate for those with level 1 document literacy skills were $14.60 per hour whereas the average for all employees in the survey was $20.60. Of this group, 30–70% said that they rarely or never performed jobs that involve reading on a regular basis.

Although there is no research available on m-learning projects for adult literacy in New Zealand, there have been successful projects conducted overseas that offer promising results and ideas that may be used here. The MoLeNET programme (Attewell, Savill-Smith & Douch, 2009) involved approximately 20,000 learners in the UK from 2007-2009 and was aimed at seeking evidence that mobile learning can have a significant and positive impact on teaching and learning. One of the MoLeNET projects, aimed at adults who were attending a literacy programme, reported 85% of learners were using their devices outside of their literacy classes at least once a week and 41% felt that using mobile technologies had improved their literacy skills. Another m-learning project, ALEX© (Munteanu et al., 2011), was conducted over 6 months in 2010 in Canada. This project provided a mobile device with ALEX© (Adult Literacy support application for EXperiential learning), a mobile language assistant, to those enrolled in adult literacy programmes. This project reported several positive outcomes including acceptance of the technology, increased confidence and motivation, and the device made it easier for learners to remember new skills such as how to spell a word.

Both of these m-learning projects showed positive results with an increase in literacy skills as well as engagement with the technology. These positive results overseas warrant further investigation of the topic within New Zealand, especially given that 79% of New Zealanders aged 18+ will own a smartphone by the end of 2015 (Horizon, 2015).

1.4 Background and need

The researcher works in the field of training and development with many programmes conducted specifically for adults with low literacy. Many of these literacy programme participants still wish to continue practicing the literacy skills they have learnt during the programme, with many continuing to use their workbook or other paper based programme resources far beyond the completion of the programme, as a way to do this. The researcher is also aware that many of these participants also own smartphones, giving an opportunity to develop m-learning resources in the form of a smartphone app, so that they are able to continue practising their literacy skills using their smartphone, rather than paper based resources such as the workbook.

A research study conducted by the NZ Ministry of Education into electronic or online learning ("e-learning") for adult literacy, language and numeracy investigated how e-learning can be used to reach a greater number of adult learners and better meet their learning needs (Davis et al., 2010). While they found no direct research evidence that e-learning enhances adult literacy, they did find indirect evidence of gains in other populations, including adults, however there was some concern around the rigour of some of the studies they researched, with challenges of locating and mapping relevant studies (Davis et al., 2010). The study recommended that "*research continues in this field and it should clearly articulate its terminology and offer theoretical underpinnings that are sufficiently complex to aid the evolution of pedagogical practice that draws on digital technologies. At times this will involve multiple and competing frameworks.*" (Davis et al., 2010, p. 4).

Another finding of the study was that mobile learning can offer new ways to blend work and learning and increase access to Language, Literacy and Numeracy (LLN) (Davis et al., 2010). The study recommended "*considering innovative ways of using mobile digital technologies during e-learning in order to increase transfer of learning between education, workplace and home locations. These technologies must, however, fit the life and work circumstances of the learners in those locations.*" They also recommended "*promoting development of mobile digital technologies that, through their operations, facilitate the development of LLN skills.*" (Davis et al., 2010, p. 6).

This research study aims to contribute to the continuing research required in this area by exploring the use of mobile digital technologies, in the form of a smartphone app, to facilitate the development of literacy skills.

1.5 Research questions

This study intends to determine which elements of effective learning pedagogy can be applied to a smartphone app that serves as a tool to enable adults with low literacy to practise their skills.

The research questions are:

- How do adults with low literacy engage with smartphones, if at all?
- Can specialised smartphone applications be developed that provide a way for adults with low literacy to practise their skills?
- Can m-learning be used to enhance and reinforce traditional learning styles?

1.6 Summary

Low literacy in the workforce is an issue for New Zealand with 40% of employed people at the two lowest levels of the IALS literacy scale. ESOL is a significant contributing factor to low literacy levels in New Zealand with 38% of immigrants with ESOL having literacy skills at the lowest level of the IALS literacy scale. The Adult Learning and Life Skills (ALL) survey conducted by the NZ Department of Labour reports that those with low literacy skills are predominantly in low paid employment, and rarely or never perform jobs that involve reading on a regular basis.

Although there is no research available on m-learning projects for adult literacy in New Zealand, overseas projects such as MoLeNET and ALEX© show positive results that may be used here. A research study conducted by the NZ Ministry of Education has found that mobile learning can offer new ways to increase access to LLN skills, however more research is required into determining how mobile digital technologies can facilitate the development of LLN skills.

With smartphone ownership continuing to increase there is considerable opportunity for development of smartphone apps in the area of low literacy education. The research intends to find out the learning styles of adults with low literacy and document how these can be incorporated into a smartphone app whilst employing appropriate learning pedagogy. This research will contribute to the field of knowledge in m-learning for adult literacy by determining how mobile digital technologies, in the form of smartphone apps, can facilitate the development of literacy skills.

2. Literature Review

This chapter reviews literature of varied topics relevant to this research project, namely 1) the state of the field of adult literacy in New Zealand, 2) the background and impact of low literacy in adults, 3) the corresponding barriers faced by those with low literacy and how this affects employment opportunities and access to Information and Communication Technology (ICT), 4) an examination of m-learning as a learning tool for adults with low literacy and 5) learning and teaching theories and practice in relation to m-learning.

Adult literacy in New Zealand in its present state is examined and discussed, including the initiatives that have been implemented by the Government to address this area. Much of the policy around these initiatives has focused on employing a traditional approach to improving skills to increase productivity in the workplace. In New Zealand, ESOL is a significant contributing factor that impacts on literacy due to a high percentage of immigrants in our workforce, thus this area is also examined. While research into e-learning's application to literacy has been undertaken by the Ministry of Education, there appears to be little research into m-learning's application. Thus, the application of m-learning for adult literacy in New Zealand is unexplored.

To understand what literacy means in contemporary times in New Zealand, the definition of adult literacy is discussed. This leads into a discussion of the barriers adults with low literacy face in accessing better employment opportunities and their limited use of ICT. With many jobs requiring increased ICT skills, this impacts on their ability to improve their skills and correlates to lower paid jobs. With the increasing availability of ICT in the form of smartphones, this is providing new opportunities for this group of people to access ICT and improve their skills.

With the increasing availability of smartphones, m-learning is addressed as a possible way to overcome ICT barriers to literacy. With a scarcity of research on m-learning in New Zealand, this section examines m-learning projects that have been conducted overseas to address adult literacy. With the success of these projects, this lends itself to similar opportunities with m-learning for adult literacy in New Zealand.

The relevant learning theories and their application to m-learning are then discussed so they may be applied later in this research to the creation of a smartphone app. Firstly, Andragogy is explained, as it is the most relevant theory of adult learning to this research, followed by Blooms Taxonomy. Then Objectivist and Constructivist learning models are explored, noting how they may be applied to this research.

Finally, the Cognitive Theory of Multimedia Learning is discussed as a teaching practice, as it offers direction in the development of an m-learning project.

2.1 State of the field of adult literacy in New Zealand

In New Zealand, the Tertiary Education Commission Te Amorangi Mātauranga Matua (TEC) was established by the Education Act 1989 as a crown entity to address education at a tertiary level (TEC, 2014a). According to the TEC, one of the Government's priorities includes an appropriately trained and competent workforce (TEC, 2014a). With 40% of employed people in New Zealand being at the two lowest levels of the IALS literacy scale, this presents a significant issue for the TEC to address. The TEC is governed by a Board of Commissioners that report directly to the Minister for Tertiary Education and their role is to provide advice to the Government on the activities and performance of the tertiary education sector, the implementation of policy and the operational implications of new policy initiatives (TEC, 2014a).

Adult literacy has only been recently addressed by the New Zealand Government, with the publication of the first New Zealand Adult Literacy Strategy in 2001 (Ministry of Education, 2001; 2012). Research undertaken in 2006 found that approximately 1.1 million New Zealanders (43% of adults aged 16 to 65) have literacy skills below those needed to participate fully in modern society (Tertiary Education Commission, 2008a). Similar statistics were reported by the NZ Department of Labour in 2010, showing 40% of employed people have literacy skills at level 1 or level 2, these being the lowest two of the five levels on the IALS scale (Department of Labour, 2010). The achievement attained on each of the literacy domains is grouped into one of five "skill levels". Level 1 represents the lowest ability range and level 5 the highest. Literacy level 3 is regarded by experts as being the minimum required for individuals to meet the complex demands of everyday life and work in the emerging knowledge society (Felligi & Alexander, 1997).

The Ministry of Education (2001) defines the IALS scale as follows:

> **Level 1:** People at this level have very poor skills, and could be expected to experience considerable difficulties in using many of the printed materials that may be encountered in daily life.
>
> **Level 2:** People at this level would be able to use some printed material, but this would generally be relatively simple.
>
> **Level 3:** This level represents the ability to cope with a varied range of material found in daily life and at work. People at this level would not be able to use all printed material with a high level of proficiency, but they would demonstrate the ability to use longer, more complex printed material.
>
> **Level 4:** People at this level have good literacy skills, and display the ability to use higher order skills associated with matching and integration of information.
>
> **Level 5:** People at this level have very good literacy skills, and can make high-level inferences, use complex displays of information, process conditional information and perform multiple operations sequentially. (p. 23)

Table 1 – Definition of literacy levels on the IALS scale

There have been several studies on the topic of adult literacy, exploring the reasons for low literacy levels and possible ways of addressing these issues such as the International Adult Literacy Survey (IALS) conducted between1994-1998, Adult Literacy and Life Skills Survey (ALL) conducted in 2003 and 2006, and the Programme for International Student Assessment (PISA) of the OECD. All of these studies show a significant contributing factor to low levels of literacy is immigrants with ESOL. The Adult Learning and Life Skills (ALL) Survey results in 2006 (Department of Labour, 2010) report that immigrants with ESOL made up 38% of those with literacy skills at level 1. Literacy issues for those with ESOL are compounded if their skills in their first language are also poor (Benseman, 2012). Bigelow and Schwarz (2010) argue that a literate person learns to process information in ways that are qualitatively different from those of a nonliterate person. For those who participate in formal schooling, they are taught skills that enable them to think in a considered manner (Bigelow & Schwarz, 2010). It could be reasoned that the more education a person has, the easier it will be for them to learn new skills, thus learning aspects of a new language will transpire more easily to them (Bigelow & Schwarz, 2010).

The Tertiary Education Commission (TEC) argues low levels of literacy contribute to a less productive workforce (TEC, 2008a). Low literacy skills contribute to errors causing wastage and re-work, poor health and safety outcomes, decreased worker engagement and high staff turnover in the workplace (TEC, 2008a). These factors in turn contribute to New Zealand's relatively low productivity (TEC, 2008a). With the changes in technology and a shift to a knowledge-based economy on a global scale, the TEC argues we need to improve the literacy skills of our workforce so that people are able to become more productive and cope with changing workplace demands (TEC, 2008a).

The "Learning for Living" programme was introduced by the TEC as part of the New Zealand Adult Literacy Strategy to formalise Language, Literacy, and Numeracy (LLN) provision in New Zealand (TEC, 2008a). This programme focused on increasing the skills of adults in the workforce and contributed to the development of the Learning Progressions (TEC, 2008a). The Learning Progressions were developed by a group of subject matter experts using sound pedagogical advice and cover a set of six steps from one (lowest) to six (highest) that identify what adult learners know and are able to do as they progress their skills in listening, speaking, reading and writing (TEC, 2012).

In 2007 the TEC and the Ministry of Education set the subsequent operational policy direction with a number of documents focused on raising the LLN skills of the workforce (TEC, 2008a). These documents include The New Zealand Skills Strategy (TEC, 2008b), Getting Results in Literacy and Numeracy (TEC, 2010), and the Adult Literacy and Numeracy Strategy 2010-2015 (TEC, 2012).

The TEC has taken a three-pronged approach to improving adult LLN skills. This approach has included building instructional infrastructure, namely the Learning Progressions, Literacy and Numeracy for Adults Assessment Tool, and Pathways Awarua, which provides learning opportunities and introduces professional development for the workforce (TEC, 2010). The activity informed by this policy approach has been a comprehensive educational change project (TEC, 2013). These strategies have taken a traditional approach to literacy with the first research into online learning (e-learning) conducted by the Ministry of Education in 2010 (Davis et al., 2010). This project showed that e-learning is relevant for most adults with LLN needs and can provide a good source of motivation and practice for ESOL learners. The TEC introduced their first e-learning programme, Pathways Awarua, in 2011 (TEC, 2013). This programme showed that learners were very engaged with the programme, and most learners were repeating activities until they had the correct answers (TEC, 2013).

Although the TEC has conducted studies on e-learning for adult literacy in New Zealand, there appears to have been no research into the use of m-learning in this area. This signifies an opportunity for m-learning to be further investigated in the New Zealand context. M-learning for literacy is therefore discussed in detail in section 2.3 with examples of its application in other countries reviewed.

2.2 Background and impact of low literacy in adults

This section summarises the definition of literacy and its contributing factors. The impact of low literacy on employment is then examined and discussed, which leads to a discussion of the barriers faced in accessing ICT and the low skills possessed because of this.

2.2.1 What does literacy really mean?

What does literacy mean today and what are the implications of low literacy for adults who wish to participate fully in modern society? To answer these questions, this section explores the various definitions of literacy and the obstacles faced by those with low literacy. The discussion of definitions is undertaken to identify how this research can contribute to addressing low literacy in a meaningful way.

Put simply, core literacy skills are about the ability to read and write articulately (Hanifan, 2008). It is only once this level of literacy is achieved that the next step of using these core skills to learn other skills, for example reading to learn, can take place (Hanifan, 2008). Thus, it is essential that these core literacy skills are attained before any other learning can occur.

The definition of literacy has changed over time as a reflection of globalisation, labour force changes and new work practices (Hanifan, 2008). For the working-class of the 1800s, literacy meant only the ability to write your name or recite a passage from the *Bible* (Hanifan, 2008). It was only the middle and upper classes who enjoyed the privilege of higher literacy skills (Hanifan, 2008). As time moved on, increasing social and economic demands on adults have led to a need for greater levels of literacy skills, and thus the meaning of literacy continues to evolve (Hanifan, 2008).

The International ICT Literacy Panel offers a current definition, arguing literacy is not just the ability to read and write, but includes *"a continuum of knowledge, skills, and strategies that individuals acquire over the course of their lives in various contexts and through interactions with their peers and with the*

larger communities in which they participate" (International ICT Literacy Panel, 2002, p. 14). The International ICT Literacy Panel also notes that as we move into the 21st century of increasing technology, literacy must include skills and abilities that enable people to function effectively and engage with that technology (International ICT Literacy Panel, 2002).

The TEC (2009) defines literacy similarly:

> Literacy relates to the written and oral language people use in their everyday life and work; it includes reading, writing, speaking and listening skills essential for good communication, critical thinking and problem solving in the workforce. It includes building the skills to communicate (at work) for speakers of other languages. (p. 2)

The main differences in the two definitions offered by the International ICT Literacy Panel (2002) and the TEC (2008) can be attributed to being situated in different fields, as one would expect an ICT panel to have particular focus on ICT, and an educational panel (TEC) would have particular focus on broader skill sets. However, both agree the end goal is for the learner to function adequately within their community and workplace. By taking the two definitions we can extract a basic list of skills or requirements a literate person should have, namely ICT, reading, writing, speaking, listening, critical thinking, and problem solving.

The multitude of skills or knowledge that can be considered as literacy have led to conceptual frameworks such as Multiple Literacies Theory (MLT), which positions an individual as reading the world, the word, and self in the context of home, school, and community (Masny, 2005). According to Masny, it is the individual talking, reading, and writing that leads to the construction of meaning within a particular context. MLT covers a range of aspects, and those that are applicable to this research include Community Literacy: the individual's reading of literate practices of a community (Masny, 1997; Bangou & Waterhouse, 2008), and Global Education, which denotes the impact of global economic, political, social and culture movements on education, in a world which favours a high level of technology with English as the favoured language (Masny, 1997).

It is clear to see that literacy involves a range of activities including critical skills for the workplace. The definition of literacy that this study aims to address is as defined by the TEC (2009) "the written and oral language people use in their everyday life and work". By increasing these literacy skills, this will enable them to improve their English skills that will in turn assist them to fit in better with both their community and their workplace. With the evolution of mobile computing technology and the recent emergence of smartphones in particular, this research aims to identify if the use of m-learning may contribute to an increase in these literacy skills.

2.2.3 Impact of low literacy on income levels and employment opportunities

There are a multitude of challenges faced by adults with low literacy. Poor literacy skills can often translate into limited employability options beyond unskilled jobs that pay low wages and often result in a greater chance of future unemployment (OECD, 2012). Increasing use of technology in the workplace is eliminating many low skilled jobs such as the introduction of automated warehousing (OECD, 1999a). People who may never have owned or operated a computer may now find they are required to use one in their employment and this raises a number of issues for them and for their employers. As the International ICT Literacy Panel (2002) and the TEC (2008) both argue, it is essential that people have the literacy skills required to function successfully within their community and their workplace, which includes ICT skills as well as other core literacy skills such as reading and writing.

There is also an increasing demand for higher cognitive skills than those with low literacy often possess (OECD, 2012). People need to be able to think critically and problem solve, as well as possess at least a minimum level of literacy skills just to remain employed in even the most basic jobs (OECD, 2012). Results from the International Adult Literacy Survey, 1994-1998 indicates that individuals with low literacy skills have a very small chance of successfully completing problem solving tasks (OECD, 2012). This study therefore highlights a link between low literacy and poor problem solving skills. The study also notes this presents a very real issue for those with low literacy sustaining any type of employment as a result (OECD, 2012).

There is a strong connection between those who have lower levels of education and those in low paying jobs (Carnevale & Rose, 2001). The Adult Learning and Life Skills (ALL) Survey results (Department of Labour, 2010) show that those with low literacy skills are predominantly employed in low paid jobs. At the time of the survey in 2006, the average hourly rate for employees with the lowest level of literacy skills (level 1) was $14.60 per hour whereas the average for all employees in the survey was $20.60. The survey also reported that up to 70% of employees with level 1 literacy skills rarely or never performed jobs that involve reading on a regular basis. This lack of opportunity for people to practise literacy skills in the workplace may have a corresponding impact on the ability to improve these skills and thus a person's employment situation.

The Dynamics of Income in Children in New Zealand, 2002-2009 study shows that those in low income jobs tend to stay in them (Gunasekara & Carter, 2012). This longitudinal study set out to examine the distribution of incomes and how incomes change over time, in an attempt to understand changes in New Zealanders' economic situation and poverty in New Zealand. Data were gathered from the Survey of Family, Income and Employment (SoFIE), an annual panel survey administered by Statistics New Zealand, from 18,000 individual sample members, including 4,930 children for seven years from 2002 to 2009.

The study used a "moving line approach", setting the poverty line as a proportion of median income from each survey so that the threshold for low income moves in lockstep with median income. The study defined low income as <60% of median income and identified around 19% of the children sample as being in low income. Using this approach the situation of a low income household is considered to have improved if its income gets closer to that of the median household, irrespective of whether it is better or worse off in real terms (Perry, 2008).

According to the New Zealand Household Economic Survey (HES), 20% of children were in low income households in 2007 and this remained at 20% in 2013 (Perry, 2008; 2010). Comparative information from EU countries also reported 20% of children in low income households in 2007 which also remained at 20% in 2013 (Perry, 2008; 2010). Findings from the OECD in 2011, which uses an income poverty rate of 50% of median income lines, reports 11% of children in low income, with New Zealand reporting 13% at the same measure (Ministry of Social Development, 2014). With 19% of the children sample of the Dynamics of Income in Children in New Zealand, 2002-2009 study identified as being low income, this is close to the New Zealand "child poverty" rate found in New Zealand and OECD literature (Gunasekara & Carter, 2012). Thus, this survey can be reasonably viewed as representative of the New Zealand population as a whole.

The Dynamics of Income in Children in New Zealand study reports that the majority of people who experience poverty for at least one year will move in and out of poverty over time, with an adverse effect for those who experience low income on their health and employment, and exposure to extremely low income or accumulated periods of low income being detrimental for children. Results of the study showed that low income rates were higher for Māori and Pacific children and for children younger than 10 years of age. It showed a high recurrence of those on low incomes with 71% in low income households in the second year of the study and 46% remaining in low income at year seven. Of those who were in low income households each year, around two thirds were chronically in low income, this being below the average low income line. The study also revealed that 20% of children were in low income households for all seven years.

Many low income families have young children (Acs, Phillips & McKenzie, 2001; Gunasekara & Carter, 2012) so are constrained by the type of employment they are able to obtain. For many this means a struggle to afford the basics and adequately support their families. Remaining in low income employment not only impacts the person who has low literacy, but also their family and the whole community. This can be seen argued in the 1999 OECD Report on social policy agenda:

> …there is concern in many OECD countries that there is a section of the community that faces extraordinary barriers to full participation in the labour market and society. The results are well known: benefit dependency leads, sooner or later, to financial deprivation. Access to public services may be denied because of lack of address or employment record. Households are no longer in control of their own destiny. Health status may be damaged by poor diet and living conditions.

Upon reaching retirement, lack of contributions to employment-based public pension schemes leads to continued reliance on minimum benefits. Children grow up without examples of the normal status of work in society, increasing the risk that disadvantage is transmitted across generations. In some countries, deprived areas or even regions become detached from the modern economy, becoming unable to take advantage of any improvements in the macroeconomic environment. (OECD, 1999b, p. 100)

Low income earners have a smaller chance of moving into higher paid jobs with most remaining at the same level of income and employment (Carnevale & Rose, 2001; Gunasekara & Carter, 2012). The research data discussed thus far shows that those of low literacy have a high chance of working in low income jobs and have little opportunity to improve their literacy skills. The OECD notes this, stating that adults with low literacy are around four times less likely to engage in informal learning than those at a higher level (OECD/Statistics Canada, 2005). In New Zealand, the TEC has responded to this by funding workplace literacy programmes (TEC, 2014b). The funding provided is based on three strands: Tertiary Education Organisation (TEO)-led programmes, Employee-targeted programmes, and Employer-led programmes. The aim of the employee and employer targeted funding is to increase the literacy (and numeracy) skills of employees and contribute to workplace productivity through the provision and evaluation of literacy (and numeracy) learning in a workplace context (TEC, 2014b). For many learners, these workplace literacy programmes are the first formal learning they have engaged in since leaving school (Skills Highway, 2014).

2.2.4 ICT barriers and the Digital Divide

As the International ICT Literacy Panel (2002) states, ICT skills are part of literacy (see section 2.2.1), so it is appropriate to cover this topic in relation to this research. The International ICT Literacy Panel (2002) describes ICT literacy as: "using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate and create information in order to function in a knowledge society" (p. 2). There are many barriers to people using ICT. This literature review has already discussed two potential barriers of illiteracy and poverty (see sections 2.2.1 and 2.2.3). Additional barriers also include lack of skills and confidence, limited or no access, insufficient user friendliness, and limited opportunities to use technology (Gulati, Yates & Tawileh, 2013). Even with government policies aimed at reducing the digital divide, the issue still remains, mainly due to vast inequalities in income distribution and social, educational, and skills barriers (Gulati, Yates & Tawileh, 2013).

As recently as 2012 the NZ Household Use of ICT survey (Statistics New Zealand, 2012) showed that there are still 20% of all households who do not have an internet connection. Out of the 20% who have no internet connection, 36% stated the costs are too high, 14% stated lack of knowledge, confidence, or skills, and there are 4% who do not have the ability to connect to the internet. With 36% reporting the cost being too high, adults with low literacy, who are predominantly in low income jobs with little prospect of an improvement in their situation (Carnevale & Rose, 2001; Gunasekara & Carter, 2012; OECD, 2012), will most likely continue to face significant barriers to ICT. This makes solving low levels of ICT literacy challenging as access becomes a problem.

How does one overcome ICT access issues in New Zealand? The same NZ Household Use of ICT (Statistics New Zealand, 2006; 2009; 2012) studies may hold some clues. The results of these studies show there is an increasing trend in both mobile phone ownership and those who use mobile phones to

access the internet for personal use. In 2006, 64% of unemployed people owned a mobile phone, which increased to 73% in 2009 and those in low income brackets also showed a similar trend. In 2012, this dataset was not included, however it did include data on the number of people who access the internet on their mobile phone for personal use. In 2009 it showed that 21% of unemployed people accessed the internet on their mobile phone, which increased to 47% in 2012. The results also show a similar increasing trend for employed people in most income brackets. The Neilsen Company also showed increasing rates of smartphone ownership, reporting an 11% increase from 2011 to 2012 (Wade, 2013) and a Horizon research survey reported 69% of New Zealanders owned a smartphone at the end of 2014 with 10.4% of respondents intending to get one by the end of 2015 (Horizon, n.d.). This general increase in smartphone ownership may provide an opportunity to engage those of low literacy with ICT, potentially overcoming issues of access. This however needs further research.

Access to ICT has been identified as a potential barrier by Gulati, Yates & Tawileh (2013), but no data on smartphone access and ownership of those with low literacy in New Zealand presently exists. To determine if smartphones could potentially overcome issues of access, specific data would need to be collected. Also, as cost is indicated as a potential barrier (Statistics New Zealand, 2012), further data on perceptions of those with low literacy relating to the cost of engaging with learning opportunities via a smartphone would be beneficial. Additional data on smartphone behaviour of those with low literacy would also be beneficial to help answer if smartphones could be used to overcome ICT barriers to literacy.

2.3 M-learning

The previous section (see 2.2.4) identifies smartphones as a possible way to overcome ICT barriers to literacy, therefore this section will discuss using such devices as a means of providing learning opportunities.

Mobile learning, more commonly known as m-learning, has been seen for many years as simply the provision of education by means of using mobile devices, such as smartphones, to deliver content (Traxler, 2009). This is a simplistic view that goes only a small way in explaining all aspects of what m-learning means not just today, but as we move forward in time and with continuing advances in mobile technology. This section explores the definition of m-learning. Then the impact of m-learning on adult literacy is examined with a discussion of m-learning projects that have been conducted. With a scarcity of research available on the use of m-learning in New Zealand to improve literacy skills, this section focuses on m-learning projects that have been conducted in other countries. These projects show promising ideas and results that may be of use to this research and are discussed at the end of this section.

M-learning is not just the combination of the words "mobile" and "learning" (Traxler, 2009). It is about the concept of mobile learning as it relates to learners' experiences, device ownership, informality, movement, and context that is not accessible to other forms of learning (Kukulska-Hulme, 2009). The key attributes of mobile learning are the potential for learning to be personalised, situated, authentic, and informal (Kukulska-Hulme, 2009). Naismith et al., (2004) suggest that mobile technologies relate to six

types of learning: behaviourist/objectivist, constructivist, situated, collaborative, informal/lifelong, and support/coordination. For this research, it is the objectivist activity in the form of instant feedback enabled by a smartphone app that is of interest. It is also informal and lifelong learning that is essential to the success of this research project, where an increase in literacy and ICT skills can be achieved and maintained with the use of mobile devices that people often carry with them constantly, allowing them to source information as required or recording it on the go for future consultation.

Desmond Keegan (2005) took the view that the definition of mobile learning is about the mobility of learning. He defined mobile learning as "the provision of education and training on PDAs/palmtops/handhelds, smartphones and mobile phones" (as cited in Traxler, 2009, p. 2). Others view mobile learning in terms of the individual and community being mobilised. Sharples (2006, cited in Traxler, 2009) established that mobile learning is taking learning to individuals, communities, and countries that were previously too remote, socially or geographically for other types of learning initiative.

Kukulska-Hulme and Traxler (2007) suggested a number of categories that define mobile learning from a different perspective. These categories included: Technology-driven mobile learning, where a specific technological innovation such as the iPhone is used to demonstrate a pedagogic possibility; miniature but portable e-learning, where mobile, wireless, and handheld technologies are employed using approaches and solutions normally found in e-learning; and mobile training and performance support, where technology is used to improve workers' productivity by delivering information and support in a just-in-time manner with context for their immediate priorities, roles, and duties (Traxler, 2009).

While there are many views on the definition of mobile learning or m-learning, according to Wagner (2005) they all support the view that learning can happen any time, anywhere and on any device. This is the stance adopted by this research, that m-learning is the ability to provide learning any time, anywhere, whether in the classroom or at home, that offers up the potential for m-learning to be used to enhance and reinforce traditional learning styles. This research aims to explore if specialised smartphone applications (apps) can be developed to provide a way for adults with low literacy to practise their skills and if this method of m-learning can be used to enhance and reinforce traditional learning styles.

Although there is no research available on m-learning projects for adult literacy in New Zealand, there have been successful projects conducted overseas that offer promising results and ideas that may be used here. One such project was a major m-learning programme called MoLeNET, used in the UK from 2007 to 2009 (Attewell, Savill-Smith & Douch, 2009). This programme aimed to support colleges with the introduction of mobile learning and seek evidence that mobile learning can have a significant and positive impact on teaching and learning. It involved approximately 20,000 learners and 4,000 staff in 115 colleges and 29 schools during 2007 to 2009.

The MoLeNet programme included a number of individual projects with 18 of the projects aimed at improving literacy using a variety of devices, including smartphones. A key focus for one project was to raise literacy levels, as it was a key priority for the borough (Attewell et al., 2009). This project reported that 85% of learners were using their devices outside of their literacy classes at least once a week and 41% felt that using mobile technologies had improved their literacy skills (Attewell et al., 2009). It also noted that using mobile technologies encouraged learners to remember spellings (Attewell et al., 2009).

With learners choosing to use their device in their own time and indicating that using a mobile device had increased their literacy skills, these outcomes support the use of m-learning as a tool to aid adults to practise their literacy skills and are a key focus of this research (Attewell et al., 2009).

Another MoLeNet project, involving learners with poor literacy skills attending adult literacy classes, noted that their literacy users gained the most benefit as the mobile devices catered for a range of learning styles and enabled learners to work at their own pace (Attewell et al., 2009). A key finding from this project was that using technology removes the stigma of poor literacy skills and feels very "adult". A key aim of this research is to develop a smartphone app with content that may be of a low literacy level but is aimed at adults, as they have had very different experiences to children. It is encouraging to note that learners from this project felt that using mobile devices did not stigmatise them and supports the use of such technology in this research study (Attewell et al., 2009).

Other findings from the MoLeNET programme included an increase in achievement for disadvantaged learners and also an increase in ICT and m-learning technology literacy and competency. This was attributed to increased levels of engagement, motivation, and enthusiasm for learning. The findings also reported higher levels of intrinsic motivation with improved independent learning and ownership of learning. These outcomes were achieved by leveraging m-learning's ability to provide learning any time, anywhere, and on any device to suit the learner. An additional factor reported was the technology made the learning more enjoyable, encouraging students' own learning potential and a passion for ongoing learning.

Another m-learning project, ALEX© (Adult Literacy support application for EXperiential learning; Munteanu et al., 2011) was conducted over 6 months in 2010 in Canada. This project provided a mobile device with ALEX©, a mobile language assistant, to those enrolled in adult literacy programmes and workplace essential skills training. The ultimate goal of the project was to provide a system that could deliver practical support for those with low literacy to become increasingly literate and independent.

There were several reported positive outcomes of the programme including acceptance of the technology, ease of use, increased independence, and increased confidence and motivation. Some participants reported that they found ALEX© easier to use than a paper dictionary, as they found the system intuitive and this motivated them to look up even more words. One of the features of the system was the "Read" function, which allowed the user to hear the pronunciation of a word. It was reported that this feature made it easier for users to remember how to spell a word.

The MoLeNET and ALEX© projects used m-learning as a way for adults to practise their literacy skills any time, anywhere, by developing their own applications for a variety of mobile devices, including smartphones. These projects both reported positive outcomes with an increase in ICT and m-learning technology literacy and competency, with many learners indicating that using mobile technology has improved their literacy skills. The positive results from these overseas m-learning projects for adults with low literacy, shows promise and confirms the viability of researching the development of smartphone apps as a method of m-learning in this area in New Zealand.

2.4 Theories of learning and teaching and their application to m-learning

Although m-learning is a relatively new and emerging field, it still employs pedagogical models and sound learning theories that are reflected in the design of the learning. This section discusses these models and how they apply (or do not) to m-learning. The discussion of these models also takes into account the differences in andragogy from pedagogy, and the motivations for adults to learn. The learning theories that have been reviewed are selected based on their application to the field of m-learning and the motivations of adult learners (andragogy).

As adults learn differently from children this section first discusses andragogy as the most relevant theory of adult learning and its application to m-learning. Following that is an examination of Bloom's Taxonomy, a model used extensively by many learning designers that explains how we learn and outlines the six levels of learning in the cognitive domain. This model corroborates the connection between remembering, understanding and applying in relation to this research and how it may be applied to an m-learning project.

The Objectivist model is then examined as it is an efficient method of transferring knowledge from the teacher to the learner. This model is often used in traditional learning methods, for example assessments, multiple choice, and short answer tests.

Constructivism has been explored as it is concerned with how we construct knowledge. Constructivists believe that knowledge is socially constructed with the teacher facilitating new knowledge with the learner and their peers as part of the process, they do not believe that knowledge is just an entity to be passed on.

2.4.1 Andragogy

The definition of Andragogy has continued to evolve since the term was first coined by Alexander Kapp in 1833. Knowles (1980) perhaps best defined Andragogy as the art and science of helping adults learn (p. 43), whereas Pedagogy is the art and science of teaching children (Wang, 2009).

Andragogy was first authored by Alexander Kapp (1833), a German high school teacher, in his book *Platon's Erziehungslehre* (Plato's Educational Ideas) in which he defines andragogy as the lifelong necessity to learn (Reischmann, 2004). The model was originally intended for adult learners, however, as it assumes learning occurs through self-reflection and life experience, its application can stretch beyond this (Henschke, 2010). Andragogy's focus on self-reflection and life experience at the time marked a shift in focus from the teacher to the learner.

Those in the field of adult education have contributed numerous additional theories to the definition of andragogy over time. It was Lindeman (1926, cited by Henschke, 2010) who believed that it is about teaching adults by discussion, differentiating between how adults learn and how we teach children. Simpson (1964, cited by Henschke, 2010) posed that andragogy is about identifying a body of knowledge relevant to training those in adult education.

It was Malcolm Knowles (1980), an American adult educator, who provided the most comprehensive understanding of andragogy with a learning theory based on six components: (1) Adults need a reason to learn; (2) Adults need to be self-directed and take responsibility for themselves; (3) Adults bring their own experiences with them which is a resource for their learning; (4) Adults learn when they are ready because they have a need to know or to be able to do something that affects them personally; (5) Adults seek solutions to tasks or problems; and (6) Adults are much more intrinsically than extrinsically motivated.

As Henschke (2010) argues, of all the varying theories of andragogy, it is the principle of self-directed learning that is the most significant. Adults learn because they want to, not because they have to, and it is this internal motivation that is key to this research study.

If this research finds that adults with low literacy do engage with smartphones and are positive about using such technology, then m-learning is likely to be a suitable method of learning, which addresses the research questions.

2.4.2 Bloom's Taxonomy – Learning in Action

According to Bloom's Taxonomy (Bloom, Engelhart, Furst, Hill & Krathwohl, 1956) there are three domains to learning: Cognitive, Affective, and Psychomotor. The Cognitive domain describes intellectual capability, i.e., knowledge, or "think". The Affective domain describes feelings, emotions and behaviour, i.e., attitude or "feel". The Psychomotor domain discusses manual and physical abilities, i.e., skills or "do". The aim of this research is to increase knowledge by improving a person's literacy skill, thus it is the cognitive domain that is the relevant domain for this study.

In the cognitive domain, there are six levels: 1. Remember, 2. Understanding, 3. Application, 4. Analysis, 5. Evaluating and 6. Creating (Anderson & Krathwohl, 2001). This aim of this research is to develop a smartphone app that enables adults with low literacy to practise their literacy skills, so they can then apply these skills in real life. As those with low literacy often possess poor problem solving skills (OECD, 2012), the higher levels of analysis (Evaluating and Creating) are beyond the scope of this research. It is therefore the third level, Application of learning, which must be addressed by this research. As each level of learning must be mastered before the next level can be reached, the first two levels, "Remember" and "Understanding" must also be addressed by this research.

At the first level of learning, "Remember", a person is able to recall or recognise information. This means they may be able to recall a process, rule or definition but do not necessarily understand what the information means (Anderson & Krathwohl, 2001). Once a person can remember a piece of information they need to be able to understand what that information means. At the second level of learning, it is the ability to understand that builds on a person's knowledge by developing the ability to understand the meaning of something where they can explain or interpret meaning from a given scenario or suggest a solution to a given problem (Anderson & Krathwohl, 2001). It is at the third level, "Application", that a person is able to remember a piece of information, understand what it means, and then be able to apply that knowledge and understanding in real life situations (Anderson & Krathwohl, 2001). This research

aims to reach this level by enabling learners with low literacy to remember and understand literacy skills such as tenses and punctuation and how they should be used in real-life situations by using content they can relate to. Once they have learned these skills they can then apply that knowledge to real-life situations by remembering answers to questions that relate to situations they would be likely to experience in their lives at work and at home, for example, questions about grocery shopping or driving a car.

As those with low literacy often possess poor problem solving skills (OECD, 2012), levels four, five and six require higher order skills than those who have low literacy likely possess and are beyond the scope of this research. The fourth level, "Analysis", requires the ability to de-construct a methodology or process, make qualitative assessment of elements, and to be able to identify root causes (Anderson & Krathwohl, 2001). In this research there is no requirement for a person to make any evaluations, only to answer questions based on their knowledge, so the next level of "Evaluate", where a person is able to make judgements about ideas or materials (Anderson & Krathwohl, 2001), is beyond what is required in this research. The sixth level of "Creating" requires a person to be able to build a structure from diverse elements, for example writing a company process manual (Anderson & Krathwohl, 2001), and is again well beyond what is required of the learners aimed at in this research.

2.4.3 Objectivist model

Objectivism is a model of learning that views knowledge as a reality that is an external entity existing independently of the human mind (Jonassen, 1991). Under the objectivist model it is the role of the teacher to transfer their knowledge to the learner (Leidner & Jarvenpaa, 1995). According to Jonassen (1991) this model makes several assumptions. The first assumption is that there is a reality that individuals agree exists. Second, this reality can be represented objectively and transferred to learners. Third, the mind of the learner reflects this reality, rather than interpreting it. Fourth and last, it assumes that all learners use the same processes to represent and understand the world. Learners are not encouraged to make their own interpretations of reality, rather the teacher is to instruct them on what the reality is so that learners can replicate the knowledge given to them (Jonassen, 1991).

The objectivist model seeks to transmit knowledge from the teacher to the learner (Leidner & Jarvenpaa, 1995). It is commonly used to teach low order skills such as remembering and understanding new knowledge (see 2.4.2 Bloom's Taxonomy), and is associated with traditional learning methods, for example lectures (Berardi & Blundell, 2014). Learning is an incremental process where the lower order skills must be mastered before the higher order skills can be attained (Hannafin, 1997).

The objectivist model offers a structured and efficient method of transferring knowledge to a learner so it can be recalled by them and is seen as the most appropriate model for factual or procedural-based learning (Leidner & Jarvenpaa, 1995).

The objectivist model has much to offer this research because it is an effective model for developing the lower order skills this study aims to reach in the area of literacy which is based on factual knowledge.

2.4.4 Constructivist model

The Constructivist model of learning believes that knowledge is created by the learner rather than transmitted to them, which differentiates it from the Objectivist model (Leidner & Jarvenpaa, 1995). As Leidner & Jarvenpaa (1995) argue, "*the mind is not a tool for reproducing the external reality, but rather the mind produces its own, unique conception of events*" (p.267). Under the Constructivist model, learning is founded on the idea that the learner is an active participant in the process, bringing their own experiences with them that they must evaluate new information against to form new knowledge (Brooks, 2005).

A fundamental component of the Constructivist model is the prior knowledge of the learner (Brooks, 2005). It is believed that individuals learn better when they discover things for themselves rather than being told (Leidner & Jarvenpaa, 1995). In order for the construction of new knowledge to occur, the teacher must facilitate the learning process so that the learner can compare their own knowledge against that which is being given to them so they can confirm or rebut their original thoughts and come to their own conclusions (Brooks, 2005; Leidner & Jarvenpaa, 1995). It is this process, where the learner is an active participant, that leads to the construction of new knowledge (Brooks, 2005).

As learning takes place by comparing already acquired knowledge to new ideas, learners require some previous knowledge to compare against. Therefore the constructivist model is well suited for the higher orders of learning (see 2.4.2 Bloom's Taxonomy) where the learner is able to analyse information, evaluate ideas and create a structure from diverse elements, for example, a company process manual.

The teacher's role in learning under the Constructivist model is as the expert, where they guide learners to new knowledge they could not otherwise attain on their own (Brooks, 2005). Vygotsky (1962) referred to this as the zone of proximal development (ZPD) (Brooks, 2005). Vygotsky defined the ZPD as "*the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined by problem solving under adult guidance or in collaboration with more capable peers*" (as cited in Sanders & Welk, 2005, p. 203). The role of the teacher is to guide the learner to reach toward higher levels in the zone through scaffolding techniques that are constructed based on the needs of the learner (Sanders & Welk, 2005).

In the role of the expert, the teacher provides an intellectual framework that is above where the learner's current knowledge lies (Brooks, 2005). It is this framework that provides the conditions that allow the learner to see relationships and examine the finer details that aids the learner in restructuring their current knowledge (Brooks, 2005).

The Constructivist model has much to offer to m-learning in its wider context where a teacher can guide learners to new knowledge using this technology whether in a group situation or by distance learning. However, as Constructivism caters more for the higher orders of learning and is limited by its requirement of prior knowledge, it is not well suited for this research project.

2.5 Learning and teaching practice

While m-learning is a relatively new method of learning, there are sound models of learning practice that can be applied to m-learning, just as there are with more traditional learning methods (i.e., teacher-based, classroom style).

This section explores the Cognitive Theory of Multimedia Learning and its application to m-learning. This theory offers guidelines for the development of an m-learning project.

2.5.1 Cognitive Theory of Multimedia Learning

There are three assumptions underlying the Cognitive Theory of Multimedia Learning: dual-channels (humans possess separate information processing channels for visual and auditory material), limited capacity (humans can only process a limited amount of information at one time) and active processing (humans actively engage in cognitive processing in order to construct a coherent mental representation of their experiences) (Mayer, 2005).

Working memory incorporates auditory and visual working memories (Baddeley, 1986). When information is presented visually, we begin by processing the information in the visual channel, and similarly when information is presented auditorily, we process that information in the auditory channel first (Mayer, 2005). Even though we may process information through separate channels, learners may be able to convert information from one channel to the other, meaning a learner can devote their cognitive resources to one channel (Mayer, 2005). For example, a reader may be able to view text on-screen while also mentally converting the images to sound while they read the text or alternatively, while listening to a sound the listener can raise mental images of the sound (Mayer, 2005).

Limited capacity assumes that humans can only process a limited amount of information in each channel at one time (Mayer, 2005), this is consistent with Sweller's Cognitive Load Theory (Sweller, 1988). If too many pieces of information are presented at one time, this can cause cognitive overload (Kalyuga, 2009). Cognitive load is comprised of intrinsic and extraneous cognitive loads (Kalyuga, 2009). Intrinsic cognitive load is the internal intellectual complexity of the task or material and extraneous cognitive load is caused by external design-related factors, for example, poor interface design or task sequencing (Kalyuga, 2009).

Multimedia environments involve many sources of cognitive load with the key concept being to establish connections between elements of information presented in working memory and integrating these with the knowledge available, in line with certain instructional goals (Kalyuga, 2009). By establishing these connections, new or modified knowledge is established in our long-term memory (Kalyuga, 2009). This signifies an understanding of the situation which generates knowledge-based response actions and is generally referred to as intrinsic cognitive load, caused by internal knowledge of the task or material (Kalyuga, 2009).

People process elements of information differently. For example, for a person beginning to learn a second language, each letter could be a separate element of information, whereas someone with more knowledge of that language may process whole words or even combinations of words as elements of information (Kalyuga, 2009; Wilson & Wolf, 2009). Each element is treated as a single unit when processed by our working memory, so when many elements are presented simultaneously, this can impose a high intrinsic cognitive load (Kalyuga, 2009; Wilson & Wolf, 2009). This constraint on our processing capacity means we have to make decisions about which information to place the most importance on (Kalyuga, 2009; Wilson & Wolf, 2009). In a multimedia environment this requires focusing on only one piece of learning on each screen (Mayer, 2005). The learner may be asked a question with a picture included on the screen that relates to the question. The learner can focus on that single question, while processing the picture at the same time and be able to answer the question without a heavy cognitive load (Mayer, 2005). For example, the question could be, "Is this sentence correct: I am playing tennis last week?", with a picture of a tennis ball underneath the question on the screen (Mayer, 2005). The learner will be able to process both the question and the picture simultaneously, without exerting a high cognitive load (Mayer, 2005).

Individuals each have a set working memory capacity to process incoming information, so design elements that minimise the amount of working memory required to process new information will aid them to understand the core messages being conveyed (Wilson & Wolf, 2009). Learning is most meaningful when a learner selects relevant information from their working memory, sorts the information into a logical representation, and makes connections between them (Mayer, 1997). When elements of external design-related features, for example the interface design, are poorly presented this causes extraneous cognitive load (Kalyuga, 2009). These design features take various forms, for example animations or simulations, they can be verbal or pictorial and use visual or auditory modalities (Kalyuga, 2009). Extraneous cognitive load is often caused by presentations where related textual, graphical or audio elements of information are separated over distance and time, with their integration requiring the person to search and recall some elements, until other elements are finally presented and can also be processed (Kalyuga, 2009). This means if a graphical element is used it should be presented at the same

time as the text, so would need to appear on the same screen (Kalyuga, 2009). As Mayer (2005) argues, if a relevant picture is presented at the same time as the text, the person should be able to focus on the question while processing the picture at the same time without imposing a heavy cognitive load.

It is the intrinsic and extraneous cognitive load that result in the total cognitive load (Kalyuga, 2009). The most effective learning happens when the total cognitive load imposed doesn't exceed the capacity of a person's working memory (Kalyuga, 2009). If the intrinsic load is at a level the person is able to manage without too much effort, then an extraneous cognitive load, caused by a poor design related feature for example, may not cause any issues and learning may still occur successfully (Kalyuga, 2009). However, when the intrinsic cognitive demand is high, any extraneous cognitive load caused by poor design may be detrimental to learning as the total cognitive load may exceed the learner's working memory capacity (Kalyuga, 2009).

For adults who have low literacy, and especially those who have English as their second language, it is likely that their working memory capacity for learning new literacy skills in English may be quite low, so any extraneous cognitive load should be avoided wherever possible (Kalyuga, 2009). Thus, in this research project it is essential that what is presented to the learner is kept to only what is necessary for their learning. This means avoiding the use of design elements that may cause extraneous cognitive overload, for example using animated images or an audio narration of the question as well as presenting it in textual form. It is vital that one piece of learning appears on each screen and any auditory elements used are presented only as they are required, for example, a short auditory confirmation of getting an answer correct or incorrect, so that extraneous cognitive load is not imposed. If images are used they must be presented at the same time as the text and must relate to the text so the user can focus on the question, not the image.

According to the Cognitive Theory of Multimedia Learning humans are viewed as active processors who seek to make sense of multimedia presentations (Mayer, 2005). This means the multimedia design needs to provide a coherent structure and provide guidance for the learner on how to build the structure. Essential to active learning is the ability to select relevant material, organise, and integrate selected material with existing knowledge (Mayer, 2005). So a learner would be integrating selected material with existing knowledge to build new knowledge (Mayer, 2005). For this research project, this means presenting the learner with a range of topics to choose from, for example, tenses, grammar, and punctuation, with increasing levels of difficulty for each topic. This gives a logical structure for the learner to work with. The learner must use their existing knowledge to answer what they can, with increasing levels of difficulty enabling them to increase their skills by building on their current knowledge with new knowledge.

2.6 Summary

This review has shown that low levels of literacy are a very real issue for New Zealand's workforce, with 40% of employed people being at the two lowest levels of the IALS scale. Immigrants with ESOL are a significant contributing factor to low literacy in New Zealand, making up 38% of those with literacy skills at the lowest level. Whilst the Government has developed a number of initiatives to improve literacy levels since 2001, data from a range of sources confirm that there is still a significant issue in this area that needs to be addressed.

With many jobs now requiring increased ICT skills, this impacts on the ability of those with low literacy to improve their skills and correlates to lower paid jobs. However, with the increasing availability of ICT in the form of smartphones, this is providing new opportunities for this group of people to access ICT and improve their skills. M-learning was discussed as a possible way to overcome ICT barriers to literacy. With a scarcity of research on m-learning in New Zealand, two successful overseas m-learning projects were discussed. The positive results from these projects confirm the viability of researching the development of smartphone apps as a method of m-learning for addressing low literacy in New Zealand.

The relevant learning theories and their application to m-learning were then discussed so they may be applied later in this research to the creation of a smartphone app. Andragogy was discussed as the most relevant theory of adult learning, with Bloom's Taxonomy explored in relation to the levels of learning. It is the lower order levels of remembering, understanding and applying that apply to this research project and these are also addressed by the Objectivist learning model. The Objectivist model believes that knowledge is an entity that can be transferred from the teacher to the learner, rather than the learner creating their own knowledge, as with the Constructivist model. It is this ability to transfer knowledge that makes the Objectivist model best suited for this research. The higher order levels of analysing, evaluating and creating are beyond the scope of this project and are more suited to the Constructivist model, where the learner is an active participant in creating their own knowledge and has prior knowledge. Whilst the Constructivist model has much to offer m-learning in a wider context, it is not well suited to this research project.

Finally, learning and teaching practice was explored with the Cognitive Theory of Multimedia Learning which offers sound practical advice in the development of an m-learning project and has many ideas that are of use to this research.

3. Methodology and Research Design

This chapter discusses the methodologies employed by the research. Firstly, Heuristic Research is outlined as the core methodology this research is guided by. This is followed by a discussion on Mixed Methods: Quantitative and Qualitative Approaches, which was used to conduct and analyse the surveys and interviews, and informed the recommendations for developing the app. Practice-based Research is then discussed as a means to address the heuristic creative synthesis phase. Lastly, the research design is outlined with an explanation of how the different methodologies worked together for this study.

3.1 Methodology

This section explains the methodologies used in this research. It covers heuristic research, mixed methods: quantitative and qualitative research, and practice-based research. The following section 3.2 Research Design discusses in detail how these methodologies were synthesised into the approach used in this research.

3.1.1 Heuristic research

Heuristic inquiry is an open-ended process, which is guided by an initial question and uses a trial-and-error approach to discover what works, with what succeeds becoming the answer (Sela-Smith, 2002). It is noted by Sela-Smith (2002) as particularly useful for studies exploring new technologies, such as this study. Heuristic research utilises a number of processes and phases. The processes utilised by this research are identifying with the research, tacit knowledge, and indwelling. The heuristic phases, as described by Moustakas (1990), are: initial engagement, immersion, incubation, illumination, explication, and creative synthesis. An additional phase, validity, is also present.

The first process of heuristic inquiry is identifying with the research. Moustakas (1990) states, "*in heuristic research the investigator must have had a direct, personal encounter with the phenomenon being investigated" (*p. 14). In this study, the researcher has many years of professional experience in the field of adult literacy creating learning materials for a Private Training Establishment (PTE). This role also includes reviewing feedback from the learners on their experiences. It is this personal engagement that led to the initial research questions emerging and this research being undertaken.

Tacit knowledge is another central process in heuristic research as it is the key to discoveries. Moustakas (1990) identified tacit knowledge as "*the deep structure that contains the unique perceptions, feelings, intuitions, beliefs, and judgements housed in the internal frame of reference of a person that governs behavior and determines how we interpret experience"* (p. 32). Tacit knowledge is deeply embedded knowledge, knowledge we are not consciously aware of, or knowledge that is hard to explicate (Sela-Smith, 2002). As the researcher has many years of experience in the field of adult literacy, an approach that can leverage the researcher's tacit knowledge developed over the course of a career is advantageous. The ability to account for tacit knowledge, along with identifying with the research, is why heuristic inquiry was selected for this study.

Indwelling is another important process to heuristic inquiry. As Moustakas (1990) explains, indwelling is "*the process of turning inward to seek a deeper, more extended comprehension of the nature of meaning of a quality or theme of human experience. It involves a willingness to gaze with unwavering attention and concentration into some fact of human experience in order to understand its constituent qualities and its wholeness*" (p.24). Indwelling is a process aimed at contemplating aspects of the research in order to fully understand them, allowing for tacit knowledge to weigh in.

Moustakas (1990) identified the heuristic research phases as: (1) Initial engagement. Within the researcher is a topic or question of intense interest and passionate concern. For this research this involved forming the research questions and this has been outlined in section 3.1.1.
(2) Immersion. Once the question has been uncovered the researcher then lives the question in waking, sleeping and even dream states. Virtually anything connected with the question becomes raw material for immersion. Everything offers possibilities for understanding the phenomenon. (3) Incubation. This is where the researcher retreats from the intense, concentrated focus on the question. This period allows the inner workings of the tacit dimension and intuition to continue to clarify and extend understanding on levels outside the immediate awareness. (4) Illumination. This process occurs naturally when the researcher is open and receptive to tacit knowledge and intuition. Illumination is a breakthrough into

conscious awareness of themes inherent in the question. (5) Explication. This phase fully examines what has been awakened into consciousness, in order to understand its meaning. A comprehensive depiction of the core themes are developed which the researcher brings together and organises into a comprehensive depiction of the essences of the experience. (6) Creative Synthesis. This is the final phase where the researcher is challenged to put the components and core themes into a creative synthesis. This is usually in the form of a narrative depiction but may be expressed by some other creative form. This is the practice-based research component of this study.

Validation is an ongoing activity throughout heuristic inquiry, met through the researcher's constant checking and judging. As heuristic inquiry employs qualitative methodology to uncover themes and as such has no quantitative measurement, validity is a question of meaning. As Moustakas (1990) states, "*does the ultimate depiction of the experience derived from one's own rigorous, exhaustive self-searching and from the explications of others present comprehensively, vividly, and accurately the meanings and essences of the experience?*" (p. 32). This judgement is made by the researcher, who has undergone the heuristic inquiry through all phases. The methods selected by this study have been structured so that constant checking and judging occurs, ensuring validity of the study.

3.1.2 Mixed methods: Quantitative and qualitative approaches

The general rationale for using mixed methods is when the use of quantitative research or qualitative research alone is not sufficient to fully understand the problem (Creswell, 2015). Both methods have their strengths and weaknesses. Quantitative research provides data in the form of numbers from precise measurement and can be analysed using statistics, tables, or charts (Cavana, Delahaye & Sekaran, 2001). Qualitative research collects data in an attempt to understand the meaning, not the frequency, of naturally occurring phenomena in the social world (Van Maanen, 1983). As qualitative data are open to criticism for being subjective and biased, it is by triangulating the qualitative data against quantitative data that allows it to be verified as a true representation of the phenomenon (Cavana et al., 2001).

Mixed-methods research is the collection of quantitative and qualitative data, the data are then integrated and interpretations are drawn based on the strengths of both sets of data (Creswell, 2015). This research used a convergent design, where the quantitative data from the survey and the qualitative data from the interviews were collected and analysed, they were then merged together so the results could be compared to each other. As Fielding (2012) argues, *"Data integration is a crucial element in mixed methods analysis and conceptualisation. It has three principle purposes: illustration, convergent validation (triangulation), and the development of analytic density or 'richness'"* (p. 124).

Employing both methods allowed for the data from the survey to be triangulated against that from the interviews, so that the data may be considered more reliable and the researcher better informed about the topic.

The survey was used to collect quantitative data on smartphone ownership and use, as well as learning preferences (see Chapter 4). Interviews were conducted to collect qualitative data so the researcher now has a much deeper understanding of the topic (see Chapter 5). Participants who attended the interviews were invited to open discussion about their experiences so that the researcher could explicate the phenomenon by uncovering the themes revealed in the interviews (see section 5.3).

3.1.3 Practice-based research

Heuristic inquiry's creative synthesis phase was achieved by creating a proof of concept for a smartphone application (see section 7.2). As the creative synthesis phase of heuristic inquiry is loosely defined, practice-based research was called upon to supplement this phase. Candy (2006) describes practice-based research as an original investigation undertaken to uncover new knowledge by means of practice and its outcomes. As practice-based research has no set methods and instead draws on professional practice, the ADDIE learning design model was utilised to implement this phase of the research and is discussed in detail in section 7.1.

According to Scrivener (2000), practice-based technology research projects share a number of common features. These were reviewed and helped guide the research design. These features are detailed in bold and compared with this research study as follows.

Artefact is produced: An artefact has been produced by the development of a proof of concept in the form of a smartphone app.

Artefact is new or improved: This is a new app which has been developed as an original artefact by the researcher.

Artefact demonstrates a solution to the problem: This app addresses the research question "Can specialised smartphone applications be developed that provide a way for adults with low literacy to practise their skills?"

Artefact is the solution to a known problem: The researcher believes the app will be a useful tool for adults with low literacy to use to practise their skills.

Knowledge reified in artefact can be described: The process of developing the app as the proof of concept has been detailed in section 7.2–7.7 of this thesis with screenshots showing how the app looks on two different smartphones, Android and iOS.

The knowledge is widely applicable and widely transferable: The app has been developed using a widely accessible platform (Adobe Captivate) and the process of developing the app detailed in section 7.4 of this thesis. No special coding knowledge was used in the development of the app.

The knowledge reified in the artefact is more important than the artefact. The proof of concept app has been developed to gain new knowledge by trial-and-error to end up with a solution that works. It is not intended as a product that is ready-to-market. The knowledge gained by this research study from the process of producing the app is more important than the app itself as it contributes to the body of knowledge in adult literacy and is able to be applied by others in the field.

Key to practice-based research is the transferability of the understandings reached as a result of the research process (Candy, 2006). By developing the app as a proof of concept and documenting the process (see sections 7.2–7.7) in this thesis, this allows for the transfer of knowledge gained by this research that may be applied by others in the field of adult literacy.

3.2 Research design

The research design was constructed by blending heuristic research with practice-based research and mixed methods: quantitative and qualitative research. The phases of heuristic research were used to form the main structure of the research design, with the research moving through the phases of initial engagement, immersion, incubation, illumination, explication, creative synthesis, and validation. To aid in heuristic inquiry's requirement to collect the explications of others' experiences of the phenomenon, mixed methods: quantitative and qualitative research was used to aid in the incubation, illumination, and explication phases. Practice-based research was used to supplement the creative synthesis phase. Additionally, the ADDIE design model (see section 7.1) was implemented to aid in the creation of the proof of concept. The methodologies were synthesised together because each methodology on its own was not sufficient to guide the whole process undertaken in this research.
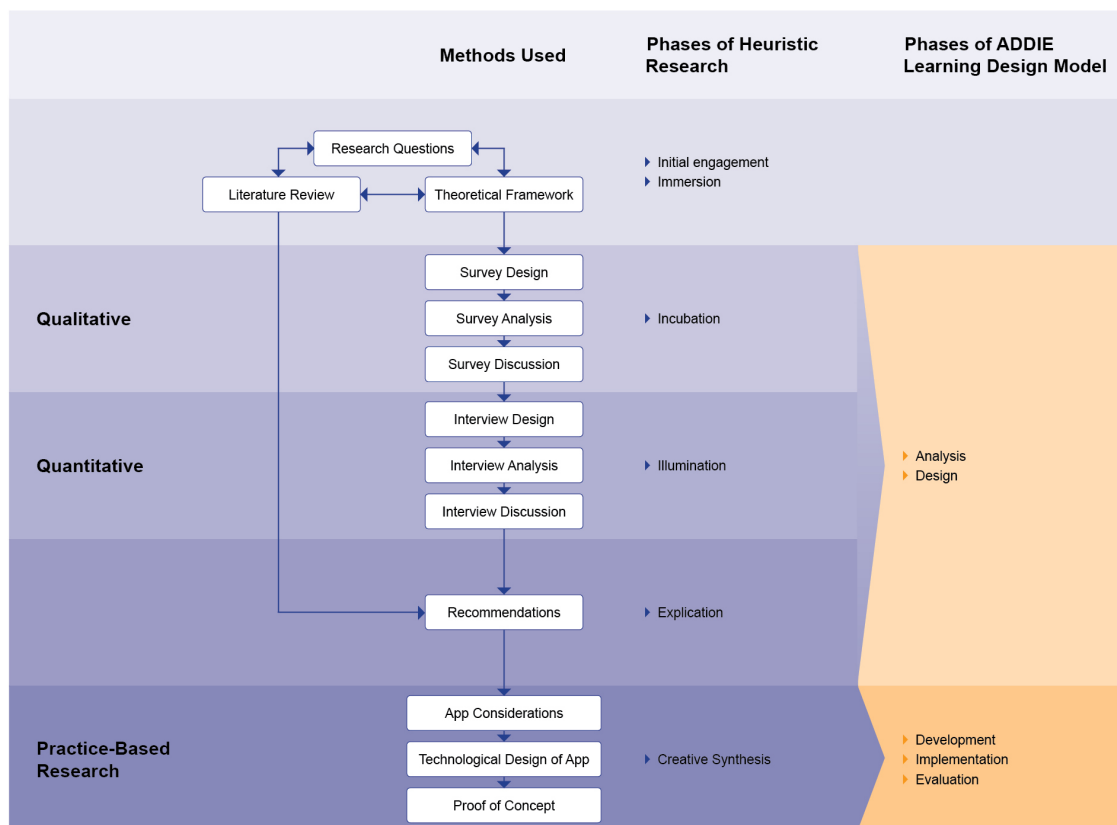
Figure 3-1. Diagram showing how the methodologies and methods selected work together and how they relate to the phases of heuristic research and the ADDIE design model

The methods used in this research are stepped so that knowledge is increased incrementally, as recommended by heuristic research (Moustakas, 1990). This incremental increase in knowledge aids the indwelling process as the researcher must return to the data many times to analyse and clarify the themes.

The first phase of heuristic research is initial engagement with the topic. The question or problem has personal meaning for the researcher, so much that they are compelled to engage in an inner search to uncover more about the topic. In this study, this phase saw the research questions defined.

Immersion in the topic is the next phase of heuristic research. It is a process that continues throughout the entire period of the research. The researcher, as a practitioner in the field of literacy training, experienced continual immersion in the research area, with new ideas coming at various and often unexpected times. Additionally, to ensure this phase was met, a literature review was conducted, immersing the researcher in the subject.

The incubation and illumination phases came next, and were closely interlinked as they together formed the mixed methods component of the study. In recognition of heuristic inquiry's requirements to not assume any knowledge, increase knowledge incrementally, and take others' experiences into account, adult learners of low literacy programmes were surveyed and then interviewed.

The incubation phase is where new thoughts and perspectives come to light. This happens naturally after a period of immersion in the topic as the researcher moves away from intense involvement to focus on other things for a time (Moustakas, 1990). This phase saw the survey conducted, collecting quantitative data on smartphone ownership and use of apps, learning styles and learning preferences amongst a group of adults with low literacy. The survey was designed based on the researcher's initial engagement with the research questions and tacit knowledge of the topic.

Illumination followed the incubation period. Illumination is where the researcher is open to their tacit knowledge and intuition, allowing new knowledge to come to light or a modification of existing knowledge (Moustakas, 1990). Once the survey was conducted and the data analysed with the results discussed, the knowledge gained was used to guide interviews designed to collect qualitative data from another group of adults with low literacy. The interviews were structured to collect data on the same topics as the survey so that the themes from both sets of data could be triangulated to give the researcher a richer depiction of the data.

The explication phase followed to fully examine the meaning of knowledge illuminated (Moustakas, 1990). It is at this stage that a more comprehensive depiction of the core themes is now developed and the researcher is able to connect all themes into a whole experience. The researcher investigates the causes and consequences, conditions and interactions, and looks for themes that cluster together (Cavana et al., 2001). The results of the data analysis, combined with the researcher's tacit and intuitive knowledge of the topic and the literature review, was used to inform recommendations for the development of a smartphone app.

During the incubation, illumination, and explication phases, the analysis and design phases of the ADDIE learning design model (see section 7.1) were implemented. The ADDIE learning design model was used to achieve the practice-based component of this research. The analysis of the performance gap is uncovered by the results of the surveys and interviews, which identifies the problems, needs, and prior knowledge of those with low literacy. The design phase verifies the desired learning outcomes and appropriate testing methods.

The final phase in heuristic research is the process of creative synthesis. This process draws on the tacit and intuitive knowledge of the researcher (Moustakas, 1990). This study has employed practice-based research to create a proof of concept as a reflection of the creative synthesis. During this phase, the ADDIE learning design model's phases of development, implementation, and evaluation were conducted. As part of the development phase the wireframes, aesthetics, user-interface, and content were decided upon by the researcher. Employing the ADDIE learning design model and incorporating the recommendations, as derived from the literature review and results of the data, resulted in a smartphone application being created in the form of a proof of concept.

Validation is a continual process of the researcher's own rigorous self-searching and from the explications of others throughout the research project. The researcher validated the research project by answering the question: "Does the ultimate depiction of the experience from one's own rigorous, exhaustive self-searching and explications of others present comprehensively, vividly, and accurately the meanings and essences of the experience?" (Moustakas, 1990, p. 32). The continual checking happened as a result of the nature of the study increasing knowledge incrementally. This continual checking was not formalised in the research design as a clear step. Rather, it relied upon the heuristic processes of indwelling resulting in the researcher often returning to earlier phases to reconsider prior understandings and resulted in existing knowledge being modified as a result. The question of meaning was answered when addressing the conclusion chapter, reflecting upon the study.

3.3 Summary

This chapter discussed the methodologies selected for this study and their synthesis into an ad-hoc research design. Heuristic inquiry was employed so as to incorporate the researcher's tacit knowledge into the study. Mixed methods: quantitative and qualitative approaches were used to triangulate results so that the data may be considered more reliable and the researcher better informed about the topic. The creative synthesis phase was achieved with practice-based research, incorporating the ADDIE model in its design. These methodologies were combined because each methodology on its own was not sufficient to guide the whole process undertaken in this research.

This chapter has avoided discussing details on specific methods, seeking only to give an overview of how all the components of this study work together in aim of answering the research questions. The methods are more fully explained in the following chapters. Chapter 4 provides the specific methods used for the survey, Chapter 5 provides the specific methods used for the interviews, and Chapter 7 provides the specific methods used for the practice-based component of this research, including the ADDIE model.

4. Survey

There were two information gathering events, an anonymous survey and an interview. This chapter details the methods used to conduct the survey, the survey analysis procedure and the results of the survey, followed by a discussion and summary of the outcomes. The following chapter will discuss the interviews.

4.1 Survey design

The main goal of the survey was to determine if adults with low literacy engage with smartphones. One of the primary objectives of the survey was to find out if this group of people own smartphones. It also aimed to determine whether they download and use apps, and when, where, and for what duration they use them. This was followed by questions around learning styles and preferences to provide recommendations for the development of the proof of concept app. The survey was structured with five distinct sections: demographic data, smartphone ownership, smartphone usage, learning styles, and learning preferences. The questionnaire can be found in Appendix II.

Demographic data section: Demographic data was collected so that this survey could be compared against demographic data in other surveys. It would also show if there is a correlation between age and ethnicity and those who have low literacy.

Smartphone ownership section: This section asked if the participant owned a smartphone and if so, what operating system their smartphone used (e.g., Android, iOS, etc.). Knowing which operating system was favoured would inform which system the app should be created for. Another outcome of the survey was to be able to compare smartphone ownership statistics for the specific demographic of adults with low literacy, compared with the whole population as illustrated in surveys run by Google in 2012, TNS in 2013 and Horizon in 2014. Participants were then asked if they had purchased or were they given their smartphone and for what reason. This was to explore if those with low literacy, who are usually in the lower socio-economic demographic, have purchased their smartphones because of a personal desire to own one or if it is an anomaly because they have been gifted the smartphone. This data indicates the likelihood of an increasing trend in smartphone ownership, and thus the viability of m-learning applications of this research.

Smartphone usage section: This section asked about participants' use of their smartphones. It does so by enquiring about general habits such as how often they access the apps on their smartphone and for what duration they use different types of apps. They were asked in what situations they use their apps, to evaluate what kind of attention they give to their apps, for example while watching TV or during a break. They were also asked how much they would be willing to spend on an app, this would determine if people are prepared to pay for an app they want or if they only use free apps. Lastly they were asked if they connect their device to a wireless connection or use their provider's 3G or 4G service. This information informs whether the app should be an offline app or if there is an opportunity for online connectivity.

Learning styles section: The survey then moved on to finding out about their learning styles with questions around what type of questions they like, for example multi choice or fill in the missing word. This would indicate the preferred type of questions to be used in the app.

Learning preferences section: The final part of the survey explored preferred learning styles, which will inform some of the functionality of the app. It posed questions about how participants prefer to learn new words, find out their meaning, and remember a new word they have learnt. This explored whether people preferred to work things out for themselves, use resources such as the dictionary or the internet, or if they preferred help from other people.

An anonymous survey of participants in a current literacy programme run by The Learning Wave, a New Zealand PTE, was conducted. Arrangements were made with the training facilitators to conduct the survey at the end of the programme, giving those who did not wish to participate the opportunity to not participate. When participants attended their next training session, the training facilitator discussed the survey with them, inviting them to participate at the following training session if they wished to do so. The training facilitator gave the participants an information sheet (see Appendix I) and a copy of the survey (see Appendix II) to take away with them and read over. At the start of the next training session, the participants were again invited to take part in the survey if they wished to do so and advised that this would be conducted at the end of the training session. At the end of the training session the training facilitator asked those who wished to participate in the survey to remain in the room and those who did not wish to participate were free to leave. The training facilitator read through the information sheet to ensure everyone was fully informed.

There were 120 potential participants, all of them chose to participate in the survey and completed the survey form. The training facilitator handed out the survey forms at the end of the programme and due to many participants having very low literacy levels, they read through the questions to ensure the participants understood them correctly and they each filled in their own form. Once the forms were completed the training facilitator collected these and placed them in a blank envelope with no identifying marks so as to maintain anonymity. These envelopes were returned to the researcher who entered all the data from the forms using Adobe Forms Central. This online framework enabled the data to be input and recorded at the same time, expediting the data entry process. The data on Adobe Forms Central was checked once entered to verify no mistakes were made. Adobe Forms Central was then used to provide reports and graphs of the data.

Anonymity was maintained throughout as the survey form did not ask for participants' names and the forms were returned in a plain white envelope with no indication of which programme or training facilitator the forms had been collected and returned from.

4.2 Survey analysis procedure

The goal of the survey was to collect quantitative data from a larger group of people than those interviewed, to give the researcher a more complete picture of the data. Employing both quantitative and qualitative methods allows for the data from the survey to be triangulated against that from the interviews, so that the data may be considered more reliable. The analysis of the survey served as the incubation phase of the study.

The survey analysis was conducted by converting the data to percentages and displaying it graphically using bar graphs. Cavana, Delahaye and Sekaran (2001) recommend using graphs to get a feel for the data by checking the central tendency and the dispersion. The use of graphs allows for visual comparisons of the data to be made and variations in the data to be clearly seen. The researcher then exported the data to an Excel spreadsheet to keep a record of the data once the form was removed from Adobe Forms Central.

The results of the survey provide the explication of others' experiences, as required by heuristic inquiry.

4.3 Survey results

This section reports the results of the 120 responses received in the survey. The responses to the questions are reported in groups based on the distinct sections of the survey: demographic data, smartphone ownership, smartphone usage, learning styles, and learning preferences. By reporting related questions together, correlations can be seen between them, allowing for more to be deduced and a richer discussion in the following section.

The results of all questions in the survey enabled the heuristic illumination phase to occur by the gaining of new knowledge and modification of existing knowledge.

Demographic data

The first three questions asked for the respondent's gender, age group and ethnicity. Results show that at 79% it was predominantly males attending the literacy programmes, with a wide range of age groups and ethnicities.
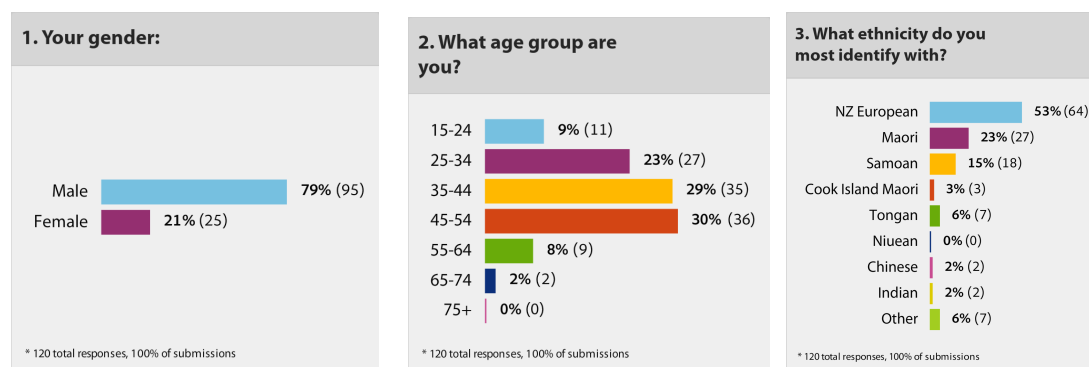
Figure 4-1 (left). Survey participants' gender.

Figure 4-2 (centre) Survey participants' age group.

Figure 4-3 (right). Survey participants' ethnicity.

Smartphone ownership

One of the objectives of the survey was to establish the level of smartphone ownership in a group of adults with low literacy. Interestingly, 6% of respondents do not own a mobile phone at all.

Question 5 (Figure 4-4) asked "*What type of mobile phone do you use today?*". The two options of: "classic" or "smart" were given as answers for this question. Out of the 112 respondents who own a mobile phone, 64% said they own smartphones and 36% classic mobiles.
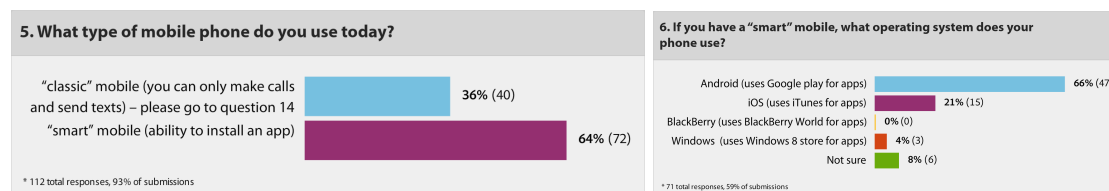
Figure 4-4 (left). Survey participants' type of mobile phone ownership.
Figure 4-5 (right). Survey participants' smartphone operating system.

Question 6 (Figure 4-5) asked "*If you have a 'smart' mobile, what operating system does your phone use?*". Participants could choose from these answers: Android, iOS, BlackBerry, Windows, Not sure. Results show that 66% use Android and 21% iOS (iPhone).

Question 7 (Figure 4-6) asked "*Why did you choose this model?*". Participants were given a range of answers to choose from: I got it for a reduced price when I signed up to a mobile phone plan, It was on special, I was able to pay it off on HP, I really wanted this phone so was prepared to pay full price for it, A friend or family member gave it to me, Someone I know upgraded their phone so gave me their old one, It was a birthday/Christmas present, It was free when I signed up to a mobile phone plan, I'm not sure, Other.

The results show 71% of people paid for their phone with 51% purchasing their phone because it was on special, at a reduced price or they were able to pay it off on HP, and 20% were prepared to pay full price. There were only 16% of people who did not pay for their phone as it was given to them as a present or was free when they signed up to a mobile plan.
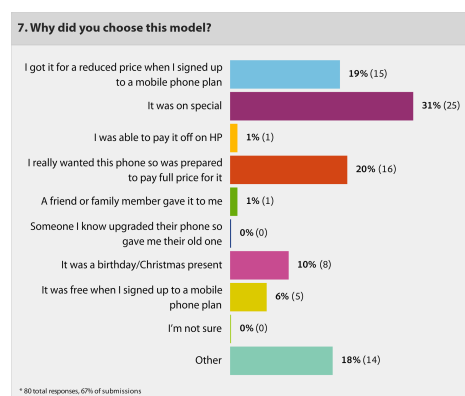
Figure 4-6. Survey participants' reason for choosing their model.

Smartphone usage

Question 8 (Figure 4-7) asked: "*When do you carry your phone?*". Participants could answer: All the time, it's usually in my bag or pocket, I take it to work, but leave it in my bag or locker, I don't take it with me to work I leave it at home, I take it with me when I go out, I usually leave it at home when I go out, I'm not sure. The results show that 83% of respondents carry their phone on them all the time.
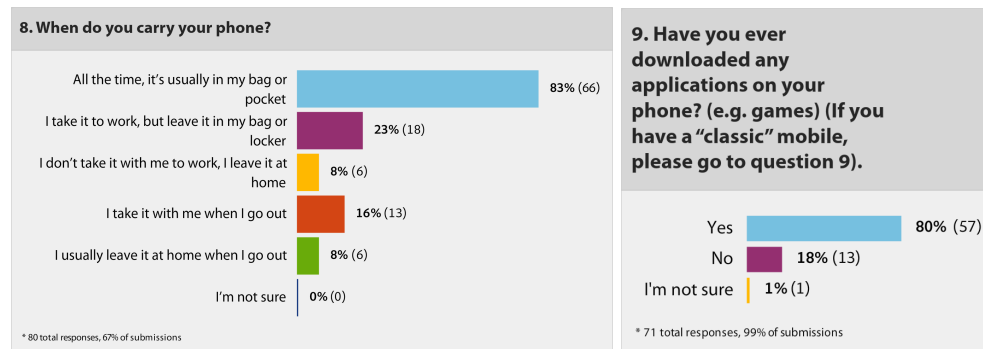
Figure 4-7 (left). When survey participants carry their phone.

Figure 4-8 (right). Number of survey participants who have downloaded apps on their smartphone.

Question 9 (Figure 4-8) asked "*Have you ever downloaded any applications on your phone?*" Participants could answer: Yes, No or I'm not sure. Results show that at 80% most people have downloaded apps on their phone.

Question 10 (Figure 4-9) asked "*Do you use any applications on your mobile phone? If so, how much time do you spend on them each day?*". There were three categories to choose from: Learning applications, Gaming applications, and Reading with the same options for each category: Don't use it, Less than 30 min, From 30 min to 1 hour, From 1 to 2 hours, and From 2 to 3 hours. Results show that for those who use their apps it is predominantly for less than 30 mins a day; with Learning applications at 41%, Gaming applications 33%, and Reading 37% of all respondents.
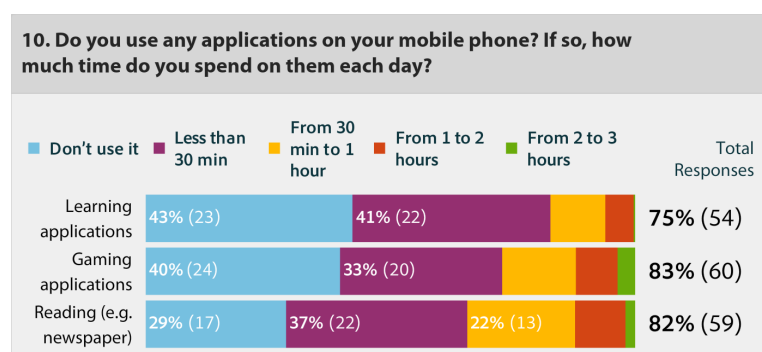
Figure 4-9. Number of survey participants who use apps and time spent using them each day.

11. When do you use your applications?

While waiting in a queue	**38%** (28)
While watching TV	**32%** (24)
During dinner	**16%** (12)
At the movies	**5%** (4)
During an event or function (e.g. school play)	**12%** (9)
At work in my breaks	**58%** (43)
In church	**4%** (3)
While shopping	**19%** (14)
At home when I'm not doing anything else	**70%** (52)
I don't use any applications on my phone	**16%** (12)

* 74 total responses, 62% of submissions
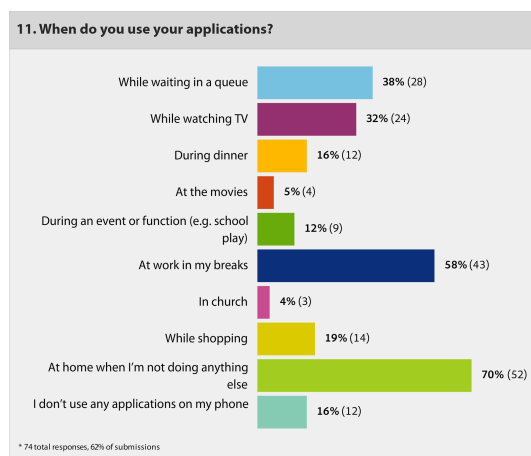
Figure 4-10. When survey participants use their applications.

Question 11 (Figure 4-10) asked "*When do you use your applications?*". A range of answers were presented and participants could choose more than one answer from the following: While waiting in a queue, While watching TV, During dinner, At the movies, During an event or function, In church, While shopping, At home when I'm not doing anything else, I don't use applications on my phone. The results show that 70% use their phone when not doing anything else, and 58% while at work in their breaks.

12. How much would you be willing to spend for an application that you want to obtain?

Nothing, I only download free applications	**53%** (37)
Less than $2.00	**10%** (7)
From $2.00 to $5.00	**14%** (10)
More than $5.00	**6%** (4)
I'm not sure	**19%** (13)

* 70 total responses, 97% of submissions

13. How do you connect your device to the internet?

I do not connect my phone to the internet.	**20%** (15)
Through the smartphones service provider using 3G or 4G	**55%** (41)
Through wifi at home	**63%** (47)
Through wifi at work	**4%** (3)
Through wifi in public places (like cafes)	**25%** (19)

* 75 total responses, 63% of submissions

Figure 4-11 (left). How much survey participants are willing to spend on an app.
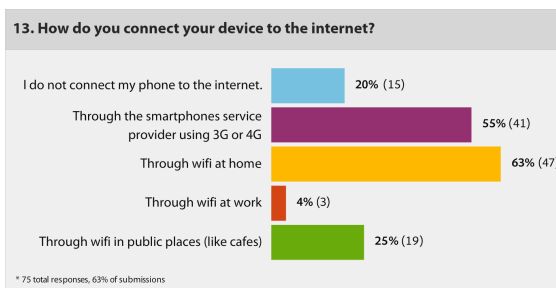
Figure 4-12 (right). How survey participants connect their smartphone to the internet.

Question 12 (Figure 4-11) asked *"How much would you be willing to spend for an application that you want to obtain?"* Results show 53% of people do not wish to pay anything for an app, 24% were willing to spend up to $5 and only 6% prepared to pay more than $5.

Question 13 (Figure 4-12) asked "*How do you connect your device to the internet?*". Participants could answer: I do not connect my phone to the internet, Through the smartphone's service provider using 3G or 4G, Through wifi at home, Through wifi at work, and Through wifi in public places. Participants could choose more than one answer. The researcher manually checked responses to ensure none who stated they do not connect to the internet responded to this question, helping maintain validity. The results show that at 63% most respondents use their wifi at home, with 55% using their service provider's 3G or 4G connection. Twenty percent stated they do not connect to the internet at all.

Learning styles

Question 14 (Figure 4-13) asked: "*How do you feel about multi-choice questions?".* Participants could choose one answer from the following: I like being given a choice of answers, I would prefer to come up with my own answer, I'm not sure. Results show that 74% prefer being given a choice of answers.

Question 15 (Figure 4-14) asked: "*How do you feel about questions where you fill in the missing word? e.g. What's the missing _____ in this sentence?".* Participants could choose one answer from the following: I like those type of questions, I don't like those type of questions, I'm not sure. 57% of participants indicated they like this type of question.

Question 16 (Figure 4-15) asked: "*If you were given a paragraph and asked to rewrite it in your own words, how confident would you feel about doing this?".* Participants could choose one answer from the following: Very confident – I'm usually able to use my own words without too much difficulty, OK – Sometimes I find it difficult to use my own words, but I can do it, Not confident – I find it difficult to write in my own words, I'm not sure. Almost half (49%) stated they have some difficulty with rewriting something in their own words and 12% were not confident.
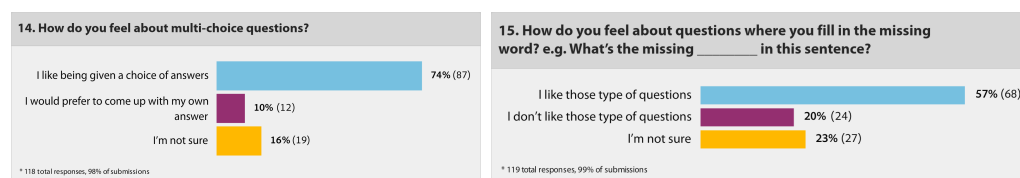
Figure 4-13 (left). How survey participants feel about multi-choice questions.

Figure 4-14 (right). How survey participants feel about questions where they fill in the missing word.
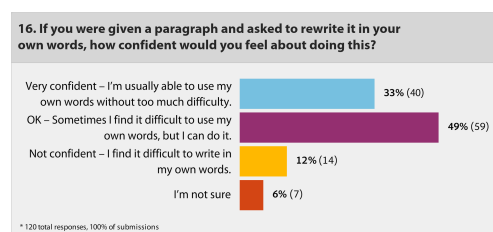
Figure 4-15. How survey participants feel about rewriting a paragraph in their own words.

Learning preferences

Question 17 (Figure 4-16) asked: "*When you're learning how to do something new, what's the best way for you to learn?*". Participants could choose one answer from the following: Reading the instructions, Watching someone else do it, Both reading the instructions and watching someone else do it, Just try it out for myself and see if I can work out how to do it, and I'm not sure. The results show that 50% prefer to read instructions and also watch someone do something when learning a new task.

Question 18 (Figure 4-17) asked: "*When you come across a word you don't know, how do you prefer to find out what it means?*" Participants could choose more than one answer from the following: Look it up in the dictionary, Ask someone else, Search for it on the internet, e.g. using a search engine like Google, Read the whole sentence and see if I can work out what it means, I'm not sure. There was also an "other" option provided for participants to write their own answer.

Results show that most people use some means other than trying to work it out for themselves: 54% will use a dictionary, 48% will ask someone else, 44% will search for it on the internet with 40% willing to work it out for themselves. In the "other" option, one respondent wrote "Wikipedia", and another said "My wife is a 'wordsmith', I ask her". These answers fit in with the options provided of "Search for it on the internet" and "Ask someone else" so were included in these datasets.

Figure 4-16 (left). How survey participants prefer to learn how to do something new.

Figure 4-17 (right). How survey participants prefer to find out what a word means.

Question 19 (Figure 4-18) asked: *"When you are learning to spell a new word, do you prefer to:"*. Participants could choose more than one answer from: Look it up in the dictionary, Ask someone else, Try and spell the word and then look it up or ask someone else, Search for it on the internet, e.g. using a search engine like Google, I'm not sure. There was also an "other" option provided for participants to write their own answer.

Results show that people use a range of methods with 41% using the dictionary, 36% asking someone else, 54% trying to spell it themselves then look it up or ask someone else and 41% will search for it on the internet. In the "other" option, responses included: sound it out, spell check, use Microsoft Word, auto correct on programs, I don't try to spell new words, ask my wife, on my phone.

Question 20 (Figure 4-19) asked: "*How do you prefer to remember a new word you have learnt?".* Participants could choose more than one answer from: Just looking at it is enough, I like to look at it and then write it down, I like to listen to the word being said and then say the word myself, I'm not sure. There was also an "other" option provided for participants to write their own answer.

The results show that most people need to do more than just look at the word, with only 29% of respondents stating it was enough to do this. More than half (51%) of respondents remember a new word by looking at it and then writing it down and 42% like to listen to the word and then say it themselves.
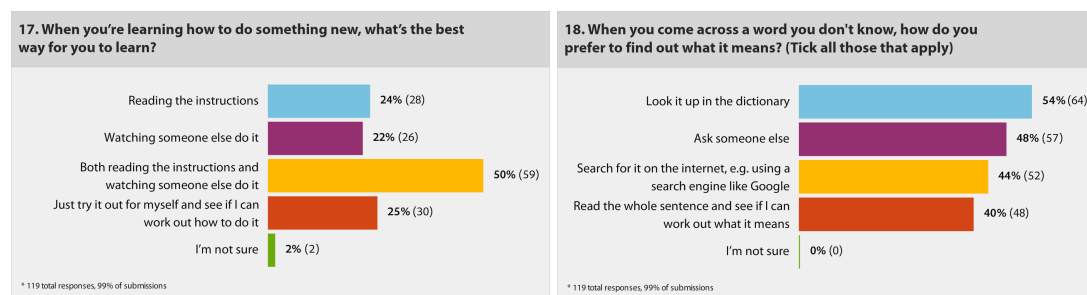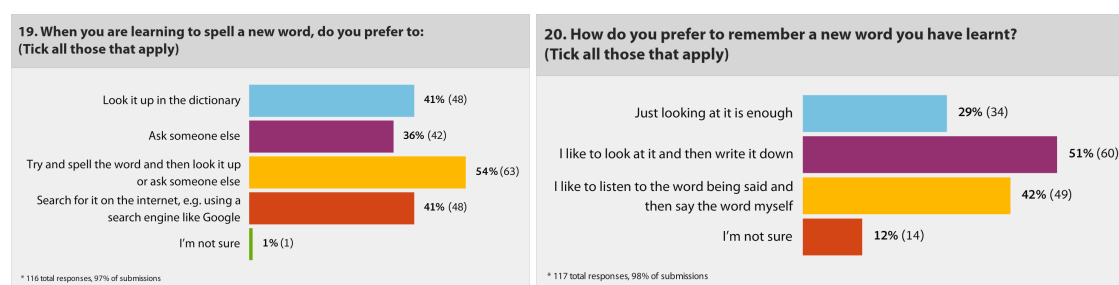

Figure 4-18 (left). How survey participants prefer to learn how to spell a new word.

Figure 4-19 (right). How survey participants prefer to remember a new word.

4.4 Survey discussion

This, in part, is the explication phase in heuristic research. Eight of the questions showed results that related directly to the development of smartphone apps and as such were of use in the list of recommendations for the app that was later used to create the proof of concept.

The demographic results show it is predominantly males attending literacy programmes. With a wide range of age groups and ethnicities, no assumptions could be made from the data on the average age or ethnicity of an adult with low literacy.

The survey results show alignment with the increasing trend of smartphone ownership. Out of the 112 respondents who own a mobile phone, results show that 64% own smartphones and 36% classic mobiles. Google's survey showed 44% of the population owned smartphones in 2012 (Google, 2012), TNS showed an increase to 60% in 2013 (Wade, 2013), and Horizon report ownership levels will increase to 79% by the end of 2015 (Horizon, n.d.), so the results of this survey confirm there is a continuing trend upwards of smartphone ownership. This shows the majority surveyed own a smartphone and thus confirms the validity of undertaking this research.

With 66% of smartphone owners in this survey using Android, this showed the predominant operating system to focus on in the development of the app, but with 21% of respondents using iOS, this is still a significant percentage of these smartphone owners and would also need to be addressed.

The results show that at 50% most people bought their phone because it was on special or at a reduced price, with only 20% prepared to pay full price. This would likely explain why Android phones are the most popular as they are generally less expensive than iPhones (iOS). This further validates the requirement to focus on the Android operating system in the development of the app.

At 80% most people have downloaded apps onto their phones, however 53% are not willing to pay anything for their apps, 24% are prepared to pay up to $5 and only 6% would pay more than $5. This result shows that most people from the sample who own smartphones do download apps onto them but with most people are not willing to pay much, if anything, for their apps. If this is indicative of the low level literacy learners in New Zealand, any app that is developed for low literacy should be provided to the user at no cost.

With 83% of respondents carrying their phone on them all the time, this gives plenty of opportunities for them to access apps on their phones. When asked if they used apps at all, 16% of respondents stated they don't use apps, this means that 84% of people do use apps on their phone so helps provide a basis for this research.

At 70% this is a large proportion of people who use their phone when not doing anything else, and 58% while at work in their breaks, so they are probably not distracted by other things (e.g., watching TV). This shows that many people may be willing to pay more attention to the app than if they were waiting in a queue for example, so an app that requires a longer duration of use could be developed.

The results show that at 63% most respondents use their phone at home and connect to the internet through wifi, with 55% using their service provider's 3G or 4G connection. However, there are still 20% who stated they do not connect to the internet at all. This is still a significant percentage and indicates that it would be advisable to develop an app that does not require an internet connection so as not to limit the potential use of the app by anyone.

When asked what type of questions people preferred, 57% of respondents indicated they liked questions where they fill in the missing word. Multi choice was the most preferred option with 75% of respondents indicating this preference and with 51% preferring to remember a word by looking at it this indicates multi choice would be beneficial to use in the app.

Rewriting something in their own words posed some difficulty for 49% of respondents with 12% stating they are not confident. This suggests that many people could benefit from an app that addresses this literacy skill, however it was deemed not suitable for this research due to the time required to develop this type of functionality. This result provides the case for further research to determine if developing an app that allows the user to practise this skill over a period of time also aids in improving in their overall literacy skills.

The results show that 50% prefer to read instructions and also watch someone do something when learning a new task. This result shows that it may be useful to include a video or animation in an app to introduce a new skill.

People use a variety of methods to find out the meaning of new words with 54% using a dictionary, 48% asking someone else, 44% use the internet, and 40% like to work it out for themselves. This result shows that it may be beneficial to include a way to show the meaning of words to users in an app.

Similar results were presented for the methods that people used to learn how to spell a new word with 41% using the dictionary, 36% asking someone else, 54% trying to spell it themselves then look it up or ask someone else, and 41% will search for it on the internet. In the "other" option, responses included: sound it out, spell check, use Microsoft Word, auto correct on programs, I don't try to spell new words, ask my wife, on my phone. These responses indicate that people are comfortable using technology as well as other means to assist them. With 41% using the internet and other responses including the use of technology, this indicates that it could be beneficial to provide options to learn how to spell words correctly in the form of an app.

When asked how people prefer to remember a new word they have learnt the results show that most people need to do more than just look at the word, with only 29% of respondents stating it was enough to do this. In contrast, 51% of respondents remember a new word by looking at it and then writing it down and 42% like to listen to the word and then say it themselves. This shows that it requires more than one approach to enable people to learn new words.

4.5 Summary

This research study employed a paper-based survey form to collect quantitative data on smartphone ownership, use of apps, and learning styles and preferences. Questions were asked to identify levels of smartphone ownership in a group of adults with low literacy to compare this with global trends and confirm the researcher's own belief that these would be at comparative levels, which was confirmed by the results. This was also to dismiss what may be a popular belief that those with low literacy do not own smartphones due to their predominantly lower socio-economic status.

Other questions were asked around what type of smartphone people own, how they use their smartphones and apps on them, along with their learning styles and preferences, in order to provide reliable data to inform the development of the app as the proof of concept in this study.

The survey was analysed by converting the data to percentages and producing these results graphically in the form of bar graphs. The results were also coded into themes using Excel. These themes were imported into NVivo and merged with the qualitative data from the interviews, so the themes could be compared against each other for triangulation. Two themes appeared in both sets of data giving a richer depiction of the phenomenon and allowing the researcher to be better informed about the topic. The key themes from both sets of data were used to identify recommendations for the development of the app.

The results of the survey show that a large proportion of adults with low literacy own smartphones and this is at a similar level to global trends. Most people chose to buy their phone with only a small percentage being given their phone for free as a present or as part of a mobile phone plan. While many people have chosen to buy their phone, most are not willing to pay much, if anything, for their apps so it would be advisable to develop an app that can be provided at no cost to the user.

While a large percentage of people connect to the internet on their phone, there is still a significant proportion that don't, so the app should be developed to be used offline so as not to restrict its potential use by anyone.

Most people have downloaded apps and many of those who use their apps use them for up to 30 minutes a day. While many people are using their phone while not distracted, they may not be using their apps for a long duration, so it would be advisable to develop an app where the user has the ability to use the app for a shorter duration if preferred, with the ability to continue for a longer period if desired. This can be achieved by offering multiple levels where the user can complete a single level for a short duration, or continue with more levels if they wish to continue using the app for longer.

People use a variety of methods to find out the meaning of, and how to spell, new words. Many indicated they use the internet, spell check or Microsoft Word so would appear comfortable using technology.

These results show that people with low literacy do own smartphones and ownership levels are consistent with global trends, they download and use apps, and appear comfortable with technology to aid their learning. This confirms the viability of this research and the development of an app to aid the practise of literacy skills.

5. Interviews

This chapter details the methods used to design and conduct the interviews. It outlines the interview analysis procedure and presents the themes of the interviews with a triangulation of the survey themes which are then discussed. This is followed by a summary of the findings.

5.1 Interview design

In order to triangulate the quantitative data from the survey, it was necessary to collect qualitative data from the interviews. This was achieved by asking questions with similar themes to those posed in the survey. To maintain the integrity of both sets of data, the interview participants were a separate group of people from those who completed the surveys. The interview questions were grouped into three categories: the literacy activities in the Pacific Pathway literacy programme, Question preferences, and Learning preferences. The interview questions can be found in Appendix VI. These categories were able to be triangulated against four of the five distinct sections of the survey: smartphone ownership, smartphone usage, learning styles and learning preferences, as well as any other themes that emerged from both sets of data.

While there is no ideal number of interviews to undertake in qualitative research (Baker, 2010), research conducted on a homogeneous group (Guest, Bunce & Johnson, 2006) suggests that 80% data saturation occurs after six interviews. A further 10% of new themes may be revealed with another six interviews, with potentially up to 30 interviews required to obtain 100% of all possible themes. The researcher was conducting purposive, structured interviews with a relatively homogenous group (i.e., adults with low literacy who have attended the same training programme). The data collected from the interviews had no quantitative measurements taken. Thus, with consideration also given to the total available sample size, time and budget constraints, it was concluded that six interviews would allow the most efficient means of capturing the majority of possible themes.

The researcher conducted six interviews with participants who had completed the Pacific Pathways literacy programme and also owned a smartphone. This programme was run by The Learning Wave, a New Zealand PTE, for Pacific Homecare staff during 2012–2013. Designing, conducting and analysing the interviews contributed to heuristic inquiry's immersion, incubation and illumination phases.

The interviews were initiated by distributing a letter of invitation (see Appendix III) to those who had completed the Pacific Pathways programme. Participants of the Pacific Pathways programme are all of Pacifica descent and English is their second language.

Those who were interested in being interviewed were requested to contact the researcher via email or phone. The researcher kept a record of those who were interested in participating and selected the six interviewees by random sampling. The random sampling method used was StatPlus, a third party plugin for Excel. Each name was given a number and a random sample of six numbers was given by the StatPlus plugin, the name beside these numbers then determined the participants.

For the interview location, participants were given the options of an AUT meeting room, a meeting room at their employer, Pacific Homecare's premises, or an external venue. All participants chose to be interviewed in a meeting room at Pacific Homecare.

The interviewees selected were then contacted by the researcher to confirm their participation and a date and time arranged to conduct the interview at Pacific Homecare. The researcher liaised with Pacific Homecare to ensure a meeting room was available for all dates and times confirmed with the participants.

The interviewees were given an information sheet (see Appendix IV) and consent form (see Appendix V) prior to commencement of the interview. The researcher read through the information sheet and consent form with the interviewee and explained each part of the form to ensure the participant fully understood them. Once the interviewee confirmed they understood the information given and they still wished to participate, they then signed the consent form to confirm their participation.

If any interviewee decided to opt out the researcher would have contacted another potential interviewee via random sampling from the list of those who confirmed their interest in participating. No participant chose to withdraw from the interviews. A Koha of either a $30 petrol or grocery voucher was given to interview participants as a means of compensation for cost of travel and their time.

5.2 Interview analysis procedure

Heuristic research requires the researcher to continually return to the data for validation, this was met by using the constant comparative method of content analysis (Glaser, 1965) to analyse the qualitative interview data.

The audio of each interview was recorded using a digital recording device and the data transcribed verbatim by the researcher. The transcripts were typed into Microsoft Word and then imported into NVivo, which was used for the qualitative analysis. As the researcher conducted the interviews and also transcribed the audio, there was engagement with the data prior to the content analysis process. By continually engaging with the data prior to, and during, the content analysis process, the researcher was immersed in the data. As the researcher continued to return to the data through all stages of the analysis process, the validity of the data was maintained, as required by heuristic research.

The researcher identified the themes in the qualitative data in the process of transcribing the audio recordings and then by reading the transcripts. These themes were clustered together into categories that related to each other, it is these categories that were then classified as the core themes.

Once the core themes of the qualitative data had been identified, the researcher re-read the transcripts to identify any further themes that emerged and what categories clustered together for axial coding (Neuman, 1997). It is this inductive process that draws upon the researcher's tacit knowledge of the topic that allows them to draw conclusions from the data and allows for new discoveries to be made. This is the illumination phase of heuristic research.

This research used a convergent mixed methods design, where the quantitative survey data and the qualitative interview data were collected and analysed, and then merged together, so the results could be compared to each other. This was done by importing the quantitative survey data, with its themes identified, into NVivo and merging it with the qualitative data that had already been analysed, with its themes identified. The researcher triangulated the data by comparing the themes from both datasets and identified two themes that appeared in both sets of data. This is in line with the content analysis process, which requires the researcher to connect all themes into a whole experience. The connections between categories are then identified to provide a fuller picture of the phenomenon being studied (Cavana et al., 2001). At the end of the content analysis, the researcher has mapped the relationships between the categories identified from the coding stages, identifying seven core themes from the whole dataset with two themes that appear in both sets of data, thus validating both sets of data.
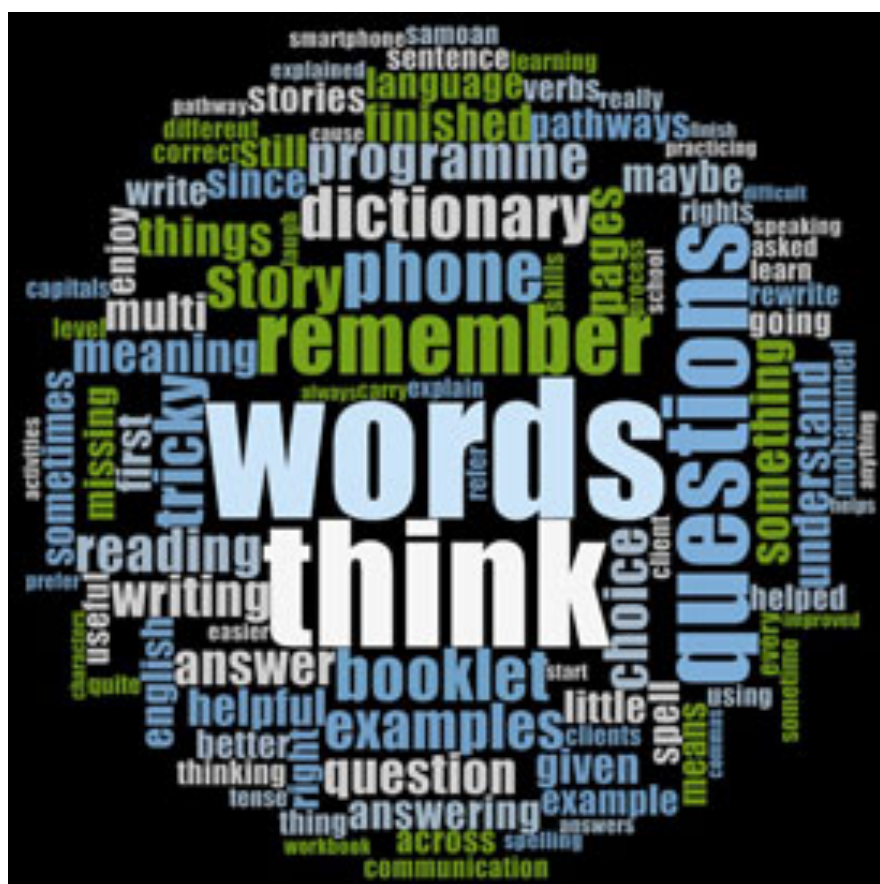
Figure 5-1. Word Cloud of top 100 words from interview transcripts.

5.3 Analysis of interviews

Six transcripts were recorded verbatim with seven core themes identified. Each participant is referred to by pseudonyms P1, P2, P3, P4, P5, and P6 to maintain confidentiality. The trainer is referred to as (Trainer) and the researcher is referred to as LW. Seven core themes were identified, namely: 1) Practises literacy skills, 2) Practice improves self confidence, 3) ESOL a contributing factor to low literacy, 4) Willingness to improve low technological skill level, 5) Images aid information recall, 6) Examples and references are useful, and 7) Financial concerns. The two themes of: Images aid information recall and Financial concerns, were also noted in the survey analysis.

5.3.1   Theme 1: Practises literacy skills

Participants were asked if they continued to practise the literacy skills they learned in the Pacific Pathways programme after the programme had finished. Most participants indicated that they did continue to practise their skills and this seemed to be because they wanted to, as there was no compulsion for them to do so otherwise. As P1 explains, "*The more I practice the more I become good at it I suppose...*" P6 said, "*Yeah, yeah, I still keep practicing...*" Confirmation of the desire to keep practising was most strongly voiced by P3: "*It feels like we don't want the Pathway to end, we want to learn more, I want to learn more...*"

Some participants said they went back to read pages from the Pacific Pathways workbook once the programme had finished. When asked why, P1 said, "*I wanted to make it soak in my mind, my rights and the client's rights. So I'm gonna practice...*"

Interviewee P1 was very proud of going to school until age 15 and felt that it was having English as a second language that held them back more than their lack of literacy skills as such. P1 said, "*Sometimes the question is hard to understand… It's just because English is my second language.*"

Participants in the Pacific Pathways programme were given a "Tricky Words" booklet to use during and after the programme. The booklet contained difficult words that participants could expect to encounter in their everyday lives at home and at work with space for them to write in the definition. There was also space for the participants to add their own words in the booklet. During the programme the training facilitator (Trainer) would ask the participants to write down any words they encountered during the day that they found difficult. At the end of the day (Trainer) would explain the meaning of those words as well as some of the words provided in the booklet and everyone in the group would add those words and definitions to their own booklet. Participants could keep the booklet and continue to add words to it once the programme had finished.

The Tricky Words booklet is a useful tool for reminding participants of difficult words when they are in everyday situations outside of work, as P1 said, "*Yeah, it's very handy… …it comes handy when someone is talking above my head and I don't look it up in front of them, I go back home and practice it…*" P6 said, "*… sometimes I go home and, hey there's that word that (Trainer) was saying to us in the class… …that's the word that he explained to us… …so when I go into the house of my clients, I use it with them as well.*"

All interviewed participants have kept their copy of the Tricky Words booklet and when asked if they carried the booklet around with them, P1, P3, P4 and P6 said they did. As P3 said, "*I always keep this one because I carry it everywhere I go, because if I don't know the meanings then I look at the book to find the words…*" P2 and P5 said that although they don't carry the book around with them they still continued to use it at home. P2 said, "*No, at home whenever I got time I always go to it…*"

Participants were asked how they prefer to remember a new word they have learnt. P4 said, "*I just write it… … look for the dictionary and then I find the words and then I have to say it to remember that one. When I go through in the paper or just some of the paper I will know, oh that word I was looking at that one, like our Care Plan or some of our forms we fill in first before our visit. The first client we do, we got the same health and safety form, some of the words we use in there I have to know what is the meaning, saying and I write in my own language the meaning, so I can remember.*"

These statements present a common theme that those who have been on a literacy programme wish to continue practising their skills once the programme is completed and will use a range of tools, including the Tricky Words booklet, to do so.

5.3.2   Theme 2: Practice improves self confidence

Being able to practise and improve their skills in the Pacific Pathways programme increased the self confidence and happiness of participants. As interviewee P3 said, "*So the first time I go there I was nervous, but when I take the Pathways I am confident.*" P3 went on to say, "*It feels like we don't want the Pathway to end, we want to learn more, I want to learn more, because I know I was improving myself, my English and even the writing.*" LW: "*You must be happier too?*" P3: "*Yes.*"

The participants of the Pacific Pathways programme are home-care workers whose clients are disabled and/or elderly and vulnerable, so it is vital they treat them with care and respect. Improving their literacy skills has not only increased their self confidence, but it has also made them more aware of how they treat others. As P3 says, "*Because (Trainer) says, you know, you do it every day to your clients, so it's helped me a lot to know how to treat my clients, how to when I come in the morning, say hello, how are you and things like that. So, it's, you know, it's a little bit hard, but when he (Trainer) explain it to us, like 'this, oh, really! We do that every day but we never realise that' and then 'oh ok, I see', But it's good for us to know, to respect our clients.*"

Participation in the programme encouraged the use of other tools, such as the dictionary, to assist with improving their skills. P3 said, "*… I didn't like much about the dictionary, so when (Trainer) encouraged us to, you know, I take the dictionary everywhere I go. I look at the dictionary to find the meaning of the words, it's the only easy way for me.*"

The training facilitator was a key factor in the success of the programme, as P3 said, "*That's why my English was very poor, I can't even speak out aye! Like when (Trainer) asks, I never speak out, I just quiet. So when (Trainer) asked us to read the paragraph, ok, read it aloud, don't worry it's not your first language, just try it. If you don't try it then you never know. So it's good.*" P3 also said, "*And some words I don't understand so (Trainer) help us, to make me understand.*"

With the opportunity to practise their literacy skills in a non-threatening environment provided by the programme and with the training facilitator encouraging them to try even if they felt extremely unsure, participants became more self confident and improved their skills as a result. This may be a contributing factor to the reason why many participants continued to practise their skills once the programme had finished. Interviewee P4 puts this into words, "*…but sometime, when I'm sitting in the workshop, they know, the words is they going fast with those words, but it's helpful when they say, if you don't understand something and you tell me to repeat it for you and sometime I ask them what is that one and that one and they explain it. And sometime, when the first time I do the workshop, I know some of them, they better than me at talking, I feel time (ashamed?) to ask question and the time I just have to say it in myself, it's not in my language, it will be embarrassing if it's my own language I'm not good with but if I feel ashamed, I will be silent and not say anything, but if I'm talking the things I get wrong with, some of my workmates will correct me and then my training, our co-ordinator, our tutors will help me to, if I'm leaving like that, not saying anything, no one will help me, they think I understand everything, so I just ask.*"

5.3.3   Theme 3: ESOL a contributing factor to low literacy

Participants of the Pacific Pathways programme are all of Pacifica descent and as English is their second language this causes issues for them. This would appear to be a significant contributing factor to their low levels of literacy. As P1 says, "*Sometimes the question is hard to understand.*" LW: "*Ok, why was that?*" P1: "*It's just because English is my second language.*" P2 said, "*I think English is my second language, I maybe, you know, not able to speak like that.*" P6 said, "*You know, because my English is, ah, English is my second language so I had to think, oh, what am I going to write here! Sometimes I had to rough copy it, then I just put it in there [box on page to write in], but sometimes (Trainer) correct me.*"

With English an issue for these participants, they often use their own language to help them work things out first in their mind, then convert what they've worked out back to English. As P4 said, "*But, I just explain the sheet and respect, like the first one with the time I was, I just doing it in my language. Like in my mind, in my language and then I explained in English so it will help us with, and say, oh yep, that one is right and that one is a little bit, needs some more.*"

P4 also said, "*Yes, I'm a little bit confused aye, because the 'an'. The words that start with the vowel, have to be with 'an' and then, when we see what is, like Auckland, we say oh, why is we put 'a' or 'the' to Auckland to, because it's a vowel to start with, that's a little bit confusing. And then when he explained it to us, 'the' for that one, 'a' for that one and 'an' for that one, and then we know what is the difference. Because at first not explain it when we fill in form or just do it in our own (language?) maybe we put the 'an' with all the words that start with vowels.*"

Participants were asked whether they enjoyed reading stories about four characters that were part of the programme's resources and if they felt that answering questions about the story helped them to learn. The four characters were Mele Tupou (Tongan), Mohammed Patel (Indian), Ana Fale (Samoan) and Margaret Fitzgerald (NZ European). While it was clear that English was an issue with their ability to understand the story, names from other ethnicities also posed problems for some. Interviewee P6 was Tongan so easily understood the story about the Tongan character Mele, but had some problems with the story about the Indian character Mohammed. As P6 said, "*Yeah, that story was hard. Mele's one was understandable, this one was confusing to me, maybe because of the names.*" LW: "*Ah, yeah because he's Indian isn't he?*" P6: "*Mm, mm, yeah.*"

Practising their English skills on the programme has helped the participants communicate with others better and increased their self confidence. P3 said, "*Because it's helpful, because before my client say 'I have no idea what you said', but now he says, 'how can you learn your English?' When I go to this programme, Pacific Homecare advised me to go to the Pathways, so that's where I learn. 'Oh good on you, go for it! Now I can really, really know what you say, I couldn't catch what you say before.' *"

5.3.4   Theme 4: Willingness to improve low technological skill level

All interview participants had low technological skill levels, especially when using their smartphones, however they were positive about trying to improve their skills and were open to the possibility of using apps on their smartphone to do so. Interviewee P6 would rather use a dictionary than the smartphone and clearly wasn't confident using apps, as P6 explained, "*Yeah, I use the dictionary a lot cause I don't know how to go on that! [points to phone].*" The researcher went on to ask P6 if they liked their smartphone (iPhone 4); LW: "*So it's not too small?*" P6: "*Nope, yeah it's good, better than my old LG phone.*" So even though they may not be confident using apps, they seem comfortable with the phone itself.

When the researcher asked participants if they would use the Tricky Words booklet if it was given to them in the form of a smartphone app, they all said that they would and were very positive about the possibility. P1 thought it would also help improve their skills using other apps as well, saying, "*Yeah, I reckon it's very helpful for me, because I'm not familiar with all these apps. It would make me a lot faster using it than trying to learn it.*" The researcher asked P5, "*So, if the tricky words booklet was on your phone and you could add words to it on your phone, do you think you might use that?*" (P5): "*Ah, yep – yes!*"

Some participants would use the app instead of the booklet as they already carry their phone around with them, but not the booklet. P6 said: "*Yeah, I would use it because I carry my phone around aye, I don't carry that one around [booklet].*" P6 also went on to say: "*It's a good idea to put the tricky words in this [phone] then you've got to find the meaning to it, because most of the words in the Tricky Words book we didn't get the meaning of [they weren't supplied in the book].*"

Some participants were comfortable using technology already and would also be interested in using the booklet in the form of an app on their smartphone. As P2 said, "*Yeah it would be useful, like I said, when*

I've got any difficult words I go on the computer and Google it so if I've got spare time, like sometimes we haven't got any client like one hour to spare, so I can sit down in my car and then tap tap tap words and then find out what is the meaning and I can google and get it."

P3 uses games on the smartphone and was very keen to get the app on their phone immediately, which was very positive. LW: "*Do you use any apps on your phone at all, like games?*" P3: "*Yes.*" LW: "*So do you think if you could get this as an app on your phone, do you think you would use it?*" P3: "*Yes, that helps. Ah I can get it?*" LW: "*Not yet, I'm just asking if I made it into an app.*" P3: "*Oh yes, I would be pleased to have it.*"

5.3.5   Theme 5: Images aid information recall

This is the first one of two core themes that appeared in both sets of data and is thus a key theme in this study.

Participants all recalled the picture of Mele (Figure 5-2) when a page showing this picture from the workbook was presented to them. P5 said, "*Ah, I remember the picture, for Mele Tupou*" and "*Yeah, yeah, see for the different colour, yeah I remember, that's for remind me for my level 1 for the Pathways for all these and the note into the book.*"

When asked if they recognised some of the things in the stories, P6 said, "*Like Mele. Cause I remember, (Trainer) was saying about, the arms, I think it's a phantom? Phantom? [pointing to amputated arm in picture].*"

P1 uses the technique of visualising a picture in the mind to help recall information, saying. "*Yeah, it's to get a scenario of the things that we are looking at, you get a picture in your mind, 'oh that's where they're going to, that's where they're running', otherwise you're left in the dark.*"

Figure 5-2 . Picture of the character "Mele" from the Pacific Pathways workbook.

There were two open responses in survey (where the participant filled in "other") that were triangulated into the same theme:

Question: "How do you prefer to remember a new word you have learnt?"

Answer 1: *"Visualise in my head"*

Answer 2: *"Associate the word with an object"*

5.3.6   Theme 6: Examples and references are useful

When teaching a new skill, the use of examples and references are often helpful. Participants all felt that the examples and references used in the Pacific Pathways workbook was useful and helped them to learn.

When asked if they thought having an example was quite useful before they had to answer the question, P1 said "*Yes, very much.*" The researcher went on to ask, "*So you prefer to have the example?*" P1: "*Yes, it's very helpful.*" As P3 said, "*but when they put down the numbers it's easier for me to answer the question [Question 1 had a range of numbers to choose from].*" P3 said, "*I look at this one first*

[examples on the previous page]… because I want to read the thing first and then I go through the thing [answers]… …easier for me to answer the question and fill in the space, because I look at the example." P3 also said, "*I know because I was looking at the example and then bring my mind ideas how to answer the questions."*

Participants also referred to pages in the workbook after they had finished the programme, so it was clear to the researcher that they still valued what they had learnt and continued to use it as a reference. LW: "*…how would you make sure that you can remember that word?"* P1: "*Go back to my workbook."*

P2 also used pages from the workbook. LW: "*So some of these Hot Tips pages and the writing process, so do you still use any of these or refer back to them?"* P2: "*Yeah, I still use it."*

Talking to P5, LW said, "*…Did you find having the samples was helpful?"* P5: "*Yeah."* LW: "*So do you think if you didn't have the example that it would be much harder…"* P5: "*Yeah, example."*

P6 also agreed that giving examples was helpful, saying, "*Yes, yeah, it helps a lot, the examples is, it's very, you know, how he put it like that, yeah, if it's like no example like that or the wording was, do you know here, it would be hard for me."* LW: "*Would you have been ok to just answer that page on its own? [p.113 of the workbook]…"* P6: "*No."* P6 went on to say, "*Yeah, I like using both of them, yeah, so I can read that one (p.112) and then I go back to this one (p.113) and I know how to choose my (answers)."*

5.3.7   Theme 7: Financial concerns

This is the second core theme that appeared in both sets of data and is thus a key theme in this study.

One interview participant made the researcher realise that they may not use apps, even if they are free, because they think they may be charged money for it. As P4 said, "*But the only thing, just only using the phone is call others and not very sure of all the programme on the phone, sometime I think it's charging me some money on the phone that's why I'm not going through with it."*

The survey showed that 53% of respondents are not willing to pay anything for their apps, 24% are prepared to pay up to $5 and only 6% would pay more than $5.

5.4 Interview discussion

5.4.1   Theme 1: Practises literacy skills

Most participants are still practising the skills they learned on the Pacific Pathways programme.

All interviewed participants have kept their copy of the "Tricky Words" booklet that was given to them during the programme and most of them are still using this regularly and confirmed they found it useful. Having low literacy skills is often seen as shameful and people usually try to hide this. The Tricky Words booklet seems to be a positive way to assist in increasing literacy skills as it is small enough to carry around in a pocket unnoticed and can be used with discretion.

Participants said that they still referred to pages of the Pacific Pathways Workbook (separate from the Tricky Words booklet) at times when they wanted to review their knowledge of a literacy skill and that

this was a useful resource for them. It is a positive outcome that participants continue to refer to the workbook once the programme has finished, however as these are in the form of an A4 encapsulated folder they are impractical to carry around thus have limited usability.

Participants were generally positive about using their smartphones and were all interested in the possibility of using the Tricky Words booklet in the form of an app. With participants continuing to practise their skills and having an interest in using the Tricky Words booklet as an app, this presents an opportunity to investigate the use of smartphone apps as a way to practise literacy skills that replaces current paper-based methods.

5.4.2   Theme 2: Practice improves self confidence

Participants were all positive about being part of the Pacific Pathways programme and the opportunity for them to practise and improve their literacy skills. The training facilitator was key to the success of this programme and all of the participants talked about him very positively and mentioned him numerous times during their interviews. Participants felt that the training facilitator encouraged them to try even if they felt nervous or unsure and provided them with a safe environment to do so and this aided their learning which increased their self confidence.

All participants indicated an interest in continuing to learn and improve their skills, and it was clear that being given the opportunity to do so has made a difference in their lives. Some participants said they could relate to their children better or even help them with their homework now that they could understand English better and they were clearly proud of this achievement.

Participants felt that improving their literacy skills, especially their English and writing, has made them happier, and being able to continue practising their skills is important to all of them.

It was clear to the researcher that the participants' positive experiences from the Pacific Pathways programme has increased their self confidence and had a significant impact on their attitude towards learning.

5.4.3   Theme 3: ESOL a contributing factor to low literacy

All participants said they had English as their second language and this was often cited as the main reason for their poor literacy skills. Participants said they often had trouble understanding questions in English and they would translate the question into their own language in their head to work out the answer and then translate their answer back to English. It is the translation from their native language back to English that seems to cause problems for many. Some participants left school early so their literacy skills in their own language are often poor, making it even more difficult for them to work out the answers in their own language and then translate that successfully back into English.

One participant found the story about Mohammed a little difficult to read and understand due to the Fijian Indian names used in this story. This can be attributed to the majority of the participants being of Pacifica descent and not as familiar with this ethnicity.

When asked how they found re-writing a paragraph in their own words most participants said they found this difficult as English is their second language. Some participants said they would think of the answer in their head in their own language, then do their best to write down that answer in English. However participants sometimes had difficulty finding the right words in English. Even though participants found this difficult they also felt it was a useful exercise as it helped them to learn and practise their English skills especially.

5.4.4   Theme 4: Willingness to improve low technological skill level

All participants had low technological skills but were positive about the opportunity to use an app as a way to practise their literacy skills. They also felt that using an app to practise their literacy skills would improve their technological skills and enable them to use more features of their phone.

All participants said that if the Tricky Words booklet was turned into a smartphone app this would be of interest to them and it would help them to practise their skills. Although some participants felt they weren't confident using their smartphone or apps at all, they also felt that an app may help them to become more confident when using their smartphones.

5.4.5   Theme 5: Images aid information recall

It is widely known that the use of images that relate to text helps with information recall. This was true for the participants who all recalled images that were used in the Pacific Pathways workbook up to two years after they finished the programme. When the researcher showed the participants a workbook page which just had picture of the character "Mele" on it, everyone recognised the picture and recalled Mele's name. Most participants liked reading the story about Mele and found it helped them to learn. Some found that the story helped them to form a picture in their mind, which helped them to understand the questions better.

Results from the survey also indicated the people use visualisation techniques to remember a new word they have learnt, by visualising the word in their head or associating the word with an object.

With positive results regarding use of images from both the interviews and survey, and the Cognitive Theory of Multimedia Learning also supporting the use of images to aid information recall, using images in an app would be beneficial.

5.4.6   Theme 6: Examples and references are useful

All participants found having examples useful and referred to them as they were answering the questions in the Pacific Pathways programme. The process of referring to examples was seen by participants as helpful to their learning. Some participants have gone back to read pages in the workbook since the programme finished to check specific literacy rules, for example when to use capitals and writing structure. Others participants stated they like to revise the workbook so they can keep practising their skills at home. When asked to answer multi choice questions about a story provided, some participants said they would check the answers against the story to make sure they had chosen the correct answer.

5.4.7   Theme 7: Financial concerns

One interview participant was concerned about using apps on their smartphone as they weren't sure if they were being charged for data while using them. This led to them stopping the app before it started.

With the survey showing 80% of smartphone owners having downloaded apps yet not using them, it may be concerns about being charged money by an app that is a contributing factor to people choosing not to download or use apps on their smartphone. The survey also revealed that 53% of people do not wish to pay anything for an app, thus money concerns may again be a contributing factor to low app usage.

As most adults with low literacy are in the lower socio-economic demographic it would be advisable to develop an app that does not require any online connection so it does not use any data or cost the user money to use it.

5.5 Summary

This research study used interviews to collect qualitative data about a group of learners and their continued practice of literacy skills beyond the scope of a literacy programme, their smartphone use, learning styles and learning preferences. Participants from the Pacific Pathways literacy programme were interviewed and asked about their experiences with the literacy activities that were part of the programme and whether they continued to practise the skills they had learned. Participants were also asked which smartphone they own to determine the relevant operating system (e.g., Android or iOS) and if they use apps on their phones, while investigating their interest in using activities from the programme in the form of apps, along with their question and learning preferences.

Six participants were selected to be interviewed based on the research conducted by Guest, Bunce and Johnson (2006) that suggests 80% of all possible themes are revealed with six interviews. It takes potentially up to 30 interviews to reveal 100% of all possible themes. With consideration given to the available sample size, time and budget constraints of this study, it was concluded that six interviews would allow the most efficient means of capturing the majority of possible themes.

Analysis of the qualitative data was conducted using the constant comparative method (Glaser, 1965). The data was first transcribed with the core themes then revealed by the marking of significant statements using NVivo. A re-reading of the transcripts was completed to ensure all core themes had been revealed and these themes were then clustered together into categories. Once the quantitative data had been analysed and coded, it was imported into NVivo and merged with the qualitative data so the themes from both data sets could be compared for triangulation.

The survey was conducted on a much larger group of people (120 respondents) providing the researcher with a more comprehensive representation of the data. The survey focused on collecting quantitative data. Employing both methods allowed for the data from the survey to be triangulated against that from the interviews, so that the data may be considered more reliable and the researcher better informed about the topic.

Both sets of data were analysed upon completion of the interviews and surveys. The survey data was analysed by converting the data to percentages and displaying it graphically using bar graphs. The

data was then coded into themes using Excel which was imported into NVivo and merged with the interview data for triangulation.

Seven core themes emerged from the qualitative data, these being: 1) Practises literacy skills, 2) Practice improves self confidence, 3) ESOL a contributing factor to low literacy, 4) Willingness to improve low technological skill level, 5) Images aid information recall, 6) Examples and references are useful, and 7) Financial concerns. The two themes of: Images aid information recall and Financial concerns, were also noted in the survey analysis.

These two key themes are validated by the review of the literature that shows adults with low literacy are predominantly in the lower socio-economic demographic and their financial status is a barrier to the ownership and use of ICT (see section 2.2.3 Impact of low literacy on income levels and employment opportunities, and section 2.2.4 ICT barriers and the Digital Divide) and the use of images being key to aiding the recall of information in a multimedia project (see section 2.5.1 Cognitive Theory of Multimedia Learning).

For the practical component of this study, the results of the data analysis will inform the development of an app, this being a proof of concept. The proof of concept will demonstrate how the recommendations from the surveys and interviews can be incorporated into an m-learning tool that is based on applicable learning pedagogies, whilst remaining a relevant and useful tool for the target audience.

6. Recommendations for the app

The following recommendations are derived from the literature review and analysed survey and interview data. These recommendations have been taken from the results and discussion of the survey and interviews and turned into points that can be applied directly to the development of the app in the practice-based research portion of this research.

1. Provide a means for learners to continue practising their literacy skills.

    Pedagogical considerations include:

    - Integrating the Objectivist learning model as a way to transfer knowledge efficiently to the learner.

    - Offering multi choice questions as participants stated a preference for these and this fits within the Objectivist learning model.

    - Offering a range of activities to practise different literacy skills, e.g., tenses, punctuation.

    - The content of the questions must be relevant to situations experienced by adults, for example driving a car or grocery shopping, so that the new knowledge may be easily used in real-life situations.

2. Provide a means for learners to reach the Application level of learning.

    - According to the Bloom's Taxonomy learning model, learners must first remember and understand information so they may then apply this knowledge in real-life situations.

3. Ensure use of the app does not impose an extraneous cognitive load on the learner.

    - Adults with low literacy levels likely have a low working memory capacity for learning new literacy skills in English, so any extraneous cognitive load must be avoided. For example, using audio to read out the question as well as presenting text and an image at the same time would likely cause a high cognitive load.

4. Use images to support learning material.

    - Based on the Cognitive Theory of Multimedia Learning we have dual channels to process information, visual and auditory. The use of relevant images presented alongside textual information is a powerful tool to aid the recall of information long after it was first learned. Survey and interview participants also stated they found images helped them recall lessons (e.g., Mele) and made it easier to remember a new skill.

5. Encourage learners' use of ICT.

    - While the content of the app may appear to be at a low level, the target audience is adults, so the design and content must reflect this.

- Allow for users who may be colour blind or hard of hearing. For example, using text and colour together - correct or incorrect, with relevant audio sounds that indicate if the question has been answered correctly or not.

6. Provide the app completely free of charge.

- For iOS the app needs to be available at no cost on iTunes and the Android version of the app can also be made available at no cost via the Google Play Store or by emailing the app file direct to the user.

- Develop the app so it can be used offline and ensure it does not require the use of any data to run the app.

7. Creative synthesis/Practice-based research

The development of a proof of concept smartphone app was undertaken to meet heuristic inquiry's creative synthesis phase. Practice-based research was used to supplement this phase, as there are no clear guidelines as to how it should occur (Sela-Smith, 2002). As practice-based research draws on methods from industry (Scrivener, 2000), the ADDIE model was used to create the proof of concept app.

Development of a proof of concept was selected as opposed to a prototype or release candidate as the research only seeks to confirm that the recommendations for an app described in Chapter 6 can be implemented to provide a way for adults with low literacy to practise their skills. The recommendations provided a list of actionable points that were applied directly to the development of the app, as outlined in section 7.2. By developing the app as a proof of concept this did not require the app to be highly refined or complete, rather it just sought to explore the app recommendations through practice as a means of further exploration and validation.

7.1 ADDIE model

The ADDIE instructional design model is a key foundation of learning design that steps through the main phases of any learning design project, with each step having a consequence that feeds into the next step. This model is well known and used in traditional learning approaches, with the same steps also applicable to an m-learning project. The ADDIE model consists of these five phases: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation (Branch, 2010; Dick & Carey, 1996).

The application of this model to m-learning and how it has proceeded in this research project is as follows.

(1) Analysis: The purpose of the Analysis phase is to identify the gap between the actual performance and the desired performance (Branch, 2010). The learning designer must identify the problem or need, the learning outcomes, the needs of the learner, and if there is any existing knowledge of the problem (Branch 2010). The designer must also consider the learning environment, any limitations that exist, how the learning will be delivered, and what the timeframe for the project is (Branch, 2010). In this research project the analysis phase was used in conjunction with the heuristic illumination phase with the collection of quantitative and qualitative data, and the explication phase with the recommendations for the app made known. The analysis phase was met by conducting a survey and interviews to identify the problems, needs, and prior knowledge of those with low literacy. These surveys and interviews also identified how the learning may be delivered by exploring any limitations that exist in regards to the technology by determining what technology the learners have access to. The researcher also conducted a review of the available literature to determine what knowledge of such projects already exists that may be incorporated into this research project.

(2) Design: The purpose of the Design phase is to verify the desired learning outcomes and appropriate testing methods (Branch, 2010). This phase was also used in conjunction with the heuristic illumination phase with the analysis of the data, and the explication phase with the discussion of the results of the

data collection. The researcher took the results of the surveys and interviews and conducted the quantitative and qualitative data analysis. The results of the data analysis confirmed that participants wished to continue practising their literacy skills and were positive about the possibility of using apps on their smartphone as a way to practise their skills. This determined the practice of literacy skills as a learning outcome of the project, using smartphone apps as a way to do this. This would require developing a smartphone app and testing it on an actual device as an appropriate testing method. It was at this stage that the wireframes were produced and the aesthetics, user-interface and content also decided upon by the researcher.

(3) Development: The Development phase involves creating and validating the learning resources (Branch, 2010). This phase requires the content to be generated, media selected from an existing source or developed if it does not exist with revisions made as required, and finally, testing of the resources produced. This phase was used in conjunction with the heuristic creative synthesis phase and employed practice-based research to create the proof of concept in the form of a smartphone app.

(4) Implementation: It is at the Implementation phase that the learning resources are prepared for use by the teacher and the students (Branch, 2010). In a typical learning project the resources that have been developed would be distributed to a group of learners to be used in a real-world learning environment. This phase was also used in conjunction with the heuristic creative synthesis phase and employed practice-based research to test the proof of concept in the form of a smartphone app.

(5) Evaluation: Evaluation of the quality of the learning resources created is usually conducted before and after the implementation phase (Branch, 2010). In this research project there is a limitation to the timeframe available, thus the researcher will employ usability heuristics (not to be confused with heuristic inquiry) in this phase by self-testing the app. As this research is limited to the Analysis, Design and Development phases, the researcher will use her own knowledge of the problem (adult literacy), to test the app and determine the effectiveness of the app. Thus, this will be the validation phase of their heuristic methodology in evaluating this research project.

7.2 Proof of concept

The creation of a proof of concept smartphone app was undertaken as a means of conducting practice-based research, to address heuristic inquiry's creative synthesis phase. Practice-based research was also used in this study as a means to illuminate and validate the use of smartphone apps as a way for adults with low literacy to practise their skills.

The proof of concept smartphone app was developed based on the recommendations taken from the review of the literature, and the results and discussion of the survey and interviews.

The first recommendation is to provide a way for users to continue practising their literacy skills, integrating the Objectivist learning model, and offering a range of activities, such as tenses and punctuation. Developing a smartphone app was deemed appropriate as survey results showed that 64% of respondents own a smartphone, 83% carry their phones with them all the time, and 41% of smartphone owners currently use learning apps for up to 30 minutes a day. Two different activities were developed for this app, tenses and punctuation, with multi choice questions used as this was a stated preference in the survey and fits within the Objectivist learning model.

To reach the Application level of learning, learners must remember and understand information so they may then apply this knowledge in real-life situations. To achieve this the app uses questions that are appropriate for adult learners, for example questions about driving a car or buying groceries, with the user required to get each question correct before they move on to the next question. The content was sourced from The Learning Wave's resources and has been aligned to the IALS scale.

In order to align with the IALS scale the app aims to address the Vocabulary progression of the Read with Understanding strand. At level 1 of this progression adults will have a reading vocabulary of everyday words, signs and symbols. (TEC, 2008c). Level 1 of the app used words that adults could expect to encounter in their everyday lives at home and at work. For example, in the Punctuation module of the app one of the sentence used is: "Secretaries, or other workers, can often get free eye tests." The words secretaries, workers and eye tests are those most adults could expect to encounter in their everyday lives. At Level 2 of the Vocabulary progression adults will be aware that many words have more than one meaning (TEC, 2008c). In level 2 of the Tenses module of the app, a sentence used is: "I bumped into an old friend yesterday." According to the Oxford Dictionary the word "bumped" can mean to knock or run into someone or something with a jolt, or to meet by chance (Oxford Dictionaries, n.d.). At level 3 of the progression adults will understand that some words and phrases can have figurative as well as literal meanings (TEC, 2008c). For example in level 3 of the Tenses module, a sentence used is: "What are the shops like around here?" This meaning of this this sentence could be figurative, for example what the person thinks of the shop from personal experience, or it could have a literal meaning, for example the condition of the building that the shop is in.

Questions have been randomised and the answers shuffle so it is a unique experience for the user each time. It would be expected that repeated use of the app over a sustained period of time would enable the user to remember the correct answers. Using relevant content aids in understanding the information which, once the new knowledge is remembered, can then be easily applied in real-life situations.

The app has been designed with a simple interface with clickable buttons, e.g., a "Submit" button, presented as a user would expect so a high cognitive load is not imposed. The only audio that has been used are two simple sounds that indicate if the answer is correct or not, and are as the user would expect with any software programme so they are not required to think about what the sound means and can focus on the content of the app.

The Cognitive Theory of Multimedia Learning, as well as the survey and interview data from this study, suggest the use of images to support the text can aid in the long term recall of information. The app has been developed using simple images that relate to each question, for example, a question about driving a car has an image of a car underneath the question. Using images that are familiar and relate to the text means the user can focus on the question while processing the image at the same time, without the user needing to think about what the image means. This also maintains a low cognitive load for the user.

The app has incorporated multiple methods of feedback for the user with the correct answer presented as "Correct! Click anywhere to continue" in a green text box. If the answer is incorrect the app shows a yellow text box with "Try again", along with a short audio sound similar to what a user would encounter in any software application that indicates if the answer is correct or not.

7.3 Usability heuristics and evaluation

Designing the user interface in technology has traditionally focused on the capabilities of the technology (Srivastava, Chandra & Lam, 2009). This approach has often neglected the actual user requirements, whereas a user-centred design starts with the requirements of the end user by exploiting the capabilities of the technology to address the users' needs, preferences and abilities (Srivastava, Chandra & Lam, 2009).

Heuristic evaluation is an inexpensive, uncomplicated method of testing the usability of a system that requires only a small set of evaluators examining the interface and judging its compliance with recognised usability principles (Srivastava, Chandra & Lam, 2009). This research employs the principles of usability heuristics to address the needs of the end user with the researcher evaluating the app for compliance with these principles. This should not be confused with heuristic inquiry, which this research also utilises.

Key usability heuristic principles that apply to this research are examined, with a discussion on how they may be applied to the development of the proof of concept app.

One key usability heuristic principle is to ensure a match between the system and the real world (Neilsen, 1995), using language that the user will relate to. Adults have had many more life experiences than children and it is essential that the language used in the app reflects this.

Another principle is to keep the user informed of their progress, giving feedback at an appropriate time (Neilsen, 1995). For each question the user must answer within the app, they should be advised whether they answered correctly or not. If an incorrect answer is given, the correct answer should be shown with an explanation if appropriate. This will enable the user to increase their skill level by learning what the correct answer is, with any explanation further increasing the user's skill level by not just remembering the correct answer (the lower order of thinking according to Bloom's Taxonomy), but also understanding

why that is the answer. Understanding is the key to then being able to apply the knowledge, lifting the user to a higher order of thinking: namely, the application level, the level this research is aiming to achieve.

There must be consistency of words used to guide the user through the app, so they mean the same thing throughout (Neilsen, 1995). Any icons, symbols and other graphical features must also remain consistent throughout the app. Go with what the user would expect, for example an "i" button for information is standard on any application, regardless of the platform (Neilsen, 1995). For the proof of concept app, graphical features such as level indicators (e.g., Level 1, Level 2, etc.) must remain consistent throughout, for example, using the same type of button, colour, font size and font type.

Only include design elements which are relevant to using the app and ensure that the aesthetics do not detract from the user experience (Neilsen, 1995). Keep the design clean so the user can focus on using the app, rather than being distracted by the visuals. The Cognitive Theory of Multimedia Learning also suggests that if too many pieces of information are presented at one time, this can cause a high cognitive load, which can be detrimental to learning (Kalyuga, 2009). This means the design of the app must only use visual elements essential to providing a way to practise literacy skills, while maintaining a good user experience.

If colour is used to convey information, for example: green = correct answer, red = incorrect answer, a secondary clue should also be used for those who are colour blind (approximately 10% of males and 1% of females) (Neilsen, 1995). This can be achieved in the app by using text as well as colour, for example: "Correct!" in green text and "Try again" in red text will easily convey the message for all users. A short audio sound could also be employed if it is a sound the user would expect. The use of appropriate audio sounds may enhance the user experience, without imposing a high cognitive load, as recommended by the Cognitive Theory of Multimedia Learning (Mayer, 2005).

Test, test and test again. To provide a positive experience the user wants to continue revisiting, you must also test the app over a length of time (Neilsen, 1995). An initial test will enable you to learn how the user interacts with the app, but only over a longer period of time will you learn whether the user is likely to return to the app and how their experience changes once the user is familiar with the app (Neilsen, 1995). In this research, the researcher will test the app on an Android and iOS smartphone to validate the proof of concept, as required by practice-based research.

7.4 Development of the app

The first step of developing the proof of concept was to determine the operating system that the app would be developed for. This was determined by the results of the survey. As 66% of respondents stated they use an Android phone and only 21% use iOS, it was decided that it would be best to focus on the Android OS. However, with 21% using iOS this still represents a significant number of users, so the decision was made to ensure the app worked on both operating systems.

Testing was conducted on both iOS and Android devices, specifically targeting operating versions that are the most compatible with the majority of smartphones. The iOS testing took place on an iPhone 5S, as this device runs a currently supported iOS version 8 that all current iOS devices use. The

Android testing was conducted on a Samsung Mini Galaxy 2 chosen as it runs on Android version 2.3. Statistics based on devices accessing the Google Play Store, indicate that there are 6.4% of Android users still on version 2.3 (Android, n.d.).

To enable the app to be developed for multiple operating systems, consideration must first be given to the platform used. The researcher went through a number of options to determine what would be the best platform on which to develop the app.

It was thought that using a WYSIWYG ("what you see is what you get") platform may be a more efficient method of developing the app, as without having to write the code the focus of the design can be given to the content. A game design engine, Game Salad, was examined. This tool offers the ability to develop game apps using a WYSIWYG system that does not require the user to know any code. However, without the ability to access the code, it was determined that this would limit the researcher's ability to do any customisation that may be required beyond the scope of what the platform offered.

The researcher then considered developing the app using a range of code, e.g., HTML, CSS, JavaScript. The researcher has experience in developing mobile web apps using PhoneGap to package the code (predominantly based on HTML/CSS), so it was decided that this platform would be suitable if all the code could be researcher-written. The decision to use PhoneGap dictated how the rest of the development would proceed and presented a number of issues (see section 7.5 Obstacles faced).

Whilst the app had not yet been developed, the researcher recognised that if there was to be a range of questions asked they would need to be randomised and the answers shuffled so the user has a unique experience each time they use the app. Many options were explored to enable this to be written in code. It was determined that a database would need to be used to enable a range of questions to be answered in a randomised order. In a website, a Structured Query Language (SQL) database would be used for this purpose, utilising PHP: Hypertext Preprocessor (PHP) to enable the functionality. The researcher explored various options to enable an SQL database to be used in a mobile web app packaged through PhoneGap. To enable the SQL database to be called upon, PHP would need to be utilised. The researcher was able to set up and connect an SQL database to an HTML page and call up unique data from the database, however when it was packaged in PhoneGap and tested on the smartphone, the PHP did not appear to work. It was discovered that PhoneGap does not support PHP, however you could use JavaScript to connect to PHP, which then connects to the SQL database. This method was tested in the same manner through PhoneGap and whilst it functioned successfully in a web browser on a computer, when tested on the smartphone it did not appear to work.

A decision was then made to explore HTML5 eLearning authoring tools that could also be used to develop a mobile web app. Adobe updated their Captivate software in May 2014 with the latest version, Captivate 8, now supporting responsive design and mobile web app options. Responsive design is an approach to web development that allows the content on web pages to be resized and images can be shown or hidden depending on the device it is being viewed on. Whilst this is essentially an eLearning authoring tool, with the ability to responsively design your project and publish for devices, a focus can be made on the mobile environment. When a project is published for devices, all source code is provided and the user is able to customise Captivate's HTML template as required.

The user can also add their own configuration file to enable more customisation, such as the icon and splashscreen that appears on the smartphone.

Once the Captivate framework had been chosen, the next step was to start developing the app. The Captivate HTML5 authoring tool offers a WYSIWYG environment that simplifies the design process. However, it also presents some limitations. In Captivate a file is called a project, and each project is published into a stand-alone app. It would appear that you can connect multiple projects within Captivate, however this is not able to be actioned once the project is published into an app. Therefore, a single project must be used to develop the app.

It was decided to develop the app as a literacy skill practice tool that presented a range of questions increasing in difficulty. For the proof of concept it was decided to include two skill options, tenses and punctuation, with three levels of each skill. Captivate provides a quiz module that offers the ability to randomise the questions and shuffle the answers. This was a key feature required by the app so it was imperative the quiz module be utilised.

The quiz shows the users their score at the end of the quiz and offers the ability to review their answers, however there can only be one set of results for each project. Ideally a user would be presented with their score at the end of each level, however with the limitation of only one set of results for the quiz, and therefore the app, it was decided to take a different approach.

The Captivate project is based on a slide show where you can insert a range of slides before, in between, and after the questions. Taking this into consideration, it was decided that a range of levels could be used within the one project, however a score would not be shown at the end. As the user would not be able to see their score or review their answers at the end, it was decided to set the questions up so that the user would need to get the answer correct to move on to the next question. The app was set up so that each time they got an incorrect answer, a "Try again" message would appear in a yellow coloured box with a corresponding sound so that three user interface (UI) options were covered by text, colour and sound. If the answer is correct a "Correct!" message appears in a green coloured box with the sound of a bell that also indicates success. Providing immediate feedback for each question aids in the learning process as the user learns the correct answer straight away, while the question and answers are still visible on screen. Reaching the end of each level is therefore the achievement for the user, and they are able to go back and repeat any level at any time. In repeating a level the user is presented with different questions, and if the same questions do appear again, the answers are also shuffled to ensure a unique experience each time the user uses the app.

It is important for the user to know where they are in each level of the app, so a breadcrumb was added using JavaScript that shows which question the user is up to, for example Q 3 of 6. This script is reset at the end of each level and also at the start of the app so regardless of where the user is starting a new level from it will always start at Q 1 of 6.

The researcher considers the uniqueness of the questions and answers, the immediate feedback provided and the increasing levels of difficulty all contribute to enhancing the user experience.

By developing the app as an m-learning tool, incorporating sound pedagogical models and learning theories into its design, the researcher considers the app to be a suitable m-learning tool that can enhance and reinforce traditional learning styles.

The proof of concept app was published in Captivate and packaged as an app through Adobe PhoneGap for both Android and iOS platforms. It is called My Skills Workout and is available to download for free on the Google Play and iTunes stores:

Google Play

https://play.google.com/store/apps/details?id=com.leoniewilliams.masters_app

iTunes

https://itunes.apple.com/us/app/my-skills-workout/id971376957?mt=8

7.5 Obstacles faced

Using a software package such as Captivate, as opposed to writing the source code using Dreamweaver for example, can present issues when an update is made to the software by the software developer, in this case Adobe. An update to Captivate 8 occurred towards the end of the development stage, causing essential graphical elements to be removed when the project was published as an app. This was a significant issue which required the app to be completely rebuilt.

Adobe released an update to Captivate which was executed automatically the next time the software was opened after the release. The researcher was unaware the software had been updated and this was only uncovered at the end of development stage when the app was published after the JavaScript breadcrumb was added. The app now looked very different to the previous time it was published two weeks prior, with the question slide images, submit button and success/try again buttons no longer appearing on the app when published.

It was discovered that Adobe had made an update to software package that caused any images used on random question slides in a responsive project to no longer appear when published. It also appeared the way a responsive project was published had also changed, so the content now adjusted to only the width of the project, with no regard to the height. Prior to the software update the images and text on the screen both resized proportionately to both the width and the height of each device so that it looked similar regardless of the screen size. After the software update, when the app was published a blue strip now appeared at the bottom of the iPhone screen as the content was not resizing to fit the height of the screen, only the width. This blue strip appeared to be a default set by Captivate that could not be changed within the project and would need to be removed as it is not an acceptable graphical element.

When the researcher contacted Adobe about these two issues it was uncovered that there was a software bug that was causing images used on random question slides in a responsive project to disappear when published. A replacement HTML file was provided by Adobe which fixed this issue.

Adobe did not see the change in responsive publishing as an issue, stating that publishing proportionately to only the width of the screen was standard practice in responsive design. This was at odds with how Captivate had published responsive projects prior to the update. With no available fix for the responsive publishing issue, the researcher was faced with rebuilding the app so that the content would appear appropriately on different screen sizes, with no coloured strip appearing at the base of the screen.

This meant the project had to be resized so the white background would completely fill the iPhone screen, thus removing the blue strip, with the content placed to fit the screen area of the Samsung phone which was wider than the iPhone, but not as high. If any content is placed at a height of more than 480px, this requires the user to scroll on the Samsung screen which is not acceptable.

Resizing a project in Captivate also resizes all of the content. With the submit button placed at the bottom of the screen, resizing the project wider would mean this button would be placed at a height of more than 480px, thus it would not appear on the Samsung screen unless the user scrolled down. This was not an acceptable solution.

The project has two topics, Tenses and Punctuation, with three levels available for each topic that increase in difficulty. Each level has six questions, with a pool of 25 questions to draw from for each level, enabling randomisation to occur. This involves a total of 150 random question slides.

If the project was simply resized, each of the 150 random question slides would need to be individually updated to ensure the content was no higher than 480px, as there was no automated way to do this. The stylised background that had been chosen would also need to be removed so the background remained white regardless of the screen size. To ensure the background of the screen remained white for the entire height of each screen the project would need to be resized to at least 587px.

It was decided that resizing the project was not practicable. This was a major setback and three days was spent rebuilding the app.

As the project had been developed "on the go", without a proper structure set in place, some of the question slides were out of alignment due to the size of the text changing as each question was added to the question pool. The alignment of the text was adjusted at the time for each individual slide, as opposed to setting up the range of slides that would be used throughout the project so the alignment would be consistent throughout. The researcher viewed this as an opportunity to clean up the alignment and take a more planned approach to the redevelopment, as well as checking to ensure the answers set in the question slides were correct.

7.6 Bug testing

Using the smartphone as a testing environment has played a vital role in the development of the app. It is not enough to use the preview provided by Captivate which runs on an internet browser. What works in the browser may not necessarily work on the phone and the project looks different in each environment.

Viewing the app on two smartphones, one a Samsung Android phone and the other an iPhone 5S, has shown a number of discrepancies between what is seen on the phone compared to the appearance in Captivate and also the browser preview. On the Samsung phone the sans serif (Arial) font used in Captivate appeared as the Android default font, Roboto. This is the same for all other apps on the phone, so appears to be a default set by Samsung. The researcher also loaded the app onto the iPhone 5S and the Arial font used in Captivate appeared as intended. There have also been a number of text alignment issues that could only be addressed when viewed on the phone.

The app includes sounds that indicate whether the user has the answer correct or not, however these sounds do not work on the Samsung phone. They do, however, work on the iPhone, so this appears to be a failure with the Samsung phone and it was decided to keep the sounds in the app with the expectation they will work on other Android phones. Although the sound may not work in some phones, by incorporating the usability heuristic recommendations of using more than one way to validate an answer, the app has also used colour (green = correct, yellow = try again) and words to indicate whether the answer is correct or not.

When the app was first tested on the phone there appeared to be a delay of at least a second between each question (these are called screens in Captivate), which the researcher felt the user would find very annoying. This delay occurred on both the Samsung and the iPhone so it appeared to be an issue with the app, rather than the phone. It was discovered that there was a display time as well as a pause set for each screen as a default by Captivate. These times could be adjusted in the timeline so each screen showed for a fraction of a second (they were set to 0.2sec) and the pause removed. Implementing these changes addressed the problem on both phones and the questions now move much more seamlessly, as the user would expect.

7.7 Screenshots of the app

Screenshots of the app as viewed on the Samsung Mini II and iPhone 5s for comparison.

Android - Samsung Mini II

Figure 7-1 (left). Welcome.
Figure 7-2 (centre-left). Choose a topic.
Figure 7-3 (centre-right). Choose a level.
Figure 7-4 (right). Question.
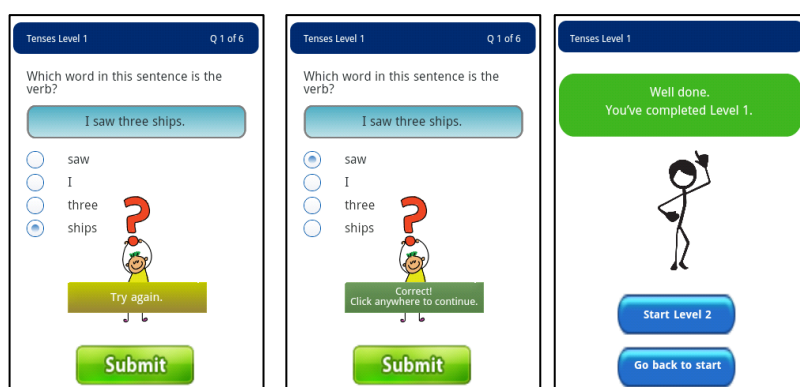
Figure 7-5 (left). Try again.
Figure 7-6 (centre). Correct response.
Figure 7-7 (right). Level completed.
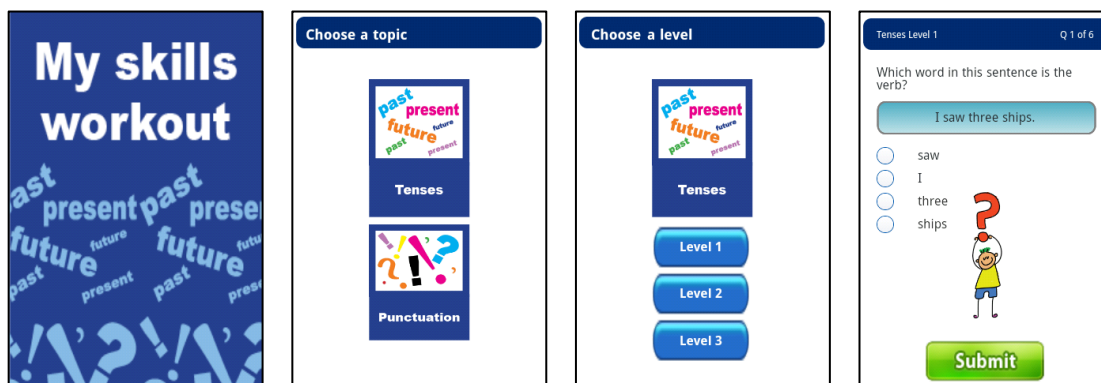
iOS - iPhone 5S
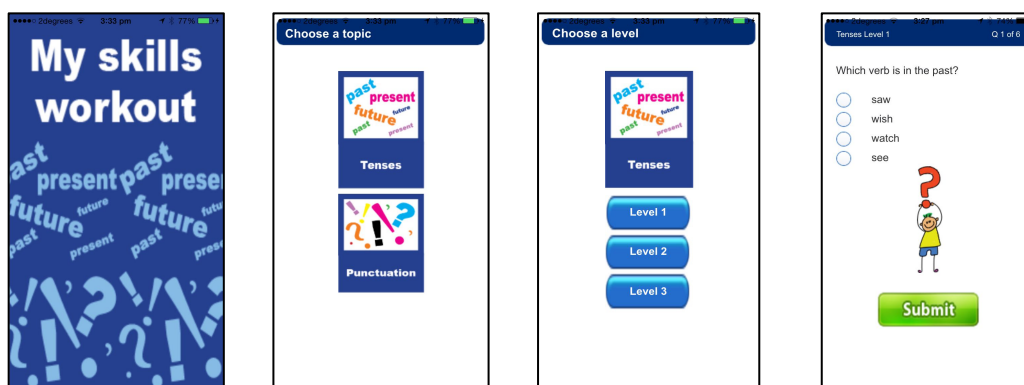
Figure 7-8 (left). Welcome.
Figure 7-9 (centre-left). Choose a topic.
Figure 7-10 (centre-right). Choose a level.
Figure 7-11 (right). Question.
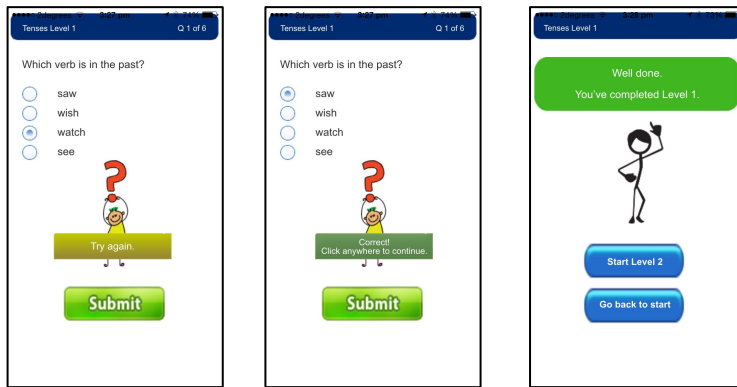
Figure 7-12 (left). Try again.

Figure 7-13 (centre). Correct response.

Figure 7-14 (right). Level completed.

7.9 Summary

This chapter has shown how the recommendations have been applied in the development of the proof of concept app. It also addresses key usability heuristics, taking a user-centred approach to the development and applying them to maximise a positive user experience.

Employing the ADDIE model in the design of the app incorporates traditional instructional design methods in an m-learning project, while honouring the heuristic phases throughout.

Developing the proof of concept has shown that an app can be developed as a way to aid adults with low literacy to practise their skills. It also shows that an app can be developed as an m-learning tool, incorporating sound pedagogy and learning models.

Documenting the process of developing the app ensures that the knowledge gained by this research is easily transferable and able to be applied by others in the field of adult literacy.

8. Conclusion

This chapter briefly summarises the research and the findings. The limitations of the study are then discussed, followed by the implications of the research. Lastly it presents recommendations for further research on developing smartphone apps to aid adults with low literacy to practise their skills.

8.1 Summary of the research

This research study intended to address the following research questions: *How do adults with low literacy engage with smartphones, if at all? Can specialised smartphone applications be developed that provide a way for adults with low literacy to practise their skills? Can m-learning be used to enhance and reinforce traditional learning styles?* Each of these questions was answered by the findings of this study.

The survey was used to find out the level of smartphone ownership in a group of adults who have low literacy and how they engage with their smartphones, if at all. The results showed that 64% of respondents own a smartphone, determining this research study was worthwhile commencing and answered the first research question. The survey also explored how people preferred to find out and remember new information to determine preferred learning styles among the group. Conducting interviews allowed for explication of the themes first explored by the survey, so that a more rich depiction of the data could be provided. Many themes emerged from the data which was finally clustered into seven core themes, with two of these themes occurring in both sets of data, providing key information and recommendations for the development of the app.

A list of recommendations was then made based on the review of the literature and the results of the survey and interviews. The recommendations provide a set of considerations for delivering an m-learning means of practising literacy skills, catering specifically to adults with low literacy.

The next step was to develop a smartphone app as a proof of concept that would attempt to incorporate all of the recommendations, which was successfully achieved. The proof of concept was undertaken as the practice-based research component of this study, in order to implement the recommendations. Undertaking the proof of concept allowed for the process of developing a smartphone app to be documented and the recommendations to be further explored. Documenting the process of developing the app ensures that the knowledge gained by this research is easily transferable and able to be applied by others in the field of adult literacy.

Developing the proof of concept has shown that a specialised smartphone application can be developed that provides a way for adults with low literacy to practise their skills, which answers the second research question.

By developing the app as an m-learning tool, incorporating existing pedagogical models and learning theories into its design, shows that m-learning can be used to enhance and reinforce traditional learning styles, answering the third research question.

8.2 Summary of the findings

There are three sets of findings from this research study, the survey, interviews, and practice-based research.

The surveys collected quantitative data from a group of adults with low literacy to determine levels of smartphone ownership amongst this group, how they use their smartphones, and their learning styles and preferences. It was found that 64% of respondents own a smartphone and 71% of smartphone owners use apps on their phone. This high level of smartphone ownership is in line with global trends, which continues to increase.

It was found that 71% chose to purchase their phone, so the high level of ownership is not an anomaly, and 83% carry their phone with them at all times. Many people already use apps at a variety of times, whether waiting in a queue (38%), at work in their breaks (58%), or when they're at home not doing anything else (70%). Most people would not pay much, if anything, for apps with the results showing 53% are not prepared to pay anything, 24% are willing to spend up to $5 and only 6% are prepared to pay more than $5. Although 80% do connect to the internet with their smartphone, there are still 20% who don't, so it was clear that any app developed should be available at no cost and should not use any more data once it is installed. The survey showed people use a variety of methods to learn and remember new information and many seem comfortable using technology to do so.

The interviews collected qualitative data to further explicate the data collected from the surveys and provide a richer depiction of the data. There were seven core themes revealed from the interviews with two themes also appearing in the survey data. Learners continue to practise their literacy skills after their learning programme has finished as they wish to keep learning and improving their skills. Learners reported that practising their skills during the learning programme also helped to improve their self confidence. Having English as a second language was an issue for all learners, with some stating that their skills in their first language are sufficient, however they have difficulty when translating information from their first language into English. All learners had low technological skills but were positive about the possibility of using a current paper-based tool as an app on their phone and felt it would help improve their literacy skills as well as their technological skills. Using images was a powerful tool for aiding recall of information with all learners recognising an image from their learning programme up to two years prior, they were able to recall the name of the character and many of the characteristics written into the character's story that was part of the programme's workbook. All of the learners preferred the use of examples when learning new information and found this helped them to answer questions about the topic more easily. Even though the learners all owned smartphones they do not necessarily have the finances to use them fully, with many having them only so others could contact them, and one learner stated that they were afraid to use apps on their phone as they weren't sure if they were being charged for it, so they stopped using the app. The survey data also revealed that although people had chosen to purchase their phone, most of them bought it when it was on special or provided free with a mobile plan and most people are not willing to pay much if anything for their apps, so finances are obviously a concern.

A list of recommendations for the development of an app was made based on the literature review, results of the survey, and interviews. Developing the app as a proof of concept and testing it on both Android and iOS devices allowed the discovery of what does and doesn't work. Deciding what software to use for the development posed some initial obstacles as the researcher's coding skills were not sufficient to write all the code. This was overcome with the discovery of an existing e-learning authoring platform, Adobe Captivate, that had undergone a recent upgrade to include the ability to develop mobile web apps using Adobe PhoneGap, which the researcher was confident using. Developing the app so that it worked on both the Android and iOS platforms was achieved by packaging the app with PhoneGap, however another update to the Adobe Captivate software caused problems at the end of the project requiring it to be completely rebuilt. Although this was a major setback it was seen as an opportunity to clean up the interface of the app and ensure the content was correct before releasing it. The app was repackaged and released on both the Google Play and iTunes store and is now available as a free download. All of the recommendations were successfully applied and proved that a specialised smartphone app could be developed to aid adults with low literacy to practise their skills. Integrating the Objectivist learning model with the use of multi choice questions allowed the app to be developed as an m-learning tool that can be used to enhance and reinforce traditional learning styles.

8.3 Limitations

The survey was only conducted on adults with low literacy who were attending a literacy programme, so they may be more open to answering a survey about learning styles and preferences. Adults with low literacy who have not attended any such programme may have different views on learning. Conducting the interviews on a relatively homogenous group of people means there is limited ecological validity to the data.

While the researcher had access to a large number of adults with low literacy, only six interviews were conducted due to the timeframe available, so the data cannot be reliably generalised to represent the whole population. In order to expedite the interview process, all the interview participants were sourced from the same literacy learning programme, so there is limited ecological validity to this data.

The proof of concept app was successfully developed, however it has not gone through user testing and feedback due to the timeframe available in this study. The researcher has partially sought to validate the recommendations by building a proof of concept and believes it to be a useful m-learning tool in this area. However, until it is completed to a release candidate and tested by a group of adults with low literacy and their feedback collected, it cannot be known if the knowledge gained is reinforced by the app.

8.4 Implications of the research

This study has shown levels of smartphone ownership by adults with low literacy are at comparable levels to ownership globally. Results from the data showed people with low literacy do download and use apps, and appear comfortable with technology to aid their learning. With global smartphone ownership trends increasing this affords the opportunity for further research into this area.

A list of recommendations for developing the app was derived from the results of the data analysis and the literature review, with all recommendations successfully implemented in the proof of concept. This list of recommendations may provide a means for others to create m-learning for adults with low literacy.

It has also been shown by the development of the proof of concept that a specialised smartphone app can be developed that can aid adults with low literacy to practise their skills. The documentation provided in this report may help others in the field who wish to further investigate the development of smartphone apps in this area.

8.5 Recommendations for further research

This study would appear to be one of the first m-learning projects to address adult literacy conducted in New Zealand. It was only the researcher's own knowledge in both the area of adult literacy and technological skills that enabled this project to be undertaken. As a result, the researcher feels there are many opportunities for further research.

As the survey was conducted with a group of adults who were currently attending a literacy programme, they may have different views on learning to those who have never attended such a programme. A survey on a much wider group of adults with low literacy should be conducted so the data are able to be more reliably generalised amongst this population.

While there was a high number of survey participants, only six people who had all attended the same literacy programme, were interviewed. It may be beneficial for further interviews to be undertaken on a wider group, so that all possible themes can be revealed and the data are able to be generalised and can be considered more reliable.

The smartphone app was only developed as a proof of concept, so although it has been professionally presented and is available for download on the Google Play and iTunes stores, it has only a small amount of content in it and lacks refinement, therefore would not be sufficient for a further research project. If further research is undertaken the app should be developed fully, with more topics available and more questions for each of the levels to choose from, and the interface improved. User testing and feedback should then be undertaken to ensure the app is suitable for this group of people and is an effective tool to aid them to practise their literacy skills.

All interviewees stated that they continued to use their literacy programme resources once the programme had finished and often referred back to them when they wanted to review their knowledge. A small paper-based literacy tool, the "Tricky Words" booklet, was given to participants during the literacy programme they attended. This booklet contained difficult words that participants could expect

to encounter in their everyday lives at home and at work with space for them to write in the definition. There was also space for the participants to add their own words in the booklet. The interviews revealed the Tricky Words booklet was still being used by all participants up to two years after the programme had finished. Some participants continue to carry the booklet with them at work as well as home. With a very positive response by all participants to the possibility of using a Tricky Words booklet in the form of an app on their smartphone, and the view that this would also help them improve their technological skills, the development of such resources should be further investigated.

The proof of concept app was developed using only multi choice questions, however there is a vast range of other literacy activities that would be worth investigating further. Survey participants indicated that they also like questions where they filled in the missing word. Interviewees stated that although they found re-writing a paragraph in their own words difficult they also felt it was a useful exercise as it helped them to learn and practise their English skills especially. Many people prefer to read instructions and also watch someone do something when learning a new task, so it may be useful to include a video or animation in an app to introduce a new skill. People also use a range of methods when learning to spell new words, so it may be beneficial to provide options to learn how to spell words correctly in the form of an app. There are a wide range of question types and literacy activities, other than the multi choice questions that were employed by the proof of concept app, that could be incorporated into a smartphone app as an m-learning tool to aid the practice of literacy skills. With the data showing that low literacy learners have a range of preferences of how they like to learn new skills, it would be beneficial to investigate incorporating other literacy activities into an m-learning tool for adult literacy.

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Mobile phone survey Information Sheet

30 October 2013

Project Title

Adult literacy mobile learning: A smartphone app proposal to aid adult learners practice literacy.

An Invite

I, Leonie Williams invite you to complete an anonymous mobile phone survey. The results of the survey will be used as part of a masters degree that I am studying for at AUT. I am also employed by The Learning Wave and am in charge of producing all of their training resources.

What is the purpose of this survey?

The purpose of the survey is to find out what type of mobile phone people own, how they use their mobile phones and about your learning preferences.

How was I identified and why am I being invited to take part in this research?

You have been invited to take part because you are currently taking part in, or have previously taken part in a learning programme that includes literacy activities.

How do I agree to take part in this research?

To take part you need to complete the survey and put it in the drop box provided.

Will I receive feedback on the results of this research?

If you would like to receive the results of the research, please email leoniew@thelearningwave.com. A short report of about one page will be given to any participants who would like to see the results of this project..

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Matthew Guinibert, matt.guinibert@aut.ac.nz, *09 921 9999 ext.8437*

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

Whom do I contact for further information about this research?

Researcher Contact Details:

Leonie Williams, leoniew@thelearningwave.com, 376 6612 or 021 533 380.

Project Supervisor Contact Details:

Matthew Guinibert, matt.guinibert@aut.ac.nz, *09 921 9999 ext.8437*

Approved by the Auckland University of Technology Ethics Committee on *4 November 2013* **AUTEC Reference number** *13/290*

Appendix II: Survey Form

Mobile phone and learning survey

1. Your gender:
   - ❑ Male
   - ❑ Female

2. What age group are you?
   - ❑ 15 – 24
   - ❑ 25 - 34
   - ❑ 35 – 44
   - ❑ 45 – 54
   - ❑ 55 – 64
   - ❑ 65 – 74
   - ❑ 75+

3. What ethnicity do you most identify with?
   - ❑ NZ European
   - ❑ Maori
   - ❑ Samoan
   - ❑ Cook Island Maori
   - ❑ Tongan
   - ❑ Niuean
   - ❑ Chinese
   - ❑ Indian
   - ❑ Other (please specify) _____

4. Do you own a mobile phone?
   - ❑ Yes
   - ❑ No – please go to question 14

5. What type of mobile phone do you use today?
   - ❑ "classic" mobile (you can only make calls and send texts) – please go to question 14
   - ❑ "smart" mobile (ability to install an app)

6. If you have a "smart" mobile, what operating system does your phone use?
   (If you have a "classic" mobile, please go to the next question).

   - ❑   Android (uses Google play for apps)

   - ❑   iOS (uses iTunes for apps)

   - ❑   BlackBerry (uses BlackBerry World for apps)

   - ❑   Windows (uses Windows 8 store for apps)

   - ❑ Other (please specify) _____

   - ❑ Not sure

7. Why do you choose this model? (Tick all those that apply)

- ❑ I purchased the phone because:
    - ❑ I got it for a reduced price when I signed up to a mobile phone plan
    - ❑ it was on special
    - ❑ I was able to pay it off on HP
    - ❑ I really wanted this phone so was prepared to pay full price for it
    - ❑ Other (please specify) _____

- ❑ I was given the phone for free because:
    - ❑ a friend or family member gave it to me
    - ❑ someone I know upgraded their phone so gave me their old one
    - ❑ it was a birthday/Christmas present
    - ❑ it was free when I signed up to a mobile phone plan
    - ❑ Other (please specify) _____

- ❑ I'm not sure
- ❑ Other (please specify) _____

8. When do you carry your phone? (Tick all those that apply)

- ❑ All the time, it's usually in my bag or pocket
- ❑ I take it to work, but leave it in my bag or locker
- ❑ I don't take it with me to work, I leave it at home
- ❑ I take it with me when I go out
- ❑ I usually leave it at home when I go out
- ❑ I'm not sure

9. Have you ever downloaded any applications on your phone? (e.g. games)
   (If you have a "classic" mobile, please go to question 9).

- ❑ Yes
- ❑ No
- ❑ I'm not sure

10. Do you use any applications on your mobile phone? If so, how much time do you spend on them each day?

	Don't use it	Less than 30 min	From 30 min to 1 hour	From 1 to 2 hours	From 2 to 3 hours
Learning applications	○	○	○	○	○
Gaming applications	○	○	○	○	○
Reading (e.g. newspaper)	○	○	○	○	○

11. When do you use your applications? (Tick all those that apply)
   - ❑ While waiting in a queue
   - ❑ While watching TV
   - ❑ During dinner
   - ❑ At the movies
   - ❑ During an event or function (e.g. school play)
   - ❑ At work in my breaks
   - ❑ In church
   - ❑ While shopping
   - ❑ At home when I'm not doing anything else
   - ❑ I don't use any applications on my phone

12. How much would you be willing to spend for an application that you want to obtain?
   - ❑ Nothing, I only download free applications
   - ❑ Less than $2.00
   - ❑ From $2.00 to $5.00
   - ❑ More than $5.00
   - ❑ I'm not sure

13. How do you connect your device to the internet?
   - ❑ I do not connect my phone to the internet.
   - ❑ Through the smartphones service provider using 3G or 4G
   - ❑ Through wifi at home
   - ❑ Through wifi at work
   - ❑ Through wifi in public places (like cafes)

14. How do you feel about multi-choice questions?
   - ❑ I like being given a choice of answers
   - ❑ I would prefer to come up with my own answer
   - ❑ I'm not sure

15. How do you feel about questions where you fill in the missing word?

   e.g. What's the missing _____ in this sentence?
   - ❑ I like those type of questions
   - ❑ I don't like those type of questions
   - ❑ I'm not sure

16. If you were given a paragraph and asked to rewrite it in your own words, how confident would you feel about doing this?
   - ❑ Very confident – I'm usually able to use my own words without too much difficulty.
   - ❑ OK – Sometimes I find it difficult to use my own words, but I can do it.
   - ❑ Not confident – I find it difficult to write in my own words.
   - ❑ I'm not sure

17. When you're learning how to do something new, what's the best way for you to learn?

- ❑ Reading the instructions
- ❑ Watching someone else do it
- ❑ Both reading the instructions and watching someone else do it
- ❑ Just try it out for myself and see if I can work out how to do it
- ❑ I'm not sure

18. When you come across a word you don't know, how do you prefer to find out what it means?

(Tick all those that apply)

- ❑ Look it up in the dictionary
- ❑ Ask someone else
- ❑ Search for it on the internet, e.g. using a search engine like Google
- ❑ Read the whole sentence and see if I can work out what it means
- ❑ I'm not sure
- ❑ Other, please explain _____

19. When you are learning to spell a new word, do you prefer to:

(Tick all those that apply)

- ❑ Look it up in the dictionary
- ❑ Ask someone else
- ❑ Try and spell the word and then look it up or ask someone else
- ❑ Search for it on the internet, e.g. using a search engine like Google
- ❑ I'm not sure
- ❑ Other, please explain _____

20. How do you prefer to remember a new word you have learnt?

(Tick all those that apply)

- ❑ Just looking at it is enough
- ❑ I like to look at it and then write it down
- ❑ I like to listen to the word being said and then say the word myself
- ❑ I'm not sure
- ❑ Other, please explain _____

Thank you for your time to complete this survey.

Research invitation

Project title

Adult literacy mobile learning: A smartphone app proposal to aid adult learners practice literacy.

An invitation

If you have completed the Pacific Pathways programme and own a smartphone (a mobile phone with a touch screen and applications on it), then you are invited to participate in an interview. The results of the interviews will be used as part of the researcher's Masters degree. It is your choice to participate and you can change your mind at any time. Your answers will be kept private and confidential, and will not be used in any way that would identify you. Your participation will have no effect on your job or your ability to participate in any other learning programmes offered by your employer.

What is the purpose of this research?

The purpose of this research is to listen to what you thought of the Pacific Pathways literacy activities (e.g. when you filled in some of the pages of the workbook) and also about how you use your smartphone.

What will happen in the research?

You will be asked questions about what you thought of the Pacific Pathways literacy activities. There will also be some questions on how you use your smartphone.

How do I participate?

Contact the researcher, Leonie Williams, (see below) to express your interest in participating.

How long will it take?

The interview will take approximately 30 minutes.

Where will the interview take place?

The interviews will be conducted at Pacific Homecare, 230 Great South Rd, Papatoetoe.

What are the benefits?

This is a chance for you to talk about what you thought of the Pacific Pathway literacy activities. Your feedback will contribute to the development of a smartphone app. Also, if you are chosen to be interviewed you will receive a $30 grocery or petrol voucher.

Are there any risks?

If you think that questions about literacy activities or how you use your smartphone have potential to cause you embarrassment or emotional stress, please do not participate. The researcher will be audio recording the interview so as not to have to take so many notes. If the recording of your voice will cause you discomfort, please do not participate.

Are there any costs?

No, only the time taken for the interview. Participants will be chosen randomly, if you are selected you will be one of 10 people interviewed.

Are my answers confidential?

Yes, all interviews will be kept confidential. Your answers will never be used in any way that would identify you. They will be combined with answers from everyone who is interviewed to make up a report.

Who do I contact for further information about this research?

Researcher contact details:

Leonie Williams, leoniew@thelearningwave.com, ph: 021 533 380 or 376 6612

Approved by the Auckland University of Technology Ethics Committee on 4 November 2013 AUTEC Reference number 13/290

Participant Information Sheet

AUT
UNIVERSITY
TE WĀNANGA ARONUI O TAMAKI MAKAU RAU

26 August 2013

Project Title

Adult literacy mobile learning: A smartphone app proposal to aid adult learners practice literacy.

An Invitation

I, Leonie Williams, invite those who have completed the Pacific Pathways programme and own a smart phone (a mobile phone with a touch screen and applications on it), to participant in an interview. The results of the interview will be used for a masters thesis in the field of communication studies.

It is your choice to participate and you can change your mind at any time. Your participation will have no effect on your job or your ability to participate in any other learning programmes offered by your employer.

What is the purpose of this research?

The purpose of this research is to listen to what you thought of the literacy activities you did as part of the Pacific Pathways programme. The results of the interviews will inform the development of a smart phone app to practice literacy.

How was I identified and why am I being invited to participate in this research?

You have been invited to participate because you have completed the Pacific Pathways programme and you also own a smartphone. Participants will be chosen randomly, if you are selected you will be one of 10 people interviewed.

What will happen in this research?

You will be asked questions about some of the literacy activities in the Pacific Pathways programme. There will also be some questions on how you use your smart phone.

What are the discomforts and risks?

If you think that questions about literacy activities or how you use your smartphone have potential to cause you embarrassment or emotional stress, please do not participate. The researcher will be audio recording the interview so as not to have to take so many notes. If the recording of your voice will cause you discomfort, please do not participate.

How will these discomforts and risks be alleviated?

The questions have been written in a way that should not cause any discomfort. However, if you find yourself uncomfortable answering any questions, you can choose to skip it with no consequences. You can withdraw from the interview at any time with no consequences.

What are the benefits?

This is a chance for you to talk about what you thought of the Pacific Pathway literacy activities. Your feedback will contribute to the development of a smartphone app. Also, if you are chosen to be interviewed you will receive a $30 grocery or petrol voucher.

How will my privacy be protected?

Your identity and any information about you, including any notes taken and the audio recordings, will be kept private and confidential. Only the interviewer (Leonie Williams) will have access to information that could identify you. Anything you say will never be used in any way that would identify you and will be combined with answers from everyone who is interviewed. The results of this research may be published in peer reviewed journals and conference presentations.

What are the costs of participating in this research?

There are no costs for participating, only the time taken for the interview

What opportunity do I have to consider this invitation?

 You may read over this information sheet and accept the invitation if you are happy to be interviewed. If you would like to know more before committing to be interviewed, feel free to contact the researcher, Leonie Williams, using the contact details at the end of this page.How do I agree to participate in this research?

You need to sign a consent form which outlines everything covered within this information sheet, which will be given to you at the start of the interview.

Will I receive feedback on the results of this research?

If you would like to receive the results of the research, please email the researcher (see below). A short report of about one page will be put together and given to any participants who would like to see the results of this project.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Matthew Guinibert, matt.guinibert@aut.ac.nz, *09 921 9999 ext.8437*.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

Whom do I contact for further information about this research?

Researcher Contact Details:

Leonie Williams, leoniew@thelearningwave.com, 376 6612 or 021 533 380.

Project Supervisor Contact Details:

Matthew Guinibert, matt.guinibert@aut.ac.nz, *09 921 9999 ext.8437*

 Approved by the Auckland University of Technology Ethics Committee on *4 November 2013* AUTEC Reference number *13/290*

Consent Form

AUT
UNIVERSITY
TE WĀNANGA ARONUI O TAMAKI MAKAU RAU

Project title: **Adult literacy mobile learning: A smartphone app proposal to aid adult learners practice literacy.**

Project Supervisor: **Matthew Guinibert**

Researcher: **Leonie Williams**

○ I have read and understood the information provided about this research project in the Information Sheet dated 30 October 2013

○ I confirm that I own a smartphone.

○ I confirm that I have completed the Pacific Pathways program.

○ I have had an opportunity to ask questions and to have them answered.

○ I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.

○ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.

○ If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.

○ I agree to take part in this research.

○ I wish to receive a copy of the report from the research (please tick one): Yes○   No○

Participant's signature: ....……………………………………………………

Participant's name: ....……………………………………………………

Participant's Contact Details (if appropriate):

…………………………………………………………………………………..

…………………………………………………………………………………..

…………………………………………………………………………………..

…………………………………………………………………………………..

Date:

Approved by the Auckland University of Technology Ethics Committee on *4 November 2013* AUTEC Reference number *13/290*

Note: The Participant should retain a copy of this form.

Appendix VI: Interview Questions

Interview Questions

About the literacy activities in the Pacific Pathway programme

1. Do you think your writing, reading and communication skills have improved since you finished Pacifc Pathways?

   How do you think your skills have improved?

   What parts of the programme do you think helped to improve your skills?

2. Have you kept practicing any of these skills since you finished the programme (if yes, how)?

3. What kind of phone do you have?

   What sort of apps do you use

   Do you think a smartphone could be used to help you (if yes, how)?

Question preferences

4. Did you enjoy reading the stories on the four characters Mele, Ana, Margaret and Mohammed? (e.g. p10-11).

   What did you enjoy about these stories?

   Did you enjoy answering the questions related to the stories (if yes, why)?

   Do you think these questions helped you to learn (if yes, why)?

5. Do you enjoy answering multi-choice questions (if yes, why)? (e.g. p48/49)

   Do you think this type of question helps you to learn (if yes, why)?

6. Did you enjoy having to rewrite something in your own words? (p14),

   Do you think doing this helped you to learn (if yes, why)?

7. Thinking back to "The dictionary" (p30-31) and Verbs activities. (p34-35). Did you find the examples for each question helpful (if yes, why)?

   Do you think including the examples helped you to learn (if yes, why)?

8. There are a number of "Hot tips" pages, for example: "Capitals", "Basic sentence structure" (p36-37), "Writing process" (p39), Commas (p62) and Speaking (p77)

   Have you ever referred to any of these pages since you finished Pacific Pathways (if yes, why)?

9. On page 112 you were given examples of when to use "a", "an" and "the" and then asked to fill in the correct word on the next page. Did you refer back to p112 as you were answering the questions on p113 (if yes, why)?

10. How do you feel about questions where you fill in the missing word? (p113)

    Do you think this helps you to learn (if yes, why)?

Learning preferences

11. When you come across a word you don't know, what are some ways you would find out what it means?

    Of these, which do you think you would most commonly use and why?

12. When you are learning to <u>spell</u> a new word, how do you normally do this?

13. How do you prefer to <u>remember</u> a new word you have learnt?

14. You were given a "Tricky Words" booklet to use during the programme. Did you find the booklet useful (if yes, why)?

    Have you used the booklet since the programme finished?

    In what situations have you used it?

15. If you were given a "Tricky Words" booklet as an application for your smartphone at no cost, do you think you would use this?

    How do you think it would help you?

    How would you like this to function?

Appendix VII: Significant Statements

Participant P1's significant statements

- Like using the mobile and listening to Ezi-tracker(?), especially sometime it's hard to understand logging in and logging out,

- and I make some mistakes along the way, and it makes it hard for the other people.

- That's the thing I need to minimize, but the more I practice the more I become good at it I suppose. Practice makes perfect.

- Yeah, it's to get a scenario of the things that we are looking at, you get a picture in your mind, "oh that's where they're going to, that's where they're running", otherwise you're left in the dark.

- Sometimes the question is hard to understand LW Ok, why was that? P1 It's just because English is my second language

- Yes, and the question is, English word is straightforward but where are going to with this question, you know? And then we hear in the discussion, they going this way and yet I'm going this way (points in different directions). Ah! You know.

- LW So, the questions for Mohammed's story were multi-choice, so you had to pick the right answer, did you like answering those questions? P1 Yeah, I like answering that, first I need to read it twice, what's the story all about, and then straightforward

- Yeah, I like multi-choice, it triggers the memories

- It's ok! I'm alright. First I gotta understand, what the… I gotta sort of put it in the back of my mind, the human rights and then I gotta remember those human rights, if I remember them then I can write it.

- Ah, yesterday (tenses), yeah

- LW Do you think having an example was quite useful before you had to answer the question? P1 Yes, very much

- LW So you prefer to have the example? P1 Yes, it's very helpful

- LW Since you finished the programme, have you ever gone back to any of the pages? P1 Yes

- I wanted to make it soak in my mind, my rights and the client's rights. So I'm gonna practice out there and know what not to do, what to do. That's the reason, I just want to make it soak into my mind.

- LW Yeah, that's the writing process. Do you still use that writing process, at work or anywhere else? P1 Yeah, I do.

- It's the grammar that I worry about!

- I ask the person.

- I go to the dictionary

- LW What about if you're having to remember a new word, you might come across a medical term or something for work, how would you make sure that you can remember that word? P1 Go back to my workbook.

- LW Did you get one of these? ("Tricky Words" booklet) P1 Yeah LW So how did you find using it P1 I carry it in my book LW Oh do you? P1 In my bag LW So you still use it? P1 Yeah, it's very handy

- It comes handy when someone is talking above my head and I don't look it up in front of them, I go back home and practice it to my daughter in law, my granddaughter. "How do you know that word – acronym? How do you know that word?" "Oh, we learn it at the class"

- It would be helpful if I'm texting someone, yeah. It would be helpful. I hate receiving acronyms in the texts! "What do you mean?!" Come on, it's only two more words to add to it, why don't you finish the sentence, why don't you finish the word?

- Yeah, I reckon it's very helpful for me, because I'm not familiar with all these apps. It would make me a lot faster using it than trying to learn it.

- LW So help you with your phone as well? P1 Yeah. Because there's a lot of apps on here "ABC? What does that mean" LW Yeah P1 If they got a page in there that tells you what the ABC means, you go back to it, "Ah, that's what it is!"

Participant P2's significant statements

- I think English is my second language, I maybe, you know, not able to speak like that

- LW Is there anything in particular, I think you were talking to me before about something that you had gotten better at, the incident forms? P2 Yeah, like writing, to report the forms, and accident and incident form and how to write the complaint

- LW So if we go over to Mohammed's story, these were the multi-choice questions, which were a little bit different. How did you find doing multi-choice questions? P2 It's easy and easier than the questions when you answer in your own words. You can choose one of the correct one and then again you can cross check which one is correct, which one is wrong.

- LW So how did you find rewriting things in your own words? P2 Yeah, it was easy and useful in our workplace also

- LW Nearly back to where we were. So some of these Hot Tips pages and the writing process, so do you still use any of these or refer back to them? P2 Yeah, I still use it, like with some of the clients we have to write all the things, what activities happened in the day time and we have to fill the support workers and the clients details form also. So the ?? just come in and check and see that and then they will know what happened these days in all these things, so we have to write it down, so it's easy you can use it, how to write it down, very long sentences and short sentences

- Like in starting I was struggling, when I learned and I thought properly you know, and (Trainer) was teaching us, so it was easy for me to go through

- Go on the computer

- No, at home whenever I got time I always go to it, I don't want to forget all those things which I get done

- Yeah it would be useful, like I said, when I've got any difficult words I go on the computer and Google it so if I've got spare time, like sometimes we haven't got any client like one hour to spare, so I can sit down in my car and then tap tap tap words and then find out what is the meaning and I can google and get it

Participant P3's significant statements

- And some words I don't understand so (Trainer) help us, to make me understand

- So the first time I go there I was nervous, but when I take the Pathways I am confident

- LW So on this one, you had multi-choice questions, so you had to pick the answer, did you like multi-choice questions? P3 Yes. It helps a lot, like when you count "oh, oh, ok" but when they put down the numbers it's easier for me to answer the question (Question 1 had a range of numbers to choose from) LW Because you know the answer's there somewhere? P3 Yes, somewhere, so I just count the people and I look at the numbers and, ok, this is the right answer. I like the multiple choice.

- Because (Trainer) says, you know, you do it every day to your clients, so it's helped me a lot to know how to treat my clients, how to when I come in the morning, say hello, how are you and things like that. So, it's, you know, it's a little bit hard, but when he (Trainer) explain it to us, like "this, oh, really! We do that every day but we never realise that" and then "oh ok, I see", But it's good for us to know, to respect our clients.

- Yeah. Like "walk, walking" like that, like "walked" (verbs). Like when we're told this, it takes my mind back like when I'm in high school, in primary school, because I was only year 8, form 2, because of my family's, my mother run away, same like my father, so my grandma asked me to stay home and look after her, that's why my English was very poor, I can't even speak out aye! Like when (Trainer) asks, I never speak out, I just quiet. So when (Trainer) asked us to read the paragraph, ok, read it aloud, don't worry it's not your first language, just try it. If you don't try it then you never know. So it's good

- Yeah, so I say, ok I have accent, I know now, I know because I was looking at the example and then bring my mind ideas how to answer the questions.

- LW Can you think, since you finished the programme, have you ever gone back to your workbook and read any of these pages? P3 Yes, I always go back because when I'm taking level 3, it takes me back, ok, some words are very difficult, but when I look back to my small book (tricky words book), it tells me to "ah I see, this one" and it reminds me and give us ideas to answer the questions to the level, so it's good.

- I look at this one first (112) before I was going, ok, because I want to read the thing first and then I go through the thing (answers), "ah, ok, yes". It's fine, easier for me to answer the question and fill in the space, because I look at the example

- When I'm taking the Pathway, I didn't like much about the dictionary, so when (Trainer) encouraged us to, you know, I take the dictionary everywhere I go. I look at the dictionary to find the meaning of the words, it's the only easy way for me.

- He was very good. It feels like we don't want the Pathway to end, we want to learn more, I want to learn more, because I know I was improving myself, my English and even the writing

- LW So is that something that you keep practicing? P3 Yes

- LW So how do you keep practicing? P3 Because me and my husband, because he's the patient here aye. I read books. You know, we go to the library, we go to the side where the kids books are, to learn the words before but now we go to where the adults books are. We always go to the library every week to bring some book to read.

- I always keep this one because I carry it everywhere I go, because if I don't know the meanings then I look at the book to find the words, because we always write the meaning of the words

- Because it's helpful, because before my client say "I have no idea what you said", but now he says "how can you learn your English". When I go to this programme, Pacific Homecare advised me to go to the Pathways so that's where I learn. "Oh good on you, go for it!" (client). Now I can really, really know what you say, I couldn't catch what you say before.

- LW You must be happier too? P3 me too, yes

- LW Do you use any apps on your phone at all, like games? P3 Yes LW So do you think if you could get this as an app on your phone, do you think you would use it? P3 Yes, that helps. Ah I can get it? LW Not yet, I'm just asking if I made it into an app P3 Oh yes, I would be pleased to have it

- Yes, tell me the meanings and plus I can take it everywhere I go, even because we plan to, I want to take my husband to finish his level 4, so it's easier for me, I carry my phone and you can do the thing on the phone and understand the words straight away.

Participant P4's significant statements

- Yep, very helpful. Because, before, we just go through, basically get used to the form we're given and then we fill out the same things that they say, but we put the "and" joining word and the sentences and which word is going in that one, sometime we put the words in the sentence, like the capital letters and things, we put in the same one because it's a difference one in our language

- Yes, it's very good, it's like the client. Because the interesting thing for Mele Tupou is the way she dresses up, we're there to help them (client) but we're not there to boss them what they do (tell them what do to), that's their choice LW They can wear what they like P4 Yeah, their choice what they want to do or they want to wear

- Yes, the first time it was a little bit difficult for me, because some of the words I don't know what is the meaning of them, and I have to read again and again and because the first time we did it we used the dictionary to use the words we don't know and then after that we have to look for the dictionary, what is the meaning of that word. But now it's a little bit different to answer the question for the day 1

- Yes, for me to ask for the, ah, in the island we do the multiple choice too, but the only thing, like I said before, we have to understand the question and you know, what is the meaning of, what is the right answer you chose, to choose to, for the right question. Sometime, when I didn't understand the question I just guessed, which one is, but when I know exactly what is that one, and then I point to the right answer.

- Because with that one, the code of rights we already go through with our co-ordinator, got 1 to 10, and then they explained it to us all the time and some of our work we explain it to us, what is it, it is helpful that the Pathway we know more how to explain in our own words.

- But, I just explain the sheet and respect, like the first one with the time I was, I just doing it in my language. Like in my mind, in my language and then I explained in English so it will help us with, and say, oh yep, that one is right and that one is a little bit, needs some more. But our training, one of our co-ordinators is, we go through level 1. Level 2 and level 3 with all the codes supplied.

- Yep. The only thing, sometimes when we do Pathway, we just put all the past (tense) in the one sentence.

- And then the verb will changing something, I just find out now with the Pathways, because the example of the words is "run" for the during and then "ran" past tense one, sometimes we just using the sentence, the now, the present tense and do the past tense verbs

- It helps for me to teach my child, sometime they got, what is it? Homework

- The only thing, we just ignore them because we don't know what these are, this one and that one and that, you know, and sometime if we just tell them, some of the parents are here then, the kids just put them down because they know more than the parents. Because they're born here they know the English and they speaking English and know how to, but the only thing I always, maybe I take 2 days in the week to re-read my book, the Pathway, so it's helpful so I can help my son.

- Sometime I put the name, it's the rough one, just put the name not the capital letter to start with, just put the name, all the capital or not writing the capital for the first letter and then the little one for the, yes, it's very helpful the Pathway.

- Yes, I'm a little bit confused aye, because the "an". The words that start with the vowel, have to be with "an" and then, when we see what is, like Auckland, we say oh, why is we put "a" or "the" to Auckland to, because it's a vowel to start with, that's a little bit confusing. And then when he (Trainer) explained it to us, "the" for that one, "a" for that one and "an" for that one, and then we know what is the difference. Because at first not explain it when we fill in form or just do it in our own (language?) maybe we put the "an" with all the words that start with vowels.

- LW So thinking about when you come across a word that you don't know the meaning of, how do you go about finding out what the word means? What do you do? P4 I ask the teacher, the Pathway teacher (Trainer) to explain, because, to ask in our first language. I'm not going to tell you the meaning of the words, but I ask him to give me a sentence and we will put the words in, like explaining the words

- Oh yes, and after the first time we look for the dictionary, what is that one, I go through the dictionary with the words

- The one too is difficult. The words I have to spell, how to pronounce them, is very difficult, for me is very difficult, but in the middle of our course, maybe, it's coming to me to know what is how to pronounce that word

- LW So, say the word, and try and spell it how it sounds? P4 Yes, I just say it, and I spell it and then I write it and I say it maybe 5 times, less than 5 times

- I just write it and then, the things like, the words I don't know, when I finish the course I go home, look for the dictionary and then I find the words and then I have to say it to remember that one. When I go through in the paper or just some of the paper I will know, oh that word I was looking at that one, like our Care Plan or some of our forms we fill in first before our visit. The first client we do, we got the same health and safety form, some of the words we use in there I have to know what is the meaning, saying and I write in my own language the meaning, so I can remember

- At work, when I'm at work, but some of the words I didn't know, I didn't know what is the meaning of the words and some of the words I know. But the words our co-ordinator, training run, goes on and on, like (name) and (name) and them, they with that one. But sometime, when I'm sitting in the workshop, they know, the words is they going fast with those words, but it's helpful when they say, if you don't understand something and you tell me to repeat it for you and sometime I ask them what is that one and that one and they explain it. And sometime, when the first time I do the workshop, I know some of them, they better than me at talking, I feel time (ashamed?) to ask question and the time I just have to say it in myself, it's not in my language, it will be embarrassing if it's my own language I'm not good with but if I feel ashamed, I will be silent and not say anything, but if I'm talking the things I get wrong with, some of my workmates will correct me and then my training, our

co-ordinator, our tutors will help me to, if I'm leaving like that, not saying anything, no one will help me, they think I understand everything, so I just ask.

- Because your phone you carry everywhere. But that book was sitting at home, but when you go to work if you need that words, where do you go to find them, find the words? But the only thing, just only using the phone is call others and not very sure of all the programme on the phone, sometime I think it's charging me some money on the phone that's why I'm not going through with it

Participant P5's significant statements

- Ah, I remember the picture, for Mele Tupou

- LW Was there anything that maybe (Trainer) got you to do that you thought really helped you P5 The communication for the client LW So you can communicate better with your clients? P5 Yes

- Because it's Mele, Mele's got, what's it called? (pointing to her arm)

- LW Ok. So if you go over to the next one, I've highlighted these ones here in The Dictionary, he's given you some examples and if you have a look over to the next one, where you covered Verbs as well and the same thing, sometimes he's given you an example and then he's asked you to keep filling it out. Did you find having the samples was helpful? P5 Yeah. She's here yesterday… he's here yesterday… you are here yesterday… (remembering the tenses)

- LW So do you think if you didn't have the example that it would be much harder, would you still like working it out or would you prefer to have the sample there? P5 Yeah, example

- Yeah, yeah, see for the different colour, yeah I remember, that's for remind me for my level 1 for the Pathways for all these and the note into the book

- Cause I remember, for the meaning, for the words, for my teacher asks me, yeah and answer, yeah and have a look for the dictionary and have a look for the meaning

- LW Ah, so you'd say the word out? P5 Yeah, say the word and then I try for the spelling

- LW Cool, so my very last question. I see you have a phone there, what's your phone, oh it's a Samsung. Do you use any apps on your phone at all, like games? P5 Yeah

- LW So, if I say could put this (booklet) like as something on your phone instead of having the book, do you think that you would use it if it was on your phone P5 Yeah, I use it for the contact and the note and for the calendar, the notes for the day for my kids, and texts!

- LW So, if the tricky words booklet was on your phone and you could add words to it on your phone, do you think you might use that? P5 Ah, yep – yes!

Participant P6's significant statements

- Yes, yes, it's helped me a lot, to read information that was given by the office

- Yeah, you know some of the hard words that he, tried to explain it to us, and sometimes I go home and, hey there's that word that (Trainer) was saying to us in the class, like something to do with the hospital. And I said to my girls, that's the word that he explained to us. And he helps us a lot to remember, so when I go into the house of my clients, I use it with them as well.

- LW So using the word over and over again helps you to remember? P6 mmm, to remember (agreeing)

- Yeah, yeah, he did. And then I had to practice it, on my clients, like the word issues and, um (thinking) yeah something to do with the clients, but it came on the TV.

- Yeah, yeah, I still keep practicing what I learned from the programme

- LW So, do you use any apps on your phone at all, do you download any, like games? P6 Yeah, my two daughters do the downloading for me

- LW So it's not too small? P6 Nope, yeah it's good, better than my old LG phone

- LW So, did you recognise some of the things in the stories P6 Like Mele

- Cause I remember, (Trainer) was saying about, the arms, I think it's a phantom? Phantom? (pointing to amputated arm in picture)

- Yes, I like them, it helped me to understand what Mele's situation is, and us support workers, how we can, how we going to, like when we're we go with our clients, if they got diabetes, it helps us to know what they're going through as well

- P6 Yeah, that story was hard. Mele's one was understandable, this one was confusing to me, maybe because of the names LW Ah, yeah because he's Indian isn't he? P6 yeah

- (Laughs) You know, because my English is, ah, English is my second language so I had to think, oh, what am I going to write here! Sometimes I had to rough copy it, then I just put it in there (box on page to write in), but sometimes (Trainer) correct me

- Some of the questions, (Trainer) put some examples, see like the present tense is run, past tense is ran

- Yes, yeah, it helps a lot, the examples is, it's very, you know, how he put it like that, yeah, if it's like no example like that or the wording was, do you know here, it would be hard for me. LW But it's good to have those P6 Yes LW Then you know what to start with P6 Yes

- Yes. And then looking into the dictionary as well, it's good, I like it, I like it.

- LW So what about any of these pages in the workbook, you didn't use any of these, just the booklet? P6 Yeah, that one, yeah cause I was put… (laughs) ah these are the words I have to use as well, in my workplace

- LW This one here (p112), see how he's explained when you use each of the words and you had to fill in the answers, did you refer to that page (112) when you were doing your answers? P6 mm? LW Would you have been ok to just answer that page on it's own (113)… P6 No

- Yeah, I like using both of them, yeah, so I can read that one (112) and then I go back to this one and I know how to choose my (answers). Like the "a", "an" and "the", so I can use it in the right sentence. This one is easy!

- Yeah, I like that one, because I have to think "what's the right word to go in there?" and then you read the question and you read it again, oh yeah, that's the right one. LW So what if you didn't have that page (112) would you still like to try and think of the missing word? P6 It would be hard

- It would be hard for me, but I think, if you read the sentence properly then think about, ah, maybe it's a past tense or maybe it's a future tense, yeah. Like this one, because (points to example on page) "I was sent ___ invitation" Like "an", not "and"

- Yeah, when I've got the other page then I refer to the other one

- Yeah, I use the dictionary a lot cause I don't know how to go on that! (points to phone)

- LW Are there any other ways you could think of? If you couldn't find a dictionary, what else would you do maybe? P6 Oh, sometimes I ask my two daughters

- Yeah, same sort of things, sometimes I have to ask my daughter "how do you spell that word" and sometimes, I have to go to the dictionary and look for how to spell it

- Yeah, I would use it because I carry my phone around aye, I don't carry that one around (booklet)

- LW What if it could say the word out for you? Do you think it would be useful if you could press a button so it would say how the word sounds? P6 Yeah, I think it would be, because some of the, especially these ones aye (refers to tricky words booklet) is hard to understand LW How do you do that normally, if you come across a tricky word, do you just guess how to say it? Sometimes I know I have trouble, depending on how the letters are written, like with your name, I wasn't sure how to say your name (both laugh). So do you ever ask anyone how to say it properly? P6 Yeah, I would ask somebody how to say the word

- It's a good idea to put the tricky words in this (phone) then you've got to find the meaning to it, because most of the words in the tricky words book we didn't get the meaning of (they weren't supplied in the book). Because some of the story like Mele's one or the other one…