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**Mobile learning in early childhood education:
A school-university partnership model.**

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other institution. To the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Signed:

Date 27/10/17

Abstract

Mobile learning (mLearning) devices are ideal for 21st century learning. mLearning devices are light and, therefore, mobile so that young children can use them anywhere. Examples of mLearning devices are tablet computers, programmable robots such as Bee-Bots and robotic Lego. The term 21st century learning is used around the world and includes the skills of collaboration, communication, new literacy, creativity, critical thinking, and problem-solving. New literacy has emerged because of new technologies and being literate in the 21st century now includes being digitally literate. However, mLearning is not widely used in early childhood education despite the fact that schools are investing in hardware, software, and infrastructure. This thesis reports on the results of a three-year study investigating the synergy between pre-service and practising early childhood teachers using a community of practice approach. The pre-service teachers presented technology rich lessons at partner schools as part of an Information and Communications Technology unit they complete during their studies. The lecturer assisted the pre-service teachers in preparing lessons. The pre-service teachers, who lacked pedagogy and classroom experience, were provided the opportunity to teach “real” children as opposed to teaching each other. The practising teachers, who exhibited excellent pedagogical skills, provided curriculum content and pedagogical feedback to the pre-service teachers and at the same time had the opportunity to observe the developmentally appropriate use of technology in their classrooms. Research findings included how technological knowledge of the participants changed and how the school-university partnerships developed. The pre-service and practising teachers’ dispositions towards mLearning became more positive with the practising teachers increasing

their technological knowledge and the pre-service teachers increasing both technological and pedagogical knowledge. Five themes emerged from the results as being central to successful school-university mLearning partnerships. These themes are presented as a chain model where each theme or chain link is important to the survival of the school-university mLearning partnership. The themes identified as pivotal to mLearning partnerships included an enhanced sense of community, cross fertilisation of knowledge and skills, more informed leadership, development of professional knowledge, and closer relationships between partners.

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Glossary

Australian Curriculum Assessment and Reporting Authority (ACARA)

Australian Curriculum Assessment and Reporting Authority (ACARA) is an independent statutory authority that is responsible for Australian National curriculum, national assessment, and national reporting.

Australian Institute for Teaching and School Leadership (AITSL)

The Australian Institute for Teaching and School Leadership (AITSL) provides national leadership for the Australian, State and Territory governments in promoting excellence in the profession of teaching and school leadership.

Android

Android refers to a computer operating system for a mobile device that has been developed by Google as opposed to Apple.

App

App is the abbreviated form of the word application. An app is a digital product that can be downloaded onto a smartphone, tablet or another electronic device (Macquarie Dictionary, 2015). An app typically refers to software used on a smartphone or mobile device.

Bee-Bot

A Bee-Bot is a brightly coloured programmable robot that is attractive to young children. Bee-Bots are particularly useful for teaching directional language, mathematics, and programming to young children.

Blog

A blog is an abbreviation for a "weblog", which is a website used to record information, in the form of text, images, media and data.

Bring Your Own Device (BYOD)

BYOD refers to students rather than schools purchasing hardware such as tablet computers or laptops.

Chatter Block

The Chatter Block is a cube that can be used to create stories. Each face has a clear pocket to put a picture. The Chatter Block can record a message on each of six faces. The Chatter Block is ideal for writing stories, communicating information, speaking and listening and as a phonic resource.

Digital Education Advisory Group (DEAG)

An Australian government advisory group to continue the work of the digital education revolution.

Digital Microscope

The digital microscope used in this research was simple to use and has a magnification of $\times 43$. A computer screen captures the images for sharing via a USB.

Early Childhood Education (ECE)

The phase of education from the age of zero to eight years old.

Electronic book (e-Book)

A digital book that can be interactive and can include text, images, audio and video.

Elementary

A stage of children's education commonly used in the United States. It is the primary stage education for children between the ages of 5 or 7 and 11 or 13.

Humanities and Social Sciences (HaSS)

A learning area in the Australian curriculum that includes, geography, psychology, and economics.

Independent Public School (IPS)

A term used in Western Australia for a Department of Education school where the Principal has increased flexibility and responsibility to make a range of decisions about school operations.

Intensive Unit

A unit of study that is delivered over a short period such as four consecutive days rather than over a more extended period with weekly sessions.

Interactive whiteboard (IWB)

A large interactive display board that is connected to the Internet.

Kindergarten-Year 12 (K-12)

K-12 is a shortening of kindergarten-Year 12 which are the first and last years of formal and normally compulsory education in countries such as Australia, Canada, and the United States.

iPad

An iPad is a multipurpose touch screen mobile computing device. A key educational feature of the iPad is the ability to be a producer of learning not just a tool for information consumption.

Metal Detector

The metal detector used in this study is a simple to use brightly coloured device used for detecting metals. It has a range of 40mm and holds a charge for three hours use.

Mobile Learning or mLearning

mLearning is a relatively new term because it is the fastest growing area of ICT in education, and consequently definitions are continuously changing. Traxler (2010) defined mLearning as "any educational provision where the sole or dominant technologies are handheld or palmtop devices." For this study, mLearning devices include devices that are mobile and readily picked up and moved by the learner, for example, tablet computers and Bee Bots.

NVivo

NVivo is software that supports qualitative and mixed methods research. It is designed to help organize, analyze and find insights in unstructured, or qualitative data like interviews, open-ended survey responses, articles, social media and web content.

Parents and Citizens Association (P & C Association)

Name given to the parent body at Department of Education schools in Australia. The P & C Association is responsible for fundraising to purchase additional mLearning resources for a school.

Pre-Primary (PP)

PP is the first year of compulsory education for children in Australia who are aged between four and five years old.

Pre-Service Teacher (PST)

A PST is a student teacher completing a University teacher training course.

Professional Experience

Field experience is undertaken by PSTs during teacher training course.

Quick Response (QR) Code

A two-dimensional barcode image that can be scanned using a device such as a smartphone or a tablet computer which has a QR code reader to take you directly to a website.

Recordable Rainbow cards

These are recordable A6 cards that come in bright colours. The cards can be decorated and wiped clean, and messages can be recorded on them.

Recording Pegs

These brightly coloured pegs can be clipped onto a variety of surfaces or attached magnetically. They are used to record and play a ten-second message. They can be used inside and outside to make talking displays.

School of Education (SoE)

A teacher training facility operating as a school within a University.

Smartphone

A smartphone is a mobile phone connected to the Internet. The Apple version is called the iPhone, and there are various Android versions. A smartphone can take photos, record audio, and video, make notes and integrate all these features easily with the Internet.

SPSS

Statistical Package for the Social Sciences (SPSS) is a software package used for statistical analysis in fields such as health and education.

STEM (Science, Technology Engineering and Mathematics)

A group of subjects containing science, mathematics, technology and engineering.

Story Sequencer

The Story Sequencer is used to create talking stories or timetables. Each of the sequencer's six frames becomes a place to store a picture and a short message. It is easy to use with a simple on/off button.

Talking Butterflies

These recording devices transform into a range of winged creatures. They are simple to use, just record and play and allow up to 500 playbacks before the battery needs replacing.

Teacher Education Ministerial Advisory Group (TEMAG)

The Australian government has established a Teacher Education Ministerial Advisory Group to provide advice on how teacher education programs could be improved to better

prepare new teachers with the right mix of academic and practical skills needed for the classroom.

TPACK

TPACK refers to technological, pedagogical and content knowledge which are required when teaching with technology (Koehler and Mishra, 2009).

Chapter 1 The Research Defined

1.1 Introduction to mobile learning (mLearning)

This research explores the implementation of mobile learning (mLearning) in early childhood education (ECE) at two public schools in the metropolitan area of Perth, Western Australia, through the lens of school–university partnerships. The partnerships require pre-service teachers (PSTs) from a local University to deliver lessons using mLearning to early childhood children at partner schools.

The term *mLearning* (sometimes spelled *M-learning*) is a relatively new term because it is the fastest growing area of Information and Communications Technologies (ICT) in education (Traxler & Vosloo, 2014), and consequently definitions are continuously changing. Traxler (2005, p. 262) defined mLearning as “any educational provision where the sole or dominant technologies are handheld or palmtop devices”. For this research, mLearning includes devices that are mobile and readily picked up and moved by the student – for example, tablet computers and Bee-Bots.

According to the Organisation for Economic Co-operation and Development (OECD) (2015), mLearning is ideal for the early childhood setting and has been shown to have a positive impact on student learning. Pegrum, Oakley, and Faulkner (2013) supported this premise in a study of Western Australian independent schools, where they found that mLearning improved both student motivation and overall learning.

The ICT revolution in education has vastly increased the breadth of mLearning resources available to facilitate the teaching and learning process (C. Clark, Zhang, & Strudler, 2015). Touch-screen devices, such as tablet computers, are widely available,

combine many functions in one, and support play-based, creative and individualised learning. Schools are also increasingly seeing the potential for using mLearning devices in addition to computers or laptops (Lock, 2015). In the classroom, mLearning devices provide the greatest potential for transformational change (Ally, 2009). However, mLearning is not widely used in the early years of education (Blackwell, Lauricella, & Wartella, 2014). Despite the inclusion of technology in the Western Australian curriculum, a common societal view is that mLearning is not necessary at this early educational phase (A. Simon, Gingold, & Schoendorf, 2014). This limited observed use of mLearning in early childhood education suggests a need for research to investigate why teachers have been slow to utilise mLearning in early childhood settings.

This research involved early childhood practising teachers and PSTs, academics, school leaders and parents and carers working collaboratively to develop collective knowledge on mLearning implementation in the early childhood setting. The researcher hypothesised that many practising teachers have sophisticated pedagogical knowledge (PK) but may not have been exposed to the latest developments in mLearning. Early childhood PSTs at a Western Australian University (the University), however, might have well-developed technological knowledge (TK), learnt through engaging with specific ICT integration units offered as part of their teaching course. This research sought to determine the extent to which practising teachers and PSTs could help each other in the mastery of mLearning in the classroom for the benefit of student learning. The research adopted an interpretive approach, using a longitudinal case study design, to generate data over a three-year period.

In this chapter, the purpose of the research is presented first. The aims and objectives follow. Thirdly the research questions are presented. Finally, the significance of the research, followed by a delineation of the organisational framework of the thesis is provided.

1.2 Purpose of the research

This research set out to extend the currently limited research on mLearning in early childhood education, through examining mLearning interventions at two partner schools. As stated, mLearning is a relatively new phenomenon and few researchers are studying it in the early childhood phase of education. The early childhood phase of development is a pivotal stage in children's learning and development (Australian Government Department of Education, Employment & Workplace Relations, 2012). The Early Years Learning Framework (EYLF) guides early childhood educators in Australia and indicates that children need to use ICT to investigate and problem-solve and that learning should be play-based. ICT and play-based learning are terms that few researchers have investigated together (Hesterman, 2013).

Recent rapid advances in mLearning resources in schools have made the need for this sort of research urgent. If schools have mLearning resources available in early childhood education, then research is required to examine the extent to which these mLearning resources are educationally beneficial to children. This research did not focus exclusively on any particular mLearning tool, although it is acknowledged that the main mLearning tool available in schools is the tablet computer, which in most cases in Western Australia is the Apple iPad. iPads were released in 2010, and the education sector was responsible for 60% of the iPads purchased (Gentile, 2012).

In 2015, the Western Australian curriculum mandated digital technologies for pre-primary children. At the pre-primary stage of development, children are expected to develop computational thinking and to use digital systems. The Western Australian curriculum defined digital technologies as:

Any technologies controlled using digital logic, including computer hardware and software, digital media and media devices, digital toys and accessories and

contemporary and emerging communication technologies. (School Curriculum & Standards Authority, 2015)

This research used digital toys (Bee-Bots) and digital media (microscopes) to provide new knowledge on how these mLearning tools impact on children's learning in the newly mandated digital technologies curriculum and other curriculum areas. This research provides early childhood educators and school leaders with some practices to assist with mLearning implementation, to support the digital technologies curriculum, and to inform learning in other areas of the curriculum.

1.3 Aim

The aims of the research were to investigate mLearning in early childhood education and to examine the school–university partnerships that were established for this purpose. The benefits and challenges of mLearning at the two schools were examined in terms of the following five considerations:

1. The level of engagement that children exhibited in working with mLearning technologies.
2. How the authentic experiences contributed to the learning of PSTs.
3. How the synergy between practising teachers and PSTs helped each to master mLearning for the benefit of student learning.
4. How the partnership contributed to the practising teachers' technological knowledge (TK).
5. How the partnerships contributed to mLearning in the school and university communities.

The research was concerned with understanding educational change with regard to mLearning through a series of mLearning interventions in two school contexts. Through

these interventions which involved practising and PSTs, the research aimed to generate an in-depth understanding of the relative merits of:

- mLearning in early childhood education.
- Practising teachers and PSTs working together to build pedagogical and technological knowledge.
- Creating a school–university partnership model.

The research has generated a rich data set that can be used to inform decision-making by school leaders and teachers on the use of mLearning in the early childhood years of education. The research has the potential to bridge the perceived gap between the technological and pedagogical knowledge of the practising teachers for the benefit of early childhood students. The research outcomes contribute to knowledge in two ways: firstly, through investigating mLearning in early childhood education, an area of paucity in the literature; and secondly, through examining the effectiveness and sustainability of school-university partnerships.

1.4 Research questions

To achieve the aim of the research and to make knowledge contributions that may augment the existing literature, two research questions were developed to guide the conduct of the research:

1. What are the benefits and challenges for schools and the University of adopting mLearning in ECE?

This research question is complex. Any investigation into the benefits and challenges of educational innovations should consider a range of factors. The factors considered in this research were the use of mLearning technologies in the classroom, what impact they might have on young children, and how teachers' technological knowledge and mLearning skills shift. PSTs at the University develop a high level of technological competence in mLearning as they progress through a degree, however, they lack experience in teaching. Conversely, practising teachers typically have sophisticated pedagogical knowledge, but not many have been exposed to the latest developments in mLearning (Koh, Chai, & Tsai, 2014). This research question investigates the nature of any synergy between practising teachers and PSTs using a partnership approach.

2. What are the impacts of mLearning implementation in schools on school-university partnerships?

This research question is about the benefits and challenges of the mLearning partnership model for school and university participants and community members. Parents and caregivers had access to the latest knowledge about the potential of mLearning as opposed to having to rely on unverified media reports on the benefits and challenges of mLearning. Partnerships between university and school communities have high potential in terms of sharing ideas, generating knowledge, and improving practices (Walsh & Backe, 2013). By investigating the process underpinning the conduct of the research and its relationship to sustainable change, other universities and their communities have a model to consider for implementation in their respective contexts.

1.5 Significance of the research

As noted earlier, research into mLearning as such is embryonic and so the literature on mLearning in early childhood is even more limited. In such a rapidly evolving environment, traditional methods of conducting and publishing research can seem protracted, particularly where professionals face a lack of knowledge. Research ought to provide a bridge between theory and practice in ways that are collaborative and mutually beneficial for both researchers and practitioners.

The rationale underpinning this research revolves around whether mLearning can be shown to broaden and enrich education in the early childhood setting. Children can only benefit from mLearning if those responsible for their education – namely, parents and carers, teachers and school leaders – have the necessary skills to guide them. This research enabled participants to increase their knowledge and skills, for example:

- School leaders had access to the latest pedagogical and technological knowledge and could use this to inform strategic planning.
- Practising teachers had access to a curriculum designed by PSTs specifically for mLearning in early childhood education.
- PSTs were provided with an authentic environment where they could teach using mLearning. They also had access to the input of practising teachers with highly developed pedagogical skills.
- Parents and carers had access to the latest knowledge about the potential of mLearning.

1.6 Research design and methodology

A collective case study methodology was chosen for this research because an intense focus on each case yields extensive and varied data. The data collected at each case site yielded thick verbal descriptions enabling the researcher to examine the characteristics of the mLearning partnerships. A longitudinal approach was used where the data were collected over a three-year period.

This research used qualitative research methods to construct meaning from social experiences that arose as a result of the school-university mLearning partnerships. Quantitative data was also collected in the form of Likert survey data and information from the schools' official publications. The quantitative survey data collected in this research complemented the qualitative data collected in the semi-structured interviews, focus groups, field observations, memoing and surveys to provide rich descriptions of the cases studied.

The qualitative data was analysed using a series of steps to reduce the data so that meaningful representations could be made. The data was coded using open, axial and selective coding procedures. NVivo software which is a qualitative data analysis software tool was used to simplify the qualitative data through coding. NVivo was used to manage, shape and make sense of the qualitative data collected. The quantitative data collected in this study was Likert survey data which was collected using Survey Monkey and imported into Statistical Package for the Social Sciences (SPSS) (version 23). Exploratory factor analysis was conducted using SPSS (version 23) to reduce the data and group the survey items into themes with a shared variance.

1.7 Thesis framework

There are nine chapters in the thesis. Table 1.1 provides an overview of the chapters.

Table 1.1
Overview of the Thesis

Chapter	Content
Chapter 1	Introduction
Chapter 2	Literature Review
Chapter 3	Methodology
Chapter 4	Findings from the PSTs
Chapter 5	Findings from the Practising Teachers
Chapter 6	Findings from the Schools
Chapter 7	Findings from the University
Chapter 8	Discussion
Chapter 9	Conclusion

1.7.1 Chapter 1.

This chapter presents the aims and purpose of the research along with the research questions that guided the research. The significance of the research and an overview of the methodology is followed by an outline of the ten chapters that comprise this thesis.

1.7.2 Chapter 2.

Chapter 2 is a review of the literature surrounding the research topic, including the benefits and challenges of mLearning in early childhood education from school and

university perspectives. The literature review defines mLearning and early childhood education. The final part of the chapter examines school–university partnerships and the associated benefits and challenges. The literature review informs the research and frames the findings and subsequent implications of the research.

1.7.3 Chapter 3.

The methodology, introducing the theoretical framework that underpins the research is delineated in Chapter 3. There is a description of the research methods used, together with an outline of the specific qualitative and quantitative methods. The research was longitudinal using a case study approach with two public primary schools being the two cases examined. The chapter contains a description of the methods of data collection – namely, surveys, focus groups, semi-structured interviews, field observations and memoing. The description of the method of data analysis and the research limitations is followed by a discussion of the ethical considerations of the research.

1.7.4 Chapter 4.

Chapter 4 is the first of four chapters that present the results gathered from field observations, interviews, surveys, and focus groups with the practising teachers, PSTs, and lecturers. This chapter contains the findings pertaining only to the PSTs.

1.7.5 Chapter 5.

The results collected from the practising teachers are presented in chapter 5. The results were from field observations and interviews with the practising teachers.

1.7.6 Chapter 6.

The findings from the school leaders and community members, including parents and carers are presented in Chapter 6. The findings were collected from interviews and surveys,

and were considered under each of the cases studied. Results about leadership, professional development, technical support, and mLearning resources are presented in this chapter. Data surrounding the impact of the mLearning partnerships on the school communities are also presented.

1.7.7 Chapter 7.

The findings from the University academic staff and associated community are presented in Chapter 7. The findings, collected from interviews and focus groups and during field observations, reveal how the mLearning partnerships contributed to mLearning in the University community.

1.7.8 Chapter 8.

The interpretations and synthesises the findings from chapters 4–7, addressing the research questions are presented in Chapter 8.

1.7.9 Chapter 9.

Chapter 9 is the concluding chapter. It summarises the findings and presents the recommendations that arise out of the research.

1.8 Personal statement

The reason for undertaking the research on mLearning in early childhood education was because it is an area undergoing rapid change. It is also a controversial area of research as there is much media coverage on the negative aspects of young children and technology. The researcher had a personal interest in mLearning and felt that there was a gap in the technological knowledge banks of practising teachers and PST. Undertaking this research provided practising teachers, PST, parents and school leaders with the opportunity to see children using developmentally appropriate mLearning tools to support their learning.

Gauging the feedback from these participants contributed to the researcher's passion for seeking new ways to enhance children's learning.

1.9 Conclusion

This research aimed to track how school–university mLearning partnerships could assist with mLearning integration in early childhood education for the benefit of children's learning. Ultimately, this research provides a platform for understanding how practising and PST can work together to share skills in technology and pedagogy for successful mLearning integration in early childhood education.

Chapter 2 Literature Review

2.1 Introduction

The purpose of this research was to explore the implementation of mLearning in early childhood education (ECE) at two partner public schools in the metropolitan area of Perth, Western Australia. The school-university partnerships in this research were integral to the development of change in the use of mLearning. The study is informed by existing research. The literature identifies what is already known about mLearning in early childhood education and school-university partnerships. Table 2.1 presents the structure of the literature review.

Table 2.1
Overview of Chapter 2

Section	Heading
2.1	Introduction
2.2	Conceptual framework
2.3	Section one: mLearning in ECE
2.3.1	What is mLearning?
2.3.2	Mobile learning
2.3.3	Technology, new technologies, and educational technology
2.3.4	ECE
2.3.5	Young children and mLearning
2.3.6	The Internet and young children
2.3.7	The International context of mLearning
2.3.8	The Australian context of mLearning
2.3.8.1	Early Years Learning Framework
2.3.8.2	Digital Education Revolution
2.3.8.3	National Broadband Network
2.3.8.4	National Professional Standards for Teachers
2.3.8.5	ICT in the curriculum
2.3.8.6	Digital literacy and science, technology, engineering and mathematics
2.3.8.7	The Western Australian context of mLearning
2.3.9	Section one summary
2.4	Section two: Benefits of mLearning in ECE
2.4.1	Learning in the 21st century
2.4.2	Benefits for the classroom teacher
2.4.3	Benefits for the pre-service teacher
2.4.4	Benefits for the school community
2.4.5	Section two summary
2.5	Section three: Challenges to mLearning in ECE
2.5.1	Classroom challenges
2.5.2	Community challenges
2.5.3	School challenges
2.5.4	University challenges
2.5.5	Section three summary
2.6	Section four: School–university partnerships
2.6.1	Partnerships
2.6.2	School–university partnerships
2.6.3	Benefits of school–university partnerships
2.6.4	Challenges to school–university partnerships
2.6.5	Section four summary
2.7	Chapter conclusion

2.2 Conceptual framework

This literature review examines the literature in four sections: mLearning in early childhood education, the benefits of mLearning, the challenges of mLearning, and school– university partnerships. Section one, mLearning in early childhood education, defines mLearning and early childhood education in the context of this research. Following a definition of mLearning and similar terms used by researchers, there is an overview of children’s use of the Internet. Children’s Internet use is relevant as mLearning devices include smartphones and tablet computers that connect to the Internet and are increasingly used by young children. Section one concludes by considering mLearning in the particular context of early childhood education.

Section two reviews the literature on the benefits of mLearning in early childhood education. mLearning has been shown to increase engagement and support skills for the 21st century learner. The term *21st century learning* is used around the world and includes the skills of digital literacy, collaboration, critical thinking, communication, and problem-solving. The benefits of mLearning in early childhood education are reviewed from three perspectives – namely, the classroom teacher, the PST (pre-service teacher), and the school community which includes parents.

Section three reviews the literature on the challenges to mLearning in early childhood education. Four areas are considered – classroom, community, school, and university. The final section of the literature review discusses school–university partnerships, which were examined using the theory of alliances framework (Iyer, 2003). The literature focuses on the purpose of and reasons behind partnerships in general and then school-university partnerships in particular. The benefits and challenges of school-university partnerships follow. These four

sections are important because together they inform the research questions that guided the study.

The four sections of this literature review influenced the focus of the research, which was to explore the implementation of mLearning partnerships in early childhood education at two public schools in the metropolitan area of Perth, Western Australia. Section one, mLearning in early childhood education, is important because it defines mLearning so that the reader is clear what the term means in this research. Sections two and three review the benefits and challenges to mLearning in early childhood education. A sustainable mLearning partnership will be affected by both benefits and challenges. The final section, partnerships, is important because school-university partnerships provide in-situ opportunities for new ideas, such as mLearning implementation to be trialled. A stable partnership provides the opportunity to explore the benefits and challenges of mLearning in early childhood education by connecting theories and ideas learnt in a University with practice in the classroom. The conceptual framework illustrates how the four sections underpin the research (Figure 2.1).

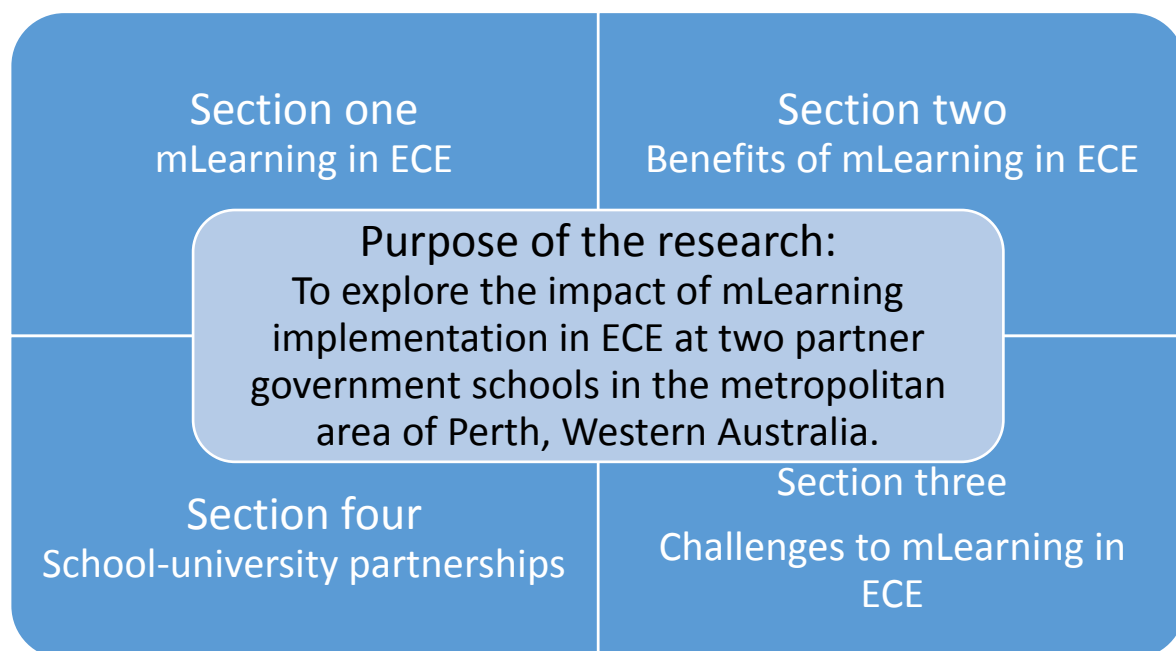


Figure 2.1. The four sections of the literature review.

2.3 Section one: mLearning in early childhood education

The first section of the literature review presents a definition of mLearning (mobile learning) along with how it contrasts with non-mobile learning. This section defines the early childhood phase of learning and reviews young children's access to the Internet because young children mostly connect to the Internet using mLearning devices (Holloway, Green & Livingstone, 2013).

2.3.1 What is mLearning?

The term *mLearning* is a contraction of the words *mobile* and *learning*. The term has different meanings to different authors. For this research, *mLearning* means using a mobile tool for educational purposes. Researchers sometimes use different terms when referring to mLearning, such as technology, new technology, or educational technology. All these terms describe mobile devices that do and do not connect to the Internet. mLearning devices – for example, tablet computers and programmable robots such as Bee-Bots and robotic Lego – are light and, therefore, mobile, which means they can be used anywhere. Crompton (2013) defines mLearning as “learning across multiple contexts, through social and content interactions, using personal electronic devices” (p. 4). It has been reported that research on mLearning, particularly in early childhood education, is not extensive (Bittman, Rutherford, Brown, & Unsworth, 2011; Mazzoni, Nicolò, Sapio, & Isaias, 2015).

Fullan (2014) describes deep learning as a partnership between students and teachers enabling students to master the process of learning. For the 21st century learning is the process where students gain the competencies necessary to prepare them for a creative, connected and collaborative future. Technology can be used to create new knowledge in the real world. Access to digital technology enables learning to occur inside and outside of traditional school settings.

Meaningful learning with technology is learning using technology where the focus is on the learning and not on the technology. Meaningful learning occurs when students are willfully engaged in meaningful tasks which are active, constructive, intentional, authentic and cooperative (Jonassen, 2008). When students are able to inquire, experiment, design, communicate, collaborate, write, model and visualise using technology, their learning becomes meaningful. The characteristics of meaningful learning will be used as a focus when observing children in the classrooms throughout this research and are incorporated into the observation instruments. Technology may not teach students but meaningful learning occurs when technology is used in a meaningful manner.

The NMC Horizon Report: K–12 Edition is an annual publication from the US New Media Consortium that predicts trends in educational technology and offers a timeframe for technologies to become mainstream in schools. In the 2013 K–12 Edition, mLearning was placed on the near horizon, meaning it was almost mainstream for schools in the United States (New Media Consortium, 2013). The European edition of the 2014 Horizon Report placed mLearning two to three years away, indicating that the United States was leading Europe in mLearning (New Media Consortium, 2014). The 2015 Horizon Report placed the adoption of BYOD (bring your own device) on the near horizon and made no specific mention of mLearning (New Media Consortium, 2015), supporting the 2014 claim by Handal, Ritter, and Marcovitz (2014) that the term *mLearning* would disappear as it became an everyday pedagogy used in 21st century classrooms. If mLearning is to become an everyday tool, then how it will be used in early childhood education is worthy of investigation. This is the justification for this research.

2.3.2 mLearning.

mLearning uses tools that are mobile and, therefore, not confined to use in any specific location. Traditionally, technology in education has been segregated from the classroom, being mainly carried out in computer laboratories (Kiili, 2003); but the increased availability of mobile devices such as laptops and tablet computers is enabling children to use mobile devices within the classroom (Henderson & Yeow, 2012). The mobile nature of tablet computers in particular means they can be easily stored and accessed in classrooms and spontaneously integrated into the curriculum (Hutchison & Beschoner, 2015). Mobility enables students to use mLearning outside the classroom in informal learning environments, which have been found to promote interactions between students and engagement with learning (West, 2013). Boyce, Mishra, Halverson, and Thomas (2014) found that using iPads on nature excursions was a powerful way to increase students' interest and foster curiosity in science. Male and Burden (2014) posited that mLearning would have an effect on education not seen since the introduction of the printing press because mLearning has the ability to transform and extend learning beyond the walls of the classroom.

A challenge associated with the portable nature of mLearning devices is that they can become lost or damaged when moved from location to location. A further challenge is providing on-going technical support. In schools, mLearning devices are often shared amongst classes. Without specific guidelines, devices quickly become cluttered with photographs and applications that can make them slow and ineffective. mLearning devices such as iPads and Bee-Bots also require charging, so if teachers do not return them to a charging station after use, they may become discharged for the next user (Moorefield-Lang & Meier, 2014).

2.3.3 Technology, new technologies, and educational technology.

Technology refers to the application of scientific knowledge in a practical setting (Collins, 2014). Technologies arise in response to an identified need and bring benefits to industry or commerce. Technologies developed for industry and commerce often end up being useful tools in education; for example, the printing press, the pencil, and television. New technologies such as smartphones and tablet computers are less than 25 years old and were not specifically designed for education, but they can serve as educational tools even if educators sometimes need to repurpose them for teaching (Traxler, 2014). Educational technology includes technologies that do not require the Internet, such as programmable robots as well as those that do require the Internet, such as tablet computers (Bartolini Bussi & Baccaglioni-Frank, 2015).

2.3.4 Early childhood education (ECE).

In Australia, early childhood education includes the education of children aged between zero and eight years old. Children can start kindergarten (which is not compulsory) in the year they turn three or four. Cost free kindergartens are attached to public schools, and private kindergartens exist in childcare centres and fee-paying schools. The compulsory school-based years of early childhood education in Australia are pre-primary (PP), Year 1 and Year 2.

Play-based learning is central to early childhood education, for it is through play that children interact socially with peers and teachers to construct meaning and understanding (Cutter-Mackenzie & Edwards 2013; Froebel & Jarvis 2003). Lev Vygotsky (1978) laid the foundations of social constructivism when he proposed that cognitive development involves active internalisation and problem-solving processes that occur through mutual interaction between children, parents, and peers. mLearning devices can act as scaffolding tools for

children, in the zone of proximal development who need additional assistance to achieve a task. mLearning devices have emerged as well suited to social constructivism and student-centred learning (Cochrane & Bateman, 2010), as well as play-based learning (Ebbeck, Yim, & Lee, 2013). Government policies are shifting towards more child-centred pedagogies (Gallo, 2007).

The early childhood years of education are key developmental stages and critical to brain function (Menon, 2013). Early childhood educators need to balance the demands of an externally imposed content driven curriculum with the need to support developmentally appropriate learning styles for young children. Play stimulates the formation of new brain pathways in young children, so enhancing children's cognitive abilities (Van Hoorn, Nourot, Scales, & Alward, 2014). Early childhood educators in the 21st century need to guide children in creative, open-ended play-based learning experiences in order to maximise learning opportunities (Nell, Drew & Bush, 2013).

2.3.5 Young children and mLearning.

mLearning tools such as tablet computers and Bee-Bots are well suited to the early childhood setting because of their user-friendly design (Hutchison, Beschorner, & Schmidt-Crawford, 2012). Bee-Bots are small and light and have a bright appearance designed to attract young children. The iPad is simple for young children to use because there is no mouse or keyboard required (Verenikina & Kervin, 2011). Tablet computers are so easy to use that it makes them a good choice for early childhood education because children can pick them up with little direction or modelling from adults (Holloway et al., 2013). It has been reported that young children are usually enthusiastic regarding the use of mLearning, are active learners, readily accept technology, and have fun using it (Pudaruth & Bahadoor, 2011). Children using tablets have been shown to solve technological problems and do not

have to wait for technical support that would be necessary when using other types of ICT such as desktop computers (Couse & Chen, 2010).

2.3.6 Young children and the Internet.

Access to the Internet is growing exponentially in society. The New Media Consortium (2013) predicted that the Internet would become mainstream in schools in the United States within a year. In June 2013, President Obama announced the ConnectED initiative, designed to enrich K–12 education for every student in America. Under ConnectED, 99% of American students will have access to fast broadband in schools by 2018 (The White House, 2015). In 2015, the Western Australian government pledged a \$32.7 million to increase Internet speed in Australian schools and a further \$20 million to primary schools for computer programs (Government of Western Australia, 2015). Internet access has become an integral part of living in the 21st century and has changed the way people communicate, socialise, bank, shop, access information, and learn. The prevalence of the Internet in the lives of young children means that they are spending more time exposed to media and technology (Hesterman, 2011a). The trend in the use of the Internet by children between the ages of five and eight has steadily increased from 38% in 2006 to 60% in 2009 (ABS, 2010). In 2015, the Australian Bureau of Statistics (ABS) reported that 79% of children aged between five and eight had access to the Internet at home, and each week engaged in ten hours of computer screen time, fifteen hours of television, and five hours riding a bicycle.

In 2014, Common Sense Media revealed that 75% of American children aged eight or under had access to the Internet. Children under nine routinely use the Internet to watch videos, play games, search for information, do homework, and socialise (Holloway et al., 2013). One-quarter of all Facebook users worldwide are under ten, which illustrates that

young children are using the Internet to access social media sites (Australian Government Department of Education and Training, 2013). Internet access from mobile devices overtook access from desktop computers in the middle of 2013 and Internet access using mobile devices is expected to exceed 90% by 2017 (Statista, 2014).

2.3.7 International context of mLearning

mLearning in schools is affected by access to the Internet and policies regarding science, technology, engineering and mathematics (STEM). Current government policies in New Zealand, the United States, and the United Kingdom acknowledge the importance of digital technology and access to the Internet in early childhood education (Neumann & Neumann, 2014). The international context of mLearning in schools is affected by broadband plans which enable Internet access in schools. Governments around the world have implemented a range of strategies to prepare students for the 21st century. A snapshot of initiatives in England, Hong Kong, Portugal, South Korea, Turkey and the USA are presented to illustrate mLearning initiatives in Europe, Asia and the USA. Similar initiatives are occurring in other countries and those presented in this chapter are not intended to be exclusive. The initiatives demonstrate that governments globally are looking for ways to improve education systems by incorporating digital technologies.

In England, the Department of Education has established outcomes for computing for all stages of education in its National Curriculum (Department of Education, 2013). In the early years, children are expected to understand algorithms, create and debug simple programs and use technology purposefully. In 1998, the Hong Kong government initiated a move to reform schools so that pedagogy became more student-centered by using ICT (The Government of Hong Kong Special Administrative Region, 2016). The aim was to have 25% of the curriculum supported by ICT within five years. The Portuguese government launched a

Technology Plan for Education in 2007 with the aim of placing Portugal amongst the top five most technologically advanced countries in Europe. As part of this plan, a laptop was provided to all primary school children (aged 6-10) free of charge or at very low cost. In 2011, the South Korean government invested US\$2.1 billion in technology and infrastructure in schools, developed policies regarding technology integration and provided professional development for teachers. It was mandated in the National Curriculum that 10% of the time spent on each subject should include technology. The Turkish Ministry of National Education introduced state-of-the-art technologies into all Turkish public schools in 2010. Every Turkish classroom installed an interactive whiteboard (IWB), and every teacher and student received a tablet computer. In the USA, the first iPad trial took place in Chicago in 2010 with children in Years 1 and 2. The results from the first trial were used around the world for ongoing trials (Center for Digital Education, 2010). In 2013, the Obama government announced ConnectEd, a plan to provide high-speed Internet to all schools and provide training for teachers in the use of digital content (The White House, 2015).

These initiatives had mixed results but were useful for informing future initiatives. The Government of the United Kingdom reported that technology was used erratically in classrooms despite inclusion in the curriculum (Flewitt, Messer, & Kucirkova, 2014). Some teachers in Hong Kong replaced blackboards and overhead projectors with PowerPoint presentations in order to meet requirements to use technology. In doing so these teachers did not use technology purposely to enhance student learning (The Government of Hong Kong Special Administrative Region, 2016). The laptop initiative in Portugal did not transform schools as the government had hoped, due to lack of preparation and little thought was given to how teachers should change their pedagogical approach (Pereira & Pereira, 2015). In Turkey, there were problems with the infrastructure such that the Internet was only accessible at school through a controlled portal (Akcaoglu, Gumus, Bellibas, & Boyer, 2014). The

issues faced in South Korea and the USA mirrored the problems in Hong Kong, England, Portugal and Turkey.

2.3.8 Australian context of mLearning

Australian Government policies exist indicating the value that Australia places on ICT integration in education. These policies include the Early Years Learning Framework (EYLF), the Digital Education Revolution (DER), the National Broadband Plan and the National Professional Standards for Teachers. In what follows, the Australian context is considered in six areas; namely EYLF, DER, National Broadband Plan, National Professional Standards for Teachers, ICT in the curriculum and digital literacy and science, technology, engineering and mathematics.

2.3.8.1 Early years learning framework (EYLF).

The EYLF (Australian Government Department of Education Employment and Workplace Relations [DEEWR], 2012) conceives of ICT as part of the multi-literacies environment that children will require for full participation in the 21st century. The EYLF recognises the importance of ICT in two of its five outcomes. Outcome four (children are confident and involved learners) and outcome five (children are effective communicators) have ICT embedded within them. An important aspect of outcome four is for children to resource learning through connecting with people, place, technologies and natural and processed materials. Essential components of outcome five are that children use ICT to access information, investigate ideas and represent their thinking and that children engage with a range of texts (digital and printed) and gain meaning from these texts.

2.3.8.2 Digital education revolution (DER).

Schools in Australia and elsewhere have started to invest in mLearning tools, but the initial focus was in secondary schools (McMahon, 2009) where the Australian government invested \$2.1 billion in a DER in 2008 to promote ICT integration into the new Australian Curriculum (DEEWR, 2008). This money was primarily used to fund laptops for secondary schools, broadband connectivity and professional development for teachers. The DER raised the number of computers in Australian schools from approximately 200,000 to over 957,000 in four years. Money was also used to upgrade infrastructure and, as a result, the number of Australian schools with broadband connectivity rose from 47% in 2008 to 60% in 2012. Four years after the commencement of the DER program, many schools choose not to continue with one-on-one laptops programs favouring class sets of computers (Nielsen, Miller, & Hoban, 2014). The Digital Education Advisory Group (DEAG) was established by the Australian government in 2011 to build upon the DER (DEEWR, 2013, p. 5). The DEAG made eight recommendations which were:

- Moving towards a ‘bring your own device’(BYOD) learning environment;
- Support for Australian Curriculum digital resources through the National Digital Learning Resources Network;
- Improved learning through interoperability;
- Strengthening partnerships in education;
- New approaches for learning by building teacher and leadership capacity;
- School learning and teaching plans which demonstrate learning for the 21st century;
- Embedding innovation in learning; and
- Strategies for building capacity in the whole community.

The recommendations illustrated the Australian government’s support for transforming learning to reflect the needs of the 21st century learner.

2.3.8.3 National professional standards for teachers.

The National Professional Standards for Teachers in Australia have ICT embedded in the standards (AITSL, 2012). There are no specific standards for early childhood teachers.

The standards that refer to ICT are shown in Table 2.2.

Table 2.2
National Professional Standards which include ICT

Standard		Lead Teacher Standard	Graduate Teacher Standard
2.6	Information and Communication Technology (ICT)	Lead and support colleagues within the school to select and use ICT with effective teaching strategies to expand learning opportunities and content knowledge for all students.	Implement teaching strategies for using ICT to expand curriculum learning opportunities for students.
3.4	Select and use mLearning resources	Model exemplary skills and lead colleagues in selecting, creating and evaluating resources, including ICT, for application by teachers within or beyond the school.	Demonstrate knowledge of a range of resources, including ICT, that engage students in their learning.
4.5	Use ICT safely, responsibly and ethically	Review or implement new policies and strategies to ensure the safe, responsible and ethical use of ICT in learning and teaching.	Demonstrate an understanding of the relevant issues and the strategies available to support the safe, responsible and ethical use of ICT in learning and teaching.

These Professional Standards guide teacher education institutions in equipping graduates to employ ICT in teaching at the start of their educational career. The standards indicate that practising teachers have to embrace ICT, and lead teachers need to become exemplary role models in the implementation of ICT and selection and evaluation of ICT resources. In 2014 the Teacher Education Ministerial Advisory Group (TEMAG) reported that teacher education providers were not rigorously and consistently assessing PSTs against the professional standards and recommended that robust evidence of PSTs reaching the standards be collected by providers (TEMAG, 2014).

2.3.8.4 National broadband network

The National Broadband Network was an Australian government initiative established in 2012 with the aim of providing all Australian households and businesses with fast broadband by late 2016 (DEEWR, 2015a). It was recognised that without universal access to broadband, students and teachers could not optimize the use of digital learning resources. The Australian Bureau of Statistics (ABS) reported that in June 2015, 99% of Australian households had access to the Internet (ABS, 2015).

Other initiatives operate at the state level, for example, the Public Education Endowment Trust (PEET) seeks to improve the education of Western Australian children. Two of PEET's foci areas, between 2011 and 2015, were technology and early childhood education. PEET recognised that there was a broad spectrum within and between schools in the adoption of the curriculum delivery to include new technologies. This broad spectrum was perhaps due to differing levels of expertise and local decision-making regarding the allocation of mLearning resources.

2.3.8.5 ICT in the curriculum.

By embedding ICT competence into the general capabilities of the Australian Curriculum (ACARA, 2013) children at all stages are given the opportunity to use ICT effectively to investigate, create, and communicate across all learning areas. The National Statements of Learning for ICT, together with their professional elaborations for Years 3, 5, 7 and 9, view ICT as an integral tool in the learning process (Curriculum Corporation, 2006). In addition to having ICT integrated throughout the curriculum, digital technologies became part of the Technologies curriculum in 2015. From 2015 children in pre-primary (PP) were expected to develop an understanding of the characteristics of digital systems, procedures and computational thinking (School Curriculum and Standards Authority, 2015).

The National Digital Learning Resources Network is a collection of more than 20,000 digital learning resources that link directly to the Australian Curriculum. Teachers can access resources through an online portal called Scootle. The Australian government Department of Education supports Scootle, which is managed by Education Services Australia on behalf of all Education Ministers. Scootle contains digital teaching resources for the early years, primary and secondary teachers. Curriculum content is categorized by year level, and underpinned by the Australian Curriculum. Scootle enables teachers to belong to a digital professional learning network, to connect, reflect, collaborate and share information. Teachers can create personalized learning pathways for students using Scootle. Although there is evidence that teachers are accessing Scootle and integrating digital technologies into the classroom, referencing Scootle has not been mandated.

2.3.8.6 Digital literacy and science, technology, engineering and mathematics.

In 2015, the Western Australian Curriculum included digital technologies within the Technologies learning area for all students from pre-primary to Year 8. Teachers will be required to report on students' progress in digital technologies from 2018. Students are required to have knowledge and understanding of digital technologies and use digital technologies to define, design, implement, evaluate and collaborate (School Curriculum and Standards Authority, 2015). The Australian government released a National Innovation and Science agenda in 2015 with the aim of increasing student participation in digital literacy and science, technology, engineering and mathematics. As part of this initiative, the government pledged to invest in promoting science, technology, engineering and mathematics skills to children aged three to five. The initiatives commenced in July 2016 (Australian Government Department of Education and Training, 2015a) so it is too early for an evaluation to have been undertaken.

The EYLF, National Professional Standards for Teachers, Australian Curriculum, Western Australian Curriculum, and National Statements of Learning for ICT are key National documents that teachers must use to plan their teaching and learning programs. All these documents explicitly refer to the value and importance of ICT integration within the curriculum so that children are ready for 21st century engagement. Figure 2.2 illustrates the Australian timeline for recent technology initiatives.

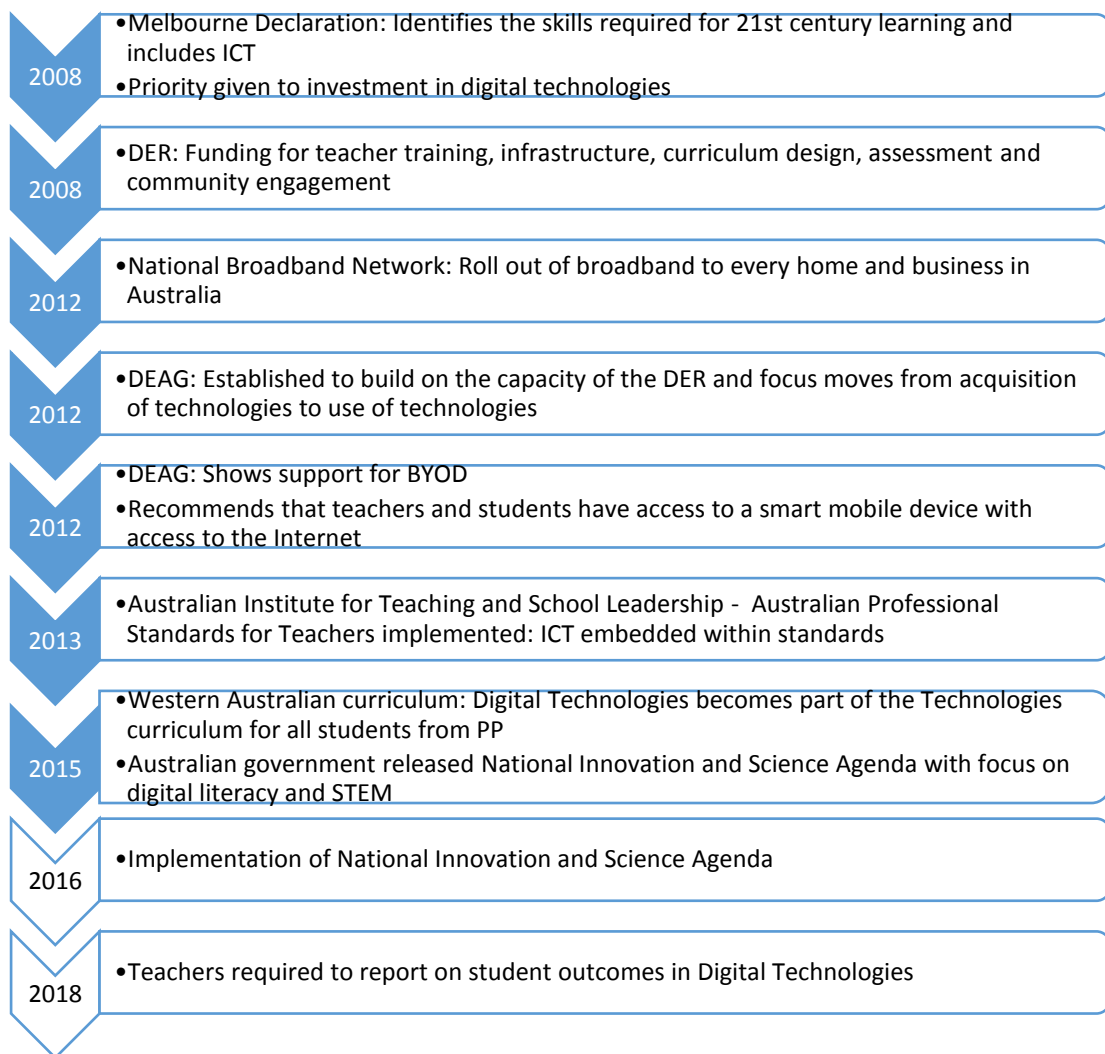


Figure 2.2. The Australian timeline for technology implementation in schools. The timeline spans from 2008-2018.

2.3.8.7 Western Australian context.

In Western Australia, schools fall into three groups: Catholic, Department of Education (public), and Independent. Catholic and Independent schools in Western Australia are non-government schools and charge fees. Figure 2.3 illustrates the percentage of students attending each school category.

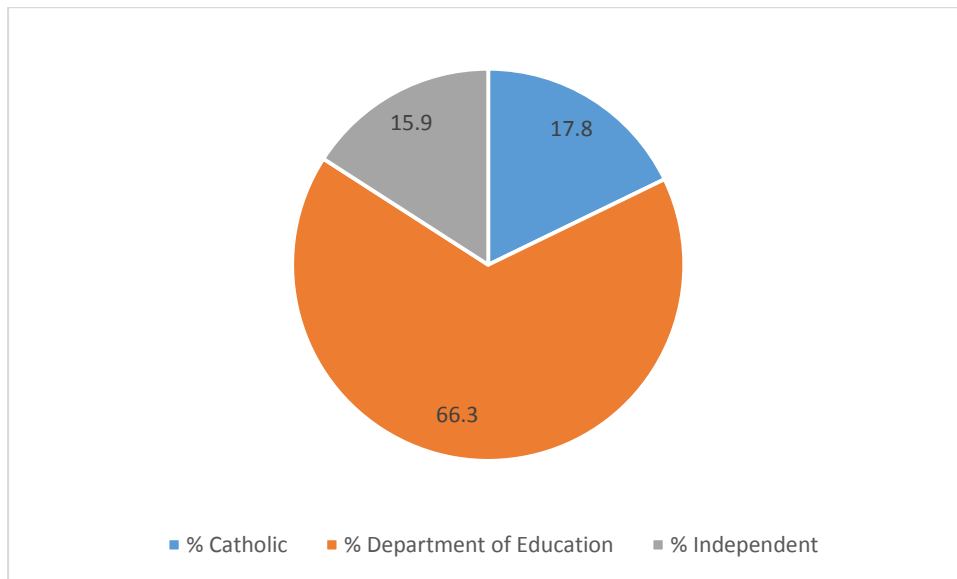


Figure 2.3. Percentage of students attending K-12 schools by sector in Western Australia. Census February 2015 (Government of Western Australia, 2015).

Catholic and Independent schools have more financial autonomy than Department of Education schools and are more likely to be well resourced with technology (Independent Schools Council of Australia, 2016). In 2009, the Australian government launched the Independent Public School (IPS) initiative to give Department of Education schools more flexibility and responsibility. The IPS initiative aimed to build strong communities, give schools greater local decision-making powers and increase the engagement of parents, community groups, business and industry in the life and operation of schools. At the time of the research more than 65% of Department of Education schools had achieved the IPS status

(DEEWR, 2016). IPS schools can recruit their staff and have a greater responsibility for administrating the school, including financial management.

2.3.8.8 *mLearning tools in Western Australian schools.*

In each year of the study, to obtain a snapshot of mLearning tool availability and regularity of use in Western Australian schools all the participating PSTs were surveyed (Appendix C) when undertaking a professional experience in a Western Australian school. The purpose was to contextualize the Western Australian school environment. Figure 2.4 illustrates the technologies available in professional experience schools attended by the PSTs. Figure 2.5 shows frequency of technology used in the early childhood classrooms, and Figure 2.6 illustrates how classrooms used the mLearning tools. An Interactive White Board (IWB) was available in 71% of classrooms whereas iPads/tablets were only available in 44% of classrooms. The IWB was included in the surveys for comparison but was not classed as an mLearning tool.

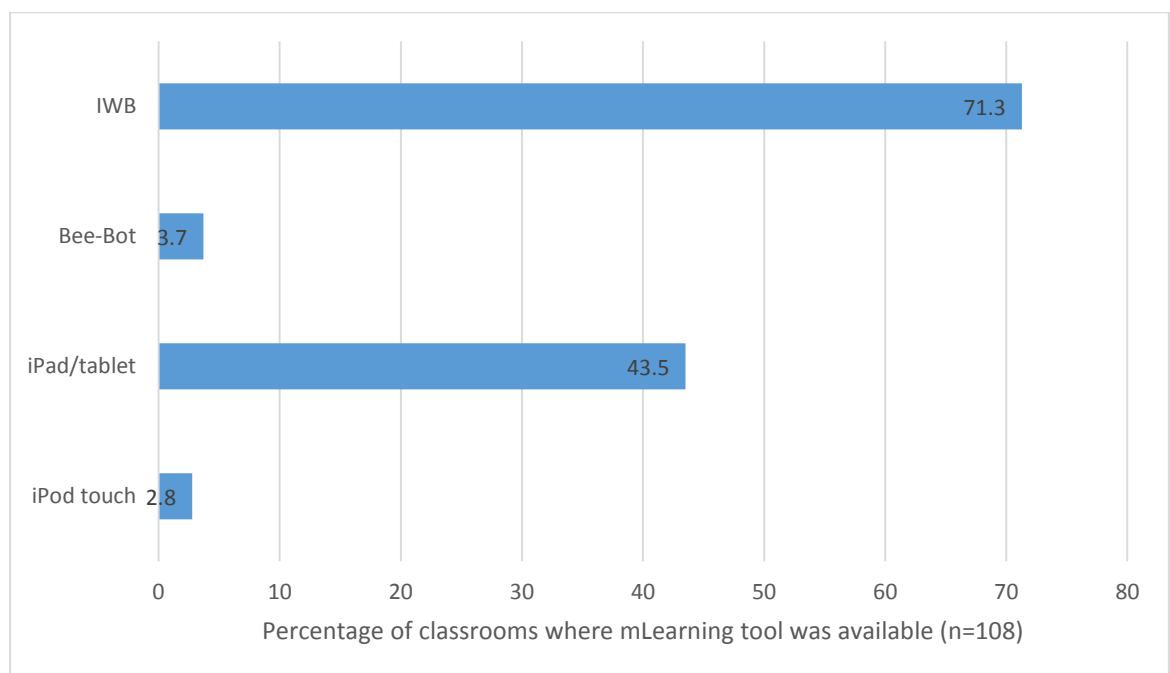


Figure 2.4. The technology that was available in professional experience schools. The figure shows the technology available in the Western Australian schools that the PSTs attended for professional experience.

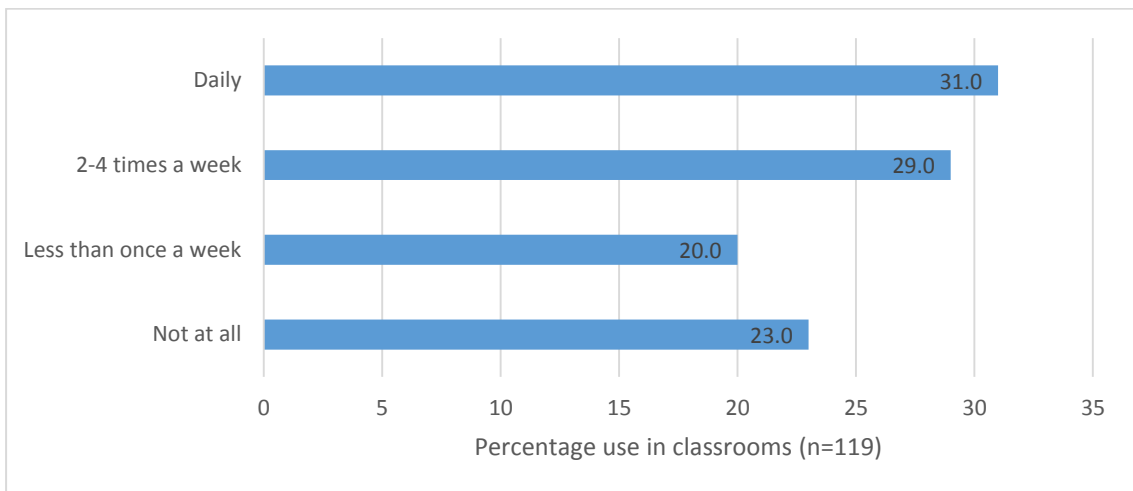


Figure 2.5. The frequency of mLearning use in classrooms at professional experience schools. The figure shows the frequency of technology use in professional experience classrooms.

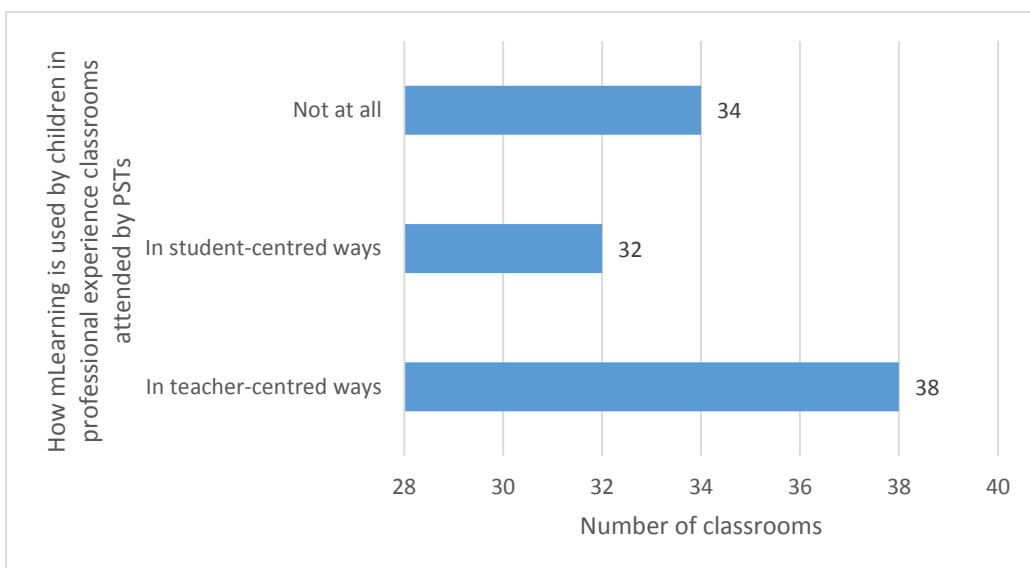


Figure 2.6. mLearning use in the classroom. The figure reflects PSTs' statements about how children used mLearning in professional experience classrooms.

Figure 2.5 indicates that the use of mLearning in early childhood classrooms was quite small and in 23% of the classrooms mLearning was not used at all. The PSTs reported (Figure 2.6) that mLearning was used in teacher-centred (64%) more than in student-centred

ways (50%) which was the method that PSTs were encouraged to use in ICT units undertaken at the University.

2.3.9 Section one summary.

This section of the literature review defined mLearning and other terms used in current research, which are sometimes interchanged with the word mLearning. The review defined the early childhood phase of learning and reviewed children's access to the Internet, which is likely to involve an mLearning device such as a tablet computer or smartphone. Despite the rapid emergence of mLearning in schools, there is a lack of published research on the efficacy of mLearning in early childhood education (Holloway et al., 2013; Lafton, 2012). This study seeks to add to the body of knowledge of mLearning in early childhood education.

2.4 Section two: Benefits of mLearning in early childhood education

This second section of the literature review includes a review of 21st century learning skills which are well aligned with the use of mLearning devices. The section follows with the benefits of mLearning for young children from the perspective of the classroom teacher, PST, and school community.

2.4.1 Learning in the 21st century.

The term *21st century learning* is used around the world and according to Noss (2012), includes the skills of collaboration, communication, digital literacy, creativity, critical thinking, and problem-solving. These skills have been shown to be aligned to mLearning, for example, Male and Burden (2014) found that children interacted with a mobile device in a social and collaborative manner, unlike working on a desktop computer in isolation. In an American study using tablet computers with young children, Geist (2012) found that

mLearning increased collaboration amongst children and did not isolate children from their peers. Henderson and Yeow (2012) found that tablets provided quick and easy access to information and enabled collaboration amongst primary-aged children. In an Australian study of young children aged between four and nine, McArdle and Prowse (2010) found that children were able to use technology to develop effective ways to communicate, and demonstrate understanding. Swan, van't Hooft, Kratcoski, and Unger (2005), in a study of uses and effects of mLearning devices such as tablet computers in classrooms, found that elementary children were motivated to collaborate and communicate more when using mLearning technologies. Children have been shown to communicate with each other more when using robots than when doing puzzles, illustrating that using mLearning is not socially isolating but rather encourages collaboration and communication (Kazakoff & Bers, 2014).

Research has shown that mLearning can be used to develop creativity and imaginative play in young children by making the learning more personal and removing the boundaries imposed by traditional resources (Alper, 2013; Lock, 2015). Bird and Edwards (2015) found that children use mLearning technologies as tools initially in an exploratory manner and when they have mastered the tools they use the tools innovatively to create new play scripts. Hutchison et al. (2012) found that using the iPad to teach literacy rather than a printed worksheet allowed for more creativity because children could express themselves in multiple ways including, audio, video, drawings, text, and photographs. Pegrum et al. (2013) posited that teachers value creative apps that allow young children to tell stories. Geist (2012) found that developmentally appropriate apps encouraged creative problem-solving in young children using a tablet computer. According to Geist, teachers found that many educational apps had closed (unchangeable) content and said that children preferred open apps where they could create their own content. In a similar vein, Flewitt et al. (2014) found that children

engaged more and had richer learning experiences when they could create original content using mLearning tools.

The preceding points illustrate that the quality of the exposure to mLearning and the pedagogical input of the teacher have the potential to affect the learning outcomes for children. Developmentally appropriate use of mLearning under the guidance of a trained educator can enhance children's learning. However, inappropriate use, such as when mLearning is used as a tack on activity or time filler may be detrimental to children's learning (Wood et al., 2012). Teachers and educators of young children need to consider new pedagogies when using mLearning with young children so that exposure is high quality and pedagogy scaffolds children's learning.

2.4.2 Benefits for the classroom teacher.

The following themes are reviewed with regard to exploring the benefits of mLearning for classroom teachers: teaching using tablet computers, teaching new literacy, teaching using programmable robots, and the positive impact of mLearning on young children's learning. Tablet computers such as iPads and Android versions are tools that have the potential to redefine teaching and learning. Since their release in 2010, iPads have gained momentum as tools for teaching (McCombs & Liu, 2011).

Teachers have access to a wide range of apps to support children's learning. The number of educational apps stood at 75,000 in Apple's App Store in June 2016 (Apple, 2016). These apps are largely unregulated and untested as educational apps and therefore present a challenge to teachers searching for educational apps to use in the classroom (Hirsh-Pasek et al., 2015). The Victorian Department of Education had 240 apps listed as educational on its website in 2016 (State Government of Victoria, 2016). Apps vary in quality

and educational potential. A description of some of the types of apps – namely, screencasting, drawing, creating and visualisation – is presented below.

Screencasting apps – such as Explain Everything and Show Me – enable teachers to see how children solve problems. Such apps allow children to draw or write on an iPad and speak about what they have written. Children can write using a stylus or finger and can highlight work and insert graphics. Screencasting apps encourage children to reflect on their thinking and edit their work, leading to improved outcomes for children (Soto & Hargis, 2014). Screencasting apps are useful for children to use and as teacher tools because they are used to explain things. When a child explains something, they tend to reflect on and solidify their own knowledge. Screencasting enables children to communicate their understanding using video, text and pictures.

Drawing apps, such as Doodle Buddy, provide children with tools to create visual images including inserting photographs. Children have a choice of colours and drawing tools (crayons, brushes, chalk, glitter, and so on). Teachers appreciate that the children can be very creative with Doodle Buddy (Hutchison et al., 2012). A study by Couse and Chen (2010) into the use of tablet computers as drawing tools in early childhood reported several positive outcomes and concluded that children's drawings were as expected or exceeded expectations. Couse and Chen (2010) also reported that children quickly developed the skills necessary to use a stylus for drawing after some adult instruction and peer modeling. Despite the technical issues that invariably arose, the children did not display any frustration. Most of the children preferred drawing on the tablet computer to using a paintbrush and showed high levels of engagement. Their reasons for preferring the tablet included its vivid colours and the fact that the ink never ran out. Visualising apps, such as Popplet, enable children to use pictures to convey meaning.

Contemporary literacy goes beyond the printed text. New literacies include the use of multi-modal forms of communication such as printed text, oral language, visual, auditory, gestural, tactile, and special means (Gardiner & Cumming-Potvin, 2015). Changes to print formats are relatively slow compared with changes in multimedia (Schneider, 2015). Such rapid changes can be challenging to PSTs, who are learning to teach with technology. Tablets are said to offer innovative opportunities for teaching new literacies incorporating communication, collaboration, and independent learning, which leads to positive learning outcomes (Flewitt et al., 2014). Literacy apps can assist with reading (e-books), sequencing (Popplet), drawing (Doodle Buddy), retelling (Strip Designer), cause and effect (Sundry Notes), and main idea and details (Cluster). Good apps encourage learning and revision of stories as well as provide an opportunity to create pictures and convey meaning (Østerud, Smørdal, & Sandvik, 2012). Teachers need to distinguish good apps which encourage learning, from poor apps, when choosing mLearning resources to support learning (Hutchison, Nadolny, & Estapa, 2016). Table 2.3 highlights some characteristics of apps that encourage quality learning and those that do not.

Table 2.3
Characteristics of Apps

Characteristics of apps that encourage learning	Characteristics of apps that do not encourage learning
User can create content	Closed unchangeable content
Provides opportunity to extend the learning	Direct substitution for a traditional resource
Allows sharing of knowledge and collaboration	Distracting features such as sound and unnecessary animations
Encourages user to reflect on learning	Rote learning

With regard to e-books, the teacher can control what is on an e-book's bookshelf, and children can choose books in a virtual library using skills similar to those used in an ordinary

library (Korat & Shamir, 2012). The advantages of e-books are that the size and style of the font are flexible and the meanings of words can be quickly looked up. Children can also use virtual sticky notes to make notes, highlights, and reflections, which they are not observed doing when using printed books (Hutchison et al., 2012). Further, e-books support multimedia features that allow children to read or listen to a story, which is particularly useful for struggling readers (Schugar, Smith, & Schugar, 2013). Larson (2015) found that struggling readers preferred reading on a tablet because it gave them privacy so peers would not be able to see what they were reading, especially if they were reading a simpler text than their peers. Animations can also be embedded making the reading experience richer than the traditional print-based experience (Neumann & Neumann, 2014). Hutchison and Beschoner (2015) investigated how tablets could be used to support and transform literacy instruction and found that tablets helped readers to create multi-modal responses to reading by providing new ways to communicate, the opportunity to work collaboratively and the ability to edit work efficiently. Cahill and McGill-Franzen (2013) found that reluctant kindergarten readers increased their interest in reading when reading picture books on tablets, and children showed increased word recognition, fluency, and comprehension.

Traditional literacy is print-based involving reading and writing on pages. New technologies have added extra dimensions to literacy so that communication is not only linked to the written word but includes multimedia such as video, audio, and images as well as the printed word (Kazakoff, Sullivan, & Bers, 2013). As a result of these emerging technologies, being literate in the 21st century also means being digitally literate. Digital literacy is a term used in education and refers to literacy learning using digital tools. Neumann and Neumann (2014) found that tablet computers used under the guidance of a parent or teacher enhanced children's emergent literacy skills, provided there was appropriate scaffolding. The process of making learning visual is important in expanding children's

cognitive capabilities (Alper, 2013). Luke (2000) argued that the hypertext environment of digital literacy enabled children to treat multi-modal information simultaneously in a far more demanding manner than the linear method used when engaging with just printed materials. Managing the iPad with young children has been reported as easier than might be expected, with outcomes in literacy improvement for at-risk readers being demonstrated (Getting & Swainey, 2012).

Programmable robotic toys such as Bee-Bots are concrete and, for this reason, provide hands-on experience for young children to engage with mLearning. Bee-Bots are a good choice for young children as they can stimulate problem-solving and creative role-playing activities (Janka, 2008). Teachers use Bee-Bots widely in the United Kingdom, possibly because the British curricula recommend the use of programmable toys to support learning and Bee-Bots were found to be useful across the curriculum including for literacy, numeracy, science, history, and geography (Janka, 2008). In an Australian study using Bee-Bots, Highfield (2010) showed that children successfully used Bee-Bots in the early childhood setting for mathematics and problem-solving by programming simple commands. Highfield (2010) claimed that the Bee-Bot was an ideal choice as a programmable robot because of its robust nature and highly visual interface that promoted group work. An Italian study with Year 1 children found that the Bee-Bot was a rich tool for teaching geometry, for example by programming the Bee-Bots to move in different directions or at different angles (Bartolini Bussi & Baccaglioni-Frank, 2015).

Sequencing is an important component of early mathematics and literacy education, making it a common theme in early childhood classrooms. The use of symbolic commands to control actions in an appropriate sequence in computer programming makes computer programming an excellent sequencing activity. Computer programming requires creative planning, hypothesis testing and the use of specific language, and so provides a foundation

for digital literacy (Kazakoff et al., 2013). Programmable robots have been shown to improve outcomes in science, technology, computing, engineering, and mathematics (Kazakoff, Sullivan, & Bers, 2013). Kazakoff and Bers (2014) found that young children (between four and seven) showed improvements in sequencing skills as a result of learning to program a robot.

For teachers to consider implementing mLearning into their teaching, the benefits to children's learning must be proven (Baran, 2014). mLearning has been shown by researchers to have a positive impact on student learning and to increase levels of engagement, active participation, and motivation in young children (Boyce et al., 2014; Ciampa, 2014; Chiong, Ree, Takeuchi, & Erickson, 2012). A literature review of the mLearning research conducted between 2007 and 2012 in K–12 schools by Liu et al. (2014), identified 63 studies that were either comparative (21%) or non-comparative in nature (79%). Comparative studies compared an experimental and control group, with the experimental group using mLearning and the comparative groups not using mLearning. Nine of the 13 comparative studies found positive learning gains associated with mLearning, and three showed neutral outcomes compared with traditional learning. Examples of the positive gains included children outperforming comparison children in mathematics, listening and speaking, and learning and retention rates in science. Jeong and Kim (2016) found positive gains including social interactions between children, increased language learning, and increased enthusiasm and engagement in learning.

Other researchers found evidence of positive learning outcomes for children using mLearning tools. Kiger, Herro, and Prunty (2012) for example, found evidence of positive outcomes for children's learning using an mLearning intervention with the iPod Touch in a third-grade mathematics class over a nine-week period. The authors found that children involved in the intervention outperformed comparison children. Usual practices were coupled

with mobile devices in a cost-efficient manner with improvement in student outcomes.

Gomez et al. (2013), in a study with kindergarten children, found that mLearning used as a tool under the guidance of a teacher led to increased outcomes in oral language, logical-mathematical, and social skills. These studies provide teachers with evidence of the beneficial use of mLearning in education but also show that teachers need support to develop their own pedagogical literacy in how to use mLearning to maximise the benefits to children's learning.

2.4.3 Benefits for the PST.

mLearning interventions provide PSTs with real-world experience using mLearning in early childhood education. Such experience is beneficial to PSTs because research has shown that PSTs are underprepared to use mLearning in their teaching. Gill, Dalgarno, and Carlson (2015) found that the PSTs were inadequately prepared to use ICT in teaching and learning in the course of their degree program. The study revealed that PSTs' use of ICT increased when it became an assessment requirement. The inclusion of opportunities for PSTs to reflect on the personal or observed use of ICT within teacher education courses led to improved capacity to use ICT in education (Gill et al., 2015). Teacher education institutions typically use stand-alone ICT units, which demonstrate basic skills and do not allow PSTs to practise and reflect on what they have learned (C. Clark et al., 2015). Some teacher education programs include technology within curriculum areas, but this often occurs in a show-and-have-a-go format without explicit instructions as to how mLearning resources can be used for student-centred learning (C. Clark et al., 2015). A key factor in determining how well equipped PSTs felt to use ICT in their first year of teaching was found to be the expertise and modeling provided by university tutors (C. Clark et al., 2015; Haydn, 2014). Haydn posits that funds should be directed towards training university tutors to use mLearning resources. Research has shown that PSTs use technology in ways demonstrated by university tutors, due to a busy schedule with little time to explore technologies themselves. However, many

university tutors lack the skills required to model effective use of educational technology (C. Clark et al., 2015). Jeong and Kim (2016) claim that PST education needs full integration of technology into curricula so that PSTs are prepared for service. mLearning interventions are beneficial in assisting PSTs to integrate mLearning in future classrooms because they provide opportunities for PSTs to engage in real practice in a supported environment under the guidance of university tutors.

PSTs need opportunities to use technology for educational purposes in the classroom. Young people are often described as digital natives who are experts using technology (Palfrey, & Gasser, 2013). Although young people grow up surrounded by technology, they do not tend to use technology for educational purposes. Schneider (2015) posits that PSTs are not digital natives (educational technology experts) but educational technology learners who need explicit instruction in teaching using technology. Research by Schneider found that PSTs are technology consumers growing up digitally active with computers and phones, but need guidance to move towards being technology creators and instructors. Schneider likened learning to teach with technology to learning a second language. The opportunity for PSTs to gain practise in using mLearning in a real-world setting was beneficial to them because of the additional teaching practise it provided.

An Australian initiative is the Teaching Teachers for the Future project, which was established by the Australian government in 2011 to enable PSTs to become proficient in the use of ICT in education (Education Services Australia, 2011). The project created resource packages at three levels for the early, middle, and senior PSTs, with all 39 Australian teacher education institutions being involved in this project. Anecdotal evidence in Australia suggests that PSTs are increasingly using digital technologies in professional experience and university presentations. PSTs' learning of pedagogy to match the technology suggests they are more likely to use these skills with confidence in the classroom setting (Bate, 2010; C.

Campbell & Macnish, 2010). Resources provided by the Teaching Teachers for the Future project were beneficial to PSTs because of the classroom ideas and activities that included ICT.

A study with PSTs who were required to use iPods to create authentic learning tasks for early childhood students found that PSTs were initially unsure of the place of mLearning. However, the task gave them the opportunity to gain a critical understanding of the place of mLearning (Olney, Herrington, & and Verenikina, 2008). Such studies indicate that explicit mLearning at the pre-service stage of teacher training increases the likelihood of effective use of mLearning in early childhood classrooms.

2.4.4 Benefits for the school community.

Young children are using mobile devices when parents hand over their mobile phone or tablet computer to pacify their child, entertain them, or promote learning. Many parents believe that mobile devices are educational tools and so seek out educational apps to support their child's learning (Goodwin & Highfield, 2012). Accordingly, parents often seek advice and guidance from their child's teacher or school about the best apps to purchase. Even when the teacher is a digital native, using mobile technologies to support children's learning is a whole new skill set, and some teachers struggle to provide appropriate advice (Elliott-Hall, 2013).

The mLearning partnerships in this research were potentially beneficial to parents and carers because they provided information about the use of ICT in education, enabling parents and carers to make more informed decisions. In terms of more informed decisions, for example, parents unwittingly create digital footprints for their children when they upload photographs, videos and ultrasound scans of them as babies, when they are too young to understand or give consent. Holloway et al. (2013) recommended that guidelines be

developed for parents and carers of young children to assist with young children's engagement with digital technologies and the Internet. Such guidelines would also guide parents about the impact of creating digital footprints for their children.

2.4.5 Section two summary.

Section two examined the benefits of mLearning for early childhood classrooms, PSTs, and school communities, which includes parents. Given the literature on the benefits of mLearning in early childhood education, the fact that the uptake of mLearning in early childhood education has been variable, and that research shows that PSTs are ill-prepared to integrate mLearning into their teaching, research question one evolved as a focus of the research: What are the benefits and challenges of mLearning implementation in early childhood education for schools and the University?

2.5 Section three: Challenges to mLearning in early childhood education

A review of the literature identified four key challenges to mLearning in early childhood education: classroom challenges, community challenges, school challenges, and university challenges. Unless addressed, these challenges can inhibit children's learning. Classroom challenges included factors that inhibited teachers from using mLearning effectively, namely, the vast number of apps available; selection of developmentally appropriate mLearning resources in the classroom; teacher philosophy; and teacher knowledge. A discussion of these factors follows.

2.5.1 Classroom challenges.

As at January 2017, there were more than 2.8 million Android and 2.2 million Apple apps available (Statista, 2017). The number of educational Apple apps in Apple's App Store in January 2017 represented about 8.5% of the apps available on the market (Statista, 2017).

This number is overwhelming to teachers, making selection time-consuming because teachers need to consider curriculum goals, as well as the individual needs and learning styles of their students (Powell, 2014). At the same time, there has been little systematic study on the education potential and value of apps (Goodwin & Highfield, 2012). Hirsh-Pasek et al. (2015) created a set of principles to assist educators with the selection and evaluation of educational apps for children aged zero to eight years in response to the growing number of apps targeting young children. Hirsh-Pasek et al. (2015) posits that educational apps need to consider that children learn best in the 21st century by active engagement in meaningful, creative, and socially interactive tasks. In the context of apps, active learning means that the app provides a platform for seeking new information, or encourages children's engagement with the app's content. A poorly designed app requiring a child to participate in an action that does not encourage cogitation is unlikely to encourage active engagement. Researchers such as Goodwin and Highfield (2012) and Hirsh-Pasek et al. (2015) provide assistance in the form of selection criteria and rubrics to overcome the challenge of app selection for teachers.

The positive impact of mLearning on student learning depends on devices being appropriately used (Keengwe & Onchwari, 2009; McKenney & Voogt, 2012; Organisation for Economic Co-Operation and Development [OECD], 2015). With the correct guidance, mLearning can be harnessed for learning and development; without appropriate guidance, the risk is that use can be inappropriate or detrimental (NAEYC, 2012). In 2012, the NAEYC stated that early childhood teachers should be able to integrate developmentally appropriate technology into their classroom.

F. Simon, Nemeth, and McManis (2013) suggested that 35% of teachers were not using technology because of concerns about developmental appropriateness. Many teachers and parents were possibly unfamiliar with the joint position statement issued by the NAEYC and the Fred Rogers Centre about children's technology use needing to be, aligned with

developmentally appropriate materials (NAEYC, 2012). The NAEYC have revised guidelines and no longer include the recommendation that screen time is limited to a specific amount of time and instead advise that not all screen time is the same because it is more important that technology is used intentionally and appropriately to support learning and development (NAEYC, 2015). The NAEYC guides teachers and families to select media with children's developmental needs in mind, and to help children develop a healthy and balanced relationship with digital media as they grow up in a world where screens and digital media are the norm (NAEYC, 2015). Educators and researchers are looking for ways to bridge the gap between what teachers ought to be doing and what they are doing in the classroom in relation to the effective integration of mLearning. Organisations such as NAEYC provide much-needed support for teachers to overcome this challenge.

There are educationally valuable television programs, websites, and other digital media, and there are those that have less, if any, educational value. Educators with limited technology skills and digital literacy are at risk of making inappropriate choices and using technology with young children in ways that have a negative impact on learning (NAEYC, 2012). Without proper training, teachers may use technology in a manner that is not appropriate educationally.

The personal philosophy of some teachers has been found to be a challenge to mLearning. Keengwe and Onchwari (2009) found that technology conflicted with some kindergarten teachers' traditional philosophies regarding early childhood education. Shin (2014) found that teachers' pedagogical beliefs affected their ability to integrate technology into the curriculum. According to Shin, teachers with student-orientated constructivist beliefs about education were more likely to adopt new technologies because they could use them within the paradigm of their existing beliefs. Male and Burden (2014) found that adopting new technologies and student-centred learning protocols was too risky for some teachers

because their own performance was measured in terms of student achievement. Although early childhood teachers thought it was important to integrate technology into classroom practices, many felt that they were not adequately prepared to do so (Fenty & Anderson, 2014).

To change teachers' beliefs regarding technology integration in early childhood, teachers need time to plan activities using new tools as well as first-hand experience of successful technology integration (Keengwe & Onchwari, 2009). Early childhood teachers who have not experienced the creative and play-based aspects of technology may, understandably, oppose mLearning. They are unlikely to understand the value of mLearning or the place it has in a play-based early childhood curriculum. Jeong and Kim (2016) found that kindergarten teachers who could see the usefulness of mLearning were more likely to use it in their classes. Teachers with a negative philosophy towards mLearning will focus on literacy as a paper-based activity, thus denying children access to multiliteracies (Marsh, 2004). F. Simon et al. (2013), in a survey of 485 early childhood teachers and administrators in America, found that the main reasons teachers gave for not using mLearning were concerns about developmentally appropriate use (34%), program philosophy (18%), funding (60%), and not seeing the value in mLearning (16%).

The changing role of the teacher was predicted as a factor affecting the use of educational technologies in K–12 classrooms (New Media Consortium, 2014). Teachers ought to be open to new philosophies and be prepared to embrace new pedagogies to match new technologies. Educating teachers to teach in the 21st century classroom is a challenge that requires a philosophical shift towards constructivism, and in many cases, may mean letting go of old ways (Lock, 2015). An unbalanced digital diet like an unbalanced nutritional diet can lead to health problems. In the case of an unbalanced digital diet (excessive screen time), the body and mind can suffer because of lack of physical activity or over stimulation of

the senses. Good teachers will be aware of a proper balance in a child's educational diet. Early childhood teachers and parents would be wise to work together to guide and supervise children when using mLearning tools in the classroom and at home (A. Simon et al., 2014).

Teachers have cited the potential distraction caused by introducing technology into the classroom as a reason for avoiding technology. Research by Boyce et al. and Thomas (2014), with children using tablets on nature walks, found that initially children took many photographs (129 per pair) with lots of silly antics and camera options. On subsequent walks, children took fewer photographs (37 per pair) and recorded more field notes, indicating that the novelty was short-lived, and the students were rarely distracted when using the iPad as a resource. Unless steps are taken to address concerns, teachers who prevaricate when it comes to mLearning initiatives may themselves become the greatest obstacle to success with mLearning in the classroom.

McKenney and Voogt (2012) highlighted that teachers often struggle to find the right pedagogy for new technologies. Koehler and Mishra (2009) argued that teachers require a particular style of pedagogy when using technology to teach specific curriculum outcomes, and they refer to this as TPACK (technological, pedagogical, and content knowledge). Although the TPACK framework has gained much attention in the literature recently, difficulties have been recorded in applying it in the classroom (Bate & Maor, 2010). TPACK instruments have been used to measure technology integration in specific learning areas in schools (Handal, C. Campbell, Cavanagh, Petocz & Kelly, 2012). Teachers are not making the connection between ICT and improved learning outcomes for their students and often their technological and content knowledge banks remain separate from each other.

Effective teaching requires new pedagogies when teachers use mLearning (Beetham & Sharpe, 2013). Effective teaching, according to Pamuk, Ergun, Cakir, Yilmaz and Ayas (2013), requires the teacher to have:

- in-depth content knowledge (CK) and the ability to share that knowledge;
- pedagogical knowledge (PK), using items such as analogies, examples, illustrations, assessments and classroom management (Shulman, 1986).

Integrating technology into teaching and learning becomes a multifaceted process including a third knowledge base: technological knowledge. Matching pedagogy and technology are necessary for mLearning to be effective in the classroom. It is important that the technology supports the curriculum but is not the driver, so students are learning content not technology. The technology is a tool to aid the learning process.

Despite the evidence that mLearning can enhance literacy instruction, the reality is that mLearning is not used to this advantage (Hutchison & Beschorner, 2015). Australian research using tablets in literacy education in 2010 revealed that there were gaps between teachers' visions for classroom use of ICT and actual practical use in the classroom (Lynch & Redpath, 2012). The Lynch and Redpath (2012) study illustrated the challenges that occur when traditional literacy practices meet teachers trying to transform learning by integrating technology. Although the curricula in many countries incorporates the use of technology, teachers received contradictory information about the role of technology in early literacy.

In summary, classroom challenges often prevent teachers from using mLearning effectively. Teachers require time to research suitable educational apps, and the increasing number available is overwhelming to some teachers (Education World, 2012). Many teachers lack technological knowledge, and a negative philosophy towards mLearning in early childhood education may inhibit teachers from developing the necessary technological knowledge to use mLearning in a meaningful fashion.

2.5.2 Community challenges.

Most of the literature on technology and young children concerns the harmful aspects, such as excessive screen time and how parents and educators can protect young children from these aspects (He, Irwin, Bouck, Tucker, & Pollett, 2005). Society today is understandably cautious about the harmful effects of new technologies on young children in the same way that early social commentators were cautious about the impact on children of sitting in dark movie theatres (Luke, 2000). The main concerns identified in the literature are excessive screen time, musculoskeletal discomfort, and cyber safety.

The primary concerns raised in the literature about excessive screen time are the associated health risks due to the sedentary nature of screen time and the associated lack of outdoor physical play. Concerns about the effects of screen time (television viewing) on health and family life were first published in 1949 (Martin, 2011). The amount of time spent watching television has remained stable, but the recent arrival of mobile devices has led to an increase in the quantity of screen time (Martin, 2011). In a Western Australian study of the impact of excessive screen use on children's health and wellbeing, Martin posits that children who are excessively using screens encounter more physical, mental, educational, and behavioural issues than children who are not exposed to excessive screen time. Martin's report concentrates on medical research associated with lack of physical activity in children and health-related issues including, obesity, diabetes, and mental illness. These health issues are associated with screen time because screen time is a passive activity. Possible adverse outcomes of excess screen time in early childhood are irregular sleep patterns, behavioural issues, focus and attention problems, decreased academic performance and adverse impact on socialisation and language development (NAEYC, 2012). Other researchers posit that language acquisition of young children is not affected by any particular dose of media, and delayed language acquisition is associated with parents not being involved with their

children's use of media, and so not providing developmentally appropriate guidance (Bittman et al., 2011).

Screen time for children under two was totally discouraged by the American Academy of Paediatrics (Brown et al., 2011) and the White House Task Force on Childhood Obesity (Barnes, 2010). It was discouraged because interactions between adults and young children are essential to early brain development and cognitive, social, emotional, physical, and linguistic development (NAEYC, 2012). It was considered that such interactions ought not to be hijacked by screen time. In 2015, the American Academy of Paediatrics released an updated media policy, which encouraged parents to engage with media alongside their children (Brown, Shifrin, & Hill, 2015).

Concerns exist about screen time and the associated food and beverage advertising (NAEYC, 2012). The Campaign for a Commercial-Free Childhood (CCFC) is an organisation founded in 2000 whose mission is to limit the exposure of children to commercialism and access to child-targeted marketing (CCFC, 2012). CCFC aims to reduce screen time and ensure that young children have space for active and creative play with others and are connected to nature. It is worth noting that in the United States alone, \$15 billion is spent each year on marketing directly to children younger than twelve. In 1980 Quebec banned advertising to children under 13 (Alliance for Childhood, 2004). In Taiwan, there is a law that imposes fines on parents who allow children excessive screen time (Dolasia, 2015). Screen exposure to advertising vis-a-vis educational resources are not comparable, and the negative concerns surrounding advertising have in some cases, according to one researcher, obscured the learning potential of mLearning tools (de Lange, 2014).

An illustration of the role of marketing is the Baby Einstein story. When Baby Einstein products came onto the market in 1998, with claims of creating a Baby Einstein by

parking a baby in front of their DVD, world sales skyrocketed. The Baby Einstein Company became a multimillion-dollar franchise. The founder Julie Aigner-Clark was named entrepreneur of the year and the franchise was purchased by Disney. One in three U.S. households were reported to have at least one Baby Einstein product. Subsequent research from the University of Washington reported that television viewing for children under two years of age should be limited and was detrimental to language development. The study reported that there were no associated benefits for young children watching television, and recommended minimising viewing (Zimmerman, Christakis, & Meltzoff, 2007). The CCFC raised a complaint with the U.S. Federal Trade Commission against the Baby Einstein company citing false advertising, based on the American Academic of Paediatrics recommendation. The complaint was subsequently dismissed but the Baby Einstein Company offered a full refund for all products as a gesture of goodwill (Zimmerman et al., 2007).

Despite the increasing use of tablet computers in schools, there have been minimal changes in associated elements such as furniture and consideration given to ergonomics. A literature review of possible musculoskeletal discomfort associated with children's use of laptop and tablet computers by Binboga and Korhan (2014) pointed out that children's learning should not be at the expense of musculoskeletal health. Binboga and Korhan (2014) found that children have the potential to develop an awkward posture resulting in musculoskeletal problems. There are currently no guidelines for ergonomic designs most suited to using tablet computers, as a recent search suggested. An electronic string search of several online databases was conducted, which included EBSCOhost, Educational Resources Information Center (ERIC), and PsychINFO. A cut-off date of 2010 was established using the following descriptors: musculoskeletal, children, tablets, tablet computers, and iPads. The search failed to reveal any results associated with the use of tablets by young children, which leads to the conclusion that it is an area requiring further research.

Children today are more restricted than children in the past. In a world where stranger danger is a concern, a child is likely to be spending more time inside and less time in the local park or playing on the street (Veitch et al., 2011). Children are conducting some of their social life digitally (Pegrum, 2009). The current media hysteria (Kitzinger, 2000) surrounding cyber predation distracts from the more important issue that, in most cases (95%), it is a family member or acquaintance who is the predator and not an online stranger (Pegrum, 2009). Children have access to pornography, racism, violence, and other online hate sites on the Internet. Filters can help reduce children's access, but education has a role to play, and it is perhaps better for children to be taught explicitly by teachers and parents how to be safe. Parents, carers, and educators need to figure out the real dangers so that they can prepare young children to make informed and well-balanced decisions to help with all aspects of their lives, both educationally and socially (Pegrum, 2009).

Much of the discussion about children and their use of technology centres on caution about excessive use and the fact that there are limited benefits if children are merely babysat by an mLearning tool rather than using it for a more socially constructive teacher-initiated purpose. Adverse reports concerning children and media have been developed using a medical perspective and have subsequently been taken out of context in policies about technology in early childhood education (F. Simon et al., 2013). The American Academy of Paediatrics' recommendation regarding screen time in 2011 was not explicit about how or why a child was using technology and have subsequently been revised. Passive use of technology is considered an inappropriate replacement for active play and engagement with others. It is important to consider how children spend time with technology when determining what is adequate and appropriate (NAEYC, 2012). Inherent reluctance to allow young children to use technology is a view that exists in the general population because some people believe that the technology deprives young children of physical freedom and intellectual

innocence (J. Hill, 2011). There is a fear that the technology will turn young children into ‘zombies’ with limited social and emotional development (The Telegraph, 2012). Fear of the unknown may be driven by a generational gap issue. The generation gap between young children and teachers can result in natural opposition to new technologies because these are new and different (Geist, 2012). This fear does not exist to the same degree about television, simply because television is an old, accepted technology but potentially offering less educational value (Luparenko, 2014). Parents need to be informed about mLearning so that they understand the difference between recreational and education use of mLearning resources.

In summary, community challenges are associated with fear about cyber safety and the effects of excessive screen time on children. There are also medical concerns regarding the associated health problems with the sedentary nature of using screens excessively. Community challenges have a good chance of being overcome if educators and researchers can show how mLearning may be beneficial to children’s learning (Australian Government Department of Education, Employment and Workplace Relations, 2013).

2.5.3 School challenges.

The literature revealed three key school challenges relating to professional development, leadership, and technical support. A paradigm shift in education due to the presence of mLearning has created new learning opportunities that reach beyond the walls of the traditional classroom. However, teachers need professional development to design rich learning experiences for the 21st century learner (C. Clark et al., 2015). Although there are educators, such as Kathy Schrock, who specialise in educating teachers about technology integration, the reality is that many teachers are lagging behind in technology integration in the classroom (Smirnova & Bordonaro, 2014). In classrooms where technology is available,

teachers tend to be using technology in conventional ways rather than to transform teaching and learning (Flewitt et al., 2014). In a study of 485 early childhood teachers and administrators in the USA, it was found that 25% said that they had received no professional development about using technology in education (F. Simon et al., 2013).

Schools are purchasing new technologies, but many teachers have been unable to use the technologies in ways that enhance students' understanding. Hutchison and Beschorner, (2015), for example, found that 57% of teachers wanted professional development with access to examples of how to integrate technology into literacy. Teachers are seeking professional development so that they can deliver mLearning with an awareness of the limitations and benefits of tools to be used within the context and ability of the learner (Parsons, Ryu, & Cranshaw, 2007).

Professional development and training for early childhood practising and PSTs needs to be distinct from the professional development provided to primary and secondary teachers (A. Campbell & Scotellaro, 2009). In Australia, teacher professional development typically uses the one size fits all model where teachers passively receive information (Gardiner & Cumming-Potvin, 2015). To address this, professional learning needs to be targeted to the specific needs of young children so that practising early childhood teachers and PSTs can gain the confidence and expertise necessary to provide developmentally appropriate, quality-laden learning experiences for young children. It has been shown that generalised professional development in mLearning for all primary school teachers in a school creates frustration, as much of the content can be irrelevant to early childhood teachers (Ash, 2010).

Some researchers have pointed out that teachers are reluctant to use new technologies because of their fear of the unknown and lack of confidence, knowledge, or ability to integrate technology into the classroom culture (Arthur, Beecher, & Downes, 2001; Mumtaz, 2000). McKenney and Voogt (2012) reported on a study where teachers, provided with

scaffolding, actively engaged in designing technology-rich learning experiences for their classrooms. While this process required time, it facilitated teachers' learning and resulted in more effective classroom implementation. The children in this study also exhibited significant gains in literacy and numeracy.

Teachers are responsible for guiding children through the hazards and potential dangers associated with mLearning (NAEYC, 2012). With technology integration encompassed in a child's life, teachers need professional development to help progress the young child (Pegrum, 2009). With insufficient training, teachers are likely to adopt only trivial aspects of new technologies without experiencing the broader benefits. While integrating digital technologies may be a priority for many teachers, there are many more teachers who struggle to find a way to integrate new literacies with traditional methods (Hutchison et al., 2012). Likewise, there are teachers who are unaware of the range of different curriculum-based learning activities that can be completed using mLearning (Harris & Hofer, 2011).

In 2005, New Zealand introduced a framework for the development of ICT in early childhood settings (Ministry of Education, 2005). The idea was to expend funds on professional development for teachers rather than on the technology. The framework was used to show that professional development should be about purpose and pedagogy rather than software training or learning ICT skills. Teachers are time-poor, so keeping up-to-date with new technologies, plan technology-rich lessons, or research websites and suitable apps becomes problematic (Novak, 2009). If teachers are given the time and professional development, they are more likely to integrate mLearning effectively (Ministry of Education, 2005).

Without school leadership that is supportive of mLearning, access to teacher professional development, mLearning resources, and technical support will present a

challenge to mLearning integration in schools (Liu, Rirzhaupt & Cavanaugh, 2013). Technology integration needs to be a whole- of-school initiative, starting with the school Principal leading by example (Foote, 2012; Heikka & Waniganayake, 2011). The school Principal is said to be the most significant factor affecting technology integration in schools (C. Clark et al., 2015). Competing pressures in schools and the need to perform well in standardised tests can make it difficult for schools to try new approaches (Gardiner & Cumming-Potvin, 2015). Transformational leadership, which consists of leadership where leaders and colleagues share a collaborative relationship resulting in an elevation of mutual goals, is required to create the atmosphere needed for integration of new technologies (Clarke & Zagarell, 2012). A non-teaching school principal will not be able to lead by example only with regard to curriculum integration, but can nevertheless integrate technology into their role as an administrator and leader for teacher evaluation, time management, professional development, and productivity (Winslow, Dickerson, Lee, & Geer, 2012). In doing so, principals can advance their technological leadership per se. Technological leaders are critical players in facilitating hardware and software purchases, guiding pedagogical choices and technological knowledge of teachers and managing the funds to buy assets. Professional development for principals is as important as it is for teachers so that they can fulfill their role as a technology leader (Clarke & Zagarell, 2012). Few school principals have an early childhood background and may have similar concerns to teachers about the use of mLearning and, as a result, may not see early childhood education as a priority in allocating ICT resources (Henry & Barnett, 2004).

Technological leaders need to find ways to upskill and encourage staff. In the early years of education, opportunities to explore new literacies using mLearning and other technologies may be overshadowed by government directives to raise standards in literacy and numeracy (Akcaoglu et al., 2014). A multiliteracies pedagogy invites new ways of

reading but is dependent on the school culture, teacher pedagogies, and mLearning resources, as directed by the school's technological leadership. Technological leaders can encourage teachers to review their use of traditional methods and be open to social constructivist principles. Winslow et al. (2012), in a Canadian study that deployed tablets to school principals, found that the tablets augmented the abilities of principals to demonstrate technological leadership.

Limited changes only can occur in schools without the drive of the Principal (McGarr & Kearney, 2009). Lack of expertise and the ability to guide teachers makes it difficult for a Principal to monitor, evaluate, and maintain the momentum required for mLearning integration. Implementation of new learning technologies in a school context requires the support of all participants. It is, for this reason, important that school leaders plan for technology implementation (Boyle, 2001). Without a well-supported vision of mLearning integration, there will be a minimal effect on changing teachers' practice and the use of technology with students (Clausen, Britten, & Ring, 2008).

Funding is an inhibitor of the use of mLearning in early childhood education, but leaders may be able to overcome this obstacle if they are prepared to be creative when sourcing funding (F. Simon et al., 2013). Many classrooms ban smartphones, but they are a readily available source of technology that offer teachers the freedom to explore, document, and communicate, and they provide extraordinary educational opportunities (Pinner, 2016). Allowing teachers to use smartphones in the classroom for educational purposes is a creative way to access mLearning devices that are readily available. Smartphones, although not without their pitfalls, provide an opportunity for educators to enhance the learning opportunities for young children, so educational leaders might be wise to manage rather than ban such technologies (F. Simon et al., 2013). Research in America has also shown that

smartphones can potentially improve methods of assessment and communication in early childhood classrooms (Parnell & Barlett, 2012).

mLearning offers enhanced learning opportunities for children but without informed leadership, misuse can occur (F. Simon et al., 2013). Ineffective technological leadership is a barrier to technology integration in schools (Dunaney, 2001). School principals are usually responsible for the technological leadership in schools and as such ought to accept responsibility for making technology an integral tool in all grades (Keengwe & Onchwari, 2009). Technological leadership means that school principals manage hardware and software requirements, and the ongoing professional development and support for teachers. Technological leaders might support the efforts of teachers who are innovative with technology and encourage them to become technology mentors to their colleagues, with compensation being given for mentor time (Keengwe & Onchwari, 2009). The selection of hardware and software requires the collaboration of teachers and school leaders so that purchases are developmentally appropriate and aligned with curriculum goals (Powell, 2014). In doing so, principals are engaging in shared leadership.

McGuire (2008), a school Principal in California, discovered that by sharing power and authority with parents, teachers and students, the energy focused towards school improvement increased exponentially. McGuire worked as a fellow learner with teachers to collaboratively and objectively look at the instructional content of classes. As a result of McGuire's approach, the level of student achievement and engagement increased. By relinquishing power and authority and becoming part of the leadership team, real advancement occurred, which proliferated throughout the school community.

Technical support in addition to professional development is critical to the successful implementation of a new technology. Such support ought to be supplied by someone non-judgemental, with knowledge of both curriculum and technology (Ash, 2010). Teachers

report that barriers to using technology in the classroom are a lack of mLearning resources, difficulties with using software, Internet filtering, and bandwidth (C. Clark et al., 2015). When mLearning devices fail, they may be abandoned by teachers or not used for extended periods until someone has the time, money and/or knowledge to fix them. In a small primary school, or in a rural school, it may be the role of the Deputy Principal or Principal to provide technical support; however, it would be one of their many roles, and they may not necessarily have the expertise required (Keane, 2008).

Male and Burden (2014) found that over-restrictive firewalls excluded teachers and students from many useful resources. YouTube, for example, houses many valuable resources as well as inappropriate resources. Restricting access to social media and YouTube does not help children manage such resources or give them the opportunity to build responsibility. With regard to bullying, for example, there is much continuity between online and offline bullying (Thomas, Connor, & Scott, 2015). It has been found that children who are most at risk online are also those most at risk offline (Chadwick, 2014). Simply restricting online access might not be the best way to address the question of bullying behaviour. Teaching children to be good, responsible citizens must include the online as well as the offline environment (Shepherd & Woods, 2011).

A study of how ICT was used by early childhood teachers to help teach multiliteracies found that key barriers were unreliable equipment and access to technical support (Hesterman, 2011b). While in some schools there was sufficient technical support and broken resources were repaired; in others, time was consumed and frustration occurred due to the unreliable nature of the technology and lack of technical support. A plan for managing organisational and logistic issues – including recharging, repairs, protection, and deployment of applications – is necessary to ensure that the learning potential of mobile technologies is efficiently harnessed (Henderson & Yeow, 2012).

Lack of technical support contributes to the current technological divide between those schools that have access to mLearning resources and those that do not. The technological divide is a challenge that needs to be addressed in order to give all students the best opportunities for success (Clarke & Zagarell, 2012). Although the cost of devices is decreasing, schools are increasingly favouring the BYOD model because school budgets can make bulk purchasing of mLearning tools unaffordable (DEEWR, 2015b). The BYOD model was on the near horizon, in the 2014 Horizon Report (New Media Consortium, 2014). The BYOD model of technology integration means that schools do not need to purchase hardware; however, managing the BYOD model presents challenges because schools still need to manage the technical support necessary for the devices. The BYOD model also has the potential of presenting a challenge to families who are required to purchase devices.

Challenges associated with the BYOD model are the cost of the Wi-fi infrastructure, the need to support a range of devices, and access to applications. It has been reported that in European schools, only 25% of children under nine years old have access to digitally resourced schools that have high levels of well-maintained equipment such as desktop and laptop computers, IWBs, digital cameras, data projectors, and fast broadband (Wastiau et al., 2013). Many teachers who are not integrating technology into teaching say that it is a lack of mLearning resources, time, and leadership that is preventing uptake (Flewitt et al., 2014). Teachers with less experience and confidence were found to be more reluctant to use technology than their more experienced and confident peers.

Technical support is an issue that teachers and schools face when using technology. At one end of the spectrum, schools may have a full-time technical support person, and at the other end, there may be a part-time support person with limited expertise (Clarke & Zagarell, 2012). Successful studies using mLearning integration have used the technological support of a mentor or coach who has a vital role in successful implementation (Foote, 2012). Physical

barriers to technology integration such as mLearning resources, connectivity, and storage can cause frustration in teachers, who can then become barriers themselves (C. Clark et al., 2015).

In summary, the school challenges to mLearning in early childhood education stemmed from a lack of teacher knowledge and professional development, support of the leadership, and a paucity of technical support. These challenges resulted in an inability of many teachers to use mLearning in developmentally appropriate ways in the classroom. Potentially at least, school leaders may have the ability to overcome these challenges. The personal technology-related philosophies of school leaders were important factors in progressing mLearning implementation in schools.

2.5.4 University challenges.

The literature revealed three main university challenges to mLearning integration. These challenges were traditional philosophies of academics, traditional facilities and resources, and traditional pedagogies of academics. It has been reported that universities are conservative institutions regarding teaching with direct instruction being the dominant teaching style (McCarthy & Anderson, 2000). The use of technology in teacher education programs requires academics to change pedagogies to reflect more learner-centred approaches (Kehrwald & McCallum, 2015). Researchers have found that the main barriers to technology implementation in teacher education universities were the attitudes and pedagogical beliefs of the academic staff (Bakir, 2015). Training PSTs to integrate technology in the classroom requires explicit modeling at the pre-service stage of training through professional experience and modelling in units of study undertaken. Explicit modelling requires academic tutors to have the necessary skills, knowledge, and self-efficacy, which is often not the case (Bakir, 2015). PSTs are said to lack understanding about

student-centred learning with technology, and view PowerPoint and use of IWBs as integrating technology. Use of PowerPoint and IWBs are examples of teacher-centred learning and often do not extend the learning opportunities for students. The reason for PSTs lack of understanding about technology integration is possibly because of the modelling received from university tutors, which has been non-existent or teacher-centred (C. Clark et al., 2015).

Teacher education institutions with traditional learning facilities such as desks in rows, computer laboratories, and a screen at the front of the room do not provide PSTs with the opportunity to work in flexible, student-centred learning spaces like those in modern schools (Thompson, 2015). Modern schools include open learning spaces, natural light, numerous spaces for individual and group work, developmentally appropriate pods, and spaces for technology. Teacher education institutions lacking flexible furniture, facilities for PSTs to collaborate using technology, and the opportunity to use a variety of devices in classrooms are not able to create and model innovative and modern teaching and learning. Teacher education institutions are under pressure to provide learning spaces that mirror spaces in modern schools (Thompson, 2015).

One tablet per child is becoming common in K–12 schools, yet few teacher education institutions offer a similar environment. Mourlam and Montgomery (2015) found that when PSTs were given an iPad for a whole year with the support of a technology coach, many PSTs changed their beliefs about technology integration and reinvented their teaching approach. The context of the study was to immerse the PSTs in the use of the tablets and included more than 50 hours of professional experience. While some PSTs continued to use the tablets for low-level learning experiences, the majority changed their teaching style to reflect a student-centred approach.

Teacher education institutions around the world are looking for ways to integrate technology into PST education (Tondeur et al., 2012). Rosen and Jaruszewicz (2009) proposed a framework to guide early childhood teacher educators to extend developmentally appropriate practices to include the use of technology. They defined the term developmentally appropriate technology use (DATU) as use that respects the unique developmental needs of a child, and that capitalises on a child's natural desire to solve problems and construct knowledge collaboratively. DATU occurs when teachers integrate CK and pedagogy to develop technology-rich opportunities for young children to learn.

Bakir (2015) found that the support of the entire staff, including a supportive dean with strategic vision, administrative support, technology support, funding, mentoring, leadership, and access to technology had a positive impact on technology implementation in universities. Universities that have successfully integrated technology into teacher education programs have done so by making technology integration systemically occur across entire degrees instead of offering stand-alone technology units (Metcalf & Metcalf, 2015). In the United States, 85% of teacher education institutions offer stand-alone technology units. Such units typically provide PSTs with the opportunity to learn how to create technology-rich lessons and develop basic computer skills. Stand-alone technology units have been shown not to facilitate PSTs with the integration of technology in a meaningful way (Bakir, 2015). The knowledge that PSTs gain from such units diminishes with time due to a lack of connection with other units.

2.5.5 Section three summary.

This section of the review examined the challenges to mLearning in early childhood education at the classroom, school, community, and university levels. At the classroom level, the challenges were the large number of tools to choose from, selecting developmentally

appropriate tools suitable to early childhood, teacher knowledge, and teacher philosophy. The community challenges posited excessive screen time, health issues relating to sedentary activities, and cyber safety. School challenges identified in the literature included professional development, leadership, and technical support. The university challenges identified were academics having limited experience of mLearning, and not adequately preparing PSTs to use mLearning in contemporary classrooms. Given the literature on the challenges and the fact that uptake of mLearning in early childhood education is varied, research question one evolved as a focus of the research: What are the benefits and challenges for schools and the University of adopting mLearning in ECE?

2.6 Section four: School–university partnerships

This section of the review defines and examines partnerships in general and school-university partnerships specifically. There are benefits and challenges to partnerships, and this section reviews these as they apply to both school and university partners.

2.6.1 Partnerships.

A partnership is an alliance or a collaborative relationship between two individuals or organisations such as businesses, schools, and governments in which partners agree to collaborate for mutually rewarding benefits (Radinsky, Bouillion, Lento, & Gomez, 2001). Such benefits could be to increase the likelihood of achieving missions, for monetary or knowledge gain, or for personal or professional satisfaction. An amalgam of minds and resources within partnerships is more likely to achieve success than partners working in isolation (English, 2013). The theory of alliances was the framework used to examine the school-university partnerships in this study (Iyer, 2003). Partnerships normally require stakeholders to collaborate with a shared purpose, accomplished through hard work, open communication, trust, and mutual respect. Close collaboration allows the overcoming of

inequalities and differential powers (Parker, Templin, & Setiawan, 2012). Open communication facilitates goodwill, alleviates dissatisfaction, allows a partnership to grow, and creates a culture of respectful conversations that help to generate respectful relationships (English, 2013).

The theory of alliances (Iyer, 2003) provides a useful lens in which to conceptualise relationships between schools and universities. Certainly in the current study, where the schools and University are relatively small in size and resource-scarce, there was an impetus to share resources and expertise. By forming alliances, organisations are thus able to compensate for deficiencies. In the current study, the schools lacked mLearning resources and technological knowledge and the University lacked authentic opportunities for pre-service teachers to teach children using mLearning. Alliances require governance characteristics such as strategic objectives, a time frame, rules about participation and ways to communicate. In addition to partnership characteristics, it is important to consider partner characteristics such as size, location, workforce profile, advertising profile and organisational memory (Iyer, 2003). During this research, the partner characteristics were important because small schools meant few resources and the location had to be close enough to the University for pre-service teachers to reach within the constraints of other commitments at the University. The small size of the schools also meant that they served as promotional stepping stones for principals so the workforce profile was unstable. Advertising profiles became an important characteristic of the partner schools when they acquired independent public school status because few schools have university partnerships. Despite the high turnover of school leaders throughout this research there were participants who remained throughout, and provided organisational memory which assisted the partnerships transition to subsequent years.

Partnerships between training organisations and industry are common around the world and have the potential to produce economic growth. One of the earliest examples of a training partnership was the opening of McDonald's Hamburger University in 1961 in which McDonald's has invested \$40 million to improve the service industry, focusing on leadership development and business growth. The overall goals of business and training organisations (such as universities) are historically quite different – making money, versus producing employable graduates, education, and research. Progressive government cuts to public university funding has forced universities to generate their own funding using business models (Jarvis, 2013). According to many researchers (English, 2013; Evans, 2004; Jauhari & Thomas, 2013), the critical factors for successful partnerships are 1) healthy, respectful, professional relationships; 2) clear communication; 3) trust; and 4) clear, mutual goals. Partners need to have a deep understanding of one another's goals, as well as those of the partnership (Killion, 2011).

Developing and sustaining a partnership requires considerable effort from the parties involved. Partnerships go through different phases (Killion, 2011) and, to be sustainable, need to survive any difficulties that arise. Members who are committed to the partnership are not immune to competing professional pressures and, at times, may be unable to fulfil their partnership commitments. Having a large core membership is essential to the ongoing survival of a partnership because members will have competing pressures and at times will be unable to commit time to a partnership (Walsh & Backe, 2013). Healthy, positive relationships are more likely than any written agreement to identify problems that occur and present potential solutions (English, 2013). Partnerships offer both opportunities and challenges, so it is important that partners consider both benefits and challenges before entering a partnership (Killion, 2011). However, the challenges involved in a partnership are often hidden in the beginning even when partners have been explicit about predicting

challenges. Such challenges can be financial but also relate to time and responsibility (Killion, 2011).

2.6.2 School–university partnerships.

Partnerships between schools and universities provide opportunities for community members – including practising teachers and PSTs, school leaders, parents, and university academics – to learn from each other. According to Goodlad (1991) and Walsh and Backe (2013), the essential elements of school–university partnerships are a shared concept, clear and sound purpose, mutual governance, and evaluation of outcomes. Although the goals of schools and universities are not dissimilar – i.e. improved outcomes for students and producing employable professionals respectively – the differing nature, culture, funding, and resources associated with schools and universities mean that they have different priorities (Bickel & Hatrup, 1995). A successful partnership between a school and a university has to focus on common ground (Butcher, Bezzina, & Moran, 2011). The general foci of schools are the curriculum, teaching, student support, and leadership, whereas those of universities are teaching, research and service (Castle, 1997). A mutually beneficial partnership, with goals that meet the foci of both schools and universities, is more likely to be sustainable (Oberg De La Garza & Kuri, 2014; Walsh & Backe, 2013).

2.6.3 Benefits of school–university partnerships.

School–university partnerships provide opportunities such as authentic learning experiences for PSTs; research opportunities for universities; and professional development for schools. Teacher education institutions have used school–university partnerships for authentic experiences such as professional experience and service learning for a long time (Ledoux & McHenry, 2008). PSTs who participate in school–university partnerships where they have greater opportunities to teach “real” children feel more prepared and able to

convert theory into practice. Schools are always looking for ways to design, implement, and improve new programs but often lack the resources to evaluate progress. Conversely, universities have abundant research and evaluation capacities, so partnerships between schools and universities should be beneficial for both (Walsh & Backe, 2013). Partnerships between universities and other organisations also enable universities to reach new audiences (English, 2013).

School–university technology partnerships are said to be beneficial to PSTs (Dawson & Norris, 2000) and children because the PSTs are exposed to technology-rich classrooms and children increase their technological competence. School–university technology partnerships are said to create goodwill: for the school, because parents are satisfied that their children have greater access to technology; for the teachers, because they may be afforded the opportunity to enrol in postgraduate classes (Christie, 2000). If the learning of children, practising teachers, and PSTs can occur concurrently, the benefits of the partnership tend to be maximised (Chorzempa, Isabelle, & de Groot, 2010).

Partnerships are more likely to be successful with the inclusion of parents and carers. How parents and carers perceive mLearning is important, given the growing interest of schools and government in the BYOD model of technology integration (DEEWR, 2015c; U.S. Department of Education, 2010). In schools where there is a high turnover of teachers and school leaders, the parent body becomes the stable component of the school community. Providing parents with up-to-date research on current trends enables them to make informed decisions for their children at home and school.

In 2013 the Australian government commissioned the Digital Education Advisory Group (DEAG) to provide a blueprint for digital education in the 21st century. The DEAG recommended that schools reach out to the community and form partnerships to make education and learning more relevant and authentic. The DEAG made eight

recommendations, two of which referred explicitly to partnerships. Recommendation four – strengthening partnerships in education – involved the dissemination of ideas regarding technology integration using partnerships and using school–university partnerships to bring expertise into schools. Recommendation seven, embedding innovation in learning, recommended developing community and industry partnerships by developing relationships with training organisations such as universities (DEEWR, 2015c).

2.6.4 Challenges to school–university partnerships.

Key challenges to school–university partnerships are a turnover of participants, and a lack of time and resources (Jones, Ryan, & Eckersley, 2014). Additional challenges associated with school–university partnerships are the loss of instructional time for other theory and content, changing demographics, policy changes, and change of direction (Ledoux & McHenry, 2008; Officer, Grim, Medina, Bringle, & Foreman, 2013). Academics may feel that partnerships detract from research (Walsh & Backe, 2013) whereas in fact, aspects of the partnership may generate research opportunities. Partnerships between schools and universities are seldom easy and once formed must adapt all the time as people and circumstances change. If problems can be shared as they arise, they can be solved collaboratively (Bickel & Hatrup, 1995). Although partnerships between schools and universities are ideal for teacher training and professional development, in reality, the dichotomy between schools and universities means that school-university partnerships can be contentious. According to C. Clark (1999), mistrust is the natural state of the relationship between schools and universities. Killion (2011) refers to relationships between schools and universities as the struggle between “town and gown”. Nevertheless, with sustained willingness and effort, partnerships can and have succeeded (AITSL, 2012).

Successful partnerships need sustained ongoing commitment from all stakeholders, which requires time and effort (Walsh & Backe, 2013). Sustainable partnerships should be able to survive periods of difficulty such as funding being exhausted or changes in direction being mooted. Keeping multiple participants in partnerships informed using clear, ongoing communication about the partnership and goals will minimise the effects of change in participants (Walsh & Backe, 2013).

Teachers and school leaders may feel that partnerships are another pressure added to those they already face (Walsh & Backe, 2013). If a partnership is imposed from above or inherited from a predecessor, it is less likely to be sustainable than one initiated by a school or university. Traditional school–university partnerships, where the university offers a short, single professional development session with little collaboration, have been shown to be ineffective (Cochran-Smith & Lytle, 1993). For professional development, long-term partnerships are most useful for practising teachers and PSTs (Crawford, Roberts, & Hickmann, 2009). The realities of staff shortages, limited time and resources, and potentially high staff turnovers mean that long-term partnerships may be difficult to sustain. The answer may lie in establishing short term partnerships for accomplishing a specific purpose, after which the partnership is disbanded.

2.6.5 Section four summary.

This section of the review defined partnerships in general and school–university partnerships in particular. The benefits of school–university partnerships identified in the literature were professional experience and service-learning opportunities for PSTs; professional development for schools; research opportunities for universities; and evaluation of teaching and learning programs for schools. The challenges identified in the literature were time pressures; staff turnover; conflicting task pressures; and missional dichotomies between

schools and universities. Given the literature on school–university partnerships and the lack of uptake of mLearning in early childhood education, research question two was developed to guide the research: What are the impacts of mLearning implementation in schools on school-university partnerships?

2.7 Chapter conclusion

It is clear from the current research that mLearning, although in its infancy, is currently being promoted by educational policy makers in Australia and elsewhere. The lack of uptake of mLearning in early childhood have been shown to be related to a host of reasons. There are opponents to the use of all technology (including mLearning) in early childhood education, and because the early phase of education is vital to children’s development, it is important that new initiatives or innovations are properly researched (Radesky, Schumacher, & Zuckerman, 2015). Research such as that undertaken here is required because mLearning permeates the lives of young children at home and increasingly in schools. As such, parents and educators need an understanding of how mLearning can be used as an educational tool. The difference between using mLearning for recreational and educational purposes needs clarification for parents, carers, and educators.

mLearning is beneficial to children’s learning because it provides children with a tool to enhance and individualise their learning (Buckingham, 2013). Children seem to enjoy using mLearning and so become engaged and motivated to learn. However, for mLearning to be used as a transformational learning tool in education, it must be used by a trained educator who becomes a facilitator of learning.

The challenges to mLearning implementation in early childhood education are that inappropriate use may be detrimental to children’s learning and development. Teachers without the necessary technological knowledge may not be able to use mLearning in a

developmentally appropriate manner to enhance children's learning. If mLearning is used as a supplementary activity or as a time filler, it is unlikely to have an educational benefit.

Teachers and teacher educators need time for professional development so they can gain the necessary skills to integrate mLearning effectively into their teaching and children's learning. When teachers possess the mLearning skills to transform children's learning they are able to share knowledge with the wider school community, including parents and carers so that concerns and questions can be addressed.

Good technological leadership can overcome most of the challenges to mLearning uptake, such as funding, professional development, and technological support. There is no suggestion that mLearning is a quick fix to learning. Neither is it the intention that children use devices in isolation, completing tasks unrelated to whatever else is going on in the classroom. Integrating new technology into the classroom requires thought and commitment from teachers, in aspects such as in choosing appropriate hardware and software, and developing appropriate pedagogies to support the curriculum (Flewitt et al., 2014).

The partnership model used in this study aimed at being mutually beneficial to the school and the University. Working together, schools and universities can implement new initiatives, share knowledge and learn together. In this research, the synergy between the PSTs and practising teachers was an example of a mutually beneficial two-way partnership. This study puts forward a model of an mLearning partnership that aims to increase the uptake of mLearning in early childhood education by overcoming some of the barriers identified earlier in this review.

Chapter 3 Methodology

3.1 Introduction

The purpose of this study was to examine the impact of mLearning in early childhood education (ECE); investigate the synergy between practising early childhood teachers and pre-service teachers (PSTs) in the adoption of mLearning; and, consider how mLearning interventions impacted upon school-university partnerships. As the literature review revealed, there is a limited amount of published research on mLearning in the early childhood setting. Therefore, gaining some insight into the impact of mLearning in ECE was seen as worthy of investigation. Table 3.1 provides an overview of the methodology chapter.

Table 3.1
Overview of Methodology Chapter

Topic
Introduction
Theoretical Framework
Case Study Methodology
The Research Methods
The partner Schools
School A
School B
The University
Data Collection
Data Analysis
Limitations of the Research
Trustworthiness of the Data
Ethical Considerations
Conclusion

The research questions that directed this study explored how the participants of this study used, implemented and experienced mLearning in ECE. The research questions were:

1. What are the benefits and challenges for schools and the University of adopting mLearning in ECE?
2. What are the impacts of mLearning implementation in schools on school-university partnerships?

The first research question was addressed by examining potential benefits and challenges associated with adopting mLearning in ECE, such as engagement or distraction of children and the synergy between the practising teachers and PSTs. The synergy between the practising teachers and PSTs includes the opportunity for two-way learning, where practising teachers had the opportunity to increase their technological knowledge (TK), and PSTs had the opportunity to increase pedagogical knowledge (PK) and gain confidence using mLearning in the ECE classroom. The second research question was addressed by exploring how the mLearning implementation affected the relationships between the University and the schools and their communities.

3.2 Theoretical framework

The theoretical framework relates to the philosophical basis underpinning the research and discloses the epistemology, theoretical perspective, methodology, and research methods of the research (Crotty, 1998). Figure 3.1 illustrates the key components of the theoretical framework.

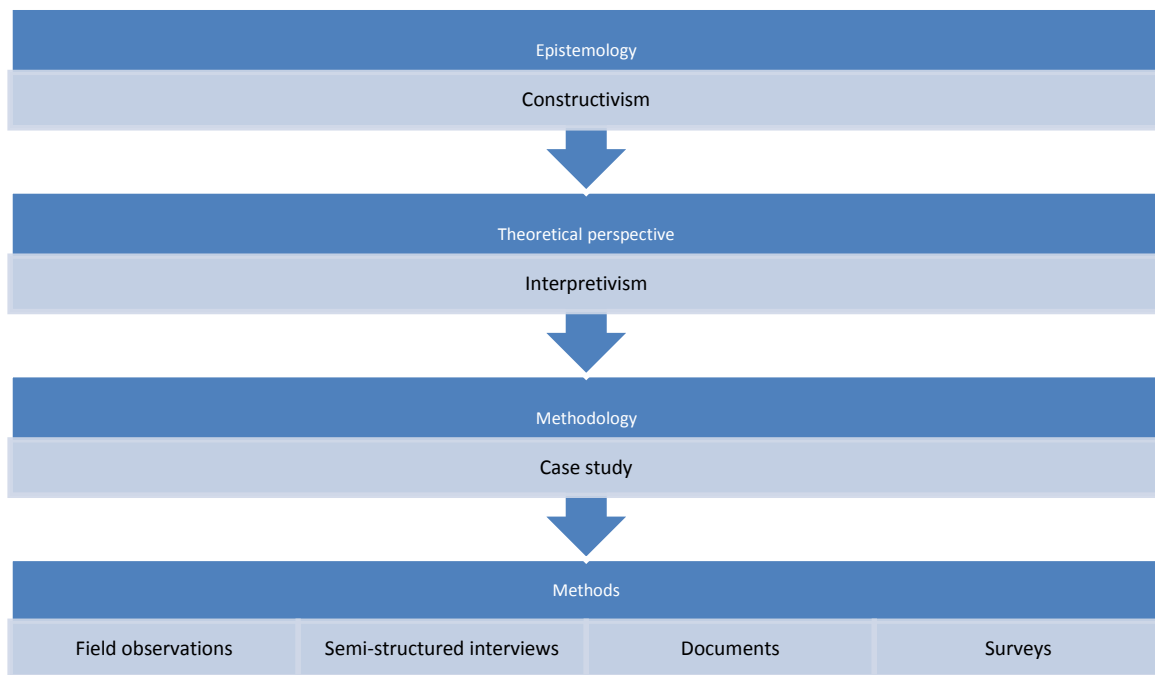


Figure 3.1. The theoretical framework. The relationship between epistemology, methodology, and method.

Epistemology is the branch of philosophy that deals with the natural origin and scope of knowledge (Roth & Metha, 2002). According to Neuman (2003), epistemology is how people understand the world around them. Constructivist epistemology was deemed most suitable to this research to gain worthwhile findings from the research questions as the participants constructed meaning and the researcher interpreted the lived experiences of the research participants. Social constructivists seek understanding of the world through the subjective meanings of experiences by valuing the complexities of human lives (Creswell, 2005). Social constructivists acknowledge that there is no single truth and that any viewpoint is equally valid and should be considered without judgement. Authentic experiences were described by the participants and interpreted by the researcher to construct meaning and understanding about mLearning in ECE without bias or judgement.

Ontology is the philosophical study of the nature of being. The two main branches of ontology are realism and relativism. Realists believe that there is one truth about the world

and consequently favour scientific research where the researcher is independent of the experiment (Robson & McCartan, 2016). Relativism is the view that what is real is subjective and evolves according to the experiences of participants. Relativism accepts that there may be multiple views of reality (Andrews, 2012). The research in this study had a relative ontology. The researcher engaged with all research participants throughout the research period which enabled the collection of rich data. The researcher was mindful of researcher bias and compared field notes with another researcher to minimise bias or subjective views.

There are several theoretical perspectives available to researchers including positivism, critical theory, and interpretivism (Willis, Jost, & Nilakanta, 2007). A positivist perspective is one where a single answer or causal relationship is sought and often found using statistical means (Halfpenny, 1987). A positivist perspective was not suitable for this research because the research did not expect to find a single view from a diverse range of participants in different contexts. Participants viewed the phenomena in different ways but the researcher considered all views with equal importance.

A critical theoretical perspective uses dialogic methods such as interviews and observations but rather than naming and describing phenomena, the critical perspective critiques and challenges phenomena (Morrow & Brown, 1994). A critical perspective does not consider historical or comparative context. The purpose of criticism is to bring about positive change. The interpretivist approach states that there is not a single answer to a question because there are multiple ways in which individuals can interpret a phenomena. Interpretivism is a traditional form of qualitative research which holds that meaning is constructed through engagement with life experiences and situations (Crotty, 1998). The interpretivist theoretical perspective embodies the idea that the social world is the creation of the purposeful actions of conscious people. Drawing meaning from data captured in natural language is best suited to an interpretivist paradigm (Neuman, 2003). Interpretivism was

deemed most suitable to the present study as the most significant findings would emerge from interviews where different participants' views on similar phenomena were captured. Figure 3.1 illustrates the theoretical framework used in the study showing the relationship between the epistemology, theoretical perspective, methodology and research methods used. The qualitative data collected in this research were analysed using an interpretivist perspective.

Qualitative research is a research method that has emerged to explore social phenomena (Denzin & Lincoln, 2005). This study used qualitative research methods to construct meaning from social experiences that arose as a result of the school-university mLearning partnerships. Qualitative data has scope to provide the sort of contextual information that quantitative data does not (Guba & Lincoln, 1994).

This study included an in-depth case study which placed importance on the individuality of each case and the participants (Hays, 2004). A case study methodology enabled the individual cases to be explored and considered in light of their unique contexts and participants. The interactions among the participants were also important and these were captured using a case study approach.

Wahyuni, (2012) emphasised that interpretivist research must aim to understand the beliefs that influence people to act in a particular manner. The research design focused on the individuals' experiences, perceptions and the construction of understanding and interpretation of reality. The interpretivist perspective is ideally suited to educational research because classrooms are socially and culturally constructed learning environments (Erickson, 1986). The researcher explored the mLearning phenomena through close analysis and reflection on all the data collected. Field observations in different schools made it possible to see how any one phenomenon appeared in different contexts. Practising teachers and PSTs are effected by the wider spheres of an organisation, such as, leadership and access to resources. Human interactions effect the way in which individuals act, so observations were important in the

classrooms to collect rich data, enabling the researcher to discover how practising teachers and PSTs used mLearning in the classroom environment (Snowden, 2002).

3.3 Case study methodology

A case study is a contextual approach used in qualitative research to give in-depth analysis of a complex phenomenon (Yin, 2009). Phenomena studied may be complex due to political, historical and personal issues (Yin, 2013). The case study approach was used to provide an in-depth, real-world longitudinal study of a complex and contemporary phenomenon; mLearning partnerships at two specific school sites. Case studies emphasise contextual analysis so results may not be transferrable to other situations. Critics of case studies cite small numbers of cases as a barrier to reliability, however, validity of this research was increased by collecting data over a three-year period and used key steps including defined research questions, carefully selected cases, and specific and varied data gathering and analysis tools. Multiple sources of data such as surveys and interviews and a variety of techniques for analysing data including NVivo, were strategies used to strengthen this case study research.

A collective case study methodology was chosen for this research as the main sources of data were collected in the field at two partner schools, yielding an in-depth understanding of mLearning at the two sites. The two cases studied were selected based on proximity to the University which enabled PSTs to attend the schools without disruption to their timetable at the University. By studying more than one case, it was possible to gain a deeper understanding of the phenomena under investigation. A case study is a detailed investigation where data is collected over an extended period of time regarding phenomena within the natural context. The approach used in this study was longitudinal, where the data was

collected over a three-year period. There are three main types of case study; namely intrinsic, instrumental and collective (Simons, 2015).

A collective case study approach is useful when the researcher is looking for common characteristics among cases. According to (Stake, 2007), a collective case study methodology is used to gain an understanding of the cases that will lead to better understanding and perhaps better theorising, about a larger collection of cases (p. 445). Merriam (1998) defines a case study as being “an examination of a particular event” (p. 31). The current research involved mLearning in ECE implementation partnerships at two public metropolitan primary schools in Western Australia.

The case study method of inquiry was chosen as a case study focuses intensively on each case, producing detailed, extensive and varied data (Newman, Biedrzycki, Patterson, & Baum, 2011). In this type of study, it was expected that the data would be more diverse and contextually rich than data collected from a one-off ‘snapshot’ examination (Rose, 1991).

In case studies, good relationships between participants and the researcher are necessary to facilitate multiple visits (Eisenhardt, 1989). There was, therefore, a focus on building relationships with the two schools and the associated communities which included parents, carers, education assistants and other teachers in the partner schools. The relationship building involved meeting with school leaders and early childhood teachers to discuss pedagogical and technological approaches and to collaborate on the details of the research plan.

Longitudinal research is used to collect data over extended periods of time. It is more time consuming and costly than cross-sectional studies, but more powerful when seeking answers about social change (Neuman, 2003). This style of analysis is powerful when researchers seek information about educational change (Hargreaves & Goodson, 2006). The

second research question explored school-university partnerships. Investigating a partnership takes time so that the relationships within the partnership can develop and become mutually rewarding. Trust and rapport are essential for a researcher to develop a partnership to gain valid insights (Erickson, 1986). The longitudinal nature of the study enabled feedback from each year to improve the partnership in the subsequent year.

Initial contact with the two School Principals regarding this mLearning project occurred in 2011 and contact was re-established with the two schools towards the end of 2012 to establish a workable research plan. A strong relationship between the University staff and the two schools was maintained throughout the three-year data collection period enabling the collection of data. The study relied on recorded exchanges between the researcher and the participants as well as surveys, field observations and memoing to gain an understanding of the participants' experiences. During these exchanges, participants used 'natural' language to express personal experiences. According to Guba and Lincoln (1994) drawing meaning from this kind of descriptive data is best suited to a qualitative methodology because it allows for critical thinking. Qualitative data can provide a rich insight into human behaviour by uncovering the emic view (Guba & Lincoln, 1994). In this research, rich data was collected using multiple sources to uncover in-depth knowledge about the lived experiences of the research participants.

Quantitative research seeks to find causal relationships and exact answers, and involves collection and analysis of numerical data (Kervin, Vialle, Herrington, & Okely, 2015). Quantitative research usually includes large sample sizes, and the findings are not often related to any particular social context (Johnson & Onwiegbuzie, 2004). While the primary method of data collection used in this study was qualitative, some quantitative data was collected in the form of Likert survey data, and demographic information about the PSTs and the schools, to support the qualitative data. The quantitative data collected in this study

contributed to the context of the cases and participants studied by adding demographic, socio-economic and responses collected from Likert scales. The quantitative survey data collected in this research complemented the qualitative data collected in the semi-structured interviews, focus groups, field observations, memoing and surveys to provide rich descriptions of the cases studied.

This study prioritised qualitative methods to generate insights about relationships within contexts on multiple levels, but at the same time captured quantitative data regarding the participants and cases studied. The quantitative data was used to support the qualitative data and provide broader insights. A qualitatively driven methodology was applied to give a nuanced understanding of mLearning in ECE. This methodology enabled the collection of comprehensive, and sophisticated, materials alongside quantified elements to enhance the study (Hall & Ryan, 2011).

3.4 The research methods

Figure 3.2 illustrates the five phases of the research plan. The first phase of the research involved establishing partnerships with the schools and meeting the school leaders. During the second phase, the PSTs completed an ICT unit titled *Transforming Learning through ICT*. As part of this unit PSTs developed, in groups, an mLearning rich lesson which they presented to peers (peer group) or children in one of the partner primary schools (authentic groups). The early childhood teachers at the two partner primary schools were invited to attend the ICT unit alongside the PSTs and have input into the curriculum prepared for the classes by the PSTs. In phase three the PSTs delivered lessons, and there were opportunities for the practising teachers to provide feedback. In phase four feedback was collected from the practising teachers, PSTs and University staff. In phase five, professional development workshops were delivered to parents and carers and staff at each school to

provide up-to-date information regarding mLearning in ECE. Parents shared views about the use of mLearning in the early years of education on such occasions.

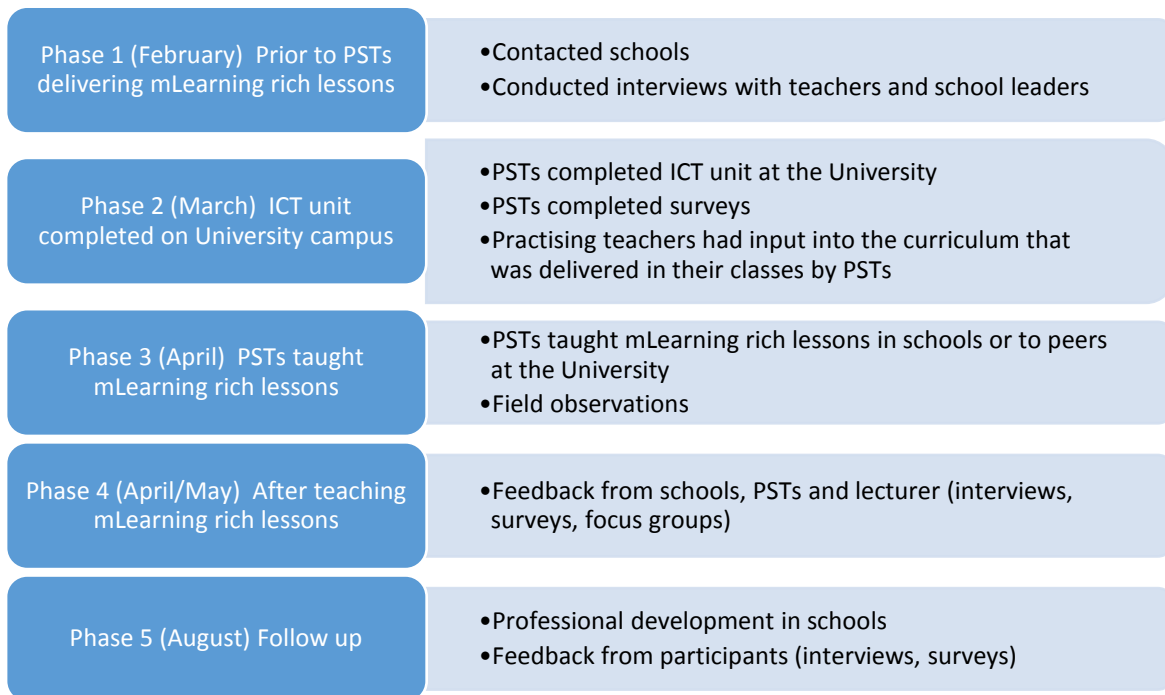


Figure 3.2. The five phases of the research plan (program repeated over three years).

3.5 The partner schools

The research explored mLearning implementation using school-university partnerships. The two partner schools were both small Department of Education schools with similar demographics. The funding received by Department of Education schools relates to the number of students enrolled. Small schools such as those in this study had limited funding and potentially fewer resources especially in mLearning and often relied on contributions from parental associations.

3.5.1 School A.

School A is a single streamed metropolitan primary school with student numbers between 2013 and 2015 of 201, 189 and 183 respectively. Technology at School A initially consisted of a bank of eighteen desktop computers which teachers could book for a weekly

session, two iPads for children with special needs and no wireless infrastructure. Table 3.2 presents the demographic profile for School A.

Table 3.2
School A Demographic Profile

School Detail	Value
Distance from the University	1.3 km
Student numbers	201 (2013) 189 (2014) 183 (2015)
Average full-time teaching staff number 2013-2015 (FTE#)	19.9
Average ECE student number 2013-2015 (K-2)	126
iPads available in the school	2 (2013) 3 (2014) 35 (2015)
Average ICSEA * 2013-2015 (State average value – 1,000)	1,138
Average attendance rate (2013-2015)	93.7%

*ICSEA is the Index of community Socio-Educational Advantage
Full-time equivalent

School A had a new Principal appointed in 2013 and it also lost most of the playground equipment because it was deemed unsafe. Towards the end of 2013, a building at School A consisting of two classrooms and the school canteen was deemed unsafe. A partial demolition resulted in the school losing one classroom, a canteen, staff room and several store rooms. Consequently, at the start of 2014 School A looked like a construction site filled with machinery and the undercover area was out of bounds. Extensive groundworks and landscaping followed the demolition in the first term of 2014. School A also had a change of principal in the middle of 2014 and at the beginning of 2015. These disruptions impacted on the school community and the partnership because the Principals had competing priorities. Table 3.3 contains the background details of the key participants at School A.

Table 3.3
Participants at School A

Pseudonym	Timeframe	Role	Technology in classroom	Years of teaching experience when joining the study	Amount of mLearning professional development in the three years prior to joining the study	Confidence in mLearning 1(low) to 5(high)
Angel	2014-2015	Year 1 teacher	IWB, two desktop computers, one iPad (2014)	28	0	2.5
Jessica	2013-2014	PP teacher	IWB, two desktop computers	15	1	1
Karen	2015	PP teacher	IWB, two desktop computers, one iPad	34	0	2
Kelly	2013	Year 1/2 teacher	IWB (not working for first six months)	0	0	2
Lara	2014	Acting Principal	NA	37	0	2
Sam	2015	Principal	NA	12	0	3.5
Tim	2013-2014	Principal	NA	30	0	2

At the commencement of the study, School A was not an IPS and had very limited mLearning resources. The first Principal indicated that the school was “broke”. Three years later School A had achieved IPS status with much greater control over finances and staffing. School A initially, had two iPads for use with children at educational risk but no iPads

available for teachers to use in the classroom. However, three years later School A had a Wi-fi network and 35 iPads. In the first year of the study, the falling trend in enrolments meant that School A was financially restricted. At the end of the study, the enrolment trend became one of growth which increased the funds available in the school. The P & C Association raised an average of \$25,000 each year. In 2014, the money was spent on the school grounds and the P & C Association approved the future purchase of a set of iPads. In 2015, the P & C Association purchased a set of sixteen iPads.

3.5.2 School B.

School B is a single streamed metropolitan primary school with student numbers between 2013 and 2015 of 96, 112 and 119 in successive years. At the inception of the study School B had desktop computers in all classrooms, a limited Wi-fi network plus one set of six laptops and one set of eight iPads for sharing throughout the school. School B's mission statement stated that through partnerships with parents and the local community it provided an inclusive environment in which students could develop the knowledge, skills, understandings, and confidence to reach individual potential. The P & C Association raised an average of \$12,000 each year and was willing to spend money on technology. In 2012, the P & C Association purchased eight iPads, and in 2013, they purchased a plasma screen television. The P & C Association also spent money on jumpers for the graduating class, keyboards, camps, sporting equipment and the graduation dinner. School B purchased four more iPads in 2014 and upgraded the wireless network. Table 3.4 presents the demographic profile of School B.

Table 3.4

School B Demographic Profile

School Detail	Value
Distance from the University	3.1 km
Student numbers	96 (2013) 112 (2014) 119 (2015)
Average full-time teaching staff number 2013-2015 (FTE#)	6.7
Average ECE student number 2013-2015 (K-2)	84
iPads available in the school	8 (2013) 12 (2014) 30 (2015)
Average ICSEA * 2013-2015 (State average value = 1,000)	1063
Average attendance (2013-2015)	92.8%

*ICSEA is the Index of community Socio-Educational Advantage update table

Full-time equivalent

The Principal in 2013 had been at School B since the start of 2011. It was her first substantive position as principal and since her arrival student numbers had steadily increased. In 2014, an acting Principal was appointed for one year. In 2015, a permanent Principal was appointed. Table 3.5 shows the details of the participants at School B.

Table 3.5

School Participants at School B

Pseudonym	Time frame	Role	Technology in the classroom	Years of teaching experience when joining the study	Amount of mLearning professional development in the three years prior to joining the study	Confidence in mLearning 1 (low) to 5 (high)
Anna	2015	Principal	NA	31	5	4
Bo	2014	Acting Principal	NA	13	5	5
Brenda	2013-2015	Deputy Principal	NA	21	0	2
Gloria	2013	Principal	NA	24	0	3
Louise	2013-2015	PP teacher	Desktop computer, plasma screen (2014-2015)	11	3	4
Rachel	2013-2015	Year 2/3 teacher	Four desktop computers, IWB	20	3	2

At the start of the research School B was relatively well resourced because it had a set of eight iPads and a Wi-fi network compared to many neighbouring Department of Education schools that had no mLearning resources. At the inception of the study, the Principal was in her third year at School B and had increased community confidence in the school and reversed the previous trend in falling enrolments. In successive years, there was a turnover of school principals, all with different approaches to mLearning implementation.

3.6 The University

The research setting is Perth, Western Australia, which is home to the Western Australian campus of the University and the School of Education (SoE) involved in the study.

The SoE on the Western Australian campus had approximately 1,000 students. The undergraduate teaching degree offered by the University has a greater practical component than that offered at any other Australian University indicating the importance that the University places on practical experience for students. The University was keen to initiate partnerships with schools as a way of providing PSTs with more practical experience. The University initiated the mLearning partnerships with early childhood PSTs because the use of mLearning in early childhood was found to be quite distinct from use in the primary and secondary settings. The mLearning partnerships provided a way for the University to improve an existing ICT unit for the early childhood PSTs.

At the beginning of each year of the study, the PSTs were surveyed about the ways that they used technology. Nearly all PSTs used technology for social networking (94%) and university study (97%) but fewer than half (42%) thought of technology as a teaching and learning tool (Figure 3.3). Most of the PSTs (90%) were under 25 making them digital natives (Prensky, 2012), but this was not reflected in their knowledge and use of technology as a tool for teaching and learning.

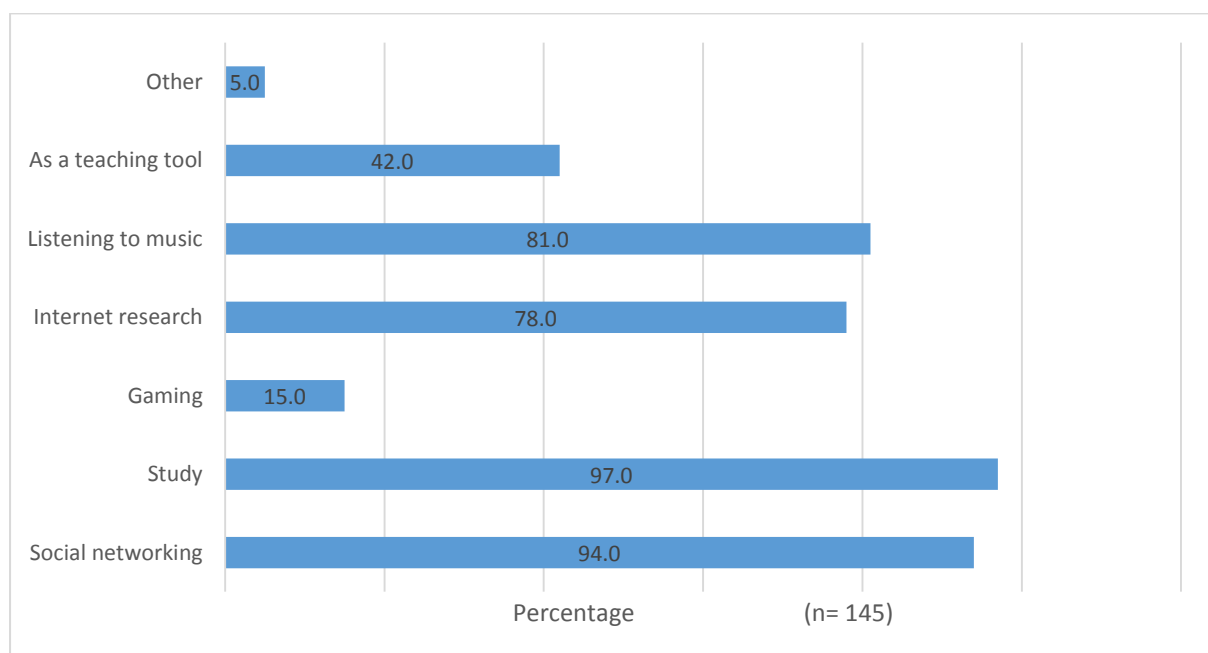


Figure 3.3. How PSTs used mLearning. The figure illustrates the ways in which the PSTs used technology.

The University participants in the study were PSTs, lecturers, the ICT coordinator and Dean of Education. In each year of the study, a new cohort of early childhood PSTs participated. The reason for this approach was to capture the PSTs at the stage in the degree when they were completing the second of two stand-alone ICT units. The second stand-alone ICT unit (Transforming Learning through ICT) is completed in the PSTs' second year of study. At this stage in the course, immediately after this second ICT unit, the PSTs would have best practices in mLearning at the forefront of their mind and be most able to share knowledge and skills with the practising teachers. Figure 3.4 illustrates the number of PSTs participating in each year of the study. The participants were all female except for one male in 2014, largely because early childhood education has traditionally been viewed as a female domain. The PSTs completed the ICT unit in one of the three tutorial groups: one tutorial group partnered with School A; another with School B and the third tutorial group did not partner with a school. The reason for this was administrative convenience but it also provided an opportunity to compare the groups presenting in school with those presenting at the University. The PSTs in tutorial groups partnered with schools A and B (authentic groups) developed and taught mLearning rich lessons to children in the partner schools. The unpaired PSTs (peer group) presented lessons to peers that are standard procedure within the SoE at the University. A comparison of the peer and authentic groups enabled the researcher to determine if the authentic setting offered benefits or challenges to the PSTs. The PSTs had not completed an extended professional experience in a school at the start of the study and had little teaching experience.

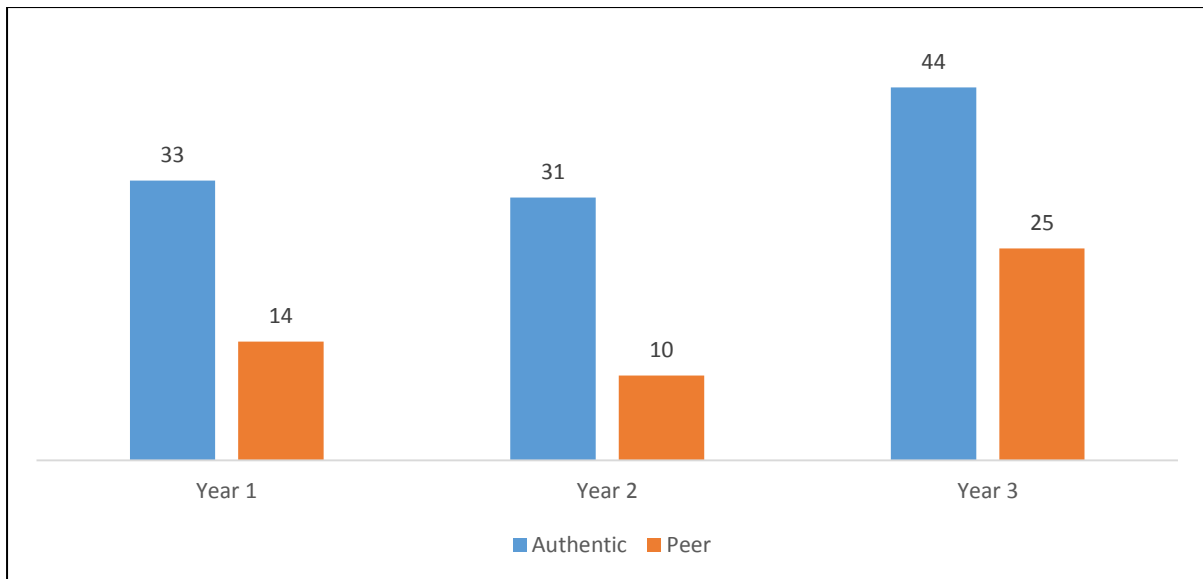


Figure 3.4. The number of early childhood PSTs. The figure shows the number of early childhood PSTs taking part in each year of the study.

Table 3.6 outlines the University academic participant details. For this study, the SoE lecturers were referred to as Victoria and Candice. Victoria was the lecturer for all the early childhood PSTs completing the ICT unit. She also conducted mLearning professional development at both schools for staff and parents and carers throughout the study. Candice was the Early Childhood and Care course coordinator at the University. Victoria and Candice were interviewed before and after the school visits. The interviews determined any differences in the ways that the different groups of early childhood PSTs were taught and presented the lessons and how this may have impacted on the delivery and outcomes of the unit as a whole.

The researcher was an integral part of the study who was present during all interactions between the University and one of the schools. The researcher held an academic position within the SoE at the University but did not teach any of the PSTs in the study and only interacted with the PSTs in tutorials and during authentic visits providing support to the lecturers. The researcher was in no way involved with the assessment of the

PSTs therefore there was no conflict of interest. The researcher was the contact between the partner schools and the lecturers to organise dates and times for authentic visits. The researcher also liaised with schools to seek details of the participating teachers and content ideas for the PSTs to use for planning their authentic lessons. The researcher's position led to the researcher becoming a board member of both partner schools at the conclusion of the three-year research period. The researcher's role in the SoE was to manage PST professional experience places and in this role the researcher placed a high value on meaningful school-university partnerships. The researcher had never taught early childhood education and had no experience using mLearning tools in an educational context prior to the study. The researcher's position within the study enabled the researcher to observe young children without expectations or knowledge about where the children were on their educational journey. The researcher was trained as a secondary school teacher who taught in secondary schools prior to working for the University. The case study methodology was chosen to maximise the school-university partnerships so that benefits might be wider than mLearning.

Table 3.6
University Academic Participants

Pseudonym	Role	Years of experience as an educator	Role in partnership
Candice	Planning and Evaluation lecturer	10	Early childhood course coordinator and lecturer for Planning and Evaluation unit. Keen to integrate mLearning within teaching and stay up-to-date with current school practices.
Delia	Lecturer in special education	20	Delivered a well-received professional development session to 27 Education Assistants from the network of School B. Has worked extensively with EAs.
Julie	ICT unit coordinator	20	Proactive in managing the partnerships and involving the Dean of Education and school Principals. Involved with all professional development. Keen to make a positive difference to early childhood pre-service education.
Kylie	Dean of Education	38	Visited schools, observed early childhood classrooms and met school Principals when invited to do so, thus more informed and up-to-date on how PSTs were using mLearning in ECE.
Lois	Planning and Evaluation tutor	15	In the final year taught two groups; one had an authentic visit and the other did not. Lois gave both groups identical curriculum and mLearning resources for their assignment.
Victoria	ICT lecturer	20	ICT lecturer

The University had a wide selection of mLearning technologies and tools from which to choose, for the PSTs to use in their mLearning rich lessons. A matrix (Appendix A) was used to rate possible mLearning tools and decide which gave the best value for money. The matrix was constructed using Jonassen’s conditions of meaningful learning which were being active, constructive, intentional, authentic and cooperative (Jonassen, Howland, Moore, & Marra, 2003). Some of the tools considered for the mLearning implementation in the partner

schools were iPads, iPad Minis, iPod Touch, Bee-Bots, Sifeto Cubes, Wiis, Story Sequencers, Talk-Time Cards and Boxes, Robotic Lego, Digital Microscopes, GPS devices, Recording Pegs, Recording Butterflies, metal detectors and Chatter Blocks. The mLearning tools selected for the PSTs to use in the schools matched the curriculum content requested by the teachers. Table 3.7 illustrates the mLearning tools used.

Table 3.7
The mLearning tools used in the Research

mLearning tool	2013	2014	2015	Number purchased	Unit Cost
iPad	√	√	√	16	\$429
Bee-Bot	√	√	√	6	\$85
Story Sequencer	√	√	√	6	\$45
Chatter Block	√	√	x	6	\$45
Recording Butterflies	√	√	√	5	\$72
Recording Pegs	√	√	√	1	\$72
Digital Microscope	x	√	√	2	\$79
Metal Detector	x	√	√	1	\$178
Recording Cards	√	√	x	1	\$45

3.7 Data collection

An extensive amount of data about lived experiences accumulates during qualitative research and this data must be interpreted by the researcher (Jackson, Drummond, & Camara, 2007). Table 3.8 presents the scope of data collected from the participants in this research.

Table 3.8
Data Collection from each Group of Participants

Practising teachers	Semi-structured interviews
School Principals	Semi-structured interviews
PSTs	Surveys, field observations and focus groups
Parents and carers	Surveys and focus groups
University academics including Dean and lecturers	Semi-structured interviews

Data was collected using semi-structured interviews, focus groups, surveys, memoing, and field observations. Appendices B-L contain these instruments.

3.7.1 Surveys.

Each of the surveys in this study was distributed through the software program, Survey Monkey. At the start of each year, before delivering mLearning rich lessons, the PSTs were asked to complete Survey 1 (Appendix B) to share their beliefs about mLearning in ECE and establish their knowledge of teaching, technology and their level of technological, pedagogical and content knowledge. The researcher consulted tools created by other researchers, including Chen and Chang (2006), Nikolopoulou and Gialamas (2009) and Oldridge (2010), when constructing the survey questions. The instruments were consulted to ensure that the surveys created for this study did not overlook important factors that might be relevant to the research questions. The survey questions used in this research were developed using instruments created by Pamuk et al. (2013) and Schmidt et al. (2009).

A survey was a rapid and methodologically defensible way of collecting a large volume of data. The PST surveys comprised of both quantitative and qualitative questions. A

disadvantage of using a survey is that respondents may misinterpret questions. For this research, surveys, field observations, and focus groups provided a balanced way of collecting data about the PSTs.

Thirteen weeks after the completion of the first survey the PSTs completed a ten-week professional experience in an early childhood classroom. At the midpoint of the professional experience (fifth week), the PSTs were asked to complete a second survey (Survey 2 - Appendix C). This second survey gathered information about the use of mLearning in professional experience schools in general, and specifically the use of mLearning by the PSTs during the professional experience.

The PSTs completed a third survey, Survey 3, in semester two (Appendix D). The third survey was completed twelve weeks after the second survey to ascertain if the presentation of mLearning rich lessons before the professional experience affected the way the PSTs were using mLearning and to identify any changes in beliefs and attitudes towards mLearning in ECE. The PST surveys also facilitated the collection of qualitative data through two open-ended questions. Between January 2013 and August 2015, 396 surveys were completed by PSTs. The PSTs were given time in tutorials at the University to complete the surveys. The surveys were loaded onto iPads and given to parents at workshops. The parents completed surveys after the parent workshops (Appendix E). The purpose of the parent survey was to gather views from the parent community about mLearning, particularly in the early childhood setting. Table 3.9 summarises the surveys conducted.

Table 3.9
The Surveys

Survey	Participant	Purpose	Link to Research Questions (RQs)
Survey 1	PST	PSTs' skills and knowledge	RQ1
		Beliefs of PSTs regarding mLearning in ECE	RQ1
Survey 2	PST	How are mLearning technologies used in the classroom?	RQ1
Survey 3	PST	Beliefs of PSTs regarding mLearning in ECE	RQ1
		Benefits of the partnership	RQ2
Parent survey	Parents and carers	Level of support provided to children by parents and carers	RQ2
		Benefits of the partnership	RQ2
		Views of parents and carers about mLearning in ECE	RQ2

3.7.2 Interviews with practising teachers, lecturers, and school leaders.

Interviews are used as a technique to discover the perspectives on events held by those other than the interviewer (Boyce & Neale, 2006). Semi-structured interviews were the preferred style of interviews for this qualitative methods study because the interviewer could use social cues such as voice, intonation and body language and was able to react directly to what the interviewee said. The semi-structured interview also allows for spontaneous interaction between the participants (Opdenakker, 2006). The purpose of the interview was

for participants to reflect on, and describe, their personal experience of the phenomenon (mLearning rich lessons). In this research, the interviewer encouraged participants to speak freely about their experiences, sought clarification of responses and encouraged the participants to think aloud.

The practising teachers and school leaders participated in semi-structured in-depth interviews at the inception and conclusion of each year of the study (Appendices K-M). These semi-structured interviews investigated the effectiveness of the teaching and learning conducted by the PSTs in the partnership schools and examined the synergy between the practising teachers and PSTs. Semi-structured interview questions were provided to the participants in advance so that they had time to reflect and prepare for the interview.

The lecturers involved in teaching the units associated with this study were also interviewed (Appendices I-J). All interviews were approximately thirty minutes in length, audio-recorded and transcribed. Each participant received a copy of the transcript for member checking. Table 3.10 summarizes the interviews conducted and gives the purpose of each interview.

Table 3.10
The Interviews

Participant	Purpose	Link to RQs
Early Childhood Teacher	How were mLearning technologies used in the classroom?	RQ1
	Did teachers' skills and knowledge shift?	RQ1
	What was the impact of mLearning on classroom dynamics and student engagement?	RQ1
	What were the benefits and challenges of the mLearning partnership?	RQ2
Lecturer	How were mLearning technologies used in the classroom?	RQ1
	What were the benefits and challenges of the mLearning partnership?	RQ2
	Did the challenges of the partnerships outweigh the benefits?	RQ2
University Dean	Were leaders better informed about mLearning?	RQ2
	What were the benefits of the mLearning partnership?	RQ2
School Leader	Were leaders better informed about mLearning?	RQ2
	What were the benefits of the mLearning partnership?	RQ2

3.7.3 Focus groups.

Small groups of PSTs formed focus groups, where the researcher led the discussion (Schutt, 2003). The focus groups were convened immediately after the PSTs presented mLearning lessons. The role of the researcher was to draw out information from the participants which was relevant to the research (Berg, 2001). Focus group interviews took place with the PSTs, parents, and carers (Appendix F & Q). Focus groups optimally have six to twelve participants (Krueger & Casey, 2000). They act as unstructured interviews, maintaining an informal atmosphere which encourages participants to speak openly and share

their thoughts. Participants in focus groups were free to interact with each other, and the role of the researcher was to motivate and encourage all members to have a voice.

The PSTs participated in focus groups immediately after lessons had been presented to gather reflections of the teaching and learning interactions and seek an understanding of their perspectives of the overall experience. The PSTs, who delivered lessons in an authentic early childhood classroom, gave additional feedback about the pedagogical input of the practising teachers. The advantage of using focus groups is that participants can be spontaneous, and there is interaction between participants (Krueger & Casey, 2000). A negative aspect of focus groups is that not all members of the group may actively participate. If there are strongly opinionated members in the focus groups, they may affect the views of other participants.

University academics visited each school to provide targeted mLearning professional development with the purpose of strengthening the partnerships. The early childhood parents and carers were encouraged to participate in the professional development. The workshops gave parents the opportunity to see what the children achieved under the guidance of the PSTs and to learn about the benefits of mLearning in ECE. Following these professional development sessions, focus groups with parents and carers were convened. The researcher recorded and transcribed all focus groups. PSTs and parents and carers were involved in focus groups in each year of the study. The parental focus groups in this research contained five to ten participants. The PST focus groups in the research contained six to ten participants. In each year of the study, there were five PST focus groups. Four of these groups were convened at the partner schools immediately after the PSTs had delivered their mLearning rich lessons and the fifth group was convened at the University with the peer group after they delivered their mLearning rich lessons to each other. The focus groups enabled all the PSTs the opportunity to reflect and speak about their experiences. Table 3.11

summarizes the focus groups conducted and states how the data collected contributed to each of the research questions.

Table 3.11
The Focus Groups

Participant	Purpose	Link to RQs
PST	Did PSTs' skills and knowledge change?	RQ1
	Beliefs of PSTs regarding mLearning in ECE and if beliefs changed as a result of authentic experience	RQ1
	Did PSTs see mLearning as beneficial to children's learning?	RQ1
Parent	Level of support provided to children by parents and carers	RQ2
	Did parents support mLearning in ECE?	RQ1
	Did parents feel better informed as a result of the mLearning partnership with the University?	RQ2
	Did parents see value in mLearning partnership with the University?	RQ2
	Did parents and carers increase their understanding of mLearning in ECE?	RQ2
	Benefits of the partnership	RQ2
	Views of parents and carers	RQ2

3.7.4 Field observations.

Observational data collected in the field by the researcher recorded details of each PST's mLearning teaching experience. Neuman (2003) suggested that field observations record the interactions between participants. The researcher collected field notes when the

PSTs and the school participants collaborated. Observations and field notes were also gathered by the researcher during ICT tutorials to observe how the PSTs prepared and planned for the mLearning sequences. A field observation instrument developed by Judson (2006) was adapted to create a framework for field observations completed in this study. When the groups of PSTs delivered lessons, data was collected using a field observation protocol (Appendix G). Field observations allow for a description of behaviours, actions, and conversations (Emerson, Fretz, & Shaw, 2001). Table 3.12 summarizes the field observations conducted.

Table 3.12
Field Observations

Participant	When observed	Observation tool	Purpose	Link to RQs
PST	In ICT tutorials when preparing mLearning rich lessons	Memos	How did PSTs' knowledge and skills shift?	RQ1
			How did preparation and planning differ between PSTs presenting to peers and children at schools?	RQ1
PST	During mLearning lesson presentations	Observation protocol	Observed PSTs PK and TK	RQ1
		Memos	Observed synergy between practising and PSTs	RQ1
		Memos	Observed classroom dynamics	RQ1
Parent	During parent workshops	Memos	Observed skills and knowledge of parents	RQ2
Teacher	During staff professional development	Memos	How did practising teachers' knowledge and skills shift?	RQ1
Teacher	During lesson presentations	Memos	Observed synergy between practising and PSTs	RQ1

3.7.5 Memoing.

The researcher memoed throughout the research project using an online journal. The journal captured dated field notes and reflections, feelings and observations. The journal helped the researcher to corroborate the findings of the interviews and focus groups. During field observations, memos were used to detail descriptions of daily events. Sometimes ordinary day-to-day operations are invisible to participants, and they are not able to articulate them. According to Erickson (1986), a critical observer can collect detailed descriptions and record what is happening in a way that is documentable. Memoing assisted the researcher to make leaps from the raw data to the interpretation of the phenomena under investigation (Birks, Chapman, & Francis, 2008). The use of memos provided the researcher with the opportunity to reflect on ideas from the interviews and focus groups informally and assess the techniques used. Memoing recorded insights and ideas that emerged from interviews and subsequent interactions with participants and helped the researcher to make sense of what was happening (Denzin & Lincoln, 1998). The researcher used Evernote software to record written and audio notes and photographs. NVivo, a qualitative data software tool, was used to store memo data which was coded with all other qualitative data collected.

The data collection instruments used in this study were interviews, surveys, focus groups and field observations. These described instruments gathered data that was used to answer the research questions. Figure 3.5 illustrates the relationship between the research questions and data collection instruments used.

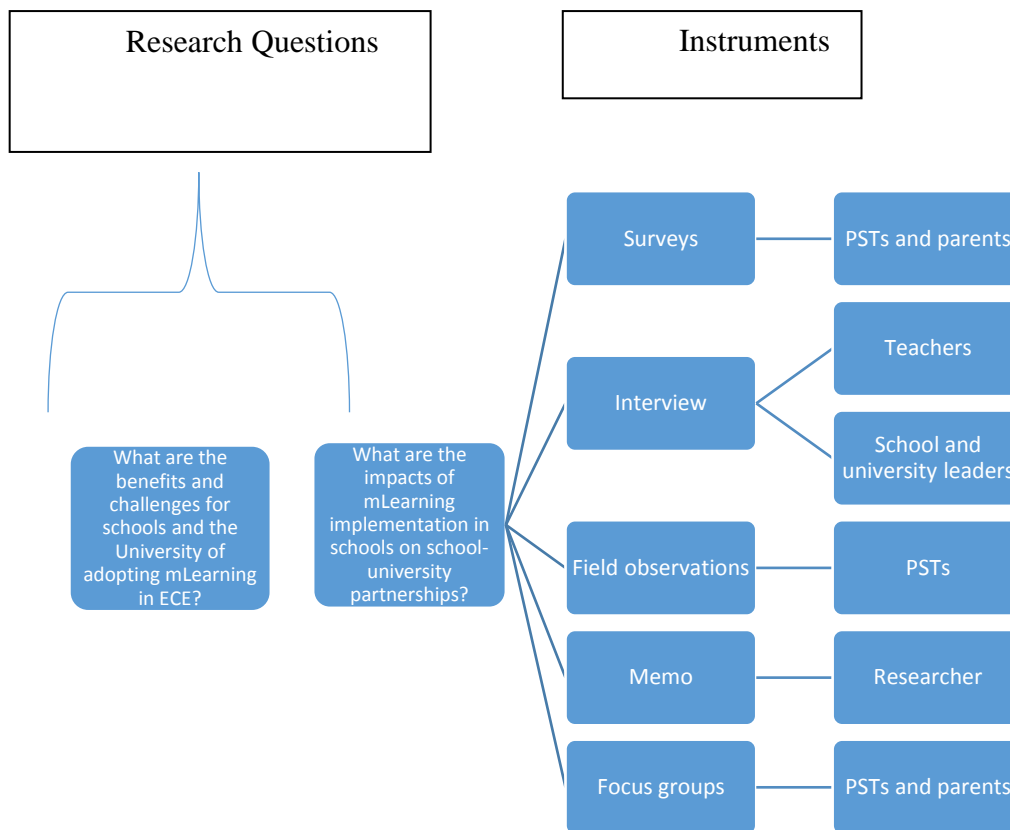


Figure 3.5. The relationship between the data collected and the research questions. The figure shows the instruments used to collect data from the different participants.

3.8 Data analysis

The research questions were designed to understand the given experiences of individuals and interpret them. The purpose of the data analysis was to make sense of the participant's experiences. The qualitative data was analysed using a series of steps from an approach described by Miles, Huberman, and Soldaña (2013). The steps involved: data reduction, occurring continuously throughout the analysis; data display, comprising of the organisation, compression and assembling of information; and drawing and verifying conclusions from displayed data. The method of data reduction provided a comprehensive, meaningful and coherent representation of the data. Figure 3.6 illustrates the data analysis process used.

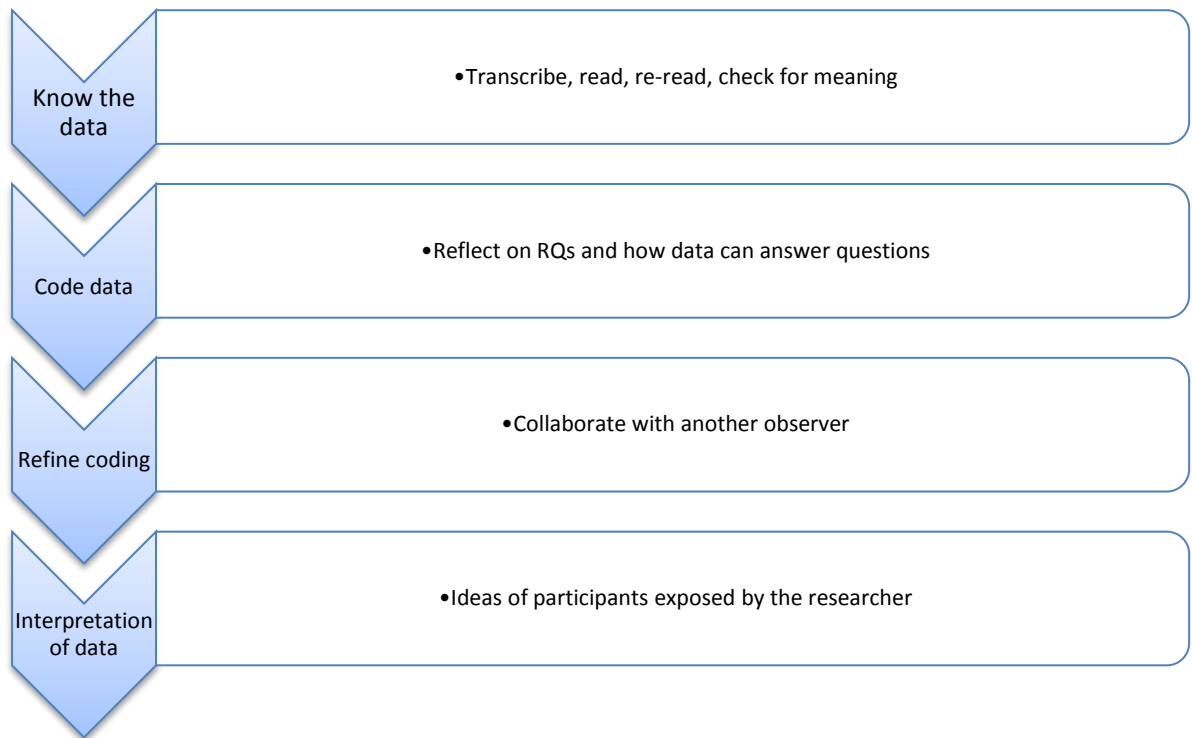


Figure 3.6. The method of data reduction. This figure illustrates how the views of the participants were exposed.

Firstly, it was important that the researcher had an intimate knowledge of the data (Raffles, 2003). Data knowledge was achieved by listening to interviews, reading and re-reading transcripts. Recordings of semi-structured interviews, and focus groups, where the participants led conversations, were transcribed and analysed along with research memos. Each time the researcher collected data in the field, it was important to spend an equal amount of time reflecting on observations made and data collected. Reflection stimulated recall and helped the researcher to develop insights. The data was coded using open, axial and selective coding (Bowen, 2008). In open coding the codes are created during the coding process. The codes were key words or phrases occurring frequently. The open coding process separated the text into useful and irrelevant information and hence reduced the total amount of data. The second stage in the coding process was axial coding where the data was recorded by merging and connecting data into categories by looking for connections and relationships

between codes. The final stage of coding, selective coding, involved re-reading the raw data seeking further data to confirm or contradict the previous coding. During selective coding, confirmation bias, where there is a tendency to seek out data that supports an idea, was avoided by collaborating with a colleague (Hernandez & Preston, 2013). Data display using tables and charts followed the data reduction process. Displaying the data enabled patterns to emerge.

All data collected during the research was entered into NVivo software which is a qualitative data analysis software tool used to simplify the qualitative data through coding (Basit, 2003). NVivo was used to manage, shape and make sense of the qualitative data collected. NVivo held materials such as audio, word and portable document format (PDF) documents, qualitative survey results and photographs. NVivo provided the researcher with space and the tools necessary to code and display the data and develop meaningful conclusions.

The quantitative data collected in this study was Likert survey data which was collected using Survey Monkey (Buchanan, & Hvizdak, 2009) and entered into SPSS (version 23) to analyse and display the data. Descriptive statistics were used to analyse the quantitative data. The Likert survey data was a way to collect the views about mLearning from large numbers of PSTs and discover if their views about aspects of mLearning were favourable or negative. The percentages of PSTs with agreeable, disagreeable and neutral views were displayed.

Dimension reduction was completed using SPSS (version 23) to see if the variance between the items was suitable to conduct exploratory factor analysis. A Kaiser-Meyer-Olkin (KMO), measure of sampling adequacy, was found to be 0.809 indicating that about 81% of the variance of the items could be explained by inter-related factors. Bartlett's Test of Sphericity gave a significant test value of $p < .05$ which confirmed patterned relationships

within the items. The significant test value was $p = 0.00$ indicating that items were inter-related. Exploratory factor analysis was conducted on the 32 Likert items using SPSS (version 23). The exploratory factor analysis reduced the data and grouped the items into three themes with a shared variance (Yong & Pearce, 2013). Factor analysis was used to regroup items into clusters or themes with a shared variance and enabled patterns and meaning to be extracted from the data. The themes were labelled PSTs' negative views about mLearning in early childhood education, PSTs' positive views regarding mLearning in early childhood education and PSTs' views about technological, pedagogical and content knowledge. A limitation of exploratory factor analysis is the naming of the factors so that meaning can reflect the variables accurately.

The process for conducting exploratory factor analysis was to firstly determine the factors, then rotate the data to get a clearer distinction between the factors. Poor factors that may be cross-loaded were dropped and then the process was repeated until the factors were clear and factor scores were calculated. In this research, there were 32 items and 141-146 respondents for each item. The 32 items were reduced to three factors. Figure 3.7 illustrates the process.

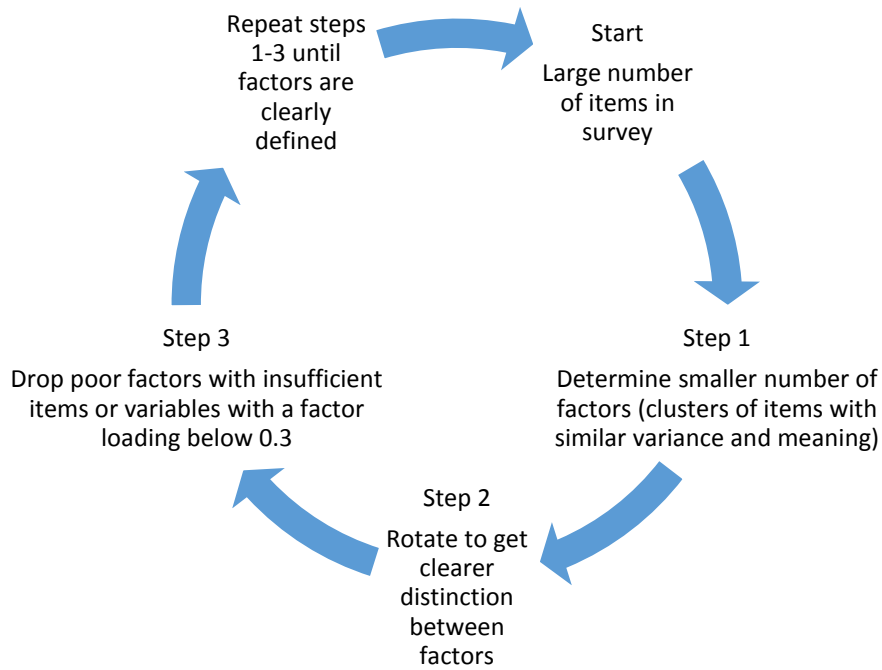


Figure 3.7. Factor analysis of Likert survey data.

The methods of data analysis enabled the researcher to uncover different layers of universality and particularity encountered in the research. It was important to develop multiple perspectives by systematically searching the entire data corpus for confirming and disconfirming evidence so that the research questions could be answered. Figure 3.8 illustrates the data analysis process used for the research.

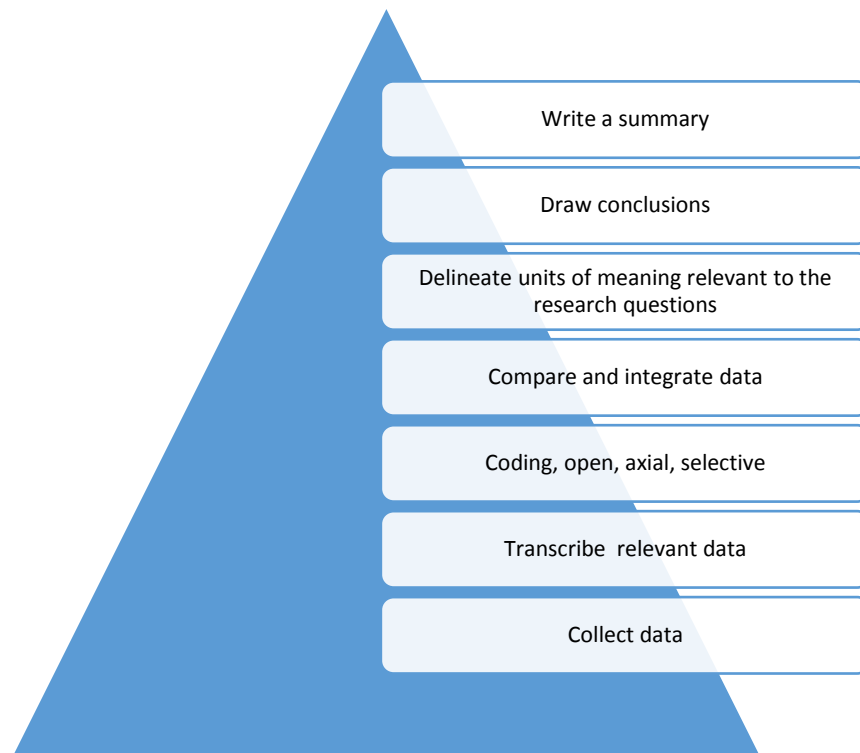


Figure 3.8. The data analysis process. This figure illustrates the process used to make meaning from the data.

3.9 Limitations of the research

The study took place in two small metropolitan primary schools in Western Australia. Within the two cases there were only a small number of early childhood teachers and school leaders and their views may not be representative of other teachers in these schools or teachers in other schools. Both schools were in the public sector, therefore, some of the findings may be specific to this context. Readers from different contexts may be able to identify elements that are meaningful outside the scope of this study. Some of the findings may apply to other school settings; however, the purpose of this study was not to make generalisations across other school settings but to explore in depth what was happening in discrete contexts.

A large number of PSTs were involved, but each cohort was only involved for one year. Within the year, the PSTs were limited to two or three school visits. The limited amount

of contact between each group of PSTs and the schools was a limitation of the study. Greater exposure to mLearning experiences in schools may have had a greater effect on the outcomes for the PSTs. It was not possible to track the PSTs over time (i.e. over the three-year period) because of logistics in timetabling and other staff having to change their teaching style to include mLearning.

The number of teachers participating in the research was small, with two from each school, each year. The small number of teachers participating was a limitation as their experiences may not be comparable with other teachers in other settings. New relationships were continually formed as there were changes in personnel in the schools over the three-year period. The length of time the individual teachers and school leaders participated in the study varied which was a limitation of the study as extended time within the study might have affected the outcomes for the participating teachers, school leaders, and their school communities. The changing commitment of the schools, rapid changes within mLearning and the fact that the teachers all had different beliefs about mLearning were limiting factors in this research. The commitment of the schools varied according to other factors within the schools, including new principals, changes to staff, Independent Public School (IPS) status of schools and significant disruptions in the schools such as unplanned major building works.

3.10 Trustworthiness of the data

The researcher was rigorous and systematic when examining the data and making inferences from it. The research aimed to minimise researcher bias and strengthen reliability and validity by implementing the following techniques:

Triangulation: According to Stringer (2008) triangulation assists a researcher in establishing trustworthiness of data by using a variety of methods and sources. Triangulation provides a method for researchers to corroborate so that the research problem and its

outcomes are illuminated. Creswell (2005) states that collecting data from various sources will support the conclusions of the study and enhance the validity. As discussed, the research took place at two sites over a three-year period. Multiple methods of data collection such as surveys, focus groups, and interviews took place at these locations. In addition, the study used a minimum of three academics at each school during PST lessons, thus providing different perspectives on the same data.

Member checking: Interview and focus transcription occurred, and interview participants received a copy of the transcript. Members confirmed transcript accuracy (Merriam, 1998). This member check ensured the trustworthiness of the interview data.

Thick description: A rich description of the study helps readers determine that the findings were appropriate (Creswell, 2005). A rich interpretive perspective enhanced the validity of the research. A thick description was obtained by considering two case study sites over a three-year period. Multiple sources of data were collected, and sufficient interviews and focus groups enabled data saturation to be achieved.

Multiple methods of data collection provided multiple perspectives and ensured that the findings were the product of the research and not biases of the researcher. Case studies are conducted in the field and require researchers to have the skills including the ability to ask questions, listen, be responsive, understand the issues studied and lack bias when interpreting data (Burns, 1994). The researcher valued these skills and referred to them throughout the research. The transferability of the research was enhanced by the detailed descriptions of the context of the two cases studied so that valid and defensible generalisations about the cases could be applied to other settings.

3.11 Ethical considerations

The maintenance of privacy throughout the research and post-research was necessary. Participants were de-identified, and an alias was used to represent them in the research. Identifier codes were used for data stored on hard drives, and the details of the participants were kept in a locked cabinet. The researcher was independent of the teaching and learning process, so there were no dependent relationships.

Formal ethical clearance was obtained from The University Human Research Ethics Committee as well as from the West Australian Department of Education. All participants received plain language statements (Appendix H) outlining the research and the option to withdraw from the study at any time. All members, namely the School Principals, University lecturers, practising and PSTs, and parents and carers gave consent.

3.12 Conclusion

In this chapter, the constructivist methodological choices made during the evolution of this study have been described. The research used an interpretative perspective and a case study methodology. A description of the data analysis along with considerations about trustworthiness and ethics followed a description of the methods of data collection. The following four chapters present the findings.

Chapter 4 Findings from the Pre-Service Teachers

4.1 Introduction

Chapters 4, 5, 6 and 7 present the results of this research. Chapters 4 and 5 present the results gathered at the classroom level, namely, from the practising teachers and pre-service teachers (PSTs) and through observations of authentic mLearning teaching experiences in the classrooms. Chapter 4 presents the results about the PSTs and chapter 5 presents the results regarding practising teachers. Chapters 6 and 7 present the results collected from the school and University leadership and communities. Figure 4.1 illustrates the organisation of the results.

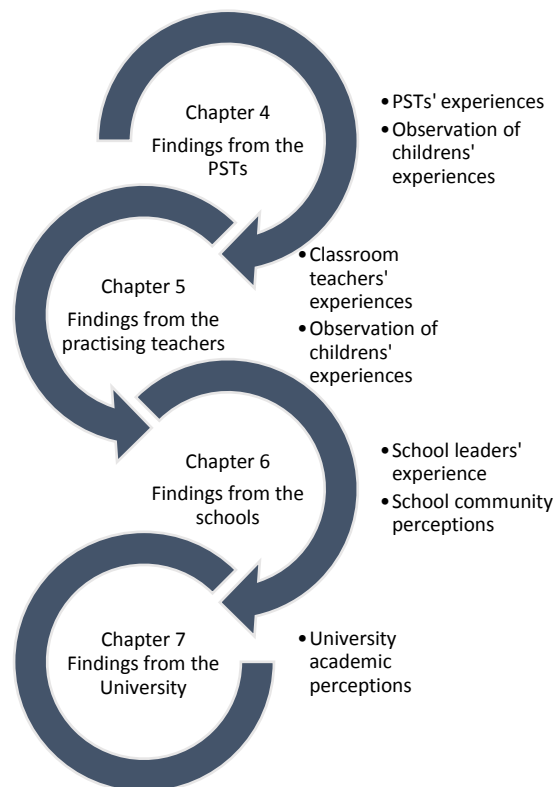


Figure 4.1. Organisation of the results chapters.

The purpose of the research was to explore mLearning in early childhood education (ECE) vis-a-vis school-university partnerships. In gauging the relative merits of these partnerships, the research examined benefits and challenges of mLearning within the ambit of five considerations:

1. The level of engagement that children exhibited in working with mLearning technologies.
2. How authentic experiences may have contributed to the learning of PSTs.
3. How the synergy between practising teachers and PSTs may have helped each to master mLearning for the benefit of student learning.
4. How the partnership may have contributed to the practising teachers' technological knowledge (TK).
5. How the partnerships may have contributed to mLearning in the school and University communities.

This chapter contains the results associated with considerations one, two and three from the perspective of the PSTs. Chapter 5 contains the results associated with considerations one, three and four, from the perspective of the participating classroom teachers. Chapters 6 and 7 present the results associated with the fifth consideration. The latter chapters contain the perspectives of the school and University communities.

4.2 The pre-service teachers (PSTs) mLearning experiences

The PSTs undertook an ICT unit as a participant in one of three tutorial groups. The PSTs in two of these tutorials paired with one of the partner schools (these will be referred to as authentic groups) and the third group (referred to as the peer group) did not pair with a school but worked with their peers at the University. The peer group was created for organizational reasons. Comparisons between the authentic and peer groups were made enabling an assessment of the benefits and challenges of the authentic teaching experiences. In each year of this three-year study, the authentic and peer groups presented mLearning-rich

lessons to children in the partner schools or peers at the University. The practising teachers selected the curriculum for the PSTs in the authentic groups and the ICT lecturer guided the PSTs to appropriate mLearning resources. The ICT lecturer also provided the PSTs with planning time and made sure that the intended activities and mLearning resources selected were appropriate. The PSTs received a high level of support from the ICT lecturer to ensure that the mLearning tools they selected were purposeful and developmentally appropriate. The children were situated in years ranging from pre-primary (PP) to Year 3.

4.2.1 Authentic mLearning experiences – School A.

The authentic mLearning experiences enabled PSTs to gain teaching experience using mLearning in the classroom. Each week, half of the authentic PSTs taught mLearning-rich lessons and the other half acted as helpers supporting the small group activities. The authentic PSTs visited the schools twice, once as a teacher and once as a helper. Tables 4.1 and 4.2 show details of the lessons at Schools A and B.

Table 4.1

Lessons facilitated at School A

Year	Year level	Learning area	Lesson	Tools used	Bloom's digital Taxonomy
2013	PP	English	Possum Magic. Taking photographs and drawing pictures to use in digital book	iPads (Book Creator)	Create
2013	PP	English	Completing digital book	iPads (Book Creator)	Create
2013	1/2	Mathematics	Directional language and measurement (formal and informal)	Bee-Bots	Investigate
2013	1/2	Mathematics	Estimation, measurement, and directional language	Bee-Bots	Investigate
2014	PP	English	Phonics, letters, and sounds	iPads (Quick Response [QR] code scanner, camera, and Writing Wizard app), Recordable Pegs	Investigate, create and communicate
2014	PP	English	Literacy, sounds and blends	iPads (camera, Writing Wizard app), Bee-Bots, Chatter Blocks	Investigate and communicate
2014	1	Science	Seasons and weather	iPads (seasons app), Bee-Bots, Talking Butterflies	Investigate
2014	1	Humanities, Arts and Social Sciences (HaSS)	Jobs in the community	iPads (video camera, Doodle Buddy), Talking Butterflies	Investigate, create and communicate
2015	PP	English	Phonics, letters, and sounds	Bee-Bots, digital microscopes, iPads (QR codes), metal detectors	Investigate
2015	PP	English	Phonics, letters, and sounds	Bee-Bots, iPads (Book Creator, PicCollage)	Communicate
2015	1	Science	Human body parts	iPads (PicCollage, Book Creator), digital microscope	Investigate, create and communicate
2015	1	Science	Insects	Digital microscopes, iPads (PicCollage, ShowMe)	Investigate, create and communicate

In the first year of the study (2013), the pre-primary teacher set a topic of story sequencing using digital books, using a familiar book by Mem Fox, namely, Possum Magic. The children successfully produced their own books by taking photographs, recording narrative and drawing pictures showing the possum in different settings. The teacher received copies of all the digital books and, as a result, of the experience went on to use the tool Book Creator with her class.

In the Year 1/2 class, the teacher requested lessons on measurement, estimation, and directional language, prompting the PSTs to employ Bee-Bots. The PSTs found it challenging to plan suitably sequential lessons and the group teaching in the first week completed more than anticipated which meant that the second group had to completely re-structure the lesson for the second week. Despite the stress and additional time required to rewrite the lesson, the School of Education (SoE) staff all agreed that the resulting lesson was of a high standard. The PSTs planned a series of rotational activities using Bee-Bots and traditional resources seamlessly to meet the learning objectives of their lesson.

In the second year (2014) the initial lessons planned for the Year 1 class were on the topic of the seasons and the weather. The app chosen by the PSTs to support this learning was not Australian and included images of snow and deciduous trees, this raising the question of relevance. The app also contained advertisements and was game like in nature. The academic staff from the SoE were disappointed with the pedagogical choices made by the PSTs although the overall lessons were well received by the children and their teachers. As a result, after this occasion, the SoE staff were more careful to check mLearning resources selected by PSTs, who were presenting in schools. In the second week, the PSTs' lessons were on jobs in the community, using iPads and Talking Butterflies. The iPads were used for taking video and drawing pictures using Doodle Buddy.

In the pre-primary class, the lessons were on letters of the alphabet. The PSTs used Recordable Pegs, Bee-Bots, Chatter Blocks, and iPads. The apps used on the iPads were a handwriting app and quick response code scanner. The iPads acted as mirrors using the camera function so that children could see the shape their mouths made when making different phonetic sounds. The activities matched the learning objectives and integrated well into the lesson with a range of non-mLearning based activities. The combination of mLearning and traditional resources highlighted how mLearning can be used as an alternative tool to enhance the learning experience. The Writing Wizard app chosen by the PSTs did not use the correct writing font, which should have been Victorian Modern Cursive, illustrating a lack of content knowledge (CK).

In the final year (2015) the pre-primary teacher gave key letters and sounds, as the curriculum for the PSTs. The PSTs organised six rotational activities which included Bee- Bots, iPads, digital microscopes, metal detectors as well as traditional resources such as Play-Doh and a mystery bag activity. The lessons ran well despite the fact that the pre-primary children had never been involved in activities where students 'rotated' through work-stations before, and the PSTs later stated that they had not previously considered how to facilitate transitions between activities. The PSTs used the mLearning resources in the context of the learning environment, and the mLearning tools were balanced with other physical resources. The activity using the iPads required the children to scan quick response codes that gave them a secret message directing them to look for an object starting with one of the letters that was a focus of the lesson. An oversight by the PSTs was that the children were at the stage of learning letters, but when they scanned the quick response code it responded with a full sentence, that many were not able to read. In the second week, the PSTs continued with letters and sounds and used five rotational activities which included Bee-Bots and iPads. The PSTs managed the transitions and timing well indicating an increased level of

pedagogical knowledge (PK), from experiences the previous week. The teacher and the ICT coordinator were satisfied at how well the PSTs catered for learner diversity stating:

Students [PSTs] you are an inspiration today, I appreciated your ability to differentiate the curriculum, to cater for different children who either needed support or extension. Everyone got to succeed. (Karen, 2015)

The Bee-Bot activity worked beautifully with the gifted child and the child at the other end of the spectrum (ICT coordinator, 2015)

The learning objective in the Year 1 class in the initial week in the final year focused on human body parts. The PSTs planned six rotational activities that used a digital microscope, iPads (PicCollage and Book Creator), an Interactive White Board (IWB), Play-Doh and a bingo game. There were problems with the timing of the rotations and children moving to the correct groups. The SoE staff deemed that the activities fitted well together and reinforced the learning objectives. The criteria used by the ICT lecturer and SoE staff to determine the quality of the lessons presented by the PSTs were:

- Learning objectives stated, used and reviewed.
- Children given a clear indication of the task(s) they were asked to undertake.
- Prior knowledge checked and acted upon.
- Activity is innovative and tasks engage audience in creative thought.
- Successful and prolonged engagement of audience by using mLearning through interactive activity.
- The mLearning selected challenged the target audience to actively engage in content and reflect on their learning.

The activities with the digital microscope were enjoyed by the children, but SoE staff observed that the activities lacked depth and needed more structure indicating that the PSTs lacked content and pedagogical knowledge. The children explored parts of their bodies with the digital microscope, but when asked to draw their observations, these observations did not illustrate their learning. The PicCollage activity and Book Creator activities ran smoothly,

particularly because the children were familiar with Book Creator from the previous year. In the second week, the PSTs continued with science, with the focus on insects. The PSTs planned six rotational activities and managed the rotations well, seemingly having learnt from the previous week. The digital microscope was used to look at some insects, but the group responsible for coordinating the activity abandoned using the microscope after the first two rotations as they struggled to manage the children and the technology. The ShowMe app was used by one group for children to demonstrate their understanding of insects and the PSTs in the group engaged with the children drawing out appropriate scientific language. One group of children created insects out of Play-Doh and the PSTs created a PicCollage of the children's work. The purpose of the PicCollage was unclear to the SoE staff observing, and the PSTs running the activity provided the children with little guidance and did not structure the lesson around specific learning objectives. Children were observed making insects with ten legs using Play-Doh and making spiders when they were supposed to be making insects.

At School A, 11 of the 12 lessons conducted by the PSTs during the three-year period were deemed by the ICT lecturer to be of a high standard, using the aforementioned criteria, and the mLearning was integrated well, enhancing the children's learning. The authentic PSTs had the opportunity to integrate mLearning into lessons and had the support of their lecturer to assist with selection of tools and ideas. The PSTs were also supported by the practising teachers to provide information about the children, select appropriate topics for their lessons and to offer assistance with management of the actual lessons if needed. The PSTs in the authentic groups were deemed by SoE staff as being creative and prepared appropriate resources to support their lessons. The critical feedback provided by the ICT lecturer was not unexpected because it related to the lack of experience of the PSTs who were in the second year of a four-year degree. The lessons taught by the PSTs were well received by the teachers. The PSTs and SoE staff posited that the mLearning experiences provided the

PSTs with pedagogical experience and technological knowledge. During the research, School A had no mLearning resources other than iPads bought for a few children with special needs. The PSTs brought new ideas and mLearning tools into the classrooms providing teachers with the opportunity to enhance their technological knowledge as evidenced in the next chapter.

4.2.2 Authentic mLearning experiences – School B.

The mLearning-rich lessons at School B followed a format similar to those at School A. In the first year of the study (2013), the lessons in the first week were well received in the pre-primary class but the teacher in the Year 2/3 class was not present. In the second week, one group of PSTs delivered a lesson which was considered to be poor by the SoE staff and participating classroom teacher, with limited mLearning in the pre-primary class and the lessons in the Year 2/3 class were well received, although considerably shortened by a very long school assembly. The teacher who was not present in the first week had forgotten about a swimming carnival that clashed with the first PST visit. The challenges presented by an absent teacher and a long assembly forced the PSTs to be flexible and adapt their lessons.

iPads were used for all the activities, as they were deemed by the SoE staff to best match the curriculum chosen by the teachers. In the pre-primary class, the teacher requested the PSTs to conduct a lesson on grouping and sorting. The PSTs chose a closed fruit-sorting app and quick response code scanner. The children engaged with the quick response code scanning, but when the codes revealed information, it proved too difficult for the pre-primary children to read. The topic in the Year 2/3 class was Remembrance Day. The objectives were for children to learn about the Australian and New Zealand Army Corps' (ANZAC) symbols, and SonicPics was used to communicate what they had learnt.

In the second year of the study (2014), the lessons were executed as anticipated, despite unexpected disruptions including a traffic accident which resulted in PSTs not arriving on time. The lessons in the Year 2/3 class were on mathematics and history. The PSTs divided the class so that in the first week half of the class created digital books based on interviews that they had conducted with a family member about school in the past. The PSTs worked with small groups of children and completed books using Book Creator, of which the teacher received copies. The other half of the class completed a range of mathematical activities using iPads. Some of the apps appeared appropriate as they allowed the children to create content, but others were game-based with closed content raising questions as to whether they enhanced the learning for the children.

In the first week of the second year, the pre-primary children completed a range of mathematical rotations involving direct and indirect measurements and the language of measurement. The mLearning used included iPads (camera), Talking Butterflies and Bee-Bots. In the second week, the English lesson was on recounting the journey home from school using Bee-Bots. The PSTs matched mLearning to the English lesson, and their lesson also matched the digital technologies curriculum that was mandated a year later in 2015. In addition to teaching children to recount their journey home, the activity enabled children to programme a robotic toy.

In the first visit in the final year (2015) of the research, the lessons were deemed to be of an exemplary standard not only by the participating teachers but also by the lecturer. The learning objectives in the Year 2/3 class were celebrations such as Christmas, Easter, birthdays and ANZAC day. One group of PSTs took the ANZAC theme and set about creating a Popplet about a key ANZAC character. Each child worked with a PST and had their own ANZAC character. To find information about their character, the children had to scan quick response codes that took them to an app such as Toontastic, Book Creator or

Comic Life. The PSTs had chosen these apps so that they contained the necessary information meaning that the activity did not require the Internet. The PSTs had originally planned the activity so that the children would source information from websites accessed by scanning quick response codes but when they realised that Internet access would not be possible, they adapted the activity to make it work without the Internet. The result was an engaging learning experience for the children. One group of PSTs experienced a problem in that the Popplet app was not working on the iPad they were using so they improvised and used the Notes app instead. In the week that followed, the PSTs used the research completed by the children on their ANZAC character to make an iMovie where they interviewed their ANZAC character for a news report. The children wrote scripts for the news reports and recorded the reports using iPads. The PSTs, who planned lessons on the ANZAC theme, delivered a lesson that the teacher and University staff deemed to be of a high standard and contributed to the children's learning. When asked which activity, they enjoyed the most, the children's responses were about the ANZAC characters and not about the mLearning tools. The classroom teacher commented: "The role-playing of journalists and ANZACs was great and really got the children thinking about the life and history of the times" (Rachel, 2015).

The PSTs, who took the Christmas, birthdays and Easter theme with the other half of the Year 2/3 class, introduced the lesson to the whole class and developed a set of three rotational activities. The PSTs grouped the children using novelty hats that they had brought, so the children were in either the Easter, Christmas or birthday group. The School Principal was present for the introduction in the Year 2/3 class and remarked that the hats were a clever idea and worked well. The PSTs used Talking Butterflies to record Easter facts, PicCollage to create birthday collages and iPads to scan quick response codes to find out Christmas facts. In the second week, the PSTs in the Year 2/3 class planned an informative lesson on Easter traditions around the world and the teacher's comment supports this: "It was interesting to me

to learn about Easter all over the world” (Rachel, 2015). The Easter facts were collated by the children using PicCollage and then put into a digital book using Book Creator so that the children could review their work on an Interactive White Board.

The pre-primary teacher thought that the activities in the first week of the final year were well conceived and stated: “Huge congratulations everyone. You did an amazing job” (Louise, 2015). The PSTs used Recordable Pegs, iPads, digital microscopes to teach the children about colours and combined them with some non-ICT resources. The Principal attended for part of the lesson, commenting that the staff were learning so much technological knowledge. The Principal was very interested in providing further opportunities for staff to up-skill. In the second week, the PSTs in the pre-primary class did not give adequate instructions to the children about how to use the Bee-Bots, and it was apparent that the PST helpers had not used the Bee-Bots before. The PSTs running a colour hunt activity group provided little guidance to the children. The teacher commented:

Unfortunately, I did not find the activities as well thought out, introduced or explained as last week’s. Students [children] weren’t familiar with the Bee-Bots and were less sure of the expectations, what they were learning and why. I really liked the activities, and the children did too, but I felt there were missed opportunities (Louise, 2015).

A short description of the lessons follows in Table 4.2.

Table 4.2

Lessons Facilitated at School B

Year	Year level	Learning area	Lesson	Tools used	Bloom's Digital Taxonomy
2013	PP	English	Sorting and grouping	iPads (QR codes, fruit sorting app)	Investigate
2013	PP	English	Sorting and grouping	iPads (games)	Explore
2013	1	HaSS	Remembrance Day symbols: Taking photographs, recording students' stories	iPads (SonicPics)	Investigate, create and communicate
2013	2/3	HaSS	Remembrance Day symbols: Recording students' stories Creating an audio book	iPads (SonicPics)	Investigate, create and communicate
2014	PP	English	Recalling the journey to school	Bee-Bots	Investigate and communicate
2014	PP	Mathematics	Using body parts for direct and indirect measurement using various rotational activities	Bee-Bots, iPads (camera), Chatter Blocks, Talking Butterflies	Investigate, communicate
2014	2/3	HaSS	Family past and present. Creation of digital books using interviews of a family member	iPads (Book Creator)	Create and communicate
2014	2/3	Mathematics	Rotational groups using a mixture of iPad apps to reinforce addition, subtraction, and measurement	iPads (Show Me, Math Ninja, Math is fun, Math Addition, Math word problems, Adventures Undersea Maths, Montessori Maths, Math Bingo, Popplet)	Investigate and communicate Drill and practice Instructional game
2015	PP	The Arts	Colours	Bee-Bots, iPad (PicCollage)	Create
2015	PP	The Arts	Colours	iPads (camera), digital microscopes, Recordable Pegs	Investigate and create
2015	2/3	HaSS	Celebrations	iPads (Popplet, Book Creator, Toontastic, Comic Life, iMovie)	Investigate, create and communicate
2015	2/3	HaSS	Celebrations (Easter, Christmas, and birthdays)	iPads (PicCollage, QR codes), Talking Butterflies	Investigate, create and communicate

At School B, 10 of the 12 lessons over the three-year period were deemed by the ICT lecturer to be of a high standard, using the criteria, and the PSTs were awarded above average grades for their lessons. The lessons that were not of a high standard gave the PSTs the opportunity to reflect upon their pedagogical mistakes. The pedagogical mistakes reflected the stage of learning of the PSTs who were less than half way through a four-year degree. The PSTs learnt to be flexible as uncontrollable school events meant that lessons had to be modified. They gained teaching practice with the support of the practising teachers to assist with the children and the ICT lecturer assisted the PSTs with the integration and use of mLearning. The PSTs demonstrated the ability to consider the needs of children by creating a range of traditional resources to support their lessons in addition to the mLearning resources. Teachers at School B observed a range of new technologies not available in their school which provided an opportunity to increase their own technological knowledge.

4.2.3 Peer mLearning experiences.

The peer groups were able to select both the age group and the curriculum for their lesson. Groups of two or three PSTs delivered a lesson to the rest of the group who took on the role of children in that class. The ICT lecturer supported the peer group and provided assistance when needed. The ICT lecturer reported that the peer groups rarely asked for advice. Table 4.3 articulates the lessons presented by the peer groups. A short description of the lessons follows.

Table 4.3

Lessons Facilitated by Peer Groups

Year	Year level	Learning area	Lesson	Tools used	mLearning context
2013	PP	Science	Keeping water clean to protect sea creatures	Games on desktop computers	Explore
2013	PP	HaSS	Weather and what to wear	Season's app used on IWB as a whole class activity, iPads for game	Explore
2013	2	Science	Planets and the solar system. Find out about the planets in our solar system	Wiki on desktop computers	Explore
2013	2	Mathematics	Telling the time	Game on IWB, iPad game to match analog and digital time	Investigate
2013	3	Science	Animals (mammals)	Desktop computers (create word clouds), Wiki, iPads (GoAnimate)	Investigate and create
2014	2	English	Fairytales story sequencing	iPads (Book Creator)	Create
2014	1	Science	Animal habitats	Talking Butterflies, iPads (Book Creator)	Investigate and communicate
2014	K	Science	Create a weather forecast	iPads (Tellagami)	Create and communicate
2014	2	Health	Healthy and unhealthy foods	IWB, iPads (camera), SpiderScribe, Padlet, Inspiration	Investigate and communicate
2015	PP	History	Family relationships	iPads (Bubbl.us)	Create
2015	PP	Science	Five Senses	iPads (Book Creator, camera)	Investigate and create
2015	3	Science	Life cycles	iPads (QR codes, Popplet)	Investigate and create
2015	1	Science	The needs of animals	iPads (video camera)	Create
2015	2	Science	How things grow (apple trees)	iPad (Popplet), Jukebox Print	Create
2015	2	History	ANZAC	iPad (QR code scanner), website (survey monkey)	Communicate

The ICT lecturer awarded the peer group presentations low grades in 2013, as only one group used technology in a creative and meaningful way to enhance the lesson. The 2013 peer groups did not cater for learner diversity and clear instructions about the tasks were not provided. Further, the PSTs tended to use videos that in some cases looked like promotional tourist videos. The PSTs assumed that the mLearning would be easy to access, and no group explained how to log on and access software. Resources created would not have worked in the classroom as the peer groups assumed that the children would be able to read and follow instructions independently.

In 2014, the peer group presentations were judged by the University staff to be of a much higher standard than 2013, and understanding of effective use of mLearning was displayed. The early childhood cohort was smaller than usual in 2014, and there were only two tutorial groups for the ICT unit in the semester, plus a small group who completed the ICT unit as an intensive. This small group was included because all early childhood PSTs were captured in each year of the study. The peer group in 2014 was part of the intensive ICT unit where PST completed the ICT unit in five consecutive full days rather than weekly over a thirteen-week period. The higher standards may reflect the high levels of motivation of the PSTs undertaking an intensive unit outside the normal university semester.

In 2015, the peer group lessons were considered by the University staff to be pitched too high for the early childhood target audience. One group of PSTs chose to look at life cycles and used the caterpillar as the example. This group used iPads and quick response codes to go to poorly chosen websites which were beyond the reading level of the majority of early childhood students and contained images of exotic caterpillars not found in Western Australia. The ICT lecturer and researcher observed that the PSTs did not provide adequate instructions as to how to scan quick response codes using an iPad. Another group selected the topic of the five senses for a pre-primary class and had activities on a Weebly website which

required students to type a long URL, which proved to be difficult for pre-primary children. The PSTs had not tested the Weebly website on the iPad and were unaware that many of the games and interactive quizzes (macromedia) required Flash and did not work on an iPad. The lesson objectives were for children to learn about the five senses and create a book using Book Creator to demonstrate their knowledge. There proved to be an unrealistic amount of work in the allocated time, and the ICT lecturer commented that the activities did not fit well together.

A group of PSTs chose family relationships as a topic and planned to create a family tree using Bubble.us on iPads. The Bubbl.us app was not installed on the iPads, so the participants had to complete the activity on desktop computers. There were no instructions about how to use the program, and the program was too challenging for a pre-primary class. Another peer group chose the needs of animals pitched at a Year 1 level. After an introduction and a long Interactive White Board matching activity, the children were asked to make videos using the iPad to demonstrate their understanding of the external features of an Australian animal. The University staff observed the activity and viewed a lack of structure to the lesson, and there was little guidance on using the iPads to make a video. One of the peer groups chose ANZAC as a topic for Year 2. The University staff thought that the lesson lacked appeal for children, was incorrectly pitched, and did not use mLearning to enhance the learning. An Interactive White Board activity, which involved reading a poem, introduced the lesson. The reading level of the poem was beyond the ability of these Year 2 students. Following the poem, a brainstorming activity was completed using the Interactive White Board. The PST's writing on the Interactive White Board was illegible, and the activity was teacher-centred with the teacher choosing the facts. The activity for the children was to use an iPad to scan a quick response code that was on the Interactive White Board. There was limited guidance for finding the quick response code scanner or how to scan a quick response

code. The quick response code directed the children to a survey monkey quiz. Children were given 15 minutes to complete the quiz that comprised four multiple choice questions directly linked to the brainstorming facts on the Interactive White Board.

Of the peer presentations in 2015, only one was considered by the SoE staff as well thought out and engaged the participating group. The topic, growing apple trees, was introduced with an informative video. The children were then asked to brainstorm using an iPad (Bubbl.us) in preparation for a poster that they would later make about growing apple trees. The Bubble.us app that the PSTs suggested was in fact not on the iPads, so the lecturer directed them to use Popplet. Using the Popplet, a poster was then created using a website called Jukebox paint.

Over the three-year period, there were 15 peer group presentations. The ICT lecturer noted that five of these lessons might have worked well in a classroom setting, and the technology would have enhanced the learning. The opinion of the ICT lecturer was that the remaining ten lessons would not have worked well in the authentic setting as, they were poorly thought out and prepared. The peer group view obtained from focus group interviews was that their primary focus was their assessment and obtaining a good grade. The peer groups indicated that they spent more time on other assessment tasks within the ICT unit because their main focus was getting a good grade for the overall unit. The PSTs in the peer group put less time into the mLearning task and did not properly consider the needs of children. As a result, no peer group made any resources to complement their lesson and the lessons were poorly planned compared to the lessons planned by the authentic groups.

4.2.4 Section summary.

The descriptions of the mLearning lessons presented by the PSTs revealed that the authentic groups gained valuable pedagogical experience and were able to plan lessons which

considered the needs and abilities of real children. The peer group presentations were deemed, using the criteria, to be of a lower standard, and most would probably not have worked well in a real classroom. The difference between the peer and authentic groups showed that the mLearning partnerships did contribute to the authentic PSTs' learning. After a poor authentic presentation that lacked technology, Victoria, the ICT lecturer said:

Overall you had to take on so much planning, thinking and doing. It has made such a difference in the way you have presented your lesson. I think you have learnt from last week to this week. You knew you were supported. You were never going to drown. Compared to the peer group you were miles ahead. (Victoria, 2015)

Victoria's comment illustrates that the poor lessons delivered by the authentic groups were still of a higher standard than the lessons delivered by the peer groups.

4.3 PSTs' views, use, and knowledge of mLearning

Gauging the views of the PSTs about using mLearning in early childhood education was an important way to measure the PSTs' understanding about mLearning. PST views were collected using surveys and through focus group interviews. The focus groups convened after the mLearning lessons took place. The survey (Appendix B) used open-ended questions and five Likert items, part of a Likert-type scale, with answers ranging from strongly disagree (1) to strongly agree (5). Positive (agree and strongly agree) and negative (disagree and strongly disagree) responses were combined. The response rates for the surveys were very high (98%) due to the PSTs completing the surveys during class time. The surveys were anonymous, so PSTs were able to choose to participate or not without being identified. The initial survey took place in the ICT unit in semester one at the start of the University year and contained 38 Likert-type items. These items are presented in Table 4.4. Exploratory factor analysis was used to group the inter-related items into factors with a common variance. Table 4.5 shows

how the three groupings were determined using the pattern factor matrix scores. The 38 items were reduced to three factors which were; negative views regarding mLearning (Figure 4.2), positive views regarding mLearning (Figure 4.3) and views about technological, pedagogical and content knowledge teaching skills (Figure 4.4).

Table 4.4
PST Likert Survey Items

Number	Statement	% Disagree	% Neutral	% Agree	Number of responses
1	I know how to solve my own technical problems	11.6	26.7	61.6	146
2	I can learn technology easily	7.6	12.5	79.9	144
3	I keep up with new technologies	6.8	20.6	72.6	146
4	I frequently play about with technology	11.7	14.5	73.8	145
5	I know a lot of different technologies	13.0	23.3	63.7	146
6	I have the technical skills I need to use technology	64.3	15.1	78.8	145
7	I know how to organise and maintain classroom management	6.9	32.4	60.7	145
8	I can adapt my teaching style to different learners	2.7	21.9	75.3	146
9	I am nervous about being observed by the classroom teacher	8.9	19.9	71.2	146
10	I am worried about the technology not working properly	19.9	27.4	52.7	146
11	I lack pedagogical skill	46.2	43.5	10.3	145
12	I lack technological skill	64.1	23.5	12.4	145
13	I lack content knowledge	57.0	35.2	7.7	142
14	I know about mLearning technologies that I can use for understanding and teaching several learning areas	13.1	40.0	46.9	145
15	I can use technologies that enhance the content of a lesson	9.6	24.0	66.4	146
16	I critically think about how to use mLearning in the classroom	17.2	37.9	44.8	145
17	ICT integration in ECE degrades the role of the teacher	73.6	22.2	4.2	144
18	The use of mLearning by children does more harm than good	61.8	29.2	9.0	144
19	mLearning is only useful for playing games	90.3	7.6	2.1	144
20	The role of the teacher is not affected by integration of ICT in ECE	26.2	38.3	35.5	141
21	I would not like to use mLearning with children unless it is imposed from 'above'	60.4	30.6	9.0	144

22	The use of mLearning motivates children	4.2	16.8	79.0	143
23	The use of mLearning is complementary (and not essential) to the whole educational process	18.3	35.2	46.5	142
24	The role of the teacher becomes as a facilitator when children use mLearning	7.7	38.7	53.5	142
25	The use of mLearning promotes passive learning	17.7	51.8	30.5	141
26	To the fullest extent possible, I intend to use mLearning with the children	11.9	32.9	55.2	143
27	Using mLearning in ECE may lead to new pedagogical methods and approaches	2.1	24.7	73.2	142
28	I would not like to use mLearning because learning becomes mechanical	62.7	28.9	8.5	142
29	The use of mLearning promotes children's active participation in the learning process	5.6	32.2	62.2	143
30	The use of mLearning by children promotes their social isolation	30.8	43.4	25.9	143
31	I am sceptical about using mLearning in my teaching	44.6	30.9	24.5	139
32	mLearning restricts children's imagination and creativity	44.4	35.9	19.7	142
33	I am not interested in integrating mLearning with children; there are other priorities for ECE	64.1	28.2	7.7	142
34	The use of mLearning is only useful for processes that cannot be accomplished otherwise	49.7	42.0	8.4	143
35	mLearning is a useful tool to support and enhance children's learning	2.1	24.7	73.2	142
36	I intend to use mLearning, sometimes, because it familiarizes children with technology	7.6	23.6	68.8	144
37	ICT integration in ECE restricts the role of the teacher	56.6	37.1	6.3	143
38	The integration and use of mLearning in ECE is necessary	5.6	35.7	58.7	143

Table 4.5

Pattern Factor Matrix scores for Likert Survey Items

Likert survey item number		Pattern factor matrix scores		
		Positive views	Negative views	Teaching skills: TK, PK & CK
33	I am not interested in integrating mLearning with children; there are other priorities for ECE		.810	
37	mLearning integration in ECE restricts the role of the teacher		.766	
32	mLearning restricts children's imagination and creativity		.761	
28	I would not like to use mLearning because learning becomes mechanical		.742	
18	The use of mLearning by children does more harm than good		.690	
17	mLearning integration in ECE degrades the role of the teacher		.637	
31	I am sceptical about using mLearning in my teaching		.627	
21	I would not like to use mLearning with children unless it is imposed from above		.585	
34	The use of mLearning is only useful for processes that cannot be accomplished otherwise		.536	
19	mLearning is only useful for playing games		.520	
30	The use of mLearning by children promotes their social isolation		.461	
22	The use of mLearning motivates children	.574		
38	The integration and use of mLearning in ECE is necessary	.659		
26	To the fullest extent possible, I intend to use mLearning with the children	.609		
27	Using mLearning in ECE may lead to new pedagogical methods and approaches	.563		
29	The use of mLearning promotes children's active participation in the learning process	.635		
35	mLearning is a useful tool to support and enhance children's learning	.705		
5	I know a lot of different technologies			.778
6	I have the technical skills I need to use technology			.737
3	I keep up with new technologies			.716
1	I know how to solve my own technical problems			.714

7	I know how to organise and maintain classroom management	.596
14	I know about mLearning technologies that I can use for understanding and teaching several learning areas	.585
2	I can learn technology easily	.577
15	I can use mLearning technologies that enhance the content of a lesson	.573
4	I frequently play about with technology	.561
16	I critically think about how to use mLearning in the classroom	.378
8	I can adapt my teaching style to different learners	.351
12	I lack technological skill	-.745
13	I lack content knowledge	-.362
11	I lack pedagogical skill	-.341

4.3.1 PSTs' positive and negative views about mLearning.

PSTs were asked to agree, or disagree with positively and negatively phrased items about mLearning. Figure 4.2 presents the items suggesting a negative PST view of mLearning in early childhood education as determined by factor analysis and Figure 4.3 presents the items suggesting a positive PST view of mLearning in early childhood education.

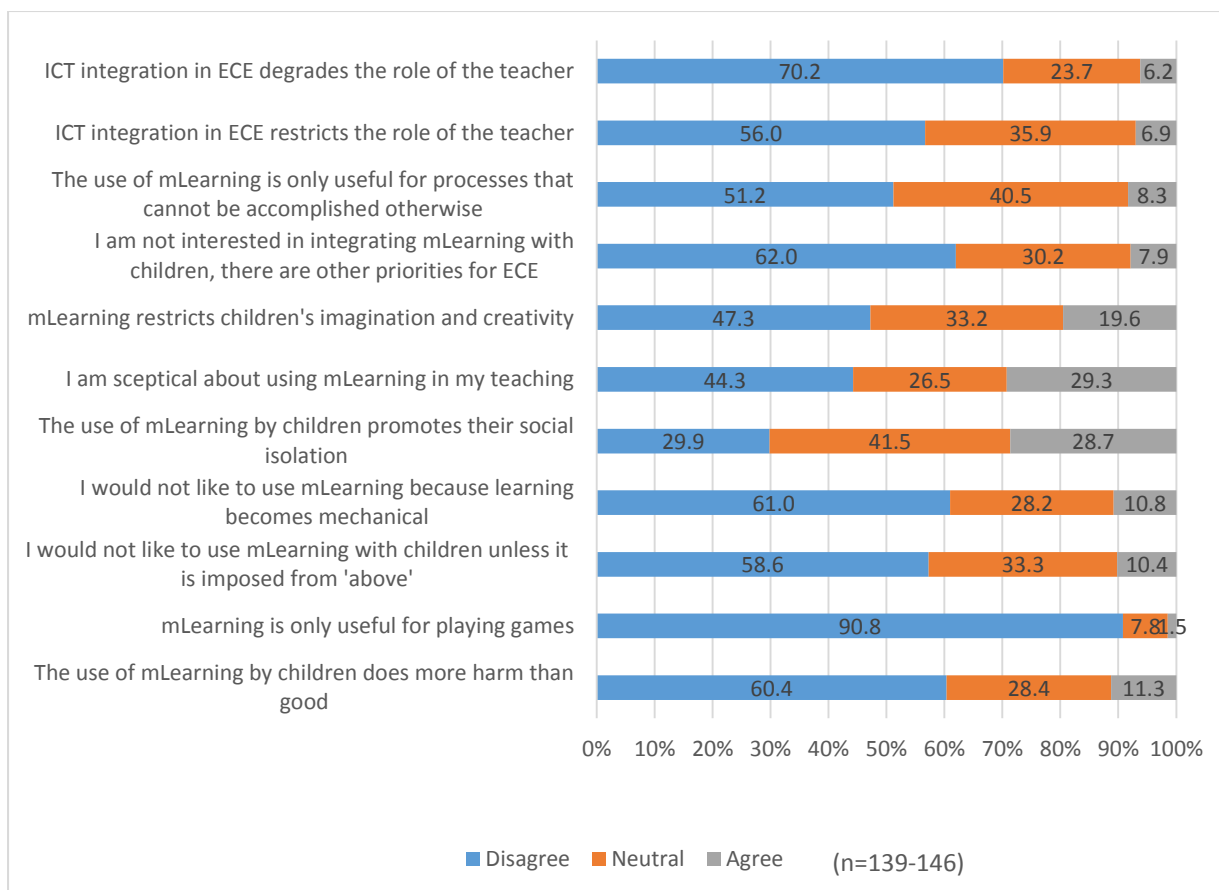


Figure 4.2. PSTs' negative views regarding mLearning in early childhood education.

The percentage of PSTs, who agreed with negatively phrased statements was smaller than those who disagreed, meaning that the students were generally positively inclined towards the use of mLearning in early childhood education. Statement 30, “*The use of mLearning by children promotes their social isolation*” had similar numbers of PSTs agreeing and disagreeing with the majority (42%) of PSTs giving a neutral view. Except for statement 19 “*mLearning is only useful for playing games,*” all of the statements prompted the students to record a neutral view between 23.7% and 41.5% of the time.

The common view was that mLearning does not restrict the role of the teacher or degrade the role of the teacher. It was important to determine whether or not, the PSTs saw that mLearning changed the role of the teacher, as the literature suggests (Lock, 2015).

Although the PSTs largely disagreed with the negatively phrased comments, “*ICT restricts the role of the teacher*” and “*ICT integration in ECE degrades the role of the teacher*” many (36% and 24% respectively) PSTs had a neutral view, perhaps indicating a lack of knowledge of many PSTs about how the teacher’s role might be affected by the use of mLearning in the classroom.

Figure 4.3 presents the PSTs’ responses to items with a similar variance about the positive value of mLearning in early childhood education. The number of respondents for each item varied between 141 and 146. For each item the numbers represent the percentage of respondents answering each question.

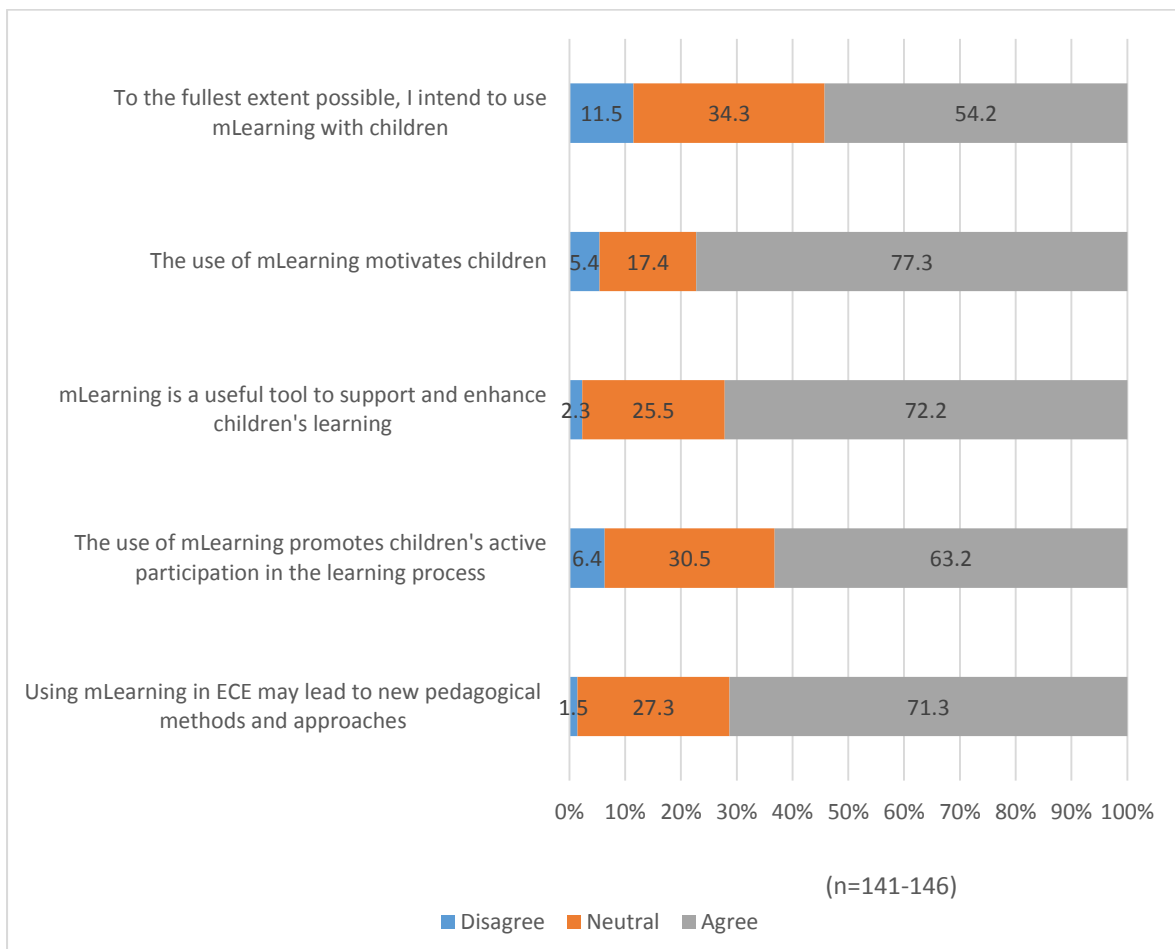


Figure 4.3. PSTs’ positive views regarding mLearning integration at the inception of the partnership.

The number of PSTs who agreed with the positively phrased statements regarding mLearning integration was greater (54.2-77.3 %) than the number who disagreed (1.5-11.5%) with between 17.4-34.3% having neutral views.

4.3.2 PSTs' levels of technological, pedagogical and content knowledge.

Factor analysis grouped 14 items with a similar variance about technological, pedagogical and content knowledge. Figure 4.4 displays these items from the survey with similar variance as deemed by factor analysis.

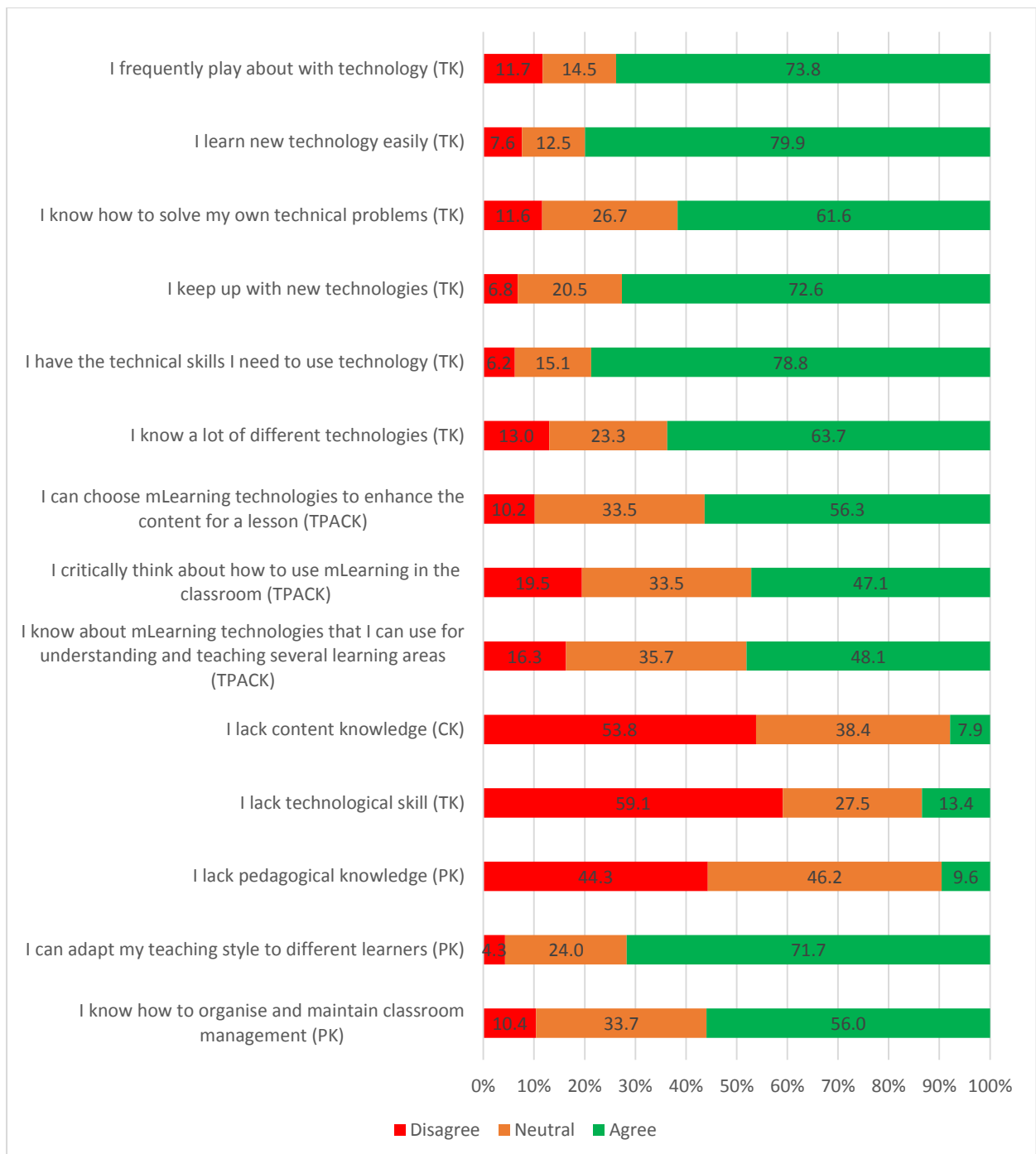


Figure 4.4. PSTs' rating of their levels of technological, pedagogical and content knowledge at the beginning of the year.

The PSTs tended to disagree with statements about lacking content knowledge, pedagogical knowledge, and technological knowledge. Less than one-tenth (9.6%) of the PSTs thought they lacked pedagogical knowledge. The majority of PSTs (72%) agreed with

the statements about knowing how to cater for different learners and maintain classroom management. The PSTs (61-80%) had positive views about their technological knowledge. Few (6.2-13%) indicated a lack of technological knowledge and 12.5-27.5% had a neutral view. Between 47.1% and 56.3% of PSTs agreed with the TPACK statements, 10.2% to 19.5% disagreed, and about one-third had a neutral view.

Despite the students own perceptions, the researcher observed many occasions that demonstrated a lack of content knowledge, technological knowledge, and pedagogical knowledge from the PSTs. The PSTs difficulty in time management and running out of things being one demonstration of a lack of pedagogical knowledge. Another example illustrating a lack of pedagogical knowledge of the PSTs was one group of PSTs suggesting that Bee-Bots were only good for teaching numeracy and not useful for learning directional language. This was contradicted when another group of PSTs taught a successful lesson using Bee-Bots to teach directional language. This highlighted a lack of content knowledge from the PSTs from the first group. Further, one group stated that the teacher provided feedback on the wrong lesson, which was not the case. These findings show that the self-perceptions of the PSTs did not always reflect actual practice which is consistent with literature about the gap between what teachers say students are doing and what they are doing (Bate, 2010).

Field observations revealed that 87.5% (21/24) of the lessons presented by the authentic PSTs illustrated a good understanding of TPACK in contrast to the 33.3% (5/15) of the lessons presented by the peer group. This finding revealed a difference in the perceived and actual abilities of the PSTs. The PSTs expressed generally positive views about their technological knowledge (59.1 to 79.4%). However, when asked what they used technology for, only 42% stated that they used technology for educational purposes.

The PSTs provided further information regarding TPACK during focus groups and through field observations. The focus groups revealed that the PSTs gained practical

knowledge on the use of mLearning technologies in the classroom and were able to describe what they liked and disliked about the technologies. For example:

I would not use the Chatter Blocks. They were very time-consuming to set up. (PST, Focus Group [FG], School B, 2013)

It was great to see what children know and how quickly they picked up things. (PST, FG, School B, 2013)

I used the digital microscopes, and they [the children] loved it. (PST, FG, School A, 2014)

I now see it [mLearning] as a tool, not just a babysitter. (PST, FG, School A, 2015)

I didn't realise that there was so much you could do with technology. I thought it was giving them an iPad or sticking them in front of a computer. (PST, FG, School A, 2015)

The partnership enhanced the PSTs' technological knowledge as illustrated by these quotes.

Field observations showed that the PSTs often failed to display pedagogical knowledge. For example, in 2015 the Year 1 class at School A was split in half by the PSTs for the introduction to the lesson. One-half of the class used an Interactive White Board and included a video. The other half of the class who were in the same room, at the same time, was introducing the topic by having the teacher read a story. The video on the Interactive White Board proved to be a distraction to the students involved with the story. The lack of realisation that this might be the case, suggests a lack of pedagogical knowledge. The opportunity to work with the same group of children for two consecutive weeks enabled the PSTs to reflect upon lessons and make changes in the second week. For example, at School A in 2015, the transitions between activities in the first week were not well-considered by the PSTs and did not work well in the first week, but in the second week, the PSTs put strategies in places so that transitions improved. The teacher commented: "Transitions well thought out.

Fantastic. The timing was excellent” (Karen, School A, 2015). This continuity also allowed the PSTs to notice how differently the children responded to different teachers. On one occasion a relief teacher filled in for the participating teacher and one PST commented: “She just wasn’t paying attention to my lesson” (PST, FG, School A, 2014). In this instance, the relief teacher was struggling to manage a challenging class, and clearly, her priority was not on a group of visiting PSTs. The authentic teaching experience gave the PSTs pedagogical experience as illustrated by the following comments:

The classroom experience and the feedback from the children were valuable. (PST, FG, School B, 2015)

I think for prac [sic] I will be more aware of looking for creative apps. (PST, FG, School B, 2015)

I was worried that the children would get distracted when we gave them the iPads, but I was surprised how focused they were. (PST, FG, School A, 2015)

4.3.3 How PSTs used mLearning.

PSTs were surveyed at the end of each year (Appendix D) to determine how they had used mLearning in lessons they had planned and taught throughout the year. The results showed some disparity between the groups (Figure 4.5).

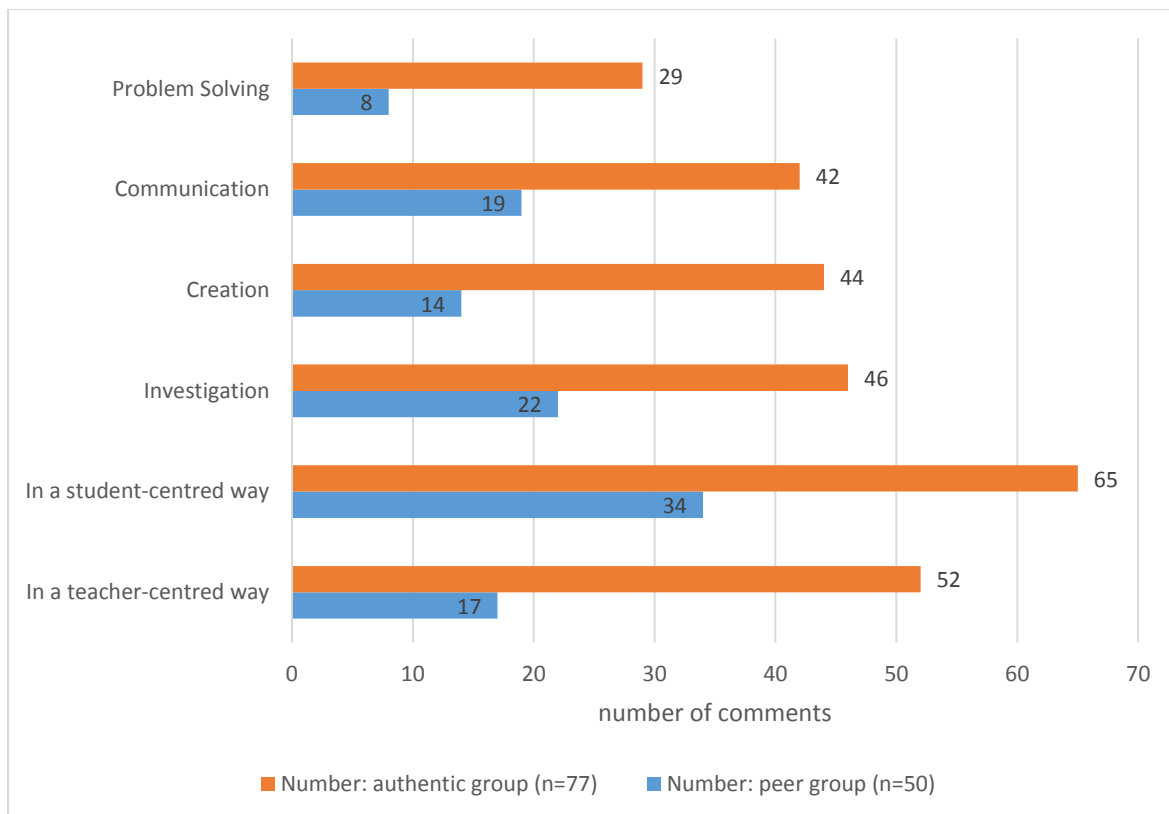


Figure 4.5. Comparison of PSTs from peer and authentic groups use of mLearning throughout the year in lessons they planned.

PSTs from the authentic groups used mLearning to a greater extent than PSTs in the peer group. Eight PSTs (16%) from the peer group used mLearning as a problem-solving tool as opposed to 31% (29) of PSTs from the authentic groups. PSTs from the authentic groups (65, 84.4%) used mLearning in a student-centred way to a greater extent than those from the peer group (34, 68%).

4.3.4 PSTs’ beliefs about mLearning in early childhood education.

The PSTs from peer and authentic groups were asked open-ended survey questions after the lesson presentations about their beliefs regarding mLearning in early childhood education. Comments from the three years of data were coded using NVivo software. Two themes emerged from their comments; mLearning should be used in moderation or with

caution, and how a negative perception towards mLearning prevents its use. Figure 4.6 summarises the PST comments after their mLearning peer or authentic teaching experiences. The numbers equate to the percentage of the total comments made by the PSTs on each theme.

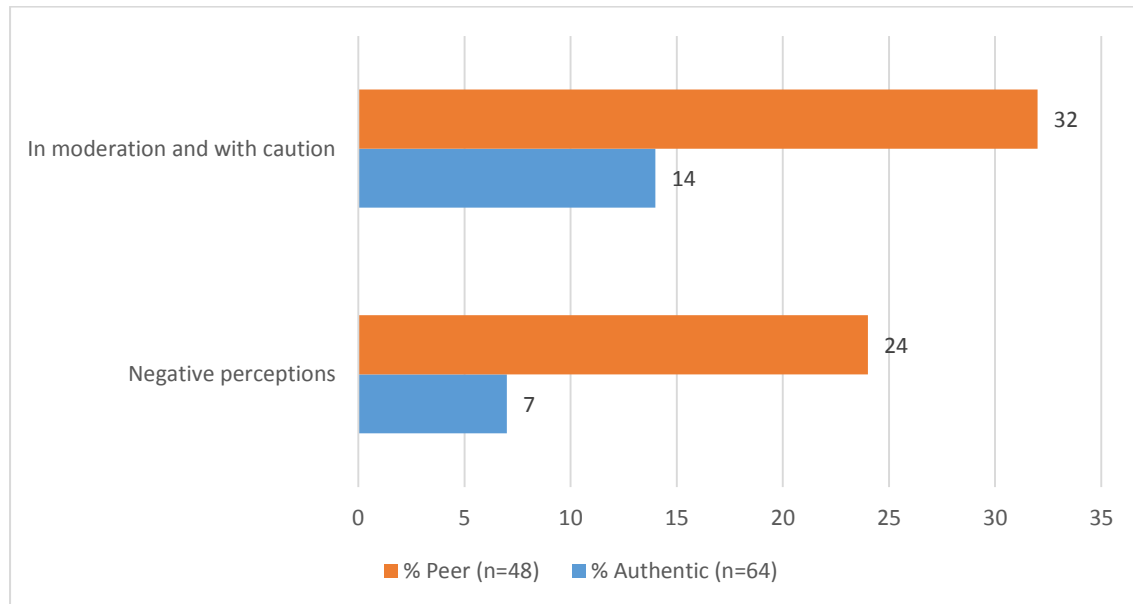


Figure 4.6. PSTs' beliefs regarding mLearning in early childhood education.

After the mLearning teaching experiences, 32% of the peer group comments and 14% of the authentic group comments reflected caution and the need to use technology in moderation. A smaller number of authentic group comments (7%) had a negative perception towards mLearning compared to the peer group with 24% of their comments reflecting a negative perception. The PSTs from the peer and authentic groups had quite different views about mLearning in early childhood education after the presentation of their mLearning lessons.

The peer and authentic groups had similar beliefs regarding mLearning in early childhood education at the start of each year. At the end of the year, the peer group was more negative with regards to perceptions towards mLearning and again more cautious than the authentic group.

Observations and focus group discussions concerning the use of mLearning in the classroom highlighted the benefits of the authentic teaching experiences for the PSTs. The PSTs' beliefs regarding mLearning in early childhood education were clearly changed by the authentic experience as shown by the following examples:

I now believe it is a positive resource that should be used if it can enhance the learning or be a source of information, but if it does not have a particular purpose or do any of the above, then I think it should not be used. (PST, Survey, 2013)

During teaching practice, my teacher was really keen for me to teach her some ICT and integrate it into the classroom teaching. She kept saying please show me and teach me, and she also got me to teach the other Year 3 class the same lesson because she loved the ICT activity so much. So in that respect, it was superb for me to have the knowledge and skills, and I felt really good about that. (PST, Authentic FG, 2014)

The benefits to the PSTs of using mLearning needed to outweigh the challenges, if the authentic experience was to be considered valuable. One challenge to the PSTs was the difficulties caused by last minute changes in the schools. These included lessons being cut short, having to present a lesson planned for a Year 3 class to a Year 1 class without notice and unexpectedly small numbers of children due to a strike or sporting event. This meant that the PSTs had to be well-organised, prepare mLearning tools in advance, request specific apps if needed, and adjust lessons from one week to the next. Clearly, there was more work involved for the PSTs in the authentic groups as illustrated by the following comments:

The thing is that most of us are not familiar with using technology in educational ways, so asking us to use it is a lot of work. (PST, Peer FG, 2014)

I think it would be a struggle for me to incorporate it [mLearning] in my lessons as I do not know how to use it. (PST, Peer FG, 2014)

4.3.5 PSTs' views about school-university partnerships.

The PSTs were surveyed using open questions before and after the authentic lessons about the benefits and challenges of the authentic presentations, as opposed to presenting to peers at the University. Comments were coded using NVivo software to illustrate the PST beliefs and how the beliefs changed. The numbers in the chart relate to the number of PSTs, who commented on each theme at the beginning and end of the year. Figure 4.7 summarises the comments.

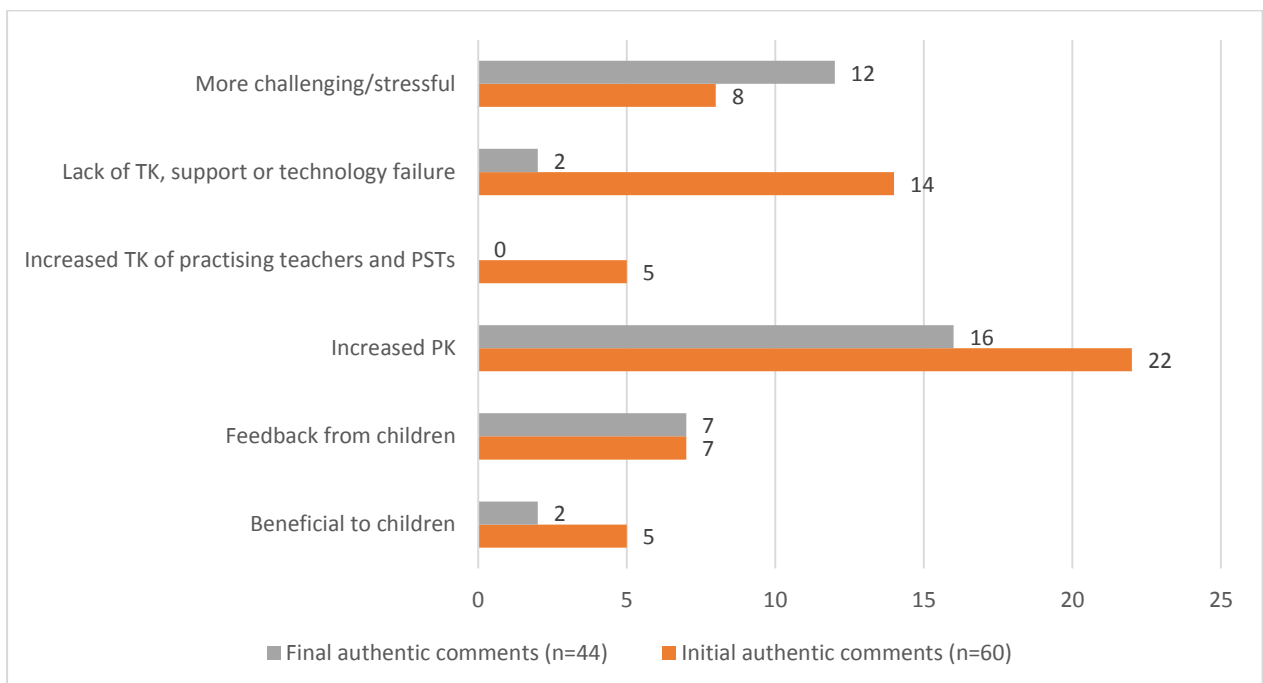


Figure 4.7. Benefits and challenges of school-university partnerships perceived by PSTs in the authentic teaching groups.

Differences between comments before and after the authentic mLearning lessons were that PSTs were less concerned about technology not working after the authentic lessons than before and that after the authentic lessons the PSTs commented more about the more challenging and stressful nature of the authentic lessons compare to presenting to peers which was the normal practice in units within the SoE.

4.3.6 Benefits of the authentic mLearning experiences for the PSTs.

By their responses, it appears that the primary beneficiaries of the study were the PSTs, who gained valuable teaching experience in schools. The benefits for the PSTs went beyond the experiences being only an opportunity for additional teaching practice but in requiring them to use mLearning tools in purposeful ways. The PSTs in the authentic groups were perceived to do this more competently than the PSTs in the peer groups, as they seemed unable to consider the needs of the children. PST comments about what they had learnt during the experience included:

I loved it. You got to see what you were doing and if it worked with children. (PST, FG, School B, 2013)

Going out into classrooms is realer. If it is not working, you have to change it. Lecturers can see how we cope in the classroom. (PST, FG, School B, 2013)

The PSTs, who presented in the classrooms, felt that they had an opportunity to develop pedagogy and when asked, 92% indicated they were glad of the experience. PSTs comments about the experience included:

It was good to see her model [pedagogical cues], so you get to see if it works. (PST, School A, 2013)

It gave us an insight into technologies used in classrooms from a practical point of view. (PST, School B, 2013)

The PSTs valued the pedagogical feedback they received from the teachers and the fact that the teachers provided a supportive environment for them to practice teaching skills. PST comments from the focus groups (n=9) about the teachers showed that the PSTs appreciated the teachers' input (n=53). For example; "She was encouraging, and she was always enthusiastic, and we felt supported" (PST, FG, 2013). Sometimes teacher pedagogical

feedback was a few dot points with comments such as *'nice encouragement'* or *'the children were engaged'*. Usually, more detailed feedback to each group of PSTs was provided with statements such as:

I liked how you introduced the session; the activities were age appropriate, relevant and fun; well done. (Kelly, 2013)

When gaining attention, use a signal such as clapping and make sure, you have complete attention before you begin. (Jessica, 2014)

You used the Bee-Bots in a well thought out way and had good extension activities for the children. (Karen, 2015)

Great work engaging with Tom (pseudonym) to stop him from distracting the others, be mindful that you are not rewarding negative behaviour. (Rachel, 2014)

Overall fantastic preparation, delivery, age-appropriate language, interactions and expectations. Well done. (Rachel, 2014)

You understood the mLearning opportunities and engaged well using them to support and extend learning. (Louise, 2015)

The PSTs copied the cues used by the teachers and appreciated the fact that the teachers did not take over. PST comments showed that they gained pedagogical experience by participating in the authentic teaching experiences. Comments included:

At the start, we picked up some good behaviour management strategies. (PST, FG, School A, 2013)

You have to think fast in the classroom. You do not get that when presenting to peers, so we learnt those skills. (PST, FG, 2015)

Early childhood PSTs were offered the use of the mLearning tools during the professional experience that followed the ICT unit. In 2013, no PST took up this offer. In 2014, two early childhood PST asked to borrow a set of iPads to use with classes whilst on professional experience, and another asked to borrow a digital microscope. In 2015, eight PSTs (all from an authentic group) borrowed equipment (digital microscopes and Bee-Bots)

during their professional experience. All the PSTs who borrowed mLearning resources were from the authentic groups.

4.3.7 The peer group mLearning experience.

The PSTs from the peer groups expressed concerns (24%) about using technology with children reflecting a possible lack of confidence. Some PSTs from the peer group (13%) expressed that they were initially disappointed when they found out that they were in the peer group but then felt relief when they observed the additional stress and workload experienced by the authentic groups. Peer group concerns over mLearning were found to be Internet safety, technology failure and managing children. The PST comments showed their concerns and the fact they realised they had missed a learning opportunity:

Making sure that it all works is my greatest fear. (PST, FG, Peer, 2014)

There is the risk of exposing children to things they should not be seeing. (PST, FG, Peer, 2014)

I am not opposed, but I am not good with technology so that it would have been a struggle for me to present in a school. (PST, FG, Peer, 2014)

It would have been more work going to a school, but I think I would like to have had the experience of going to a school. (PST, FG, Peer Group, 2014)

With our peers, if we pitch a lesson too high we would not know. (PST, Peer FG, 2014)

With us [peer group] we can just do what we want and not think about the kids. (PST, Peer FG, 2013)

These comments illustrate the PST's concern about lack of knowledge. Rather than embracing the opportunity to learn something, the PST is more concerned about not doing well.

4.3.8 Section summary.

Figure 4.8 summarises the benefits and challenges of the mLearning partnership for the peer and authentic PSTs. Green and red (bevelled) boxes represent the benefits and challenges respectively. The findings revealed that the peer group thought that it was beneficial not going to a school because of the additional time and effort that it required. They did not perceive that the benefits of the experience would outweigh the additional effort that was required.

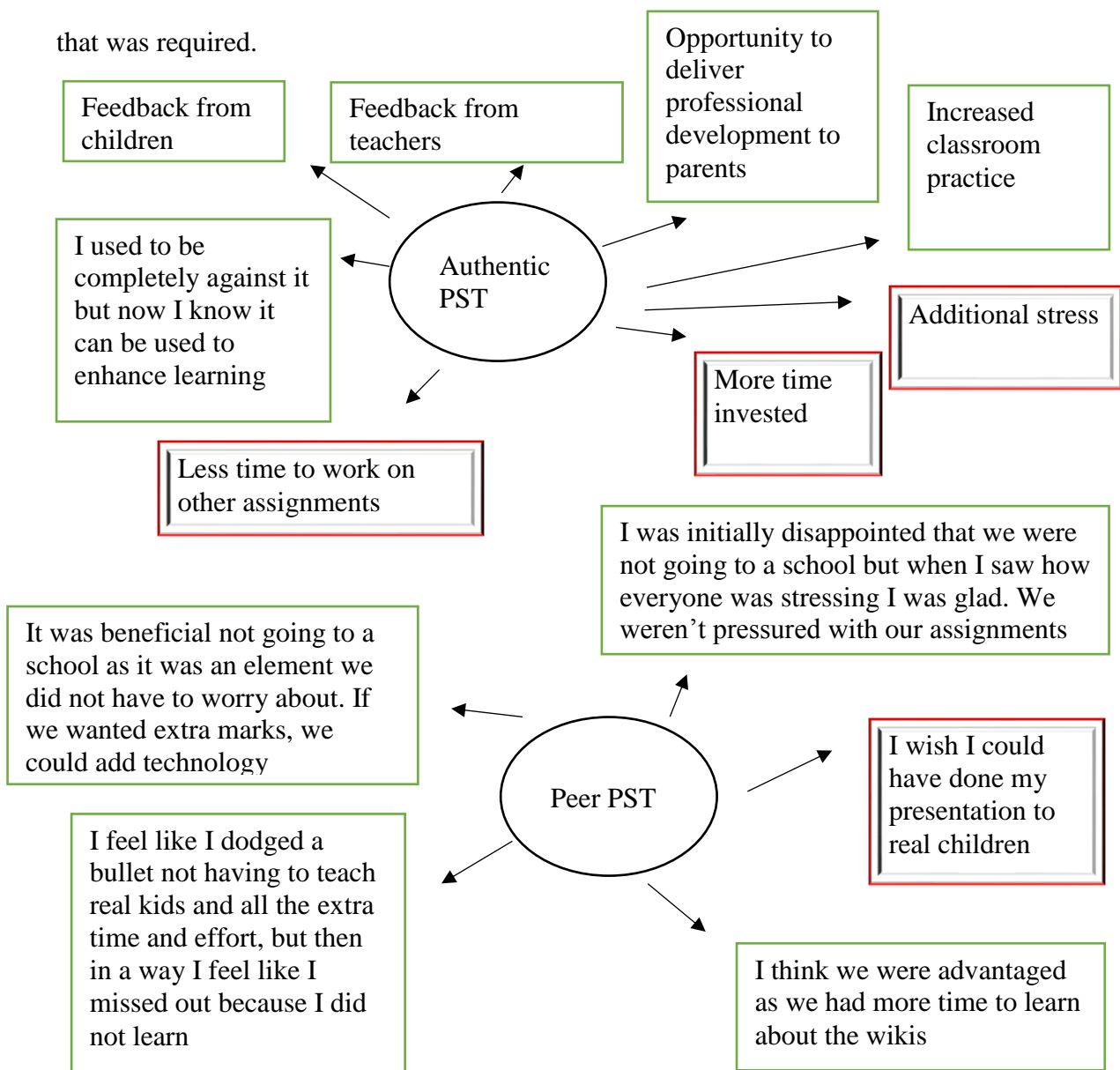


Figure 4.8. The benefits and challenges of the mLearning partnership for the peer and authentic PSTs.

4.4 mLearning and children

If they could not perceive obvious benefits for the children then, there might be no incentive (other than in following the Western Australian Curriculum) for PSTs to implement mLearning in early childhood classrooms. The PSTs all made positive comments relating to the impact of mLearning on the children's engagement. The PSTs described how the children reacted when using mLearning, and there were more than 30 comments relating to the level of engagement exhibited by the children during the authentic visits. Examples of some quotes from the authentic PST focus groups (2013-2015) regarding children's engagement follow:

I believe if mLearning is used correctly, then it has a great impact on the students and their motivation. (PST, 2013)

I think it is an exceptionally useful tool to enhance children's learning and motivate children to engage in the task. (PST, 2013)

I believe that ICT promotes active and engaging experiences making lessons more fun and interactive. (PST, 2013)

I believe that the use of mobile technologies is important because it will help motivate students to want to learn. I believe, however, that I must be careful not to overuse the technology. (PST, 2013)

Great way to teach explicitly, and it engages students. (PST, 2013)

A useful tool and engaging. (PST, 2013)

They seemed excited and more engaged. They wanted to learn. The kids said, "Are you bringing in Bee-Bots today?" (PST, 2014)

It is an engaging way to teach a subject; it allows students to get a strong understanding of technology. (PST, 2014)

The technology kept the children focused and listening to instructions. (PST, 2015)

At change over time, the kids were all saying, "*we did the best activity.*" (PST, 2015)

The children were obsessed with listening to themselves on the Recording Pegs. (PST, 2015)

4.5 Conclusion

The PSTs in the authentic group gained valuable teaching experience and delivered lessons that surpassed their peers beyond all the expectations of the University staff. The level of planning and preparation exhibited by the PSTs in the authentic groups led to high-quality lessons but did cause additional stress. Despite this additional stress, most of the PSTs were glad that they had the authentic experience (section 4.3). The perceptions and beliefs towards mLearning in early childhood education of the authentic PSTs changed as a result of the authentic mLearning classroom experiences illustrating the ability of school-university partnerships to change practice (section 4.3.5). The authentic experiences contributed to the learning of the PSTs, and it was evident that the PSTs were able to help practising teachers in their mastery of mLearning.

Chapter 4 also considered the level of engagement exhibited by children when using mLearning. The findings revealed that children at both schools were engaged and highly motivated when using mLearning with the PSTs (section 4.4). All PSTs shared this view with some indicating that they were surprised at how engaging the children found the mLearning and how easily the children were able to use the tools. The level of engagement that children exhibited in working with mLearning technologies was demonstrated to be beyond the expectations of the PSTs.

The following chapter presents the findings at the classroom level from the practising teachers. Chapter 5 considers the engagement of children when working with mLearning observed by the practising teachers. Chapter 5 also presents findings about how the practising teachers increased their technological knowledge and the synergy between the practising teacher and PSTs.

Chapter 5 Classroom Level Results - The Practising Teachers

5.1 Introduction

Chapters 4 and 5 contain the results gathered at the classroom level, namely from the pre-service and practising teachers. This was undertaken through observations of authentic mLearning teaching experiences in the classrooms, focus groups and interviews. Chapter 4 contains the results pertaining to the PSTs, and this chapter contains the results relating to the practising teachers associated with the following three considerations:

1. The level of engagement that children exhibited in working with mLearning technologies.
2. How the synergy between pre-service and practising teachers helped each to master mLearning for the benefit of student learning.
3. How the partnership contributed to the practising teachers' technological knowledge.

5.2 School participants' experience of the mLearning partnership

The early childhood teachers involved at School A were Angel, Jessica, Karen, and Kelly. Over the three years of the project, the Principals of School A were Lara, Sam, and Tim. The early childhood teachers at School B were Louise and Rachel. There were three principals over the three-year period at School B, these were Gloria, Sam and Anna. A brief description of the participants is presented.

5.2.1 School A.

Jessica was an experienced early childhood teacher who had been at School A for 12 years and was also the literacy coordinator. She was regarded as the early childhood team leader. At the start of the partnership, Jessica had limited experience of mLearning, but she

possessed a hunger for learning more and frequently asked questions. She attended an initial ICT workshop at the University alongside the PSTs, who would later visit her class in 2013. She enjoyed the session and asked many questions that demonstrated her lack of technological knowledge such as: “What is an URL?” and “What is a wiki?” (Jessica, 2013).

When invited to attend the whole ICT unit as an intensive course run in the school holidays at the beginning of 2014, Jessica was the only teacher in the partnership who was able to attend all sessions, which she did. Jessica talked about her school’s new website and the fact that with the assistance of the ICT lecturer, Victoria, she had created a blog. Jessica intended to use her blog to share classroom information in the future. She was highly supportive of the partnership and encouraged parents to attend parent mLearning workshops by distributing letters and requesting replies. The researcher and School of Education’s (SoE) ICT coordinator were invited to speak about the mLearning partnership at the initial meeting of parents in Jessica’s class in 2014. Jessica was a participant from 2013-2014. Jessica applied for positions outside School A, and in 2014, she successfully gained a position outside School A, which she commenced at the start of 2015.

Kelly, the Year 1/2 teacher at School A, was a mature age graduate and newly appointed to the school in 2013. Kelly had a prior engagement to attend a graduate professional development workshop during one of the scheduled PST visits, which provided her with a dilemma. Her colleague stepped into her class rather than a relief teacher, which had initially been proposed by the school.

Kelly was enthusiastic about being involved in the research and provided the PSTs with direction about the content that she wanted them to plan for her class. She provided the PSTs with good pedagogical feedback. She attended, in her own time, a parent workshop run by the University and professed that she enjoyed the session. Kelly purchased her first iPhone at the start of 2013 and shortly afterwards an iPad. She was supportive of the partnership and

enthusiastic about mLearning in early childhood education. Kelly participated in the research in 2013 but, as she was on a fixed term contract, lost her position when School A had to reduce staff numbers in 2014.

Angel was an experienced teacher with more than 25 years of teaching experience, half of which was in early years' education. Angel joined the research in 2014 with her Year 1 class although she had provided relief for Kelly for one of the PST visits in 2013. After the relief lesson, Angel stated that she was impressed with the lessons delivered by the PSTs and the PSTs were welcome in her class anytime. Angel attended a parent workshop at School A in her planning time and asked her colleagues for more information about the partnership in 2013. At the beginning of 2014, Angel volunteered and was subsequently involved in the research in 2014 and 2015.

Angel used an iPhone, a laptop, and desktop computer and expressed interest in the iPad. In her previous school (15 years earlier), she had been a “computer person” and stated that she liked technology. Angel indicated that she used a variety of programs such as Word, Excel, Paint, and PowerPoint. Angel stated that she was against computer games in the classroom. Angel's comments from interviews included:

I do not have an iPad, but I do want to get one. (Angel, 2014)

I am comfortable on the computer but not with the iPad yet. It would be lovely to have a set of six iPads; that would be great. (Angel, 2014)

I am using Book Creator with my class now (Angel, 2015)

School A had three iPads purchased in 2014 for the children with special needs and as one of these children was in Angel's classroom, she had access to one iPad in 2014. When questioned about the use of the iPad and who selected and uploaded the apps she was not certain. Angel used her iPhone to take photographs and videos of the children in her class.

The children enjoyed seeing the multimedia, and it proved useful to show parents what the class had been doing. Angel stated that she would like to use more mLearning in her teaching, but a lack of mLearning resources prevented her from doing so. The University offered to lend a set of iPads to Angel, but she did not follow up on the offer. Despite the fact that Angel did not borrow iPads or use the one available in her class, she did embrace iPads when School A purchased a set and used them in ways demonstrated by the PSTs. Angel's actions illustrated that she was not prepared to go out of her way to use mLearning, but when it was readily available, she did use it.

In the final year of the research, Jessica was replaced by Karen in the pre-primary (PP) class. Karen came to School A as a permanent member of staff. She was enthusiastic about being involved in the partnership as shown by her comment:

I realise that ICT is here to stay so we need to embrace it, that is why I had my hand up for this partnership. I am ready to go and upskill as I think it is important for children. I feel privileged to have this opportunity because I believe we need to use technology based on research and best practice, and I think these things are coming from the University. (Karen, 2015)

Karen's views are consistent with literature indicating that university partners are passive recipients of scholarship (Brown, Shephard, Warren, Hesson, & Fleming, 2016). At the start of the year, Karen's technological knowledge was limited. She was not sure if the tablet in her classroom was an iPad or another type of tablet and used it only for taking photographs of children's work. During the handover that Karen had completed with Jessica the previous year, Karen saw some apps, useful websites and expressed her interest in attending the ICT intensive unit that Jessica had attended. Karen was unaware how to put apps on the iPad and did not have an iTunes account. Karen was very excited to be part of the partnership as illustrated:

I am ready to have a go. I am open to it and would love to learn. I am on the edge as at my age, when you are over 50 it is a big confidence thing as you do not want to look like a fool. You do not want to admit that you do not know much. (Karen, 2015)

Tim, the Principal of School A, was new to the school in 2013. School A was Tim's first substantive position as a Principal although he had held a Deputy Principal position at a larger school previously. Tim had no forewarning about the partnership that had been set up by his predecessor. Tim was cautious about the use of technology, as he had an adverse experience in a previous school. He said that there was much time and money wasted with no obvious benefits to children's learning. He stated that he was in favour of mLearning in early childhood education but that the school had no money to implement it, as demonstrated by the comment: "I inherited a "broke" school" (Tim, 2013).

At the start of the research, Tim commented that the staff lacked technological knowledge, the school had no mLearning resources, and the Parents and Citizens' (P & C) Association lacked engagement for the purpose of fundraising. Tim stated that he wanted to establish relationships with universities, although his initial priorities at School A, were organising the school and staff, and upgrading outdated resources. He did not view the research in action until he was invited by the ICT coordinator to visit a classroom. In the first year at School A, Tim upgraded the school's website, introduced e-newsletters and applied for an iPad grant.

Tim was keen to learn more about the research and came to the University and attended part of an ICT tutorial with the PSTs, who would later come to the school. He was not proactive in communications with the University and did not take up offers of professional development for the school through the partnership model. He encouraged the teachers to liaise directly with the University. Tim moved to another school in the middle of 2014 as acting Principal. He maintained the position of Principal at School A but indicated to

the replacement that he was seeking a permanent promotion and, if successful, would not be returning. Lara replaced Tim in the middle of 2014, and towards the end of 2014 Tim gained a permanent promotion and did not return to School A.

Lara had sixteen years' experience as a school Principal and held the substantive Principal role at another school. Lara's position at School A was that of acting Principal for six months until a permanent replacement commenced. Lara indicated that School A was much closer to her home, and she was pleased to reduce her travel time. Lara had no knowledge about the mLearning partnership or the details of the iPads that were being purchased by the P & C Association, as reflected by her comment: "Well, that was before my time" (Lara, 2014).

During Lara's short time at the school, she did not engage in the partnership, possibly because she had little knowledge of it and considered her position at School A as short term. However, Lara's favourable view of mLearning in early childhood education is illustrated by her comment:

I am all for it. Recently I had a debate with the parents at the pre-primary I have just come from [at a previous school] where they wanted to make it screen-free, so I had to show them very clear links in the curriculum where it was important for children to have access to iPads and computers. (Lara, 2014)

Sam became Principal of School A in 2015 coinciding with the school gaining Independent Public School (IPS) status. Sam was a relatively young Principal who started his career in education as an education assistant, and then qualified as a teacher and was promoted to principal in a short time. Sam had been a Principal for the last three years at another school. Sam had a very young family and was particularly passionate about early childhood education. Sam owned and used an iPhone, iPad, MacBook and iPod at home and a desktop computer at work. He had a range of educational apps on his iPad for his

three-year-old child but did not use educational apps himself but was ready to bring mLearning to School A as illustrated by the following comment:

I would like to see a heightened use of mLearning. That starts with a simple purchase of some iPads for the school. I'd like to see a class set, that to me is a goal for the very near future. (Sam, 2015)

5.2.2 School B.

The teachers Louise and Rachel at School B remained in the partnership for the duration of the research. There was a new Principal each year. A description of the participants at School B is presented.

Louise was an experienced early childhood teacher who was passionate and enthusiastic about using mLearning in her pre-primary class, where she had been teaching for three years. She used free apps that directly supported the learning in her classroom as illustrated by her comment “There are times and places for games, and my tight schedule is not one of them” (Louise, 2013).

Louise had presented professional development on mLearning to colleagues and frequently helped fellow staff members. At the start of the partnership, Louise was the “go-to” person in her school for help with the iPads. She attended an initial ICT workshop at the University in 2013 alongside the PSTs, who would later come to her class. She said that the session was highly beneficial and would like to have attended more, but the cost of teacher relief made this impossible. Louise stated: “ICT needs to be part of the repertoire of every teacher, not just those with passion. It does take time, and teachers do not have much of that” (Louise, 2013).

Louise commented that she continuously explored new apps that supported and extended her professional development. Louise was working towards a promotion and was keen to take on extra responsibilities. She participated in the research from 2013-2015. At the start of 2014, she stated that she was only interested in free apps and wanted the PSTs to use some good free apps.

Ideally, I'd like the students [PSTs] to be bringing in things that we do not have access to in the school. We have got iPads so for this I'd like to see students sharing free apps with us, ones that they have found and explored themselves. (Louise, 2014)

Louise's comment showed a lack of understanding about the purpose of the partnership which was to use mLearning as a tool to support the curriculum, rather than the focus of a lesson. Louise became a member of the school council in 2014 and discussed the partnership at meetings and, as a result, three parent workshops were organized in 2014. In 2014, Louise was no longer the most technically proficient person at School B because the new Principal was experienced and knowledgeable about technology integration in education.

Rachel was an experienced teacher who was new to School B in 2013. She had limited experience with mLearning in the classroom and said that she used technology as a teacher tool. She was enthusiastic about mLearning but complained about being time poor as shown by the comment:

I am limited by getting everything done in the classroom, ideas, and professional learning. I am only limited by what I can get done, cost, just knowing more about the things that you already have and no lack of interest. I see it [mLearning] as the new way. (Rachel, 2013)

Rachel attended an ICT tutorial at the University in 2013 alongside the PSTs, who would later visit her class and said that she enjoyed it, her confidence level increased, and she learnt a lot. Her “light globe” moment was when she realised that she had been using new technologies in old ways and that there were new pedagogies to match new technologies. When invited to attend the ICT intensive in the school holidays her only question was whether she would be required to complete assignments. Rachel did not attend the intensive course but participated in the research from 2013-2015. Her confidence grew using technology which helped her to change her style of teaching as shown: “I have traditionally been more teacher-centred, but I am trying to shift towards more student-centred ways” (Rachel, 2015).

In 2015, Rachel extended her partnership with the University when she gained part-time employment as a practicum supervisor. Rachel’s participation in the partnership enabled her to make the necessary contacts which enabled her to gain this part-time employment at the University. Rachel left School B at the end of 2015 to take a position at another school but made contact with the University in 2016 to offer practicum places for PSTs and expressed interest in an mLearning partnership at her new school.

Brenda, the Deputy Principal, and Gloria, the Principal of School B attended a meeting with the researcher at the end of 2013. At the meeting, Gloria announced that she was leaving School B and that there would be a new Principal in 2014. At that point, Brenda intended to job share with Rachel in the Year 2/3 class on the days that the PSTs would visit in 2014. Brenda stated that she was excited about being part of the research and was proactive in ensuring that the PST visits ran smoothly as illustrated by her comments:

Thanks so much for coming out the other day. I am very excited along with Louise to know that our partnership will continue into next year. (Brenda, 2013)

I did want to let you know that I am working on getting Louise, and I there [to the University] next week but it is proving to be problematic so close to the

commencement of the year. Is there another option that we could do it another way? (Brenda, 2014)

I was wondering if you are at the point where you want to know what content we would like covered. (Brenda, 2014)

At the start of 2014 last minute changes at School B meant that Brenda was not directly involved in the research as Rachel was in the classroom on the days that the PSTs visited. Brenda acted as a point of contact between the University and the teachers until a relationship was established with the new Principal. Brenda organised relief teachers so that the teachers could come to the University and meet the PSTs at the beginning of 2014 and 2015.

Gloria, the Principal of School B, had been at the school for three years as Principal and was enthusiastic about the research at the beginning of the year. Gloria believed in mLearning in early childhood education claiming early on in the partnership: “We need to embrace it” (Gloria, 2013).

When she had viewed the research in action she stated:

As the year went by, I think the interactions in the classrooms were good. (Gloria, 2013)

The partnership encouraged the teachers and can only get better with time. (Gloria, 2013)

Gloria described her staff as variable in technological abilities but was working towards the school’s goals in implementing mLearning. Gloria reported that the use of mLearning in the classrooms was steadily increasing although used in variable amounts by different members of staff. She highlighted that the music teacher used the GarageBand app

along with the upper primary teacher who used the iMovie app to make films in class. She rated her technological skills as about the same as those of her staff. Gloria was promoted and left School B at the end of 2013. When Gloria informed the researcher that she was leaving School B at the end of 2013, she said on two occasions that the University was welcome to extend the research to her new school which illustrated the value she placed in the mLearning partnership.

Gloria made use of the partnership with the University to access professional learning for her staff. In the first year, Gloria requested two professional development sessions from the University, a whole staff professional development on iPads and an iPad professional development workshop for EAs from across the school's network. The two sessions were well received by the participants.

Bo became acting Principal of School B in 2014, replacing Gloria. She had held a permanent position as a Deputy Principal at another primary school. Bo had 13 years of teaching experience and had taught all year levels from pre-primary upwards. She had been a Deputy Principal for six years at a large public school that had initiated a 1:1 laptop program for children from Years 3 to 7. Bo indicated that she used technology extensively: "It is a big part of my day" (Bo, 2014).

Bo set up a Principal's blog to communicate with parents, a Google drive for document sharing and an online professional learning space where she housed videos and articles for use during professional development sessions. Each week Bo scheduled an hour of her time to look at educational sites on her Twitter account so that she could keep up to date. She said that her philosophy regarding mLearning had come about through a team approach to integrate technology at her previous school and declared: "mLearning is a tool and part of the repertoire of things that students can draw upon". (Bo, 2014)

Bo had experience in a setting with significant ICT resources but was focused on quality teaching and ensuring that there was money for teacher professional development as well as mLearning tools. Bo talked about the gradual release model of professional development where teachers worked together guided by an expert to remodel lessons, taught the lessons and then came back together to review lessons. She stated:

If the learning is not good, then technology will not help. Good teaching is good learning and poor teaching with technology is just expensive learning. (Bo, 2014)

My goal from an ICT perspective [this year] was to ensure that our teachers understood that technology should be seen as a tool for learning rather than an outcome. (Bo, 2014)

Bo rated her technological knowledge as high and indicated that she had the skills necessary to assist staff. She described children as intuitive, engaged and motivated when using technology but lacked the ability to use technology in creative ways.

Anna commenced as Principal of School B in 2015 and indicated that she would be at School B for at least three years. She was an experienced principal with prior experience in an IPS. Anna owned an iPad and indicated that she has always been very involved and passionate about ICT as illustrated:

I have an honours degree in computer education. I live and breathe computer education. (Anna, 2015)

My previous school had 70 iPads (Anna, 2015)

I think ICT done well can develop thinking skills of children. (Anna, 2015)

Before becoming a Principal, Anna had an ICT support role in a school. That role involved working with teachers and helping them to integrate ICT purposefully.

There had been little information exchanged regarding the mLearning partnership between Anna and Bo, the previous Principal. Anna appeared very interested in the partnership and asked numerous questions about how the PST visits worked and how the parent workshops had gone in the previous years. Anna indicated that she wanted to up-skill staff and create a professional learning culture amongst the staff in the school.

5.3 What are the benefits and challenges of mLearning to practising teachers?

Practising teachers considered the impact of mLearning on the children. For educators to implement mLearning in early childhood classrooms, there must be clear benefits for children. Although no data was collected directly from children, the participants were asked about the children and were observed working with children.

5.3.1 School A.

This section contains findings relevant to engagement and motivation of children at School A and the benefits and challenges for the teachers at School A. The benefits are described along with the challenges. The benefits included increased technological knowledge and confidence using mLearning. The challenges included a lack of professional development, mLearning resources, and technical support. Findings relating to the development of the partnership with the teachers at School A are also included.

5.3.1.1 Engagement and motivation of children.

The practising teachers all made positive comments relating to the impact of mLearning on the children's engagement. The teachers regarded the mLearning as enjoyable for the children and, in particular, those children who did not usually engage. Jessica, the pre-primary teacher at School A, stated that she enjoyed the PST visits and seeing how excited her class were when they saw the products that they had created with them. She

commented that the children were all motivated: “Even the boy with special needs engaged for the whole session; that was empowering” (Jessica, 2013).

Angel did not see any disadvantages to the partnership and stated that both she and the children benefited from the encounters with the PSTs:

It was nice for the children to have other adults [PSTs] supporting and guiding them. I think that was enjoyable and exciting for the children. (Angel, 2015)

I saw the children sharing ideas, so it was truly cooperative learning. (Angel, 2015)

It was good to see the children problem-solving. (Angel, 2015)

Anything that beeps, or moves or is remote control or can be recorded on, and you have them [the children] captured. (Angel, 2015)

These comments show that Angel believed that children were engaged and learned during the PST visits.

Karen stated that the children in her class associated computers with playing games so she was worried that if they were asked to use a specific app on an iPad, they may look for games and become distracted. In fact, the children were all highly engaged, and distraction was not a problem. Kelly saw one of the main benefits of the partnership for the children in her class was working in small groups with the PSTs. She felt that the children’s excitement and the potentially disruptive effect of extra bodies in the classroom were outweighed by the benefits.

After a session, with the PSTs the children were asked which activity they had enjoyed the most, and one boy said, “I liked the race” referring to a mathematical activity with the Bee-Bots. The boy was oblivious to the fact that he had taken part in a rich mathematics lesson where the class had used estimation skills to program Bee-Bots to travel between fixed points. Together, the following quotes from the early childhood teachers and

this boy provide an illustration into the level of engagement and enjoyment experienced by the participating children. The quotes show that the children were engaged using the technology, were motivated and had ownership of resources that they created.

They love it. It motivates some of the children who sit at the back of the group. They are motivated to take part so that they get a turn. (Jessica, 2013)

I think it absorbs the children. They really enjoy it, and they are more motivated. (Kelly, 2013)

The children got quite excited and switched on. (Angel, 2014)

The children were just awestruck; they were listening and engaged, and they were engaged during the mat session as well as in all the activities. Even the student whose second language is English and is having trouble settling. (Jessica, 2014)

I thought we might have an Oscar afternoon with the parents, presenting movie trailers and books that we have made. We have made two whole class movie trailers; we did Super School And Fairy Tale School at the beginning of the year, and all the kids were part of it. They were all involved, dressed up. They are so proud of it. They have amazing ownership of it. (Jessica, 2014)

I think they all engaged, and no one was off task when they were using technology. It was good for those children who are not academic and do not normally excel; it gave them a chance to shine. (Angel, 2015)

They [the children] are willing to have a go and are not worried about making mistakes with the iPads. (Angel, 2015)

I have witnessed the high level of engagement that children exhibit when using mLearning especially the boys, so that has strengthened my belief about embracing ICT in early childhood education. (Karen, 2015)

I saw the response of the children when your [University] students brought the Bee-Bots. They were engaged, motivated and excited. (Karen, 2015)

5.3.1.2 Increased technological knowledge and confidence using mLearning.

The early childhood teachers involved in this study had the opportunity to develop technological skills by observing the PSTs and engaging with them while they taught using the mLearning tools. Jessica, the pre-primary teacher, of all the teachers in the research, made the most of this opportunity. Jessica declared that as a result of the partnership her confidence

using mLearning had increased. She could not think of any disadvantages of having the PSTs visit her class. Angel gained some ideas from the PST visits which enabled her to think about how she would introduce the iPads into her teaching:

I am looking forward to using the iPads in the classroom. I see that most kids will be able to use them, but I want to use them in small groups as part of a rotation so I can assist the children. Maybe a parent helper will be useful. (Angel, 2015)

I am collecting apps at the moment. I want to use apps to make stories and movies. Letting them [children] hear each other will be fantastic then we can talk about it. (Angel, 2015)

Jessica stated that her newly acquired skills gained through the partnership prompted her to apply for new jobs. At the end of 2013, she was unsuccessful. At the end of 2014, Jessica secured a new job. The mLearning partnership gave Jessica increased knowledge and confidence that supported her to seek new challenges. Jessica used her newly acquired mLearning skills to create an iMovie with her class that she subsequently used at an interview which resulted in her leaving School A.

Karen was aware of her lack of technological knowledge and wanted to ensure that she used mLearning purposefully. When PSTs visited Karen's class for the first time, Karen told the children that the PSTs were visiting to teach them about computers and used the term information and communications technologies. Karen's actions demonstrated her lack of understanding of integrating mLearning into the curriculum. Karen planned to teach the children how to use iPads respectfully before they would be able to use them as learning tools.

Forty-seven comments were made by teachers and school leaders at School A regarding increased technological knowledge and confidence using mLearning. The comments showed that teachers increased their technological knowledge and confidence

using mLearning through interactions with the PSTs. Some examples of these comments are illustrated:

I rate my mLearning skill as about four out of five. It has absolutely gone up from last year. I am a lot more confident. (Jessica, 2014)

This year's groups have shown me how to use mLearning for phonological awareness, which is a big thing for pre-primary. (Jessica, 2014)

That sight word app was fantastic. The kids loved all the activities. Thank you so much. (Karen, 2015)

It was a holistic experience and an example of two-way learning. I realised that you can adapt things so that they can be done with technology. (Karen, 2015)

Figure 5.1 illustrates how the technological knowledge of the participating teachers at School A changed as the partnership progressed. The comments made by the teachers indicate the effect of the mLearning partnership on the teacher's technological knowledge.

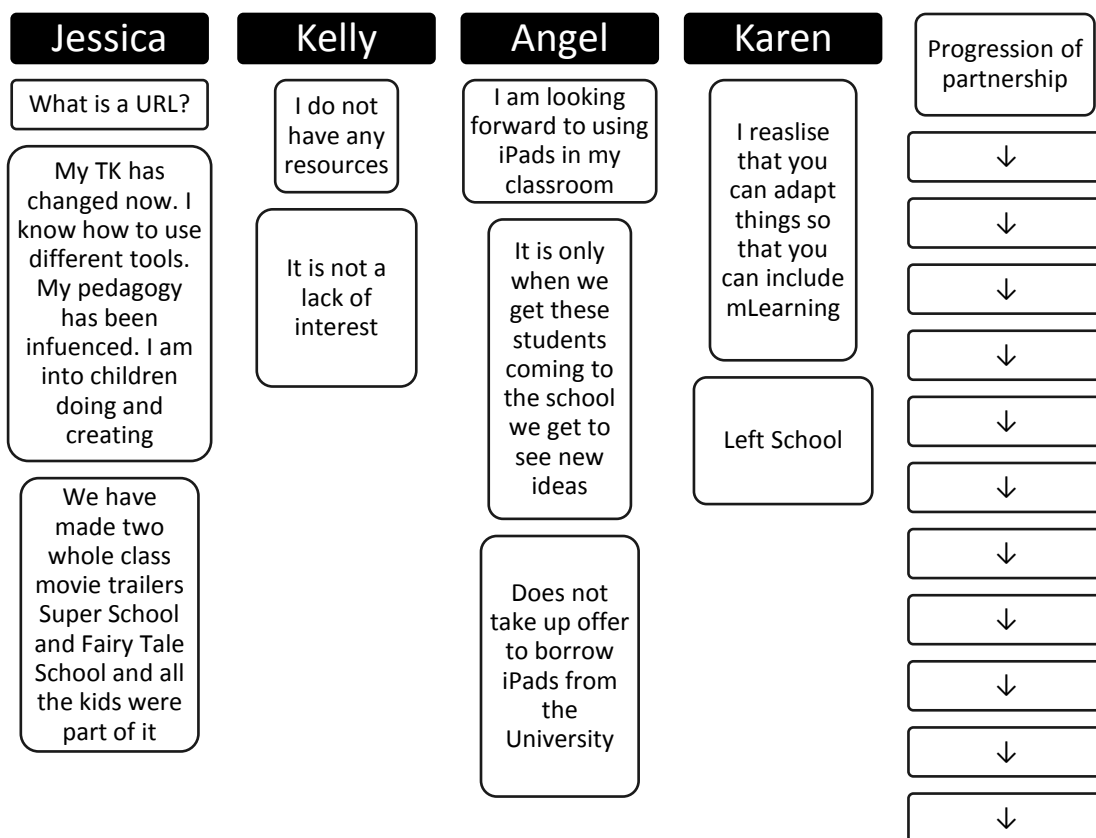


Figure 5.1. The technological knowledge of the teachers at School A.

Jessica stated that the ICT tutorial that she attended at the beginning of 2013 was a highlight and that she learnt a lot from it. Jessica provided the PSTs with excellent feedback and got totally immersed in the classroom activities. Jessica made several comments indicating that she had learnt about mLearning from the PST visits such as:

The sequencing activity was age appropriate, relevant and fun. I also liked the storyboard app and would use it in my class. (Jessica, 2013)

I have gained many ideas from these sessions, and I have realised that using ICT in the classroom is quite simple. (Jessica, 2013)

Wow, Book Creator is so easy to use and a great way for children to be involved in making a digital book. (Jessica, 2013)

I liked the seasons app. I will look at using that with my class. (Angel, 2014)

Such comments illustrated the synergy between the pre-service and practising teachers. The practising teachers learned by watching and engaging with PSTs. Jessica sent an email to the University after the PST visits thanking the PSTs. Jessica also requested a copy of the lesson that one group of PSTs did in her class and said:

I liked how I was able to ask the students [PST] a question, and they were all willing to help and give me advice. (Jessica, 2013)

I gained a lot of great ideas, and the children enjoyed the activities. (Jessica, 2014)

In the first year of the study, Jessica asked the PSTs to make digital books with her pre-primary class. Jessica later revealed that she looked at the English curriculum and saw that she had to design digital books with her pre-primary class and stated: “I thought this [creating digital books] is impossible” (Jessica, 2014). After she saw the PSTs making the digital books she went on to say: “Now I have found that it is quite easy to do, and we are doing it quite regularly, and the kids are in control of that” (Jessica, 2014).

The PSTs given the task of creating digital books had no idea how to go about this task. They were guided by the ICT lecturer and were easily able to share knowledge with Jessica perhaps because the skills were new. PSTs stated:

She [Jessica] sat down with the first group of children and me and was really into it. She was happy to ask for our help, and we got to explain stuff to her and in the end she said, this is wicked. (PST, FG, School A, 2013)

The teacher asked about the story app that we used and how we added the photos. (PST, FG, School A, 2013)

When asked about her beliefs regarding the use of mLearning in early childhood education and whether they had changed throughout the course of the research Jessica responded: “Yes, absolutely. I saw that it was so easy. The students were so friendly and explained how to use the program over the sessions” (Jessica, 2014). Kelly, the Year 1/2 teacher, said that the PST visits reinforced her beliefs regarding the importance of mLearning in early childhood education.

The technological knowledge and confidence of the teachers at School A increased as a result of the mLearning partnership. Jessica of all the teachers, gained the most technological knowledge because she was enthusiastic and prepared to commit time to maximize her learning opportunity. Kelly and Karen were also enthusiastic but remained in the partnership for only one year, so there were limited opportunities for them. Angel was in the partnership for two years, stated that she was enthusiastic but was not prepared to commit personal time, so the partnership between Angel and the University did not develop as fully as the partnership did with Jessica. The partnership provided an opportunity for the teachers to develop technological knowledge and confidence using mLearning but the teachers had to be prepared to be proactive and liaise with the University to optimize outcomes.

5.3.1.3 Lack of professional development.

In every interview, the teachers at School A made comments made about the lack of professional development opportunities. In the three years prior to the partnership, Jessica received no professional development in using ICT in the classroom. Jessica took up the University’s offer to come and work one-on-one with her. She spent time developing a blog and looking at IWB resources with the ICT lecturer, Victoria. Jessica was appreciative of Victoria providing non-threatening, friendly technological support. Kelly stated that it was not a lack of interest that prevented her from using mLearning in the classroom, and she was

keen to use more mLearning in the future. Kelly reported that her technological skills were held back through lack of practice.

Karen was an experienced classroom teacher and new to School A in the final year of the study. She was a firm believer in lifelong learning and wanted to up-skill herself so that she could integrate new technologies in the classroom:

I believe in lifelong learning, and part of that is embracing the new. My beliefs are that we need to embrace ICT. However, there is a lot to learn on the way to use it in an informed, positive and constructive way. (Karen, 2015)

To ensure that it [technology] is used correctly is the tricky bit for me. I think we are in transition, and that is always the case when you are teaching a new process. (Karen, 2015)

When we purchase apps for this age group, we need to be sure that they have a voice or music so that kids can operate with prompts but without the need to read. (Karen, 2015)

Time and competing pressures were key limiting factors for the teachers. Karen described how she was learning to use a software program for a non-verbal child in her class and was learning to connect the child's 'talker' to the IWB. A speech therapist had been assisting her in this process, and she recognised that these new skills would complement the use of other technologies in the classroom:

I do not have the time at the moment as lots of new things are happening, so there is not the time to play. (Karen, 2015)

With that [learning about the talker] and the iPad professional development, I will eventually be able to marry the two. (Karen, 2015)

Jessica and Kelly also acknowledged time as a limiting factor:

What stops me from using technology in the classroom is knowing what to do, time and what is easy for the students to use. (Jessica, 2013)

There is a lack of time and staff training on mLearning. (Kelly, 2013)

In the first year of the study, the University invited the participating teachers to attend free professional development alongside the PSTs at the University. The cost of teacher relief meant that only one teacher from School A was able to attend one whole session. In subsequent years, the participating teachers were invited to attend free professional development in the school holidays and one teacher from School A, Jessica took up this offer in 2014. Karen expressed an interest in attending the ICT intensive in the school holidays but left School A unexpectedly in the middle of the final year of the project.

The findings revealed that the teachers wanted the opportunity to attend professional development on mLearning integration, but there was a lack of opportunities and time available.

5.3.1.4 Lack of mLearning resources and technical support.

Lack of mLearning resources in School A was a barrier to mLearning implementation. All the teacher and school leader participants at School A commented on the lack of mLearning resources. One benefit of the partnership was that the University was able to loan equipment to School A. Jessica borrowed a set of iPads on two occasions in the second year. When advised about opportunities to borrow equipment Karen indicated that towards the end of the second school term after the reports had been written would be a good time for her to borrow the Bee-Bots: “At the end of the term, I will be able to utilize them more effectively. I will think about that” (Karen, 2015).

Karen did not follow up and did not borrow mLearning resources from the University, possibly because of competing priorities and a lack of time. Angel also expressed interest in borrowing mLearning resources from the University but did not follow up on the offer.

Jessica said that she would like to use more mLearning in the future but felt that it was mLearning resources holding her back as well as learning how to use the mLearning

resources effectively. In the second year, Jessica requested to borrow a set of iPads from the University on two occasions, and each time borrowed a set of iPads for a week or two.

Jessica also asked technical questions such as, how to project from her iPad to an IWB and how to share files with parents.

Kelly repeatedly said that the barriers were a lack of technical support and mLearning resources. Her whiteboard was not interactive for the first two terms, and when asked about this she stated: “Schools are busy places” (Kelly, 2013).

Kelly clearly saw the benefits of using mLearning and was not afraid of technology, but had limited opportunity to use technology in the classroom because she did not have any mLearning resources.

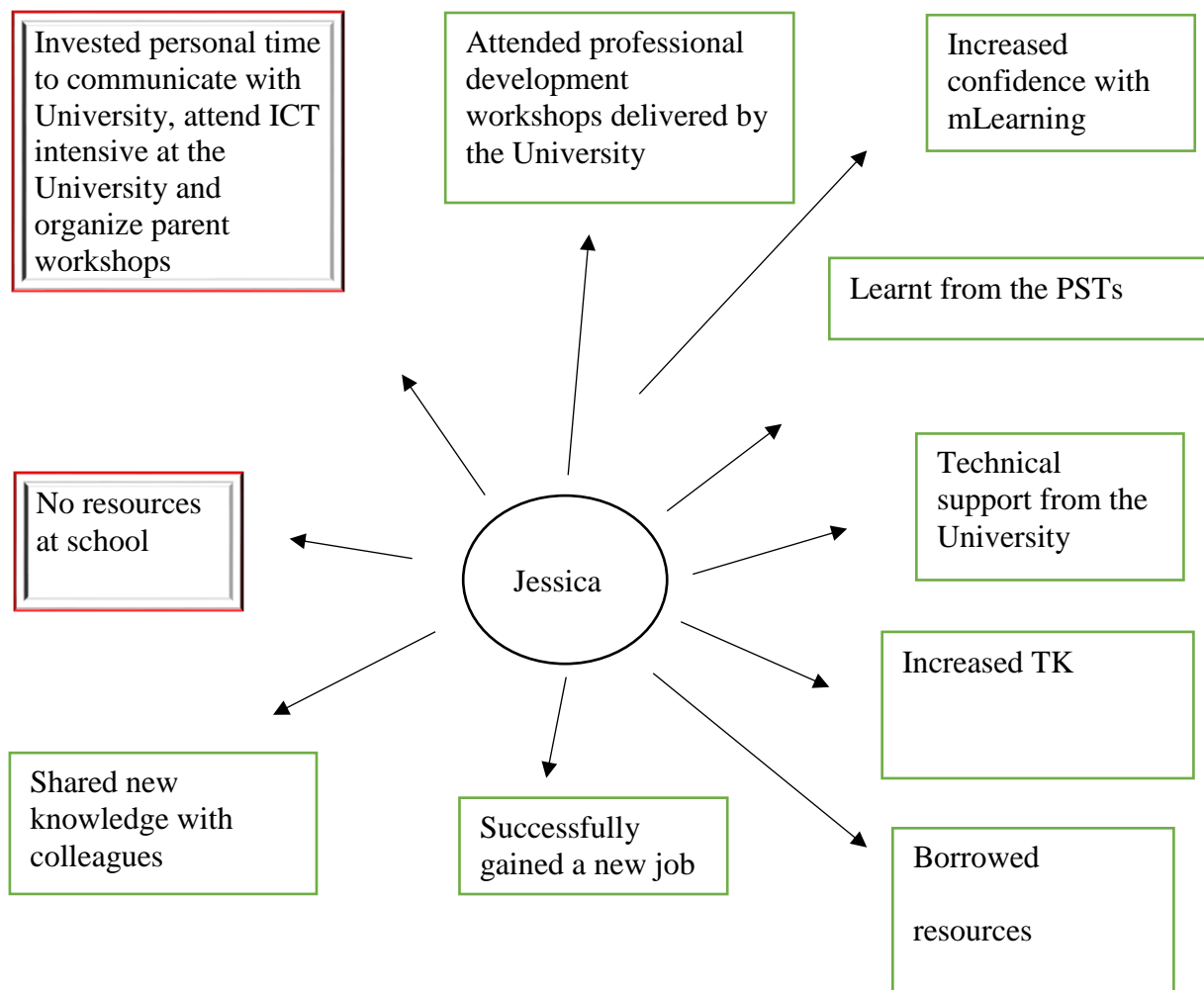
5.3.1.5 The partnership.

Despite the instability of the participants throughout the three-year research period, the partnership at School A grew. Initially, when Jessica visited the University and met the PSTs in the ICT tutorial, the researcher observed that she seemed quite nervous. On subsequent visits, Jessica appeared quite relaxed and comfortable with the PSTs, lecturers and her role in the partnership. Jessica commented that meeting the PSTs at the University was useful because she could see that they were a little overwhelmed. The opportunity for the PSTs to meet the teachers before visiting their classes enabled the PSTs to gain a better understanding of the children they would be teaching. The meeting also broke down the barriers between the practising teachers and PSTs so that on successive visits both commented that they were more relaxed.

In the first and second years of the study, Jessica was a key participant at School A. When Jessica left at the end of the second year there were concerns about the partnership. The University lost the key participant in Jessica and gained a new Principal; Sam who

commenced in 2015. In the final year, Sam became the key participant at School A. Sam was enthusiastic about mLearning and the partnership with the University. This enthusiasm was demonstrated by Sam observing the research in action during the first PST visit and then ordering a set of iPads for School A. Sam also invited a University representative to be part of the new school board. The stability of the University staff enabled the lessons in the final year to run well as University staff were familiar with the school setting and the new Principal was supportive of the partnership.

The benefits and challenges for the participating teachers are summarized in Figure 5.2. The University staff remained constant and improved the structure of the PST visits. It became much easier for the University staff to manage the additional stress involved with overseeing PSTs teach lessons as guests in a local school.



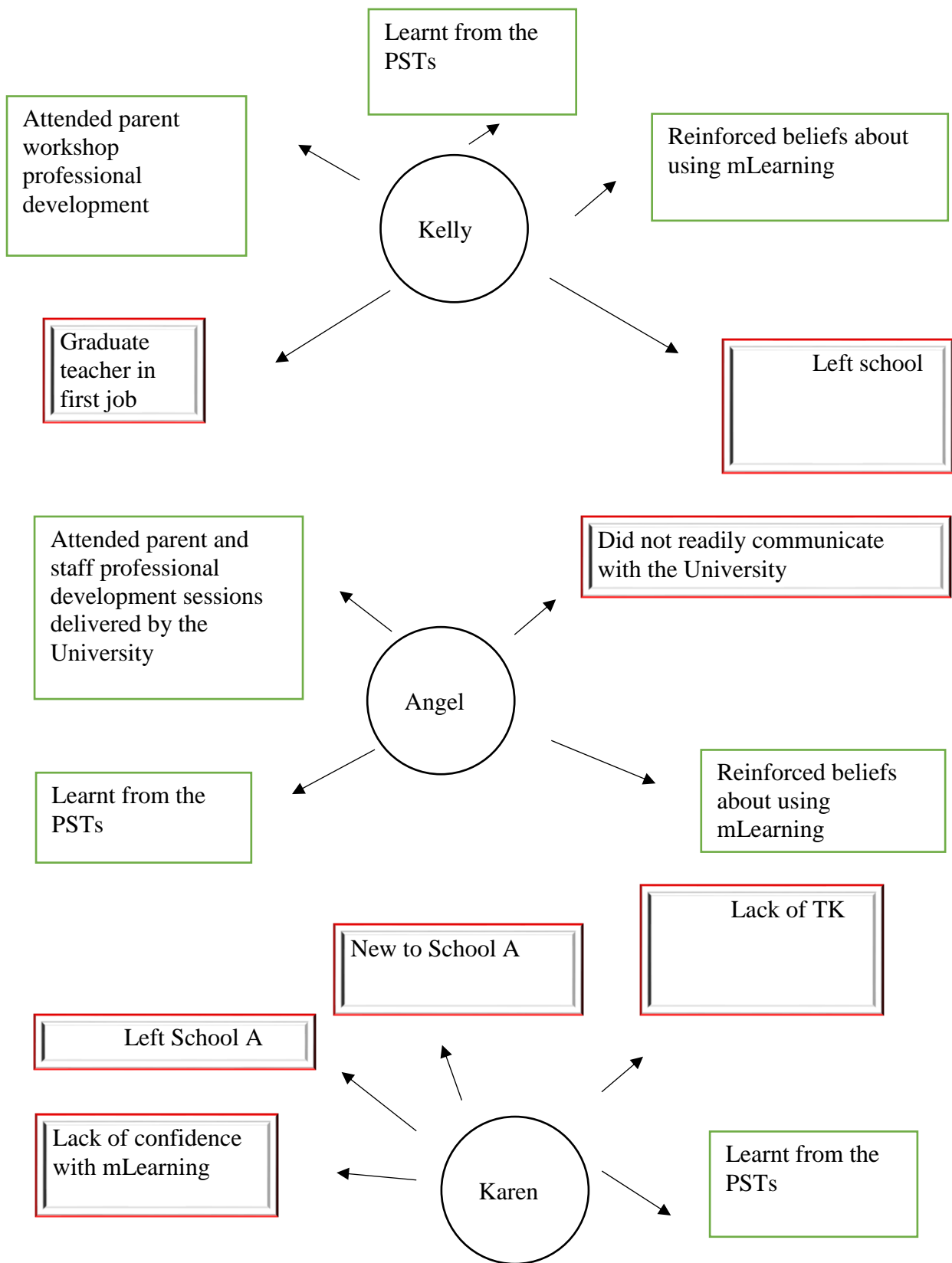


Figure 5.2. The benefits and challenges for the participating teachers at School A.

5.3.2 School B.

This section contains the findings associated with engaging learning experiences for the children at School B and the benefits and challenges for the participating teachers. The benefits included increased technological knowledge and confidence using mLearning and the opportunity to borrow mLearning resources. The challenges were a lack of mLearning resources and technical support. The partnership challenges between the teachers at School B and the University are presented.

5.3.2.1 Engaging learning experiences for children.

Evidence that the partnership created positive learning outcomes for the children at School B is supported by the 43 NVivo coded items. NVivo, a qualitative data software tool, was used to store and code data including focus group transcripts and field observations.

The presence of the PSTs in the classrooms enabled the children to be fully supported and guided when introduced to new technologies. The efforts the PSTs took to create interesting dynamic lessons is illustrated by the following statements made by the teachers:

It was great for the children to have the experience working with adults and the technology. (Louise, 2014)

The digital microscopes were awesome; the children really responded to using them and discovering answers themselves. (Rachel, 2014)

For the children, it is all beneficial. Your students go above and beyond to plan exciting, fun cross-curricular exciting sessions. They work well with the children. (Louise, 2015)

The above comments also support the findings reported by the University academics that there was a vast difference in the standard of the presentation between the authentic and peer groups. No peer group PST appeared to have gone ‘above and beyond’ whereas many of the authentic PSTs produced lessons that were beyond expectations. The teachers and

children enjoyed the lessons that the PSTs delivered. The teachers indicated that the children learnt from these lessons as shown by the following comments:

Fantastic ideas and activities for Anzac day. The students have done the basics in the past so to investigate individual Anzacs is great. (Rachel, 2015)

The children get very excited when we use the iPads. They love the independence and are motivated to do research. (Rachel, 2015)

The children love watching their Anzac videos and are constantly referring to their characters. It was a meaningful learning experience, and the children have learnt. (Rachel, 2015)

The children in my class fully engaged and had the opportunity to do something that I had not done with them during the PST visits. (Louise, 2013)

The following quotes are from the teachers at School B regarding the engagement and motivation of the children. The finding revealed that the participating teachers all agreed that the children were engaged in positive learning experiences during the PST lessons.

The children were very engaged. (Louise, 2013)

It [mLearning] really gets them engaged. The minute they see something new and exciting, their eyes light up. (Rachel, 2014)

The children like having others in the classroom and they were engaged. (Rachel, 2014)

Very engaging, a perfect topic for this age group. (Rachel, 2014)

Huge congratulations everyone. The whole class was fully engaged in every activity. (Louise, 2015)

The students love to act so your use of acting and videoing really engaged them. (Rachel, 2015)

The interactive nature of the activities kept the children engaged and excited. (Rachel, 2015)

The children love it [technology]. It engages the children. (Rachel, 2015)

5.3.2.2 Increased technological knowledge and confidence using mLearning.

The teachers had the opportunity to learn from the PSTs when they came into the classrooms. In the second year (2014), Rachel requested that the PSTs create something using interviews that the children had completed with family members about what school was like in the past. The PSTs created digital books using iPads in the grounds of the school. The children shared their books with Rachel, who asked for copies of all the books.

In the final year, Rachel commented that the Anzac movies that the children completed with the PSTs were relevant to the Year 3 history curriculum and good for assisting with her program. As a result of the PST Anzac lessons, Rachel modified her history program. Rachel requested copies of the movies which were provided a few days later so that the children could watch them on a large screen in class. Rachel commented that she would use the QR code idea modelled by the PSTs for guided reading comprehension questions in her future teaching. The comment shows that the technological knowledge gained through the interactions with the PSTs was transferrable. After the third year of PST visits, Rachel was clearly more confident using mLearning and had a positive outlook. When she was asked about the negative media surrounding technology she responded:

I think all we can do is promote it [mLearning] and be positive and show the media how it can benefit students' learning. (Rachel, 2015)

I get new fresh ideas and enthusiasm and different ways to approach things that you may have done the same way for a long time. (Rachel, 2014)

I have made an iMovie with my class. (Louise, 2015)

Teachers need more professional development to guide children's learning. (Rachel, 2015)

Louise, the pre-primary teacher at School B, was the most experienced teacher participant in terms of her technological knowledge in the classroom. She used a set of iPads

in her class three times each week. Louise commented that she had not used QR codes in the classroom before. She said that the experience had made her move out of her comfort zone. She observed the groups of children and PSTs, so she was acutely aware of what they were doing. Although Louise spent a lot of her personal time exploring mLearning and considered herself to have a high level of technological knowledge, her Principal (in the first year of the study) said that she might have been exposed to some new things.

Louise thought carefully about what she used the set of iPads in her class for and only used them in well thought out purposeful ways as illustrated when she made the following comments:

As an educator, I do struggle to ensure that what [technology] I am choosing has got valid educational use and is not just a toy or a timekeeper. (Louise, 2013)

One of the things that Victoria [ICT lecturer] taught us, early on was to look for something that's going to engage the children creatively. A lot of the apps do support education, and it is not many that extend the learning. (Louise, 2014)

When the PSTs used iPads in her class in the first year, Louise observed a number of new apps, provided the PSTs with good feedback and was satisfied with the experience.

Louise and Rachel made the PSTs feel welcome and provided them with detailed pedagogical feedback. In addition to pedagogical feedback Rachel often made positive comments about the technology used such as: "That is great; I love the ShowMe app" (Rachel, 2014).

In the second and third years of the study, Louise and Rachel engaged well with the PSTs, provided feedback and frequently visited each other's classes so that they could observe the activities in both classes and therefore gain maximum technological knowledge.

In the first year of the study, the University invited the participating teachers to attend free professional development alongside the PSTs in ICT tutorials at the University. The cost

of teacher relief meant that the teachers from School B were only able to attend one whole session in the first year. Rachel said that she enjoyed the ICT tutorial that she attended at the University in 2013.

In subsequent years, the participating teachers were invited to attend free professional development in the school holidays. This offer was not taken up by the participating teachers at School B. In the first year of the study the University delivered two staff professional development sessions at School B. Twenty-five comments were made by teachers and school leaders at School B regarding professional learning that occurred as a result of the partnership. Some examples of these comments are illustrated:

I was exposed to things I may not have seen or had time to explore. (Louise, 2013)

I think I have learnt a bit. I have improved in that I have seen lots of different things, and different ways the students [PSTs] have approached things. (Rachel, 2014)

They [PSTs] come in with a different view; it makes you think out of the box. (Rachel, 2014)

When they [PSTs] come I always look at what they are doing and think about how I can use their ideas in my lessons. Some of the apps and things they have introduced me to they have shown me a new way of doing something that I had always done on paper. (Rachel, 2015)

Louise and Rachel increased their confidence using mLearning and personal technological knowledge as a result of the interactions with the PSTs. Louise used free apps in her class and stated that as a result of the professional development from the University she was starting to think about purchasing some apps in the future. Figure 5.3 illustrates the development of technological knowledge in the teachers at School B.

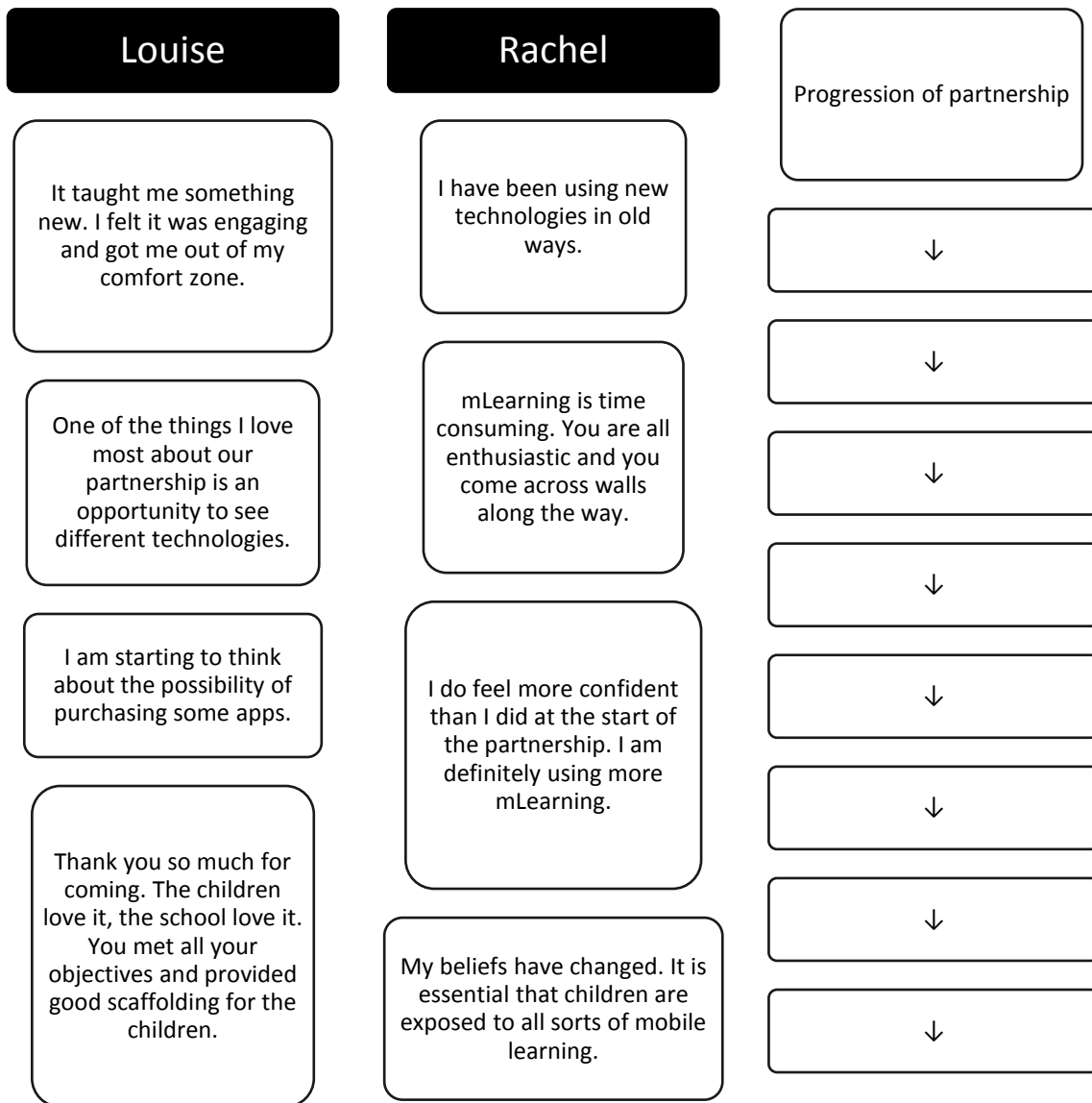


Figure 5.3. The technological knowledge of the teachers at School B.

5.3.2.3 mLearning resources and technical support.

The partnership provided School B with the opportunity to borrow mLearning resources. Louise asked to borrow the Bee-Bots in the second year and used them for a whole school term and indicated that the children frequently used and loved the Bee-Bots. Louise wrote an article for her school's newsletter including a photograph of children using the Bee Bots. Both participating teachers borrowed Bee-Bots and digital microscopes. After borrowing digital microscopes from the University, School B decided to purchase some of their own. All the teachers and school leaders at School B made comments regarding mLearning resources.

A barrier to mLearning at School B was a lack of technical support. The process for managing the iPads in School B improved with time. In the first year, children were responsible for collecting the iPads at the end of the day and charging them. The staff were responsible for collecting and returning the iPads to a secure charging station in the second year. The change of leadership in 2014 affected the technical support in School B because the Principal was proactive with respect to technology integration and provided the necessary technical support. School B purchased a secure charging station and carry boxes at the start of the second year of the study. The Wi-fi was also upgraded in 2014 because it did not function well in some parts of the school and would only support a limited number of devices. In 2015 the Principal stated that poorly working technologies gave teachers an excuse to avoid using technology. Ten comments were made relating to technical support. Some examples are:

You go to do an activity with your class; you presume that the apps are going to be on the iPad and then they are not. (Louise, 2014)

I tried to put some apps on [the iPads] and for some reason, it is not letting me put anything on, and it was a bit of a downer, and we are still trying to figure that out. (Rachel, 2014)

The partnership has given me more confidence to use mLearning in the classroom more effectively, but I still have issues at times, accessing the Internet and uploading new apps. (Rachel, 2015)

5.3.2.4 The partnership between the teachers at School B and the University.

The logistics of the PST visits to the schools presented challenges on occasions. The challenges associated with the teachers were that teachers forgot about the PST visits and were disappointed if a group of PSTs delivered a poor lesson. In the first year, one group of PSTs who delivered lessons in Louise's class did not engage well with the children and did not include any mLearning activities. Louise was disappointed and relayed her disappointment to the school Principal who commented that the teachers did not get much out of the experience. When the researcher wanted to conduct the final interviews in 2013, the Principal asked if she could provide the feedback from the teachers as they were reluctant to take part in an interview. However, Louise was professional in the classroom and made all the PSTs welcome and provided them all with quality feedback.

Rachel, the Year 2/3 teacher, was not present for one of the PST visits. Another teacher with her Year 1 class stood in for Rachel. This teacher did not use mLearning and according to the Principal was not interested in using it. She provided limited feedback to the PSTs but after a successful lesson that children clearly enjoyed; this teacher commented she had learnt a lot and could see how mLearning could be beneficial in the classroom. The children demonstrated their enjoyment of the lesson by showing enthusiasm and willingness to engage in the tasks set. The Principal reported that a spark was ignited in this teacher immediately after the PST visits but four months later at a staff iPad professional development workshop, she had lost whatever interest she may have had earlier because

during the professional development the teacher did not engage with the iPad, instead busily glued envelopes.

The researcher's impression was that although Rachel was keen, she was busy in a new job, was time poor, and the partnership was not a high priority. Rachel illustrated the lack of priority she placed on the partnership by forgetting to tell the University that she was unavailable for the first PST visit. On another occasion, Rachel's class was very late returning from an assembly so that the PSTs' lessons were cut short.

Partnerships need people to communicate and work together to achieve common goals. Whilst the teachers were enthusiastic about the mLearning partnership at times other factors, such as a lack of time affected the teachers' abilities to commit to the partnership.

The relationships between the participants and the University staff grew throughout the three-year period. Expectations were clear and good communications were maintained. Clear benefits for both school and University participants gave the partnership the ability to go beyond the three-year research period. Anna, the Principal in the final year, understood the benefits of the partnership and plans were put in place to provide professional development opportunities for the staff at School B using PST mentoring and the ICT intensive course during the school holidays. Figure 5.4 summarised the benefits and challenges for the participating teachers at School B.

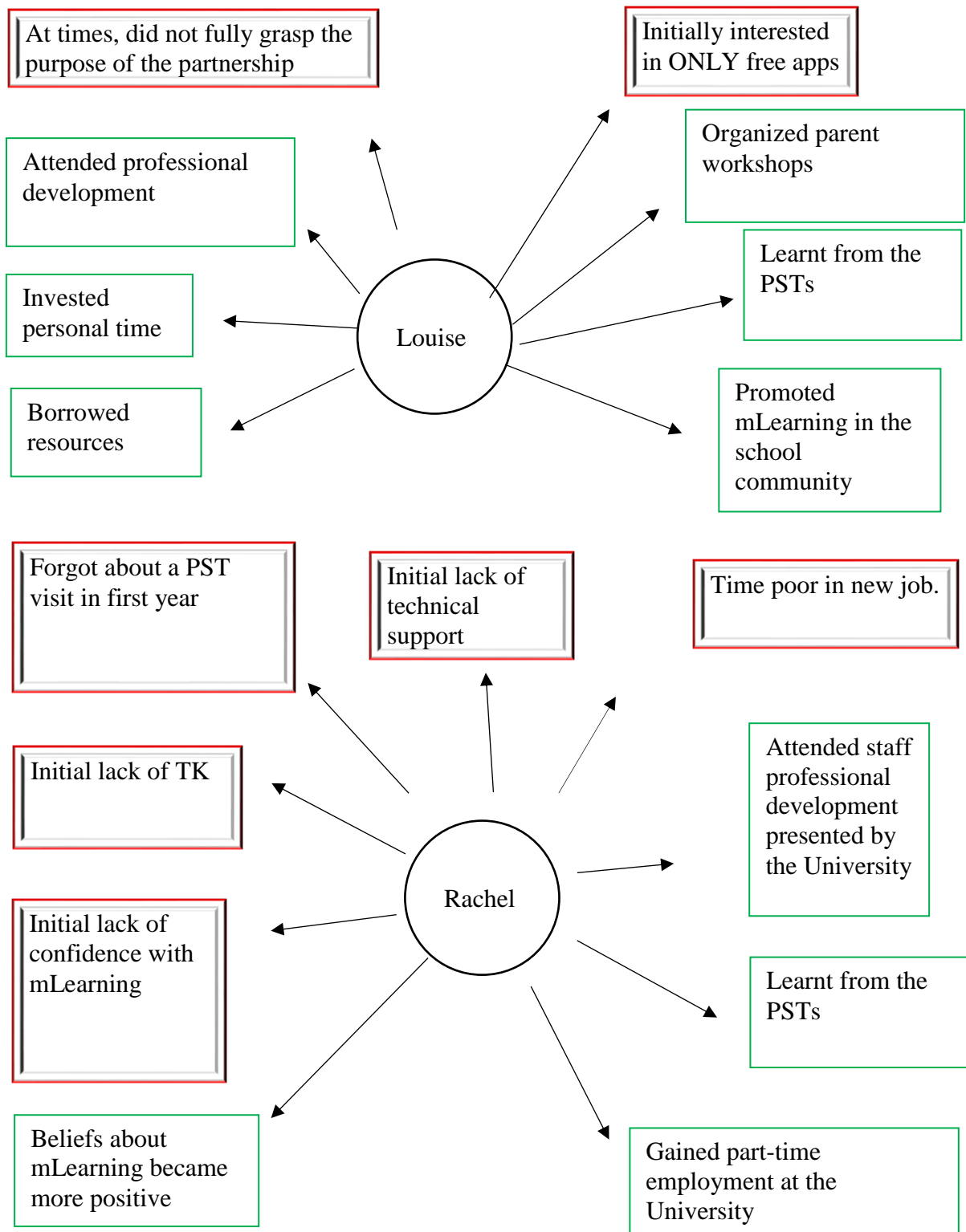


Figure 5.4. The benefits and challenges of mLearning for the participating teachers at School B.

5.4 Conclusion

The six participating teachers in the research were individuals with different levels of technological knowledge and differing attitudes regarding mLearning in early childhood education, commitment, and engagement with the partnership. They were affected by the context of their schools which included parents and carers and school leadership. The degree to which each teacher contributed towards the partnership differed. Whilst all the teachers welcomed the PSTs in their classrooms and provided pedagogical feedback some teachers were more engaged and shared what they learnt with colleagues in their schools.

The teachers all indicated that the children benefited from the PST visits because they were engaged and motivated to take part in rich learning activities which included cooperative learning and problem-solving. Concerns about the technology distracting from the learning were not realised. During the PST visits, the children worked in small groups with a high ratio of adults to children. These small groups were deemed by the teachers to be beneficial to the children's learning.

The participating teachers gained technological knowledge through the classroom encounters during the PST visits and had the opportunity to take up further professional development by working one-on-one with the University ICT lecturer or attending professional development workshops delivered by the University. All the teachers indicated that they learnt from the experience with some engaging and gaining more than others. One of the teachers commenced the partnership without knowing what a wiki or url was, and a year later she was competently creating iMovies, digital books with her class which demonstrates an increase in her technological knowledge.

There was a lack of opportunity for teacher professional development in mLearning in the partner schools. The mLearning professional development offered by the University to

the schools was beneficial to the participating teachers and other teachers within the partner schools. The University also offered technical support and mLearning resources for the schools to borrow. Teachers at both schools borrowed mLearning resources from the University and asked for details about where mLearning resources could be purchased.

The relationships between the teachers and the University took time to develop and with time interactions became easier and problems more easily resolved. The philosophies and beliefs towards mLearning in early childhood education of the practising teachers changed as the partnerships developed illustrating the ability of school-university partnerships to change practice.

Chapter 6 Findings from the Schools

6.1 Introduction

This chapter considers the benefits and challenges of adopting mLearning in early childhood education (ECE) from the perspective of the school leaders and school communities, which included parents, carers and non-participating teachers. This chapter presents the findings associated with the following research question:

What are the impacts of mLearning implementation in schools on school-university partnerships?

The results of this research were divided into four chapters. Chapters 4 and 5 present the findings collected at the classroom level. Chapters 6 and 7 present the findings gathered from the school and University leadership and communities. Chapter 7 presents findings from the participating School of Education (SoE) staff and the community at the University. Table 6.1 presents the organisation of the leadership and community findings in chapter 6.

Table 6.1
Overview of Chapter 6 Findings from the Schools

Section	Content
6.1	Introduction
6.2	The experiences of School A's leadership
6.2.1	Tim
6.2.2	Lara
6.2.3	Sam
6.3	Benefits and challenges of adopting mLearning for School A
6.3.1	Professional development
6.3.2	mLearning environment
6.4	The experiences of School B's leadership
6.4.1	Gloria
6.4.2	Bo
6.4.3	Anna
6.5	Benefits and challenges of adopting mLearning for School B
6.5.1	Professional development
6.5.2	Leadership
6.5.3	mLearning resource management
6.5.4	Technology infrastructure
6.6	The impact of mLearning on school communities
6.6.1	School A
6.6.2	School B
6.7	Conclusion

6.2 The experiences of School A's leadership

Over the three-year research period, there were three principals at School A. At the inception of the research (2013), there was a new Principal, Tim, who became Principal for the first time. After eighteen months (2014), Lara replaced Tim, as acting Principal for six months before the appointment of a new permanent Principal. In the final year (2015) of the study, Sam became the permanent Principal. The leadership instability over the three-year period meant that relationships between the school leaders and the SoE staff had to be re-established each year. In the course of the first and second years, the partnership grew deeper particularly with the practising teachers, ICT lecturer, researcher, and ICT coordinator. In the final year of the partnership, a new Principal and the loss of a key participating teacher at School A posed a challenge to the partnership, but the stability of the University staff and an enthusiastic and supportive Principal assisted the partnership to continue. A description of the experiences of each leader at School A follows.

6.2.1 Tim.

Tim's predecessor established the mLearning partnership with the University, and Tim knew little about it. The partnership was reliant on pre-service teachers (PSTs) teaching children in School A in the very first school term of the school year. Prior to teaching the children at School A, the participating teachers needed to visit the University to meet the PSTs and provide curriculum ideas for the lessons. With little forewarning, Tim agreed to participate in the mLearning partnership and released one teacher to attend the University to meet the PSTs in their ICT workshop in the second week of the school year. Tim was keen to participate in the mLearning partnership and learn more, choosing to come to the University for an interview and to meet the PSTs.

When questioned about the role of the technological leader, Tim stated the role was to encourage technology integration at the school, to budget for purchases and know about the latest Department of Education policies. Tim had previous experiences that were challenging regarding the Department of Education and ICT policies and support, and as a result, was reluctant to make decisions regarding technology without the support of the Department of Education. At the start of the study, Tim claimed that he was in favour of the BYOD model of technology integration and said: “As for the school buying them, forget that. It is not going to happen” (Tim, 2013). Tim maintained that he was strongly in favour of mLearning in early childhood education but that he was a novice. Tim also stated that the school had to rely on the P & C Association for additional mLearning resources, and he described members of the P & C Association as “*not engaged.*”

School A had no ICT policies and no professional development planned in the technology area for 2013 or 2014. Tim pointed out that computing was still an unguided weekly event in the library, and the children did not learn any skills. The PST visits in the first year were successful, highlighted by an incidental meeting in the playground, where Tim said that the feedback from the parents was good, and he wanted help providing information about good apps for parents. The University’s ICT coordinator invited Tim to take a tour of the early childhood classrooms to observe the research in action, Tim accepted the invitation.

Tim generated a grant submission for 15 iPads for School A at the end of 2013. The submission of the iPad grant was surprising because Tim’s view appeared to have changed from earlier in the year when he said that he was against purchasing mLearning devices. It is possible that the good feedback from the mLearning brought to the school by the University and some time to settle into a new role encouraged Tim to rethink his initial views about purchasing mLearning resources. Tim also spoke about improving infrastructure and installing Wi-fi but showed no interest in the University’s offer of iPad professional

development. Unfortunately, the iPad submission was not successful. The researcher and ICT coordinator were persistent in offering assistance so that School A might see more value in the partnership. When offered the loan of an iPad synchronizer he said: “Fantastic, I have heard from colleagues how time-consuming synchronizing iPads can be” (Tim, 2013).

Tim did not appear to plan too far forward and perhaps needed reminding that he was in a partnership that could be beneficial to the school. Tim’s priority in the first year at School A was to organize the school, mLearning resources, and staff. At the beginning of the first year, Tim was concerned about an out-of-date and warranty server and the lack of money in the school for a replacement. At the end of 2013, he said that he had managed to replace the server and generate some capital. Although there were still no policies regarding technology in the school, he spoke of talking to the Deputy Principal about formalizing an ICT plan. However, a plan did not eventuate while Tim was at School A.

At the end of the first year, Tim invited the researcher and ICT coordinator to attend a staff development day at the start of the new school year to talk to staff about the research and recruit teachers to participate. The need for recruitment was because Tim thought it was unlikely either of the teachers from the first year would be at the school the following year. Jessica was applying for new jobs and Kelly was on a temporary contract that was unlikely to continue.

Relief was provided by the Principal and the Deputy Principal so that the participating teachers could come to the University in 2014 to meet the PSTs. At the beginning of 2014, Tim reported that School A was purchasing ten iPads, and the P & C Association would match the school’s purchase with ten more. When the researcher contacted School A in the middle of 2014, Tim advised that he had moved to another school and provided details of the new Principal Lara, who indicated that she was unaware of the mLearning partnership or iPad submission. Figure 6.1 shows a timeline of the technological leadership at School A.

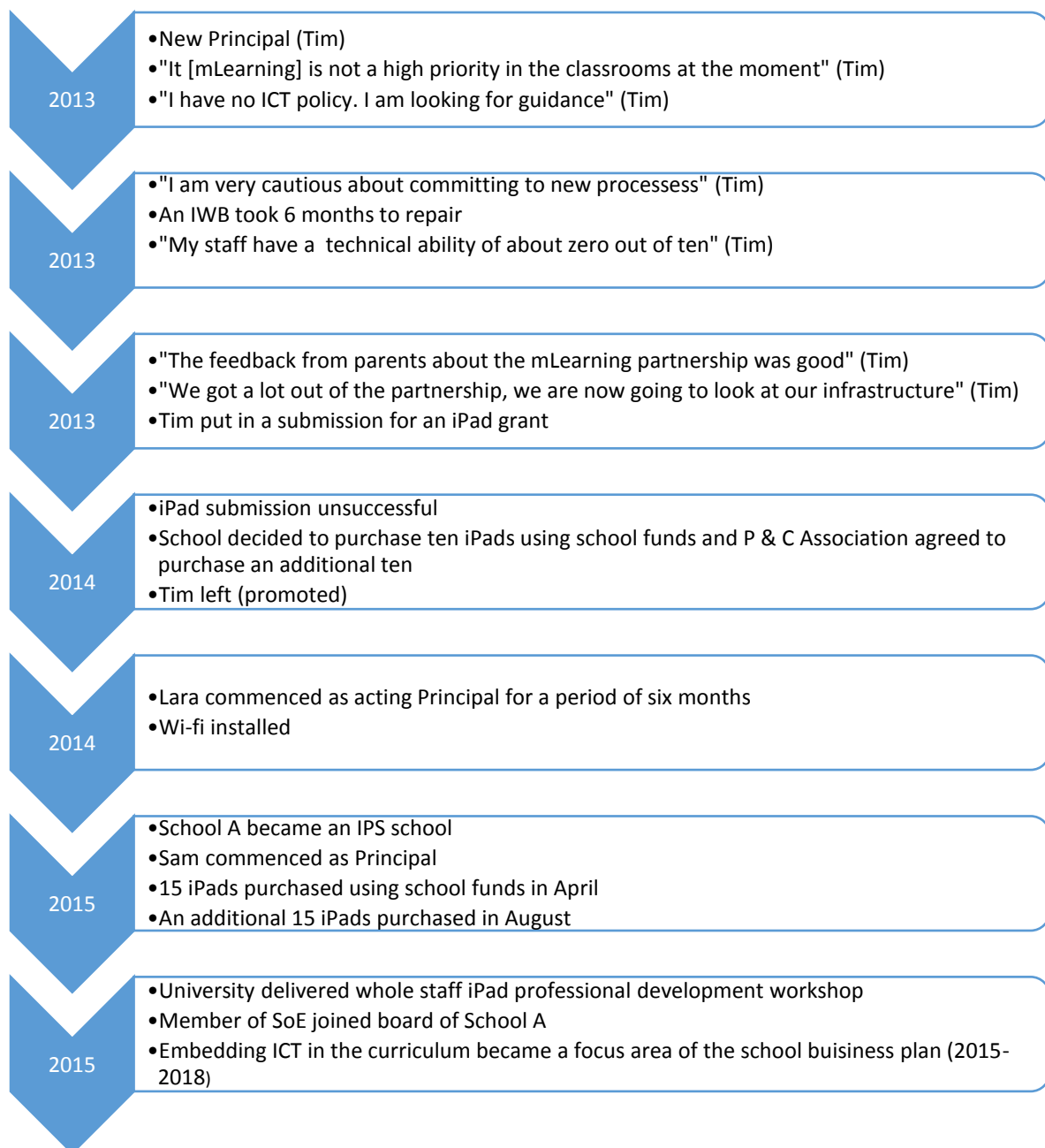


Figure 6.1. Timeline of technological leadership at School A (2013-2015). This figure shows how the technological leadership changed as the partnership evolved.

Tim came to School A as Principal from another larger school where he had been Deputy Principal and the move to School A was of no financial advantage to Tim. In semester two 2014, he won the position of acting Principal in a larger primary school, which resulted in financial advancement. A few months later, he won a substantive Principal's role

in a large primary school that he commenced at the beginning of 2015. At this point, the position of principal for School A became vacant and was advertised for 2015. Between 2012 and 2015 there were four principals at School A indicating that the school was a promotional stepping stone for aspiring principals.

6.2.2 Lara.

Lara came to School A for six months after Tim left. When asked to describe the technological leadership at School A, Lara said: “No, I can not. I think it is being led by Jessica, the pre-primary teacher, because of this project” (Lara, 2014). Lara’s actions indicated that she thought there was minimal technological leadership at School A. When describing the enthusiasm towards mLearning displayed by the two teachers participating in the mLearning partnership, Lara said: “They will probably be the [technological] leaders” (Lara, 2014). Lara described the technological leadership in her previous schools as distributed amongst teachers who had the interest and knowledge. Lara was not aware of any technological policies in School A and was unsure of how many iPads there were in the school. The decisions to purchase iPads for the school and upgrade the infrastructure occurred before Lara arrived at the school. Lara indicated that purchasing the iPads had been a contentious decision, and many of the staff were upset as illustrated:

The money put aside for the iPads and infrastructure, I think it was taken from the library, so there has been a band of teachers who have come, and said that books in the library are far more important, and they should have been consulted. (Lara, 2014)

There was no planned professional development for the staff of School A to coincide with the purchase of iPads. When questioned about professional development Lara said: “We will proceed as if I am here [next year], but once again it is not my area. I do not have a great deal of interest in it, so I am sorry, it has been forgotten” (Lara, 2014). The fact that Lara

placed little importance on mLearning was possibly because she thought there were other more important issues in the school as illustrated by her comment:

It floored me when I heard about all this IT stuff because if I were drawing up a plan for where I thought this school needed to be, it would be the need to have good teaching in the classrooms around literacy and stuff like that as well. (Lara, 2014)

Lara showed her concern for quality education in the statement: “It is a danger giving iPads to mediocre teachers” (Lara, 2014). Lara’s position as acting Principal was difficult because it was so short, but she was strategic in her thinking. School A had just been granted IPS status and Lara felt it was important to unpack the school’s vision statement so that the staff had a clear understanding of the meaning of the vision statement which stated that *School A was a contemporary learning community, which empowers students to be active and engaged citizens*. Staff member comments about the school vision statement focused on values and ICT. Although ICT was a key theme brought up by the staff, Lara thought that less than half of the staff were ready to use technology in the classroom. Lara’s approach was to share leadership to empower the staff, however, when asked how the staff could be assisted to become ready to integrate technology into teaching and learning, she had no suggestions at that time.

6.2.3 Sam.

In 2015, Sam was appointed as Principal to School A. He demonstrated his interest in the partnership by visiting all the classrooms during the PST visits without prompting and made a point of thanking all the PSTs. He commented that the staff had learnt from the PST visits. Sam stated that he would be at School A for at least three years and acknowledged that the rapid change in leadership at School A over the previous two years had affected progress regarding technology integration. Sam’s comment illustrates his view:

I think the frequent change of principals has probably injured some teachers' desire to get this [mLearning] up and running because different principals come with different thoughts about what technologies they would like to see in this school (Sam, 2015).

Sam indicated that he had the technical skills necessary to assist his staff, but when required, would call for help. He stated:

I am resourceful enough to know when I cannot help and get some assistance in as well. It is calling on some people to come and help me, upskilling myself, or if it is above me, paying someone to come out and do the work (Sam, 2015).

At the start of 2015, School A had a Wi-fi network but had not purchased any iPads. The school was ready to purchase a set of 15 iPads that the P & C Association had agreed to fund the previous year. The P & C Association wanted to source the iPads independently. After observing the first PST visit, Sam did not want to delay the introduction of the iPads further so decided to go ahead with the purchase. The iPads arrived the following week. A further 15 iPads were purchased using P & C Association funds a few weeks later. Sam saw his role as technological leader as one of providing professional leadership and creating opportunities for staff development: "I have an obligation as a school Principal to provide some professional leadership and build staff capacity in that [technology] area, but it needs to be coupled with a teacher's desire to upskill themselves and increase their skill set" (Sam, 2015). School A's 2015 annual report placed increased teacher proficiency in the use of iPads as a recommendation for the future. Sam volunteered: "I have not taught with iPads, so it is about me seeking some professional development for myself as well as the staff. I think it is the same for many principals because iPads are only 2010 onwards" (Sam, 2015).

Sam planned to store the iPads in a secure storage unit in the pre-primary (PP) classroom, because of Karen's, the pre-primary teacher's participation in the partnership.

Karen was willing and enthusiastic about upskilling herself, so Sam organized for her to attend two days of professional development: “I think Karen is going to be the driving force in the pre-primary. However, then what we potentially have is a group of pre-primary students coming into Year 1 with no mLearning, so we have to develop a plan to ensure that iPads will be available across all school years” (Sam, 2015). Despite Karen’s enthusiasm for the mLearning partnership, and Sam’s thoughts that Karen would be a driving force in the school, Karen left School A unexpectedly in the middle of the year. Sam selected the participating teachers for 2016 who would be able to share knowledge with colleagues and act as technology leaders within the school.

When questioned about his view of shared leadership, Sam described it as involving community members including teachers, parents, and carers. The school board was made up of community members who set the strategic focus of the school by collaborating to create a business plan. The business plan included the direction of the school concerning technology. Sam wanted technology integration to be important to the community and not just to the school Principal. His comment reflects this view: “I think it is about empowering the community rather than me saying I am going to purchase some iPads” (Sam, 2015). Figure 6.2 provides an overview of the technology integration at School A under the leadership of three school principals between 2013 and 2015.

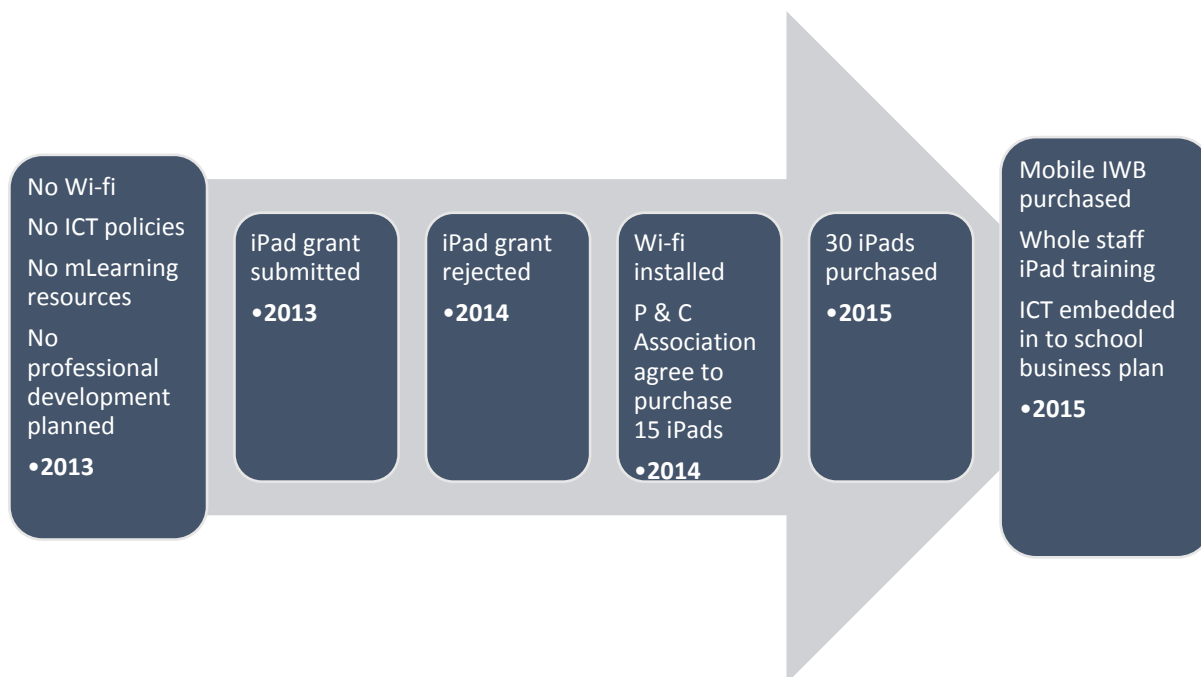


Figure 6.2. Technology integration at School A. This figure shows the steps towards technology integration from 2013-2015.

6.3 Benefits of and challenges to mLearning at School A

This section considers the benefits and challenges to mLearning implementation at School A for the school community which included school leaders, and parents and carers. Data was collected using interviews and surveys and coded using NVivo software. Common themes were identified through a data reduction process using open, axial and selective coding. The themes identified as benefits or challenges to mLearning at School A were professional development, lack of expertise, technical support, time, and mLearning resources. These themes are presented in more detail.

6.3.1 Professional development in the use of mLearning.

Key issues identified by members of the School A community were a lack of teacher expertise with mLearning and the need for teacher professional development in mLearning. These issues are considered together because a lack of expertise leads to the need for

professional development. mLearning professional development occurred in several ways throughout the study. For example, the synergy between the practising teachers and PSTs during the school visits and through the ICT units offered at the University to the practising teachers and PSTs. University staff also facilitated mLearning professional development for staff and parents.

After the initial PST visits, Jessica the pre-primary teacher commented: “It was great to sit down with the students [PSTs] and watch and learn about mLearning” (Jessica, 2013). After attending an ICT workshop at the University in 2013 with the PSTs, Jessica said she was keen to attend more and thought about swapping her planning day so that she could attend. Jessica’s comments indicate that mLearning professional development occurred as a result of the PST visits and attendance of a University ICT workshop.

Angel stated that the only professional development that she had undertaken on mLearning was the parent workshop delivered by the University at School A in 2013 and that she had used her lesson preparation time to attend. Angel was keen to attend mLearning professional development as illustrated by her comment: “I put my name down for two iPad professional development sessions, and they were both booked out. I am waiting to hear about a third” (Angel, 2014). Sam indicated that the age of the staff affected their ability and enthusiasm towards including technology:

I think there is a fear out there. Teachers are highly resistant to change. We have an aging workforce. There is nothing wrong with an aging workforce but it is about people adopting this form of technology and being able to upskill themselves (Sam, 2015).

When questioned, the participating teachers rated their confidence and skill with mLearning at the start of the research of between one and three on a scale of five. Jessica acknowledged that attending the ICT tutorial at the University increased her confidence in mLearning and gave her the desire to learn more. Jessica gave up a week of her school

holiday to attend an intensive ICT unit at the University at the beginning of 2014. Jessica used what she learnt from the ICT unit and created Wordles (word clouds) and avatars with her class a few weeks later. Jessica valued and shared her acquired technological knowledge with her colleagues and the children in her class, as illustrated by her comment:

I was lucky to do the course over the summer holidays, and I had the time to sit down with someone to guide me through how to use different mLearning tools. I found that invaluable. Now I am applying that in the classroom. Now I realize it is quite easy. To begin with, I was quite daunted. (Jessica, 2014)

Jessica briefed her successor, Karen about the mLearning partnership and shared some of her newly acquired ICT skills. Karen later asked about the ICT unit that Jessica had attended and expressed an interest in attending.

A discussion with the SoE staff in the first year of the research prompted Tim the Principal to think about professional development at School A and ask Jessica to present what she had learnt from the partnership at a staff meeting, which she did. Tim commented in the initial interview that he thought the best professional development was teachers working shoulder to shoulder. Tim initially indicated that he had little confidence in the staff's technological abilities. When asked to rate the technological knowledge of his staff of eighteen, he ranked them as zero out of ten. The University offered to provide professional development to school and parent groups. He said that he would ask the P & C Association if University representatives could attend a meeting of the Association to present information on the mLearning partnership. This meeting did not eventuate. The fact that Tim was in a new role, had competing priorities and was time poor is possibly the reason that he did not follow up on this opportunity. Encouraging School A, to accept the University's offer to facilitate professional development was a challenge.

In the final year of the research, Sam requested an iPad professional development workshop for all staff at School A. The ICT lecturer (Victoria) presented the workshop. Although some of the staff were reluctant, this hands-on session had all staff engaged, and the Principal later commented that he liked the key message that home and school use of iPads is very different. A few weeks after the staff iPad professional development session, Angel was utilizing things she had learnt with her class and said: “I am now working with small groups of eight or nine children creating a digital book using Book Creator about the school day. The first one is very simple, but the children took it to show the Principal” (Angel, 2015). These findings revealed that teachers such as Angel and Jessica at School A increased their confidence and knowledge in the use of mLearning in the classroom through the professional learning that occurred because of the mLearning partnership. The other participating teachers at School A, were only in the partnership for one year, so there was not sufficient time to determine if there was a genuine increase in their confidence and knowledge with mLearning.

The school-university partnership provided an opportunity for professional development of the participating teachers and other teachers within School A. The professional development occurred because the PSTs, guided by their lecturers, delivered lessons using developmentally appropriate mLearning tools. This provided the teachers with the opportunity to engage and learn alongside the PSTs and children. Professional development also occurred as a result of workshops delivered at the schools for staff, parents and carers and the ICT lecturer working one-on-one with individual teachers.

All the participating teachers at School A indicated that they lacked professional development opportunities and rated their confidence using mLearning as low. The partnership provided a way for the schools to access free professional development. Professional development was a challenge for the schools who were unable to provide the

training needed by the teachers. Professional development was a benefit of the partnership for School A as the University fulfilled this need. Figure 6.3 shows professional development as a challenge to mLearning at School A because of the lack of availability, cost and limited time for teachers to undertake professional development. Although the University offered one-on-one sessions with individual teachers, only Jessica at School A took up this offer. The University also invited teachers to attend an ICT intensive, however, only one teacher was willing to give up personal time and attend. The lack of time and competing pressures that teachers frequently spoke of is likely to have contributed to lack of uptake of professional development.

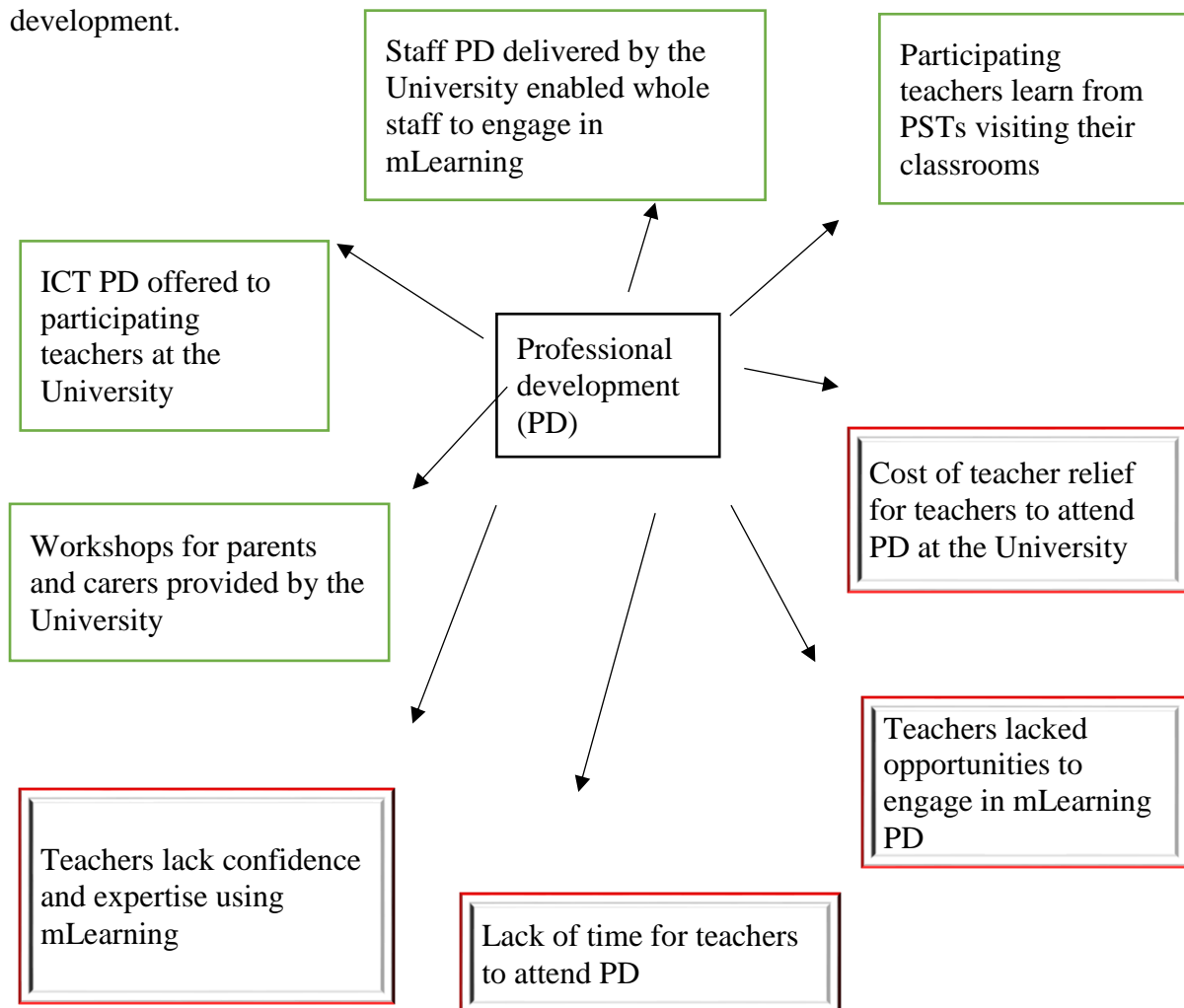


Figure 6.3. Professional development as a challenge to School A and a benefit of the mLearning partnership with the University. The green boxes indicate benefits and the red bevelled boxes indicate challenges.

6.3.2 mLearning environment.

This section is about the acquisition and management of mLearning resources at School A. The mLearning resources needed managing so that they were ready for use by successive teachers. Figure 6.4 captures the acquisition of mLearning resources at School A over the three-year research period.

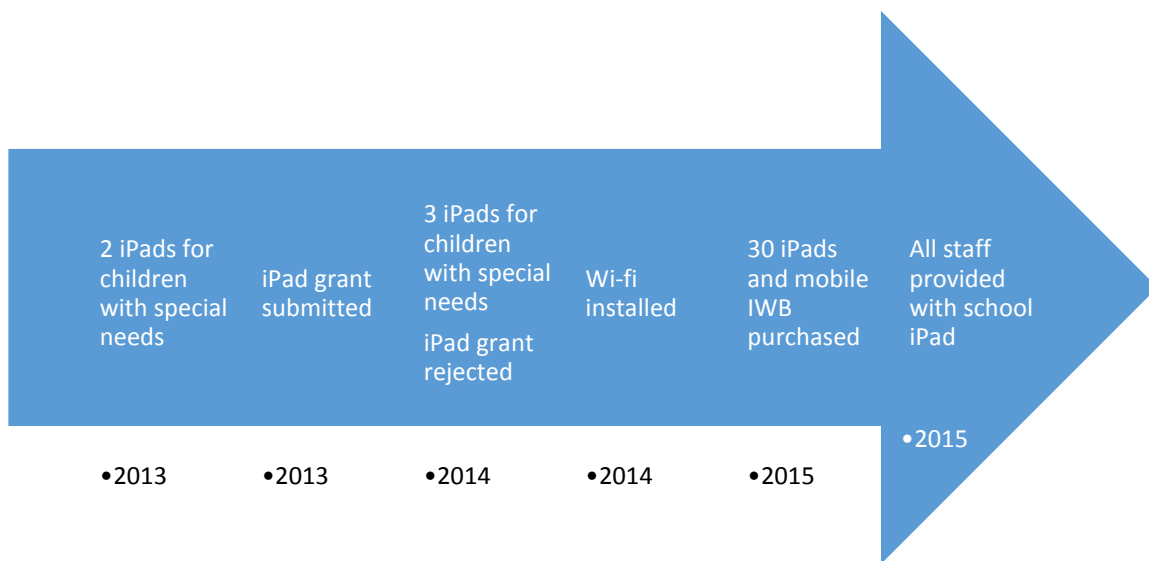


Figure 6.4. The mLearning resources available at School A, 2013-2015. The figure shows the acquisition of mLearning resources over the research period.

6.3.2.1 mLearning resources.

At the start of the partnership, School A had very limited mLearning resources and no access to Wi-fi. Teachers had the opportunity to borrow mLearning resources from the University and observe the PSTs using mLearning resources with children in their classrooms. Towards the end of the three-year research period, School A was well resourced and had technology integration embedded within the school business plan. The inclusion of technology integration in the school business plan meant that it would be a measured and

reportable outcome. At the start of 2016, School A had 50 iPads, and each staff member had a school iPad. Together with the mLearning resources was an action plan to upskill teachers and ensure the use of ICT across all year levels and areas of the curriculum. mLearning resources were a challenge for teachers at School A because these were not available at the start of the study. The acquisition of mLearning resources at School A took place as the partnership progressed and was influenced by the disposition of the school leaders towards mLearning.

6.3.2.2 *Technical expertise.*

The Deputy Principal was the person responsible for technological support in School A and this was one of many duties. One of the participating teachers, Kelly, arrived in 2013 at the beginning of the school year to an IWB that was not working. The IWB was not repaired until the start of term three. When sharing this information, Kelly said: “Having someone show me and fix things so I can get things up and running would be good” (Kelly, 2013). As the partnership developed, the University staff provided some technical support as illustrated when Jessica wanted to project her iPad onto the IWB: “Can you tell me the adaptor cable I need to connect the iPad to the computer?” (Jessica, 2014). University staff provided assistance with such technical questions and therefore removed barriers teachers’ use of mLearning in the classroom.

The Deputy Principal arranged Wi-fi for School A in 2014, but there was no provision for professional development or policies developed to support the new infrastructure. The Principal in 2015, Sam, stated that the Deputy Principal had the official role of ICT coordinator that was mainly troubleshooting rather than engaging in forward planning. Sam indicated that he was responsible for coordinating the ICT in the school in terms of planning, purchasing, rolling out iPads and setting up. When Sam purchased the first set of iPads for

School A, he used a more expensive educational company preferring to pay slightly more but having the iPads all set up and under warranty.

A lack of expertise in School A in the first two years of the research meant that teachers were unable to seek assistance within the school. Resolving technical issues was time-consuming and in competition with other school priorities which took up the time of the school leadership. Technical expertise at School A was a challenge and resulted in malfunctioning equipment not being repaired, and so unusable for long periods of time. The technical environment within School A improved in the final year of the research, with the acquisition of new mLearning resources, the Principal monitoring the use of mLearning resources, and a plan to up-skill staff.

6.3.2.3 Leadership.

The turnover of school leaders at School A provided many challenges for the integration of technology. The first Principal, Tim, needed time to settle into a new role. He had to juggle projects such as unexpected capital works, aging resources and infrastructure, and contend with a lack of funds. Tim was aware that staff members lacked technological knowledge, but other priorities were in competition for his time. The second Principal, Lara, was only at School A for six months. Lara was aware that staff lacked technological knowledge, and admitted that her lack of interest in technology resulted in no action being taken. The third Principal, Sam, was committed to integrating technology into the curriculum at School A and consequently progress towards that goal was accelerated in the final year of the research.

In terms of mLearning resources, School A was early on in its journey to integrate into the school culture. At School A, the early childhood classrooms were separate from the main school, but the Principal decided to store the first set of iPads in the early childhood

teaching area rather than in the main school. This illustrates the school Principal's commitment to using mLearning in early childhood education because storage in the main school would have been simpler for the school as a whole. The challenges to the technical environment at School A can be summarized as a lack of mLearning resources, lack of technical expertise to repair faulty equipment and support teachers, lack of time, and a high turnover of school leaders with differing levels of support for mLearning. Figure 6.5 shows the key challenges to the technical environment at School A.

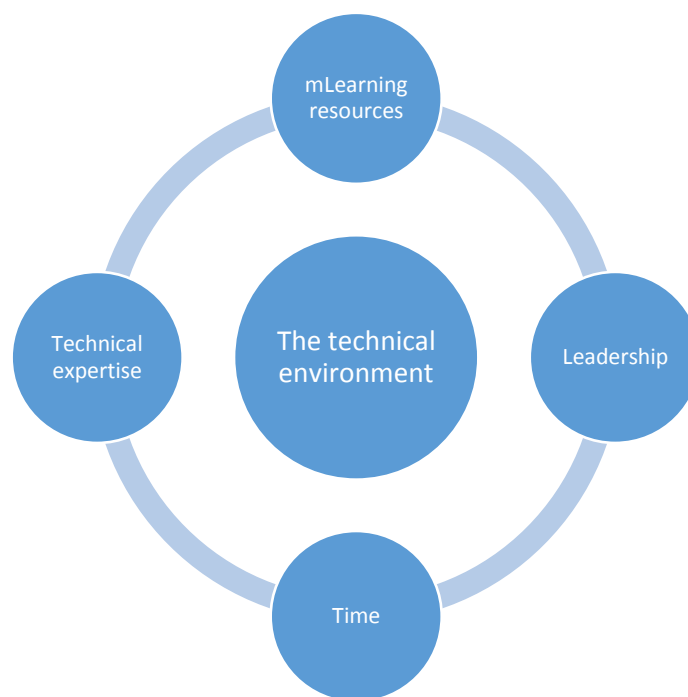


Figure 6.5. The technical environment at School A. The factors affecting the technical environment at School A were mLearning resources, leadership, time and technical expertise.

The partnership with the University was of a benefit in two ways: firstly providing technical support to teachers who were able to liaise directly with the University for assistance. A second benefit of the partnership was the opportunity for teachers to borrow mLearning resources, which they did. The University also offered School A advice on developmentally appropriate hardware and software.

6.4 The experiences of School B's leadership

The experiences of the three different principals from School B are presented. The school Principals provided the technological leadership of School B. Between 2013 and 2015 there were three different principals at School B, Gloria in 2013, Bo (acting Principal) in 2014 and Anna in 2015. A description of the experiences of the School B leaders follows.

6.4.1 Gloria.

When the partnership between School B and the University commenced, Gloria was in her third year as Principal at School B. Gloria regarded her role in technology integration as one of streamlining the process to make sure that School B purchased the correct mLearning equipment. She also saw that her role as the Principal and technological leader was one of selecting and sourcing equipment and monitoring its use. Gloria purchased iPads and wireless infrastructure at School B in 2012 while she was the Principal. An ICT audit took place at School B in 2013, and Gloria stated that she would use the results to decide what to purchase. When later questioned about the results of the ICT audit, the Principal and Deputy Principal struggled to remember the audit. This suggests that little was gained from the audit possibly because the results were not properly disseminated.

Gloria said that she was not going to spend money on anything unless it was going to be valuable and used. Gloria wanted to provide play-based, educationally justifiable and fun learning tools for the children in the early years of education. At the end of 2013, Gloria asked her staff if they would like any further mLearning tools and, to her surprise, there were no requests from staff except Louise, who requested a plasma television. It is probable that a lack of time and knowledge of potential mLearning resources prevented teachers from researching new mLearning resources.

The Deputy Principal attended the final meeting with the University participants, at the end of 2013, as Gloria, the Principal was leaving the school and wanted continuity of the partnership. Gloria had a good understanding of the partnership, and how it could work for School B. At the end of the year, she initiated a discussion about how the practising teachers and PSTs could meet at the start of the school year without the cost of teacher relief. Gloria's actions demonstrated her desire for the partnership between School B and the University to continue.

6.4.2 Bo.

Bo came to School B in 2014 in the position of acting Principal for one year. Bo was technically proficient and had lots of experience with technology integration at a previous school. Bo was able to see what had to be improved and what needed purchasing to facilitate mLearning in School B. In 2014, Bo purchased five new iPads, five Mac Books, a secure charging system and improved the Wi-fi infrastructure. Bo applied for the Principal's position for 2015 but was unsuccessful. Bo took steps to facilitate management of the iPads while maintaining a focus on improving outcomes in teaching and learning in the classrooms. Towards the end of her first year, she streamlined the use of the iPads and engaged a company specializing in providing educational, practical and technical support to schools.

From an ICT perspective, Bo's goal was to ensure that teachers understood that technology was a tool for learning and not an outcome. The business plan developed by Bo had a goal of having a basket of iPads shared between two classes and then having a set of iPads for every classroom within two years. Unfortunately, Bo was not at School B in the final year and unable to enact the business plan. She acknowledged that School B had work to do in the area of technology integration. Her comment reflects her view:

Strong learning outcomes must be achieved irrespective of the technology. I think from a technology perspective this school is very early on in its journey. (Bo, 2014)

Bo stated that the staff was starting to move away from using technology for direct substitution and starting to utilize apps that were more creative. Direct substitution is when teachers substitute technology for a traditional teaching tool without adding anything to the learning process (Cavanaugh, Hargis, Kamali, & Soto, 2013). Bo said: “The school is moving towards an environment where children can pick up a device and use it at any given time” (Bo, 2014).

The University staff wanted to present a parent workshop on the creative uses of mLearning and showcase some of the children’s work completed with the PSTs. However, Bo requested a parent workshop on cyberbullying from the University instead. Bo’s request reflects the high profile of cyberbullying in the media. Following this workshop, which was delivered as active citizenship rather than cyberbullying, two further parent workshops on this topic were requested by School B. The request for further workshops suggested that the Principal thought the active citizenship workshop was worthwhile.

During the following parent workshop, Bo downloaded a free version of the app being demonstrated and experienced the limitations of the free app as opposed to the full version. Although this app, Book Creator, had already been recommended to the Principal, she needed to see it in action to make the decision as to whether or not to load it on to all the school iPads. The Principal’s actions were consistent with literature about the importance of hands-on mLearning and the importance of vetting potential apps (A. Campbell & Scotellaro, 2009).

When asked about possible improvements for the partnership for the following year, Bo asked about including more teachers. The kindergarten teacher had expressed an interest in participating, which tended to indicate that the feedback about the mLearning partnership

within the school was positive. Logistics made including an additional class impossible, but there was a discussion about providing School B with details about the content of the ICT unit at the University so that teachers could attend single sessions.

6.4.3 Anna.

Anna was an experienced principal who came from an IPS which had 70 iPads. She had experience in managing finances vis-a-vis ICT integration as shown by her comment: “IPS schools can be creative with budgeting. My strength is budgeting. I think it is about accessing every revenue you can access” (Anna, 2015). Anna was a strong believer in effective ICT integration, and in a previous role had been an ICT support teacher, working side by side with teachers. In conjunction with the new school board, Anna wrote a business plan with a strong emphasis on technology. A focus of the business plan for 2015-2018 was developing an ICT strategy, which included teacher professional development to integrate ICT into teaching programs. Anna stated: “I see a business plan as a way of embracing technology” (Anna, 2015). Anna indicated that it was important that the school business plan was collaborative so that there was ownership of it, and that goals were measurable and achievable.

Anna visited the classrooms during the PST sessions and invited two parents, a former journalist and a photographer, to write an article about the mLearning partnership for the school newsletter. Such actions suggest that Anna thought the mLearning partnership was worth sharing with the community. Anna stated that she liked working in teams and would stay at School B for three years before seeking a larger school with more opportunity for teamwork. Anna shared leadership in School B by creating teams for literacy, numeracy, science and ICT capabilities. Different teachers were given responsibilities to lead discussions and then report back to the principal. Louise was given the ICT capabilities team

because of her interest and work in the mLearning partnership. Anna was also proactive and made suggestions that would be beneficial to the University as well as to School B, for example, she suggested that the teachers could be released to come to the University more often to give feedback to, or receive it from, the PSTs.

Anna was aware that she was the third Principal in three years and said: “I have to be careful” (Anna, 2015). The change in leadership had affected the staff and when one of the participating teachers, Rachel was asked how the iPads were being managed in the final year, she indicated that there was a new process and things were “up in the air”. Figure 6.6 illustrates technology integration at School B under the leadership of three school principals between 2013 and 2015.

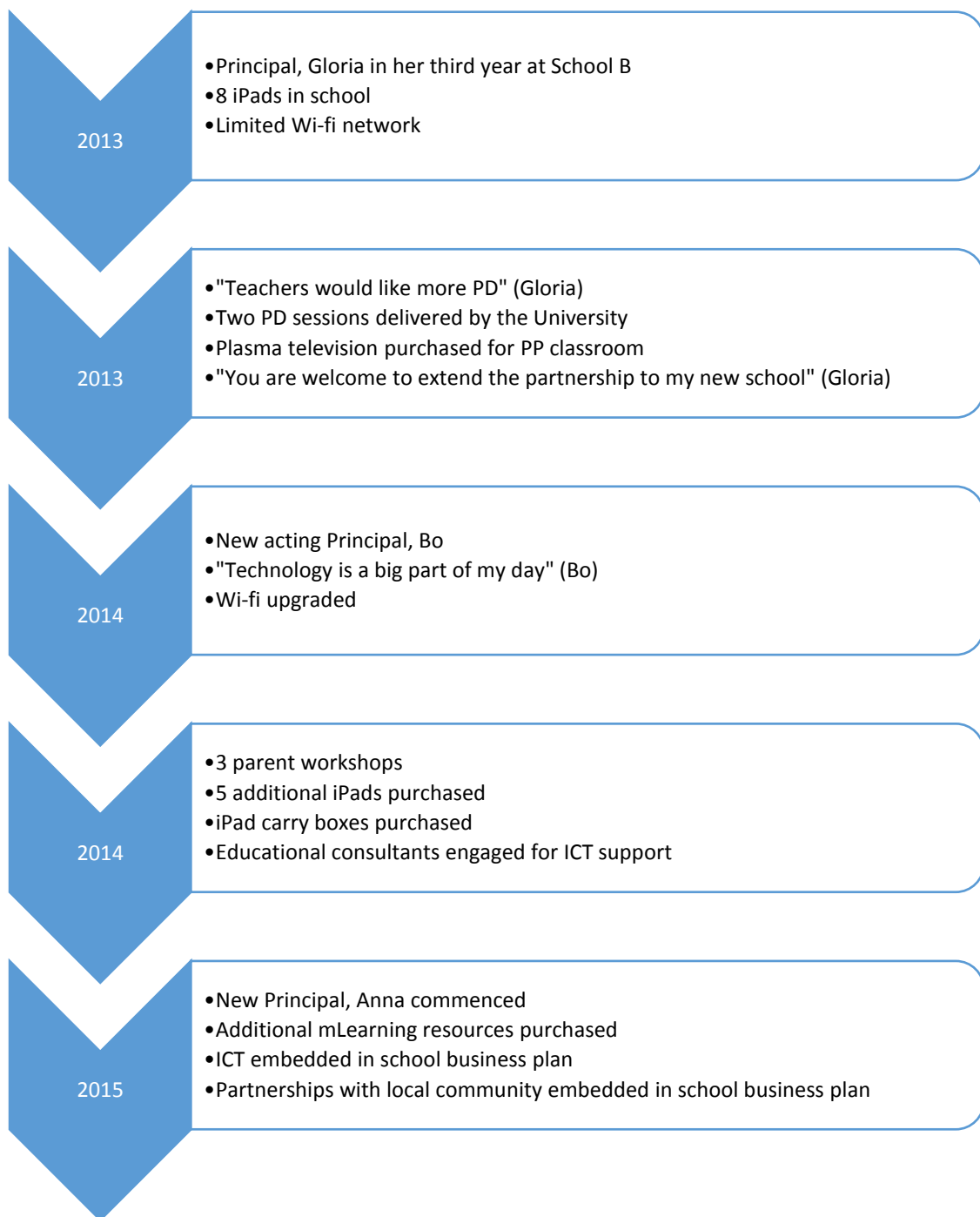


Figure 6.6. Timeline of technology integration at School B. This figure illustrates how the technological leadership changed over the three-year research period.

6.5 Benefits of and challenges to mLearning at School B

Analysis of the data collected from surveys and interviews indicate four areas of interest. These are professional development, leadership, mLearning resource management,

and technology infrastructure. A description of the benefit and challenge of each of these four areas follows.

6.5.1 Professional development in the use of mLearning.

Professional development opportunities arose through the teachers working alongside the PSTs in the classrooms. Professional development was also available as a result of lecturers working directly with the teachers to give specific individualized support and professional development workshops delivered by the University staff. Gloria, the Principal in 2013, acknowledged that the mLearning partnership exposed all her teachers to new ideas. The teachers attended a whole ICT tutorial at the University in 2013 but in subsequent years were only able to attend for half an hour due to the cost of teacher relief. Rachel, a participating teacher, stated that the lack of professional development and concomitant ideas limited her ability to use mLearning. Gloria stated that her staff varied in terms of ICT skills and needed professional development. Subsequent principals shared this view:

I think Louise has got a bit more of a grasp of how technology can be used, but I think she has got some way to go in terms of how it is seamlessly embedded. (Bo, 2014)

Our kids are capable, and I think as a school, as a teaching staff, we are not giving those kids enough opportunity to do that. I think there are three reasons for this, one it is a confidence thing. Secondly, it is knowledge about how to implement technology, and thirdly it is space and infrastructure. (Bo, 2014)

I like the plasma screen Louise has, but I would like to see it as a workstation. At the moment, it is quite teacher directed. (Anna, 2015)

One of the difficulties with professional development is that it is often too general to suit the needs of K-7 teachers, or a group of teachers with varied amounts of existing knowledge. Chiu and Churchill (2016) posit that professional development for teachers should be specific to the needs of teachers in a school. Louise's comment supports this point:

“What is relevant for K [kindergarten] is worlds apart from Year 7” (Louise, 2013).

Individualized professional development is expensive for a small school, but might be more manageable if schools can collaborate.

PSTs attending the ICT unit that was offered during the semester were grouped according to the degree for which they were studying. The ICT intensive unit was attended by primary, secondary and early childhood PSTs and, therefore, lacked degree-related specialization. One of the PSTs in the 2014 peer group who attended the intensive ICT unit made the point: “I felt that the [intensive ICT] unit was not suited to early childhood. I think we should have a separate unit so we can focus on information that is more suitable for early childhood” (PST, 2014).

Gloria was proactive in asking the University staff to deliver two professional development sessions at School B in 2013. A whole staff iPad workshop and another for EAs from across the network, also on using iPads, was planned. The feedback received from both these professional development sessions was very positive; for example, Gloria commented: “The EAs were so excited” (Gloria, 2013). The EAs, when asked what they had learnt from the professional development, gave favourable responses such as:

Great PD, all of this will help immensely in my personal life and especially at school. (EA workshop, 2013)

Helpful, professional development, I would be happy to do another one. (EA workshop, 2013)

Very useful. (EA workshop, 2013)

No staff professional development on technology took place in 2014 but Bo, the Principal, devised a professional learning model for the school’s business plan. The model aimed to increase the confidence of the teachers and enable them to reimagine and enhance

learning using technology (Morrison & Camargo-Borges, 2016). Bo stated that professional learning was the key to technology integration. The professional learning model included a planning session at the start, and then three or four more guided stages of observations, modelling, coaching, conferencing and debriefing in a series of cycles. The business plan focused on enhancing creativity in the school using technology as a tool, with appropriate funds being allocated. Bo asked Victoria, the ICT lecturer from the University to act as the expert helping to deliver this professional development.

6.5.2 Leadership.

Anna, the Principal in 2015, was an experienced school leader with a background in ICT, including a degree in educational technology. Anna had the school leadership experience and ICT expertise required to use the mLearning partnership to help with the implementation of mLearning at School B. Anna's leadership traits were consistent with those of a good technological leader which include an ability to coach people to do their best work, having a good level of technological knowledge and the ability to make good decisions (Clarke & Zagarell, 2012). Anna wanted to create a professional learning community at School B and commenced this at her first staff meeting by asking teachers to share a learning experience. There was opposition to sharing learning experiences from the staff which are, but Anna, stated that she was going to persist as illustrated by her comments:

I am passionate about using and integrating ICT but appreciate that not everyone feels the same, so I need to provide some guidelines. I see it as our performance management. (Anna, 2015)

If we have a true professional learning community, we will be learning from each other. (Anna, 2015)

I think everyone [staff] needs to be on the journey. (Anna, 2015)

I think it [mLearning use] depends on the age of your teaching staff. I think it is not used widely because of a lack of understanding of how it can support what teachers

are already doing in the classroom. Teachers need to be shown good examples then I think they will embrace it. (Anna, 2015)

Anna's leadership experience enabled her to access grants and be creative with budgeting so that she could access funds to purchase mLearning resources. Anna used her position as a leader with her technological knowledge to devise a means of implementing mLearning at School B.

Anna had delivered a great deal of professional development and attended professional development alongside her staff at previous schools. When an ICT technician visited her school to resolve a problem, Anna took the time and sat with the technician so that she could learn new skills to assist her staff. In doing so, Anna showed that she was on a learning journey. Anna was interested in the ICT intensive unit that the University offered. She expressed a desire for teachers to attend two or three sessions at the University during the summer break. Anna's actions demonstrated her understanding that the staff needed upskilling, and opportunities such as an ICT intensive at the University could be valuable for her staff. Anna led by example taking opportunities to up-skill herself as well as seeking ways to up-skill staff. The partnership provided a source of professional learning opportunities for School B, and Anna was proactive in investigating such opportunities.

Towards the end of 2015, Anna requested a list of suitable mLearning resources from the University. Anna indicated that she had \$10,000 to spend and wanted to purchase enough of each resource so that there was sufficient for children to use in the classrooms. Anna's actions demonstrated her faith in the University's research of mLearning resources selected for use in the partnership. Anna intended to showcase the mLearning resources to staff at a professional development day at the end of the school year. School B was involved in two network professional learning sessions at the beginning of the following year, and Anna

asked Louise to facilitate a session on mLearning with a group of pre-primary teachers. Facilitating a workshop would provide Louise with the leadership opportunities that she was seeking. Anna used a variety of strategies to upskill teachers including using the University's ICT unit and tailoring a job advertisement to a person with technology skills. Anna's comments reflect her leadership strategies: "To me to have that opportunity [ICT intensive at the University] is fantastic" and "I am about having mLearning resources and the knowledge, so it is important to train teachers" (Anna, 2015).

Anna observed the PSTs working with children at School B and immediately released all early childhood teachers in the school so that they could walk through the relevant classes and observe what was happening. Anna's actions exhibited leadership that took advantage of an opportunity when it arose. These early childhood teachers sat with groups of children and PSTs and engaged in the activities asking many questions about the various mLearning resources. Anna placed value in the PSTs and talked about using them to work one-on-one with teachers showing them how to use mLearning tools. Anna's idea eventuated towards the end of the third year when PSTs, delivered a professional development workshop for twenty- five parents at School B. Anna's leadership was of considerable benefit to mLearning implementation at School B. She had the skills, experience, and expertise necessary to make a successful plan for mLearning implementation. There was a high turnover of teachers at School B at the end of 2015, and Anna selected high-quality teachers for new positions and ones who had a positive disposition towards mLearning. The teachers participating in the partnership in 2016 were selected by Anna.

The turnover of leaders at School B presented a challenge because each leader had a slightly different skill set and approach to mLearning. Successive principals took School B progressively in the direction of mLearning implementation. Anna possibly had the largest impact because she was experienced in both leadership and technological knowledge. A key

enabling factor for Anna was the fact that School B gained IPS status prior to her commencement giving her greater autonomy than afforded to previous leaders.

6.5.3 mLearning resource management.

School B had a relatively small number of devices (iPads, n=8), but there was no system for managing these iPads in 2013, so problems arose. Initially, there were no boxes to carry the iPads, no system for installing apps on the iPads, and no system for booking them. The Deputy Principal who was responsible for the iPads in 2013, commented that they had lost one iPad and one iPad cord. In 2013, a child at School B collected the iPads at the end of each day and plugged them into the charging station. In 2014, the Principal took over responsibility for technical support and purchased iPad secure storage and charging boxes, and made the teachers responsible for booking the iPads and collecting and returning them to the charging station. This Principal realised that the mLearning resources needed managing, and it was no responsibility for a child.

In 2015, Anna, the Principal provided the technical support and was quick to call in support when she was unable to resolve a problem. Anna numbered all the iPads, purchased child safe cases and stored the iPads in secure baskets for moving around the school and charging. Anna put a process in place for requesting apps and booking the iPads. Much groundwork was put in place in 2015 to manage increasing numbers of mLearning devices used in the school. All the iPads were reset and formatted so that the devices all had the same apps, and could easily be accessed.

When the University staff facilitated the professional development sessions at School B in 2013, Gloria's lack of technical knowledge was highlighted. In both sessions, the iPads brought to the session by the University were not compatible with the school Wi-fi, so some teachers did not have Internet access. Gloria was unable to resolve this issue. The pre-primary

teacher at School B used the iPads for rotational activities and only four at one time. The reason that she only used four was that the network could not handle more than four iPads efficiently.

Poor management of mLearning resources is a challenge to mLearning implementation because mLearning resources become lost or in need of repair and are therefore not used. Another challenge is an mLearning environment that does not function properly, for example, poor Wi-fi and no support person to help teachers when technical problems arise. Louise's comment illustrates these factors: "If there is a problem with mLearning resources they are just left until someone has time, because we do not have a technician" (Louise, 2013).

Gloria was unaware of the technological issues involved regarding her suggestion of bringing the PSTs to School B to conduct a tutorial. Gloria saw her role as a technological leader as that of connecting people to the ways that technology could be used to enhance teaching. With regard to teachers, she stated: "I think it is that they do not know what they do not know and how it fits the curriculum. I do not think they fully understand its potential and some of the technologies that are out there" (Gloria, 2013).

Bo's experience with ICT integration at another school enabled her to solve problems that were barriers to effective integration of ICT. Upgrading the limited Wi-fi network was an example of this, as all participants at School B had commented on the poor functionality of the network and time taken to manage mLearning resources. Bo realised the importance of technical support and engaged the services of ICT educational consultants to manage the ICT network and the deployment of mLearning resources at School B.

Challenges to effective use of technology were identified by Anna, for example, the iPads were not numbered, so children's work became lost, and the kindergarten teacher was

not able to connect her laptop to the Wi-fi. Anna spent personal time resolving technological issues which included coming to the school at the weekend and spending school funds on the services of a technician. At the beginning of 2015, only seven iPads were in the secure charging unit; the remaining iPads were scattered throughout the school and took two weeks to find. Anna resolved problems quickly so that teachers did not get frustrated and said: “Technical issues are blockers for teachers. When teachers get frustrated, they give up” (Anna, 2015).

Towards the end of 2015, the Wi-fi was working well throughout the school (including the kindergarten) and had been installed in the staff room, which was useful for meetings. The technician employed by School B in 2015 was available at short notice and could work across Apple and Windows operating systems. Teachers at School B also had access to central technical support from the Department of Education. Consequently, at the end of 2015, all the mLearning resources and infrastructure were working well. In addition to the improvements to the mLearning resources, Anna upskilled her staff by using a variety of new technological resources such as BrightPath, an online assessment tool; ‘Connect’, a tool to connect school and home; and Tiqbiz, a communication tool used to send text messages and notices to parents. These systems changed the way teachers did things and encouraged teachers to engage with technology.

Anna set up an iPad and laptop timetable so all staff had access and could plan to use mLearning resources. When not timetabled, any teacher was free to use the iPads. She stated that staff needed to be familiar with some specific apps that she put on all the iPads. As the technical support improved at School B, some of the challenges were removed. At the end of the final year, the teachers did not talk about technical problems when discussing mLearning as they had in the previous two years, possibly because technical support had improved. Improvements to resource management occurred as the leaders took responsibility for

managing mLearning resources and resolving problems. When leaders at School B were focused on mLearning implementation, they took steps to remove barriers so that teachers could engage with mLearning.

6.5.4 Technology infrastructure.

Figure 6.7 captures the acquisition of mLearning resources and infrastructure at School B over the three-year research period. At the start of the partnership School B had eight iPads and a Wi-fi network. The partnership provided the opportunity for teachers to borrow mLearning resources. School B borrowed a set of Bee-Bots from the University in 2014 for the whole school term and a digital microscope for a week.

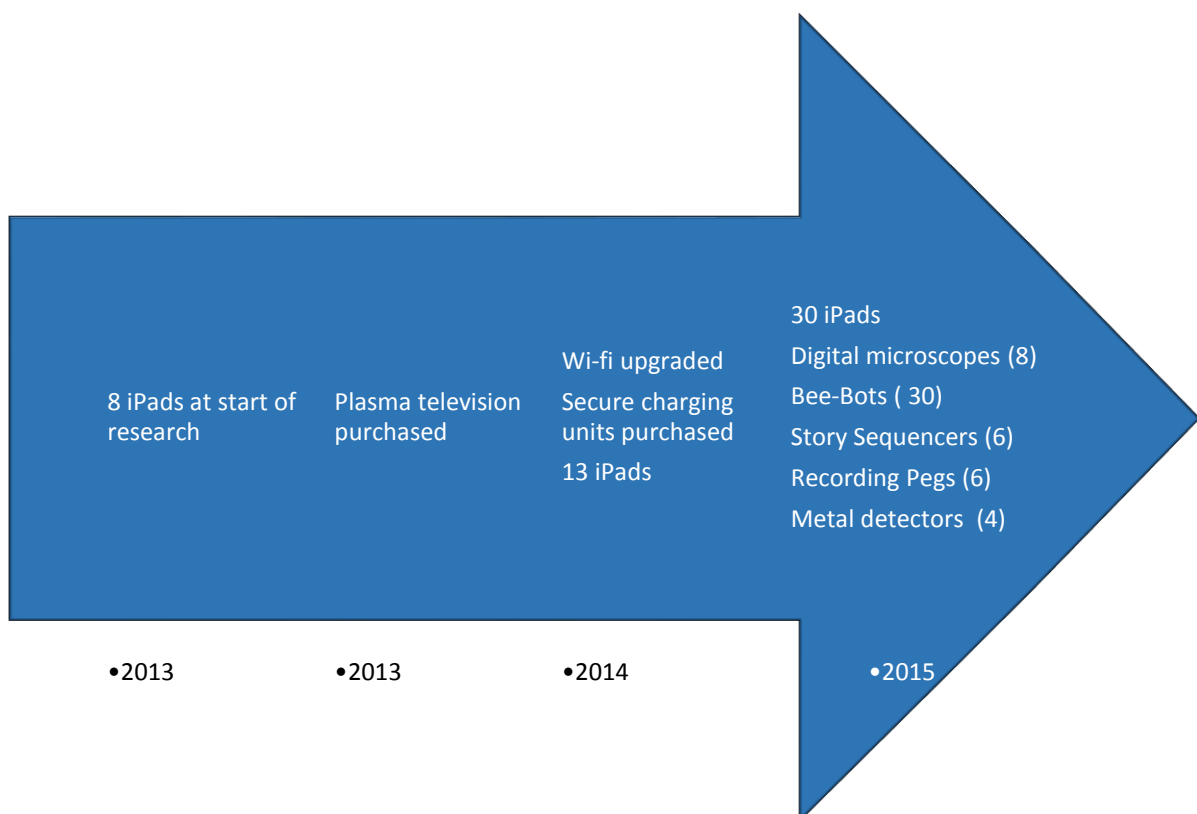


Figure 6.7. Technology infrastructure at School B. This figure illustrates the mLearning resources and infrastructure available over the course of the study.

At the end of the three-year research period, School B had two mobile trolleys of iPads (30 iPads), eight digital microscopes, two sets of Bee-Bots, a class set of Talking Butterflies, Story Sequencers, and metal detectors. Technology was embedded within the school business plan with professional development to support staff and school leaders. The acquisition of mLearning resources took place gradually. The University staff guided the mLearning resources selected and used at School B. The technological leadership, particularly in the final year, enabled School B to move towards its goal of implementing mLearning across the curriculum.

The key challenges to mLearning implementation at School B were viewed as: resource management, maintaining continuation in leadership; and upskilling staff. The benefits offered by the mLearning partnership with the University were identified as professional development opportunities, access to advice about selection of mLearning resources and apps and the opportunity to borrow mLearning resources from the University.

6.6 What are the impacts of the mLearning partnerships on school communities?

The purpose of this research was to ascertain the impact of mLearning on school-university partnerships. This section contains data collected from the school communities. Such data was obtained from parents and teachers at the schools associated with the mLearning partnerships. The data was gathered by the researcher from parent surveys, the school websites, parent workshops and interactions observed through the classroom visits. Parent workshops were conducted each year and provided an opportunity to highlight the mLearning that the children had engaged in, and provide parents with up-to-date information about best practice mLearning in early childhood education.

6.6.1 School A.

School A was a community school and placed importance on local partnerships and parents. Parents at School A were involved in leadership groups the P & C Association, School Council, and school board. The Principal in the first year, Tim, stated that the feedback from parents about the PST visits was positive. Parental opinions affected the decisions made by school principals, for example, in the first year positive feedback from parents encouraged Tim in applying for an iPad grant.

6.6.1.1 Parent workshops at School A.

Parent workshops were facilitated by the University staff in 2013 and 2014. The feedback for the parent workshop in the first year was also positive. Most parents had little knowledge about mLearning and came to the workshop hoping to learn something that would enable them to better support their children. Feedback from the parents and carers indicated that they considered mLearning essential in early childhood education but were cautious and thought that children using mLearning required close supervision. After the parent workshop at School A in 2013, two parents who had not been present asked which apps had been demonstrated and bought the apps used in the workshop. The parents stated that they heard positive feedback about the workshop and the parents and teachers who attended stated that it had been a worthwhile experience. The president of the P & C Association attended the parent workshop in 2013 and was influential in the P & C Association's decision to purchase iPads for the school the following year. The P & C Association raised \$38,000 in 2014, \$22,000 in 2014 and \$15,000 in 2015 making a significant contribution towards mLearning resources at the school. The parent workshops provided parents with information about mLearning and gained the support of parents who were influential in organisations such as the P & C Association.

The early childhood teachers were proactive in organising parent workshops at School A. Kelly and Jessica distributed information in the school newsletter and sent letters home to the parents in the first year. Kelly stated that she thought the parents would appreciate some up-to-date information on mLearning in early childhood education. Jessica and Kelly requested replies from the parents and encouraged them to attend the workshop. Nine parents attended the session in the first year along with three teachers from the school, and eight parents attended in the second year. In the second year, Jessica wrote some information for her school newsletter regarding the parent workshop and sent it to the University before giving it to the parents. Jessica's actions revealed her support of the partnership and willingness to collaborate with the University, to ensure that the parent workshops had the correct focus.

The parent workshops were hands-on sessions and took place at the beginning of the school day. Angel did not participate in the parent workshop in 2014. In 2014, Jessica mentioned that she was a member of her school's council and suggested a future evening event coinciding with a council meeting as a way of attracting more parents to attend. Again, Jessica was proactive in her engagement with the University revealing a desire to make the partnership work. In 2015, the researcher discussed a parent workshop with the Principal who was in favour and suggested an evening session. The parent session did not eventuate in the final year due to unforeseen circumstances, as the Principal who agreed to organize the workshop had to take some unplanned leave. Further, the partnership needed the support of multiple participants. This need was highlighted when the Principal was on leave and one of the participating teachers was no longer at School A, resulting in a lack of leadership required to organise the workshops.

6.6.1.2 The importance of local partnerships at School A.

The term community was used in School A policy documents and referred to being connected to the locality. There were 20 comments in School A's business plan to show that School A was a community school. In part, this was evidenced via School A's community connections with the University and with a local sporting team. The following examples from interviews illustrate how teachers and school leaders regarded the importance of partnerships with the local University community:

The benefits [of a University partnership] are multi-faceted: educational philosophy, new technology, guidance with the latest technologies. It is great to have links with the local University. This school is community-based. (Tim, 2013)

We like to use things that are close to us [school]. (Angel, 2014)

We want to have a representative from the University on our school board. (Sam, 2015)

The School A Annual Reports for 2013, 2014 and 2015 stated that “parents were partners, community engagement was fostered, and the school had an extremely active P & C Association and school council”. The Annual Reports were written by the Principals at the start of each year and reflected on the previous year's business. The 2014 annual report, written by Sam in 2015, stated that a goal for the future was community connectedness and the ICT parent workshop delivered by the University was a highlight of the year. The Principals at School A all placed value on the partnership with the University. Traditionally School A had a strong emphasis on the arts and parents, and carers placed importance on the arts as reflected by a parent survey comment: “School A has a strong sense of community and belonging, and it is aware of the importance of arts in the curriculum” (Parent Survey, 2014).

6.6.1.3 The importance of parental support.

The Bring Your Own Device (BYOD) model of technology integration is gaining popularity in schools globally (New Media Consortium, 2015). The BYOD model required parental support so that parents could see the value of the technology and agree to the purchase of mLearning resources. Tim, the Principal in 2013, was in favour of the BYOD. In 2015, the school business plan included a statement about exploring BYOD opportunities as a means of increasing the number of iPads in the school.

6.6.1.4 mLearning at School A.

A key focus area for School A in the 2015 Annual Report was planning and modelling the effective use of ICT as a learning tool for staff and students. This was a change in focus for School A. The Principal was aware that School A historically viewed itself as having a strong arts program, but he wanted to embed Science, Technology, Engineering and Mathematics (STEM) and ICT into the school culture and used the school business plan to achieve this goal. The school replaced the music specialist with a science specialist teacher in 2016 leaving the school without a music specialist. Members of the parent community (14) used social media to express concerns about this change including: “Let us hope a music teacher will be part of the new staff” (School A parent, 2015) and “Given that this town is the home to many amazing musicians I think it is sad that we have officially let go of what I thought was an integral part of School A” (School A parent, 2015). Only one parent stated that a science specialist might be an asset to School A.

6.6.1.5 Results from the parent survey.

Parents and carers completed a survey at the conclusion of parent workshops (Appendix E). The purpose of the surveys was to determine the mLearning resources available in the homes of children attending School A, how they were used, and to determine

the views of parents about mLearning in early childhood education. The number of surveys completed was 17, reflecting the small number of parents and carers who attended the workshops. However, the response rate was high with 100% of parents and carers who attended the workshops completing surveys. The parents of School A all had the Internet at home, so access to mLearning devices was high (94%). Children had access to mobile learning devices such as the smartphone (65%), iPad (59%), iPod (18%) and Android tablet (12%). Figures 6.8, 6.9 and 6.10 illustrate the ‘at home’ mobile devices available, frequency and type of use by children attending School A.

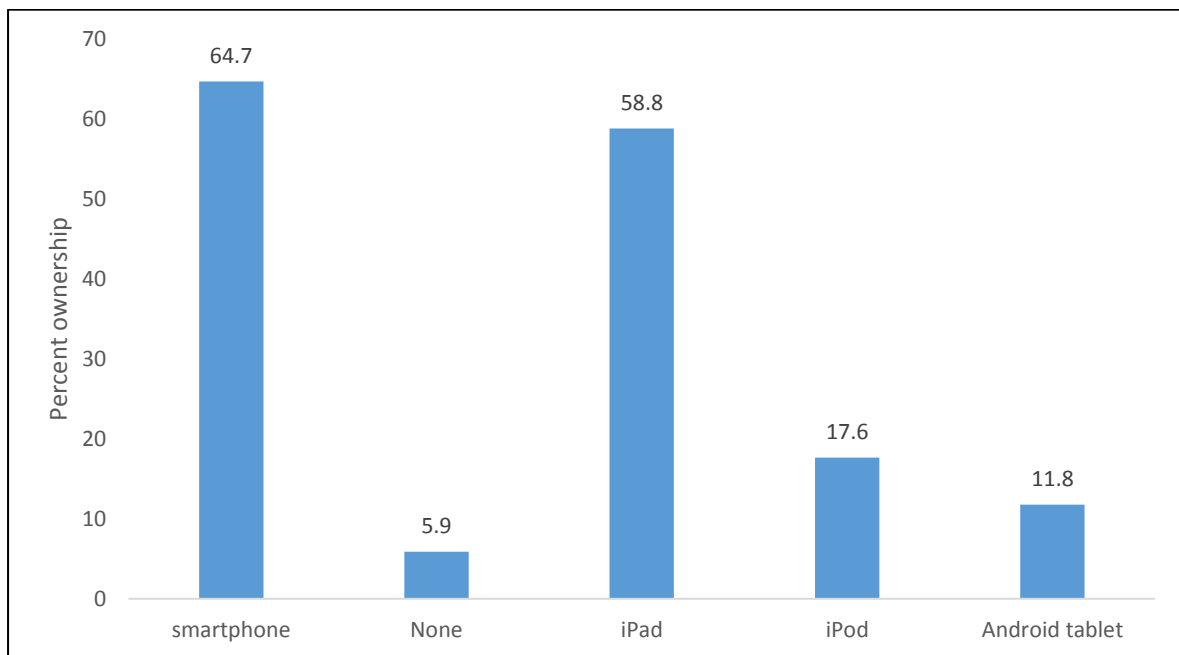


Figure 6.8. Mobile devices used by children attending School A, at home. The results are from data collected from 2013 to 2015.

More than 70% of the children from School A used mLearning devices at least once a week and the greatest (59%) use of mLearning with children was for playing games.

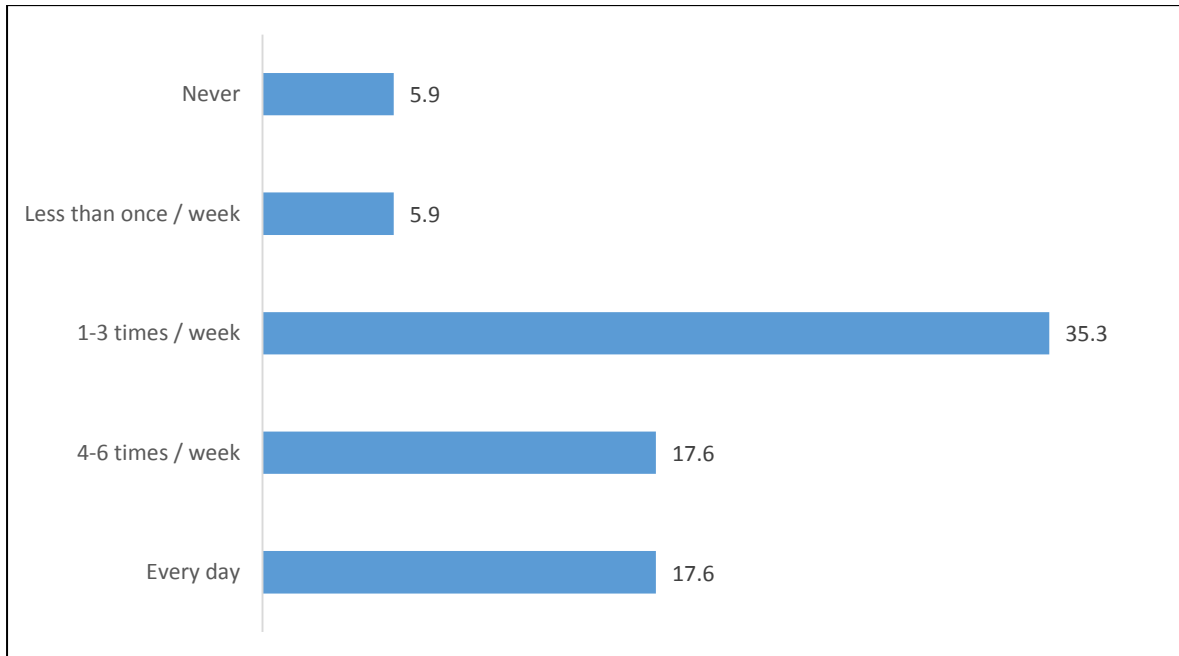


Figure 6.9. The frequency of mobile devices used by children at School A, at home. The results are percentages from data collected from 2013 to 2015.

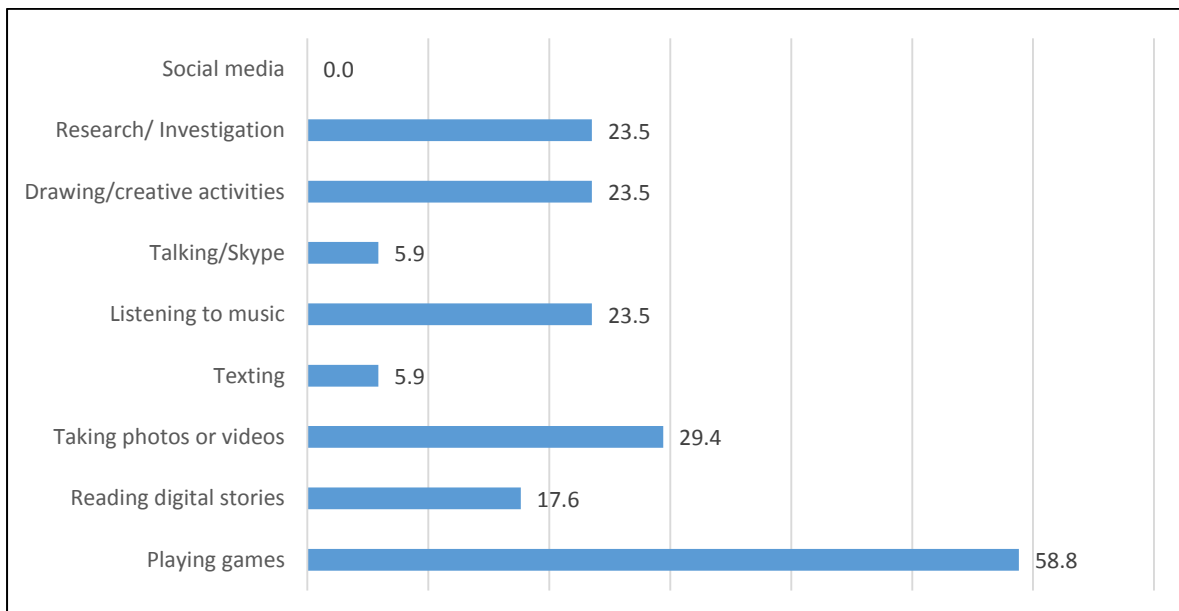


Figure 6.10. How children from School A use mobile devices at home. The results are from data collected from 2013 to 2015. The numbers represent percentages.

Current literature reveals that parents see the educational potential of mLearning devices, frequently supply tablets and smartphones to young children but lack the knowledge to guide educational use (Goodwin & Highfield, 2012). Such literature is consistent with the findings of the present research, which showed that children are using devices mainly for playing games rather than for educational activities. Regarding support for mLearning in early childhood education, parents were asked questions using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Positive (agree and strongly agree) and negative (disagree and strongly disagree) responses were combined. Figure 6.11 illustrates the support from the parents of the children at School A about using mLearning in early childhood education.

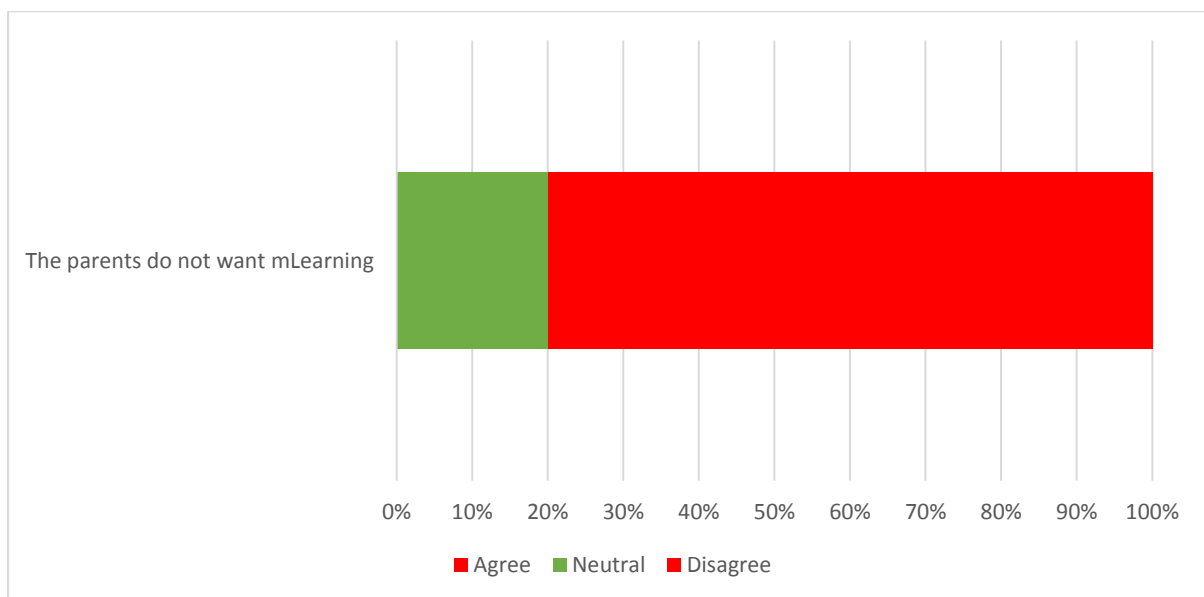


Figure 6.11. Parental views on mLearning in ECE. The results are from data collected from 2013 to 2015 at School A.

Results from the surveys showed that parents supported the use of mLearning. No parent agreed with the statement; *The parents do not want mLearning*. It was important to view the results of the parental surveys in the correct context, namely, a small number of respondents consisting of parents who already had a high level of interest in mLearning as

evidenced by their attendance at the workshops. An parent who had just enrolled her child in School A was concerned about the use of iPads in early childhood education and stated to the researcher: “The Principal has all the children using iPads” (School A parent, 2015).

The parents of the children at School A were asked to rate their personal level of technological knowledge using a five-part Likert scale with answers ranging from strongly disagree (1) to agree strongly (5). The results (Figure 6.12), show that half of the parents thought they lacked technological skills.

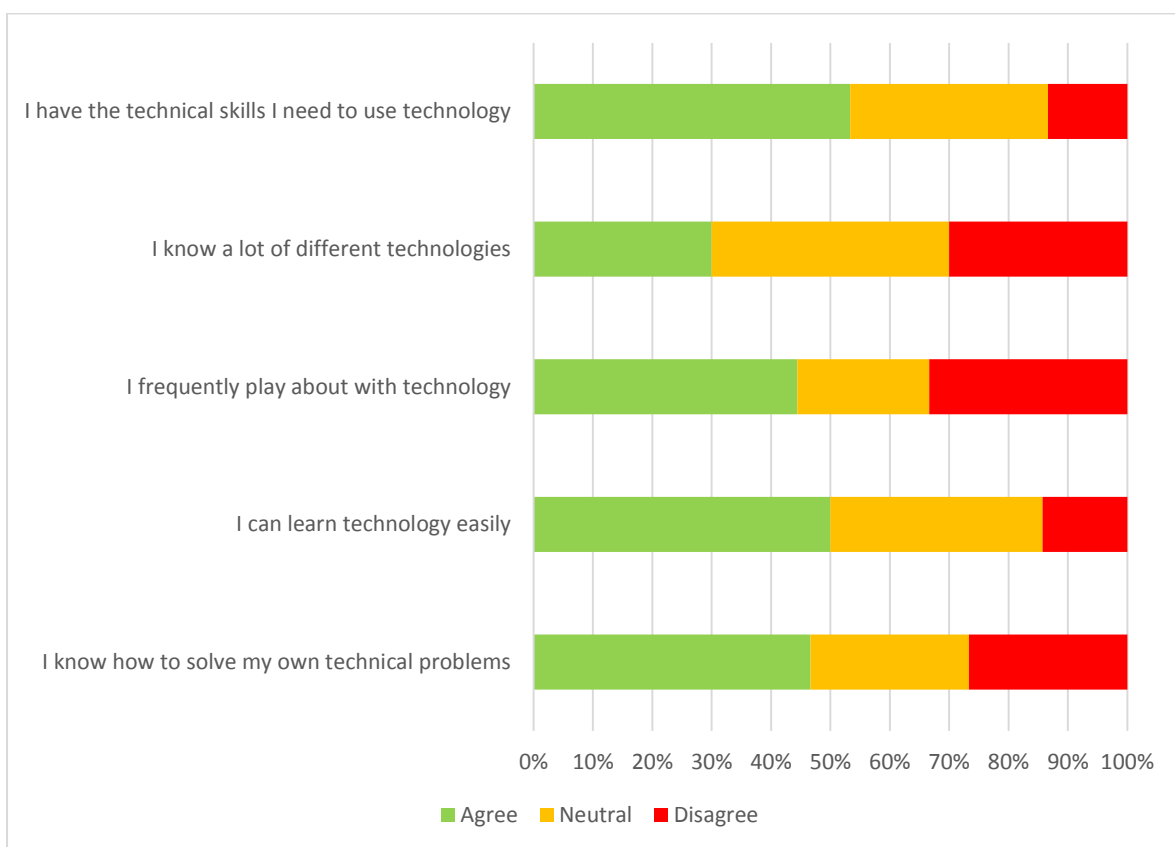


Figure 6.12. Parental views on personal technological knowledge. The results are from data collected from 2013 to 2015 at School A.

Figure 6.13 illustrates the parental views regarding the value of mLearning in early childhood education, which were positive except for the statement about mLearning developing social skills for collaboration, where only 55% of parents agreed with the

statement. This view aligns with common fears surrounding excessive screen time and the fact that technology use at home is usually in isolation as opposed to collaboratively as in the classroom setting, which research has shown to promote social interactions (Moore & Adair, 2015).

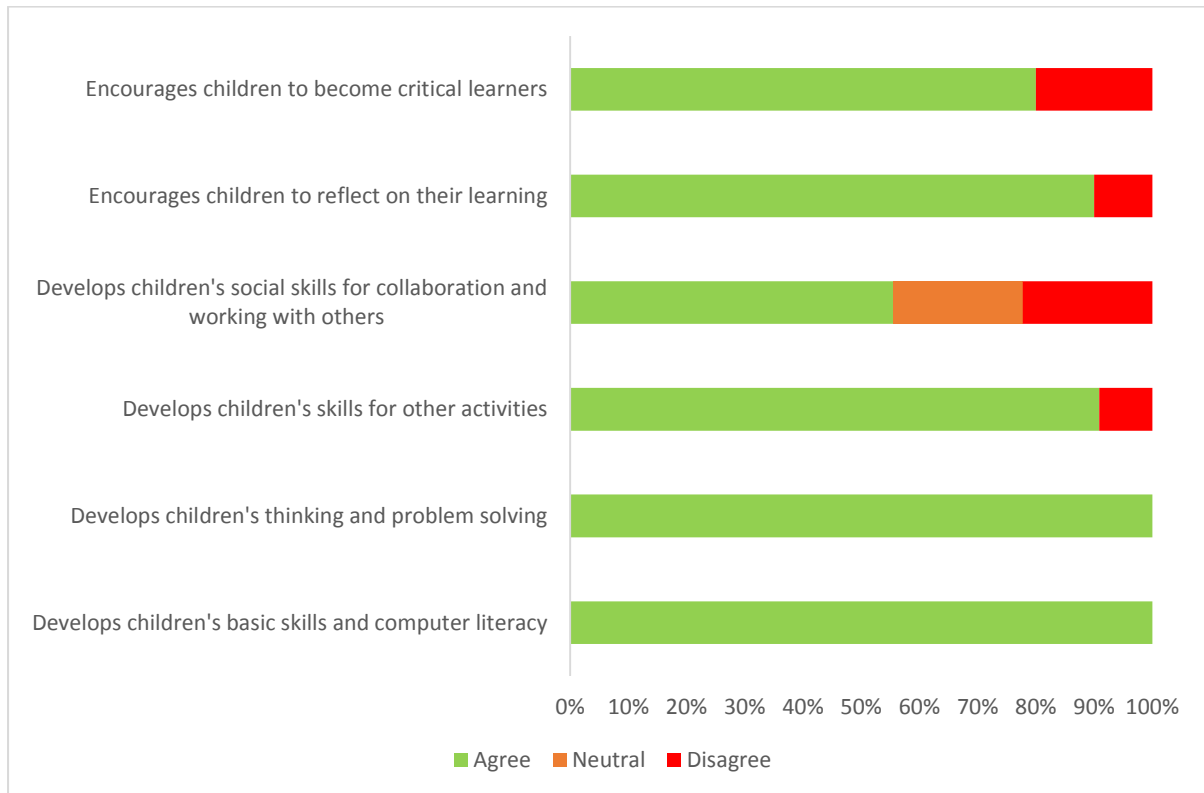


Figure 6.13. Parental views regarding positive aspects of mLearning in ECE. The results are from data collected from 2013 to 2015 at School A.

In open-ended survey questions, parents commented about their views on mLearning in early childhood education and whether they had any concerns. Figure 6.14 presents the responses. Responses were coded using NVivo and grouped into four themes. The themes were, positive beliefs, negative beliefs, not concerned and concerned. The diamond shape illustrates the percentage of parental comments about each of these four themes.

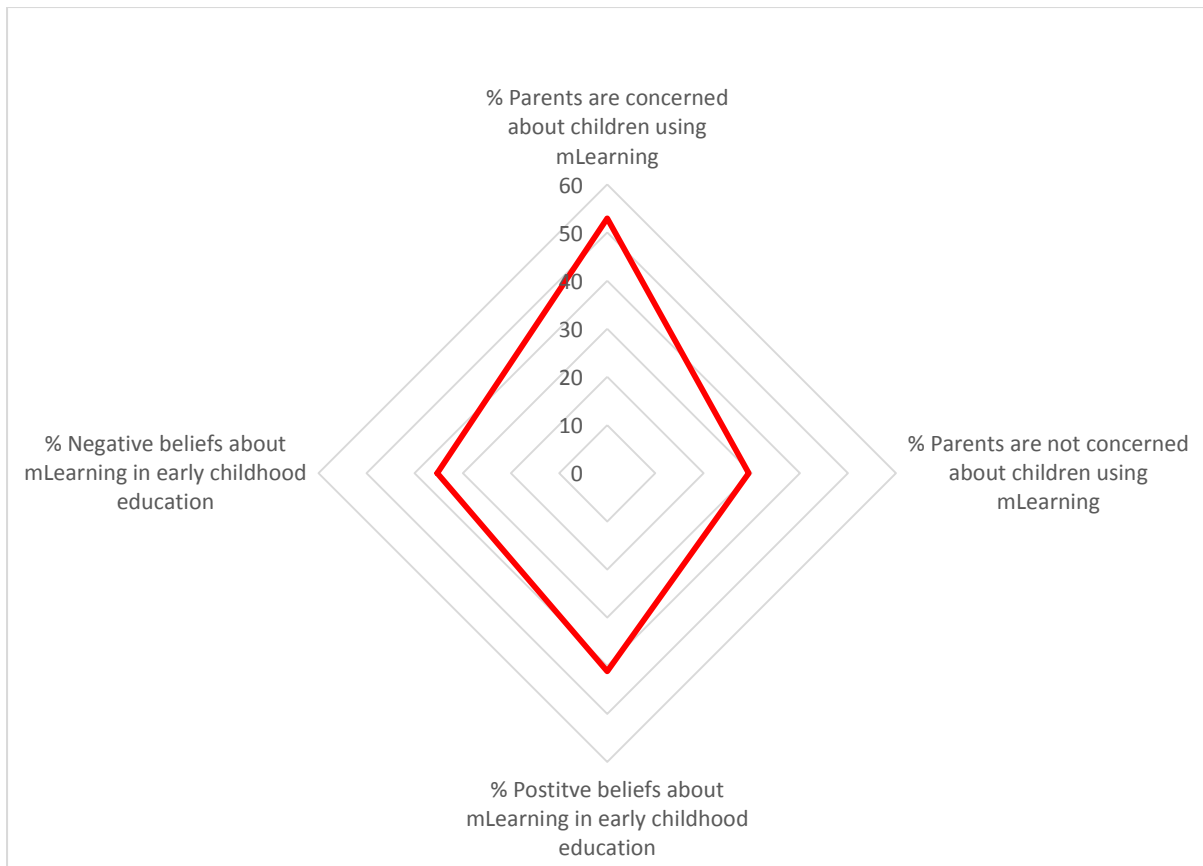


Figure 6.14. Parental views about children using mLearning tools. The results were from open-ended survey questions completed by parents at School A.

Figure 6.14 indicates that more parent comments reflected concern (53%) about children using mLearning than no concern (29%). Positive views were slightly greater (41%) than negative views (35%) regarding mLearning in early childhood education. School A parents were surveyed about the benefits of school-university partnerships. Figure 6.15 presents the results. School A parents placed a high value on partnerships with more than 80% agreeing that school-university partnerships are beneficial to the school, the teachers, the parents and the children.

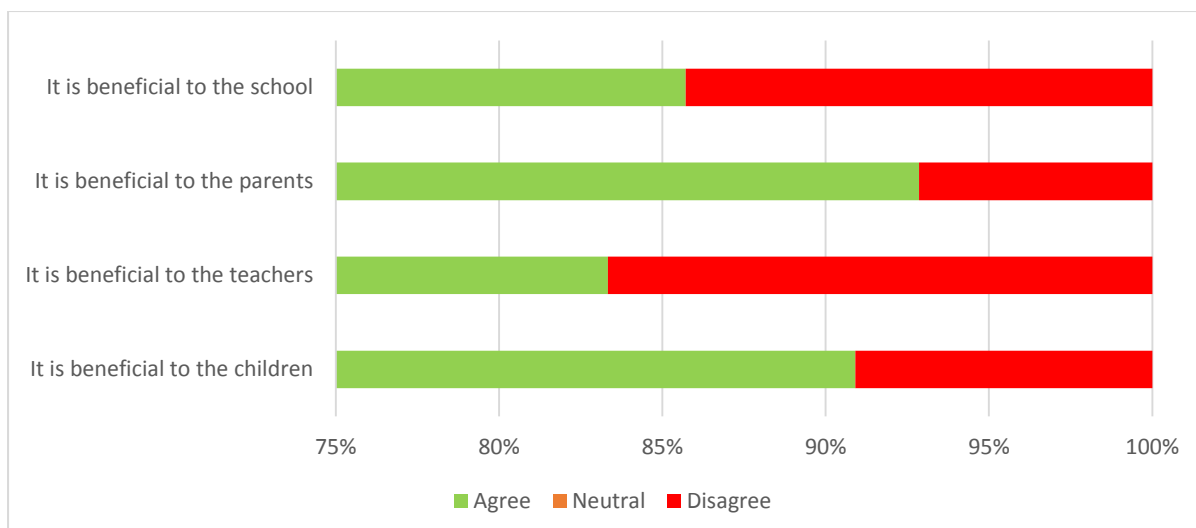


Figure 6.15. Parental views about the value of school-university partnerships. The results are from data collected from 2013 to 2015 from parents of children at School A.

6.6.1.6 The School A-University partnership.

The partnership between School A and the University developed over the three-year period and provided mutually beneficial opportunities for both partners. The benefit for School A was meeting business plan objectives. School A’s business plan 2015-2017 created by the IPS board had four main parts; every child is a successful student, high-quality teaching and learning, beneficial partnerships and school environments. Three committees were set up to oversee the main components of the business plan. The Principal requested a University representative on the teaching and learning committee because that committee included the targets associated with mLearning and STEM. The Principal’s actions demonstrated that partnership with the University was beneficial to School A. Having partnerships embedded in the school business plan meant that partnerships had to be measurable and achievable. Figure 6.16 summarizes the partnership between School A’s community and the University.

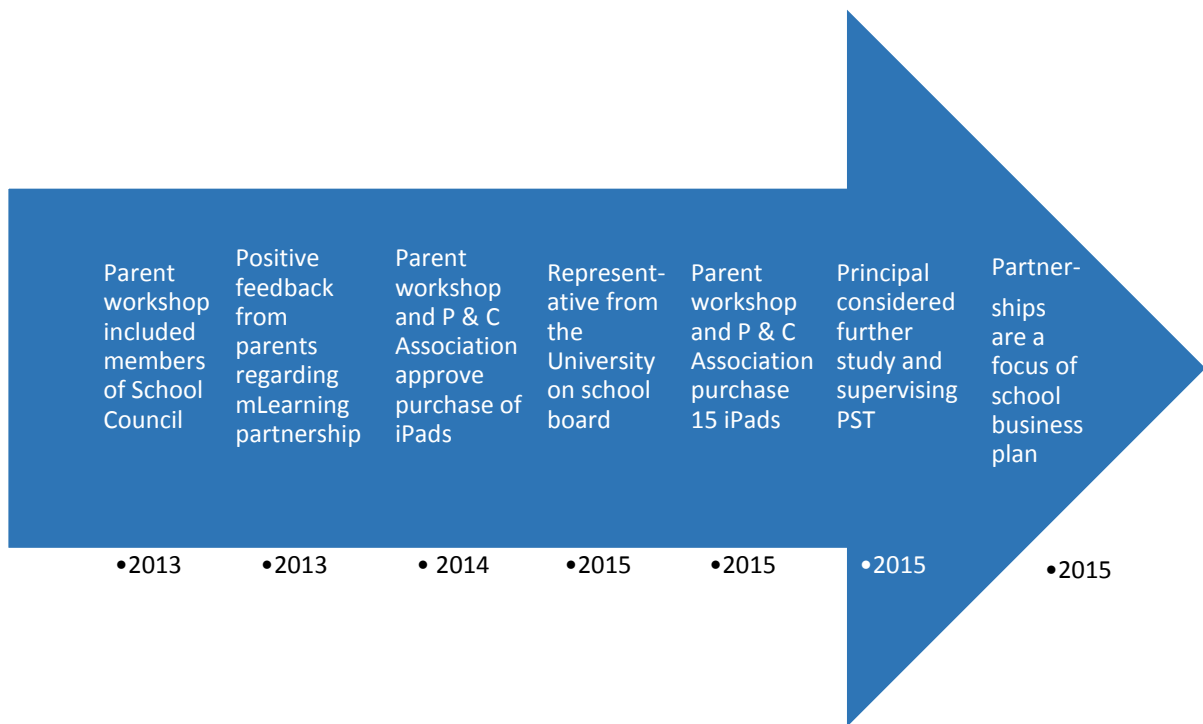


Figure 6.16. The partnership between School A and the University. The figure shows how the partnership developed during the research period.

The importance of the partnership for School A is illustrated by the following quotes:

The partnership is really important as we are part of the same community. It gave me the opportunity to observe my students, and there is rarely time to do that. It was good to see what universities are teaching PSTs. It was also lovely to have young, vibrant people in the classroom and be part of their journey. (Karen, 2015)

I have been looking for ways to network with universities. This [partnership] is just fabulous. (Tim, 2013)

In summary, the findings show that School A valued being part of a local community. The University was in the same locality as School A so the locality aspect of *community* was achieved. In order for partnerships to be sustainable, they need to be mutually beneficial. The

findings revealed that in the final year the partnership became mutually beneficial, and the benefits went beyond just the participants in the mLearning partnership.

6.6.2 School B.

School B was a community school and placed importance on local partnerships. Members of the School B community stated that local partnerships were important. For example; Louise stated early on: “I think this is the beginning of an exciting partnership” (Louise, 2014). Anna saw value in the partnership: “I think our partnership is great. I am new to the district, and I need support. I think the partnership is a great resource” (Anna, 2015). Bo’s comments also reflect her support for the partnership:

I think it has been a really good partnership in the way that our teachers and students have been exposed to some really strong practice in terms of embedding technology (Bo, 2014).

I think the professional learning component [of the partnership] for our staff has been the major thing. (Bo, 2014)

The partnership is a resource for the school which is amazing to have, but I think the school needs to continue to be stronger in that [mLearning] area because I do not think we are anywhere near where we need to be. (Bo, 2014)

At the end of 2013, Gloria stated that the University was welcome to extend the mLearning partnership to her new school in 2014 indicating that she valued the partnership. She said that having the opportunity to view technology in action before investing money was advantageous. She made the most of the partnership with the professional development sessions that the University arranged for School B at her request. Before leaving School B, she made sure that School B supported the University with PST professional experience placements without any prompting. As a result, School B took PSTs from the University for an extended professional experience for the first time in five years. The following year,

Gloria's new school also offered professional experience places to the University for the first time.

Parents at School B were involved in parent associations such as; the P & C Association, School Council and school board. Annual report statements and feedback from the community illustrated the importance of strong ties with the local community at School B:

Strong partnerships between our community and school have ensured many positive outcomes for our students. (Annual report, School B, 2013)

I think the benefits of our partnership are outstanding. It is a fantastic professional learning opportunity for staff, to have engaged hands-on practitioners. The time and effort that they [PSTs] put into one lesson is huge. In the future, I will free up teachers so they can come and observe. (Anna, 2015)

The annual Report for School B stated that the success of the school was in part due to the high level of parental support and that partnerships with parents were important. In 2015, community partnerships were embedded into School B's business plan, and a University representative was invited to become part of School B's board.

6.6.2.1 Parent workshops.

Parent workshops took place in each year of the study. The purpose of the parent workshops was to provide parents with up-to-date information about the use of mLearning in early childhood education and to gauge parental views on mLearning. Parental attendance of workshops was a challenge and required the support and enthusiasm of teachers and school leaders.

6.6.2.1.1 Year 1 (2013).

The location selected for the first parent workshop at School B in 2013 was not ideal. It was noisy and far away from the classrooms. The parent workshop was supposed to be an

opportunity to showcase the work the children had completed with the PSTs, combined with a practical hands-on session where parents explored mLearning. However, it was advertised, unbeknown to the University as a question and answer session. A question and answer session did take place with the few parents (n= 4) who attended, the Principal and one of the teachers, Louise. There was no opportunity to showcase the children's work. The University answered questions and gave advice rather than delivered the planned hands-on session. The Principal at School B, Gloria gave one of the teachers, Louise, the task of organizing the parent and carer workshop. A discussion about the workshop with the Principal revealed that Louise had not distributed the information to parents or requested replies from them. As Louise, did not succeed in encouraging parents to attend, the sense from the SoE staff was that Louise was not supportive of the parent workshops. This was further illustrated by the fact that Louise incorrectly advertised the workshops on a further occasion, again indicating a lack of understanding about their purpose. Louise's lack of support for the parent workshops was a challenge in the first year of the partnership.

6.6.2.1.2 Year 2 (2014).

There were three parent workshops arranged at School B in 2014. The first was on digital citizenship at the suggestion of the school, with seventeen parents attending; and the second on using iPads creatively, with six parents attending. Although only a few parents attended the second workshop, the Principal, Bo, and pre-primary teacher Louise were present and participated in the activities. The parent workshops provided an opportunity to upskill the Principal who subsequently used the acquired knowledge to select apps for the school's iPads. Despite poor attendance (n=4) at the third parent workshop in 2014, personal relationships between the University staff and school leadership strengthened.

6.6.2.1.3 *Year 3 (2015).*

In 2015, when the University suggested a parent workshop at School B, Anna had just observed a PST session and indicated that she wanted parents to see the activities the PSTs delivered to the children. Presenting professional development thus became an opportunity for PSTs in the second year of their degree. Six pairs of PSTs were invited to be presenters, chosen by their lecturers. Anna distributed two different flyers advertising the workshop in the hope of attracting as many parents as possible. The first flyer advertised the workshop as a hands-on opportunity to explore mLearning technologies. Anna distributed a second flyer when few responses to the first were received. The second flyer invited parents to come for coffee and cookies and learn about some fun mLearning devices. On the morning of the parent workshop, the Principal was embarrassed that she had only received six replies and was apologetic. The two fliers and the fact that the Principal was disappointed by the number of responses indicated that she wanted the workshop to be a success. Despite initial concerns, 25 parents attended. The PSTs presented a well-received session, introducing and explaining their lessons and describing how the mLearning tools supported the children's learning. The PSTs then engaged with groups of parents while their young children demonstrated the mLearning resources in a highly competent manner. Positive comments made by participants demonstrated that the parent workshop was a success:

Show and tell today was brilliant, great to see what is out there. Thank you for coming to our school. (Parent, School B, 2015)

Feedback from parents was really good; one parent thanked me for forcing her to come. (Anna, Principal School B, 2015)

I am so proud of you all. I could never have imagined this three years ago. (Julie, ICT coordinator, 2015)

The PSTs commented that many parents had asked where to purchase various mLearning resources and how much they cost. The mLearning tools used did not include iPads because the activities planned were based on curriculum suggested by the teachers and

iPads were not deemed to be the best choice. The mLearning resources used were Bee-Bots, metal detectors, Story Sequencers and digital microscopes. The Principal commented that many parents had a disposition towards the arts and music and not technology, so the parental workshop was empowering because it highlighted a variety of mLearning tools without iPads. The Principal requested details of all the mLearning resources and stated that she would purchase all the mLearning resources that the PSTs had used at School B.

In the final visit of 2015, the Principal, Deputy Principal and one of the participating teachers approached the SoE staff to ask about the partnership. The previous evening the Principal had announced at a Board meeting that the school-university partnership was at the end of the original three-year plan. They all expressed concern that the partnership was over. The University staff involved made a commitment to maintain the partnership, as they considered the visits to be beneficial to the PSTs. The partnership continued the following year.

6.6.2.2 Parent surveys.

Parents and carers in School B completed a survey at the conclusion of parent workshops (Appendix E). The purpose of the survey was to determine the degree to which mLearning was available in the homes of the children at School B, gauge parents level of technological knowledge, and their views about mLearning in early childhood education. The number of surveys completed (n=33) reflected the small number of parents and carers attending the workshops over the three year period. The parents of School B all had access to the Internet at home. Access to mobile devices by children at School B at home was high (97%). Access to mobile learning devices included the smartphone (88%), iPad (79%), iPod (73%) and Android tablet (18%). Figures 6.17, 6.18 and 6.19 show the mobile devices used by children attending School B, frequency and type of use.

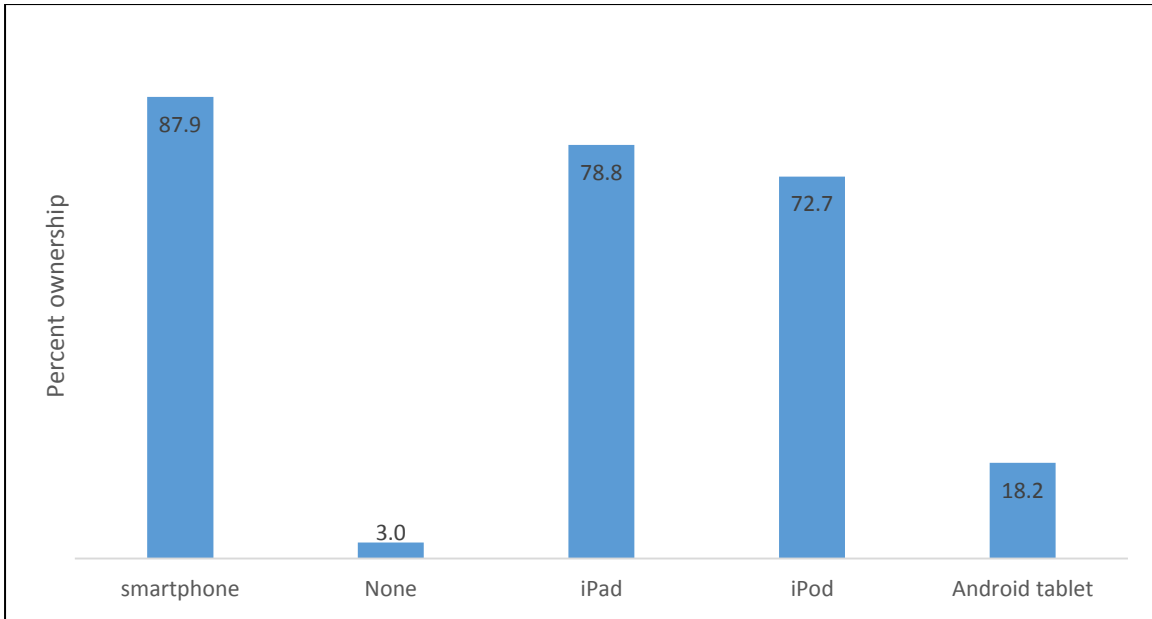


Figure 6.17. Mobile devices used by children attending School B, at home. The figure shows data collected between 2013 and 2015. The numbers represent percentages.

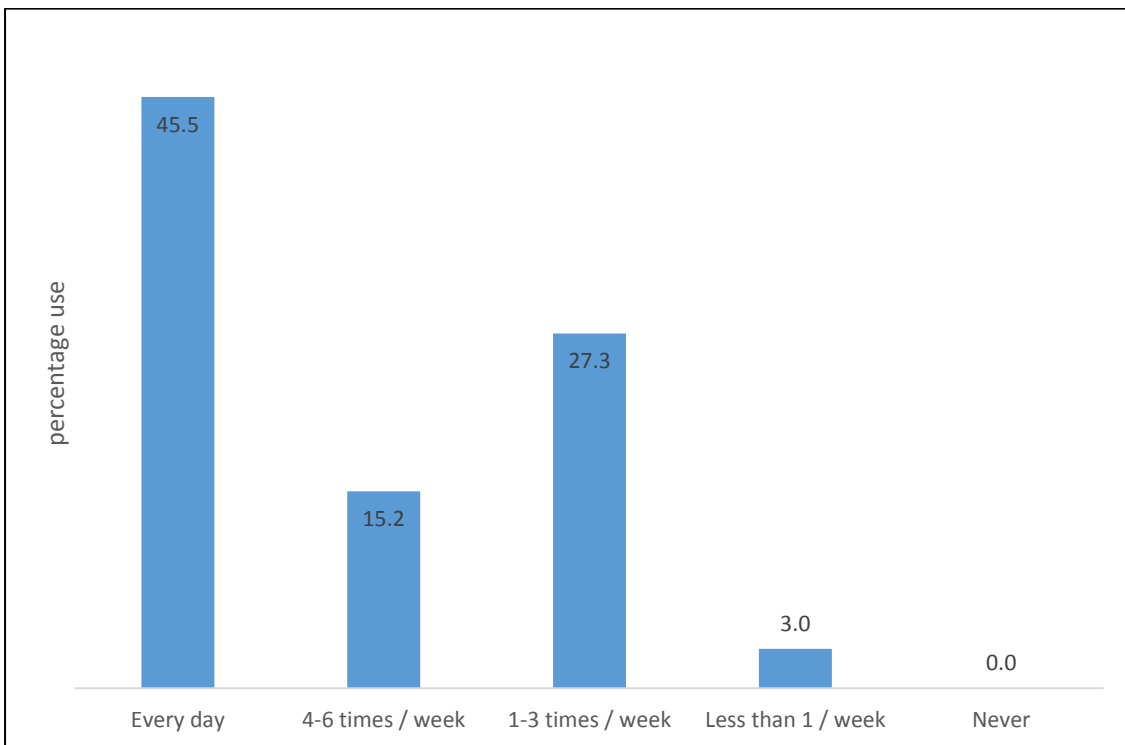


Figure 6.18. The frequency of mobile devices used by children attending School B, at home. The figure shows data collected between 2013 and 2015. The numbers represent percentages.

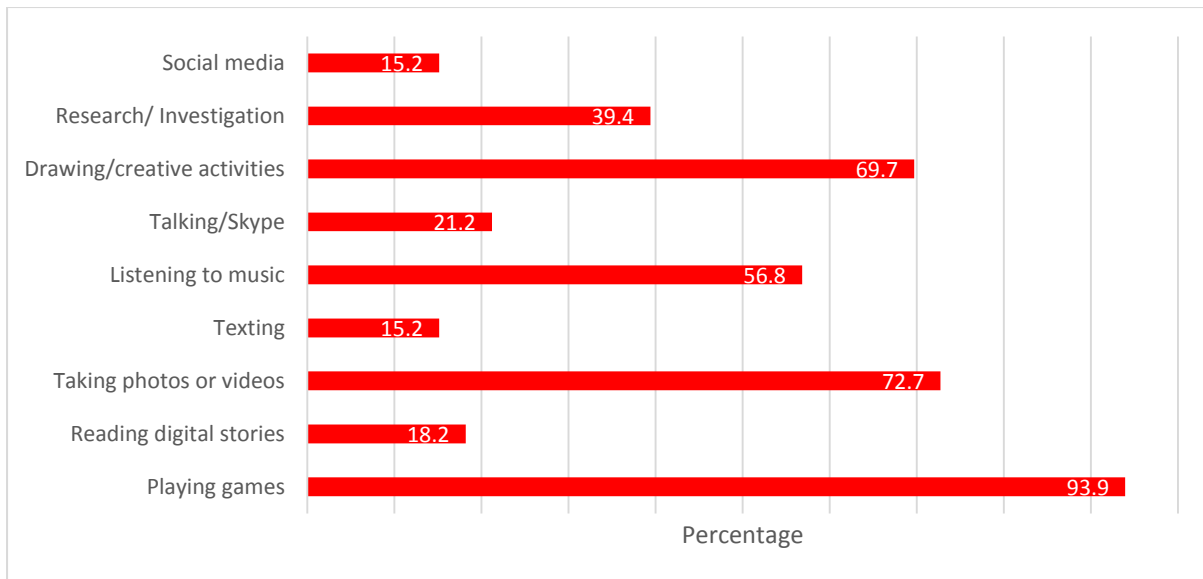


Figure 6.19. How children from School B use mobile devices at home. The figure shows data collected between 2013 and 2015. The values are percentages.

Most of the children (97%) from School B used mLearning at least once a week at home. The children used mLearning mostly to play games (94%), take photographs and videos (73%), to draw and create (70%) and to listen to music (57%). Parents showed their support for mLearning in early childhood education at School B using a five-part Likert scale with answers ranging from strongly disagree (1) to agree strongly (5). Figure 6.20 illustrates the results.

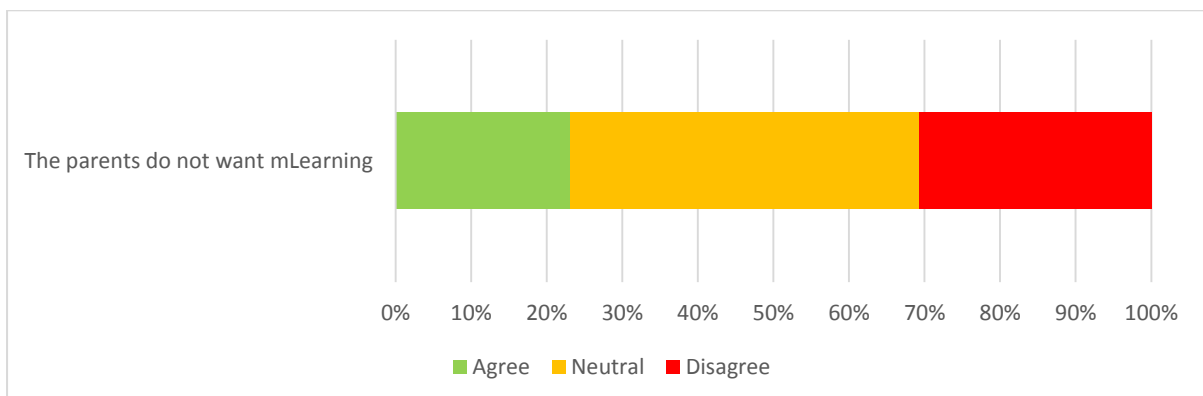


Figure 6.20. School B parental views on mLearning in ECE. The figure shows that few parents (23%) opposed mLearning in ECE.

Figures 6.21 and 6.22 illustrate School B parents and carers personal levels of technological knowledge and views on the value of mLearning in early childhood education.

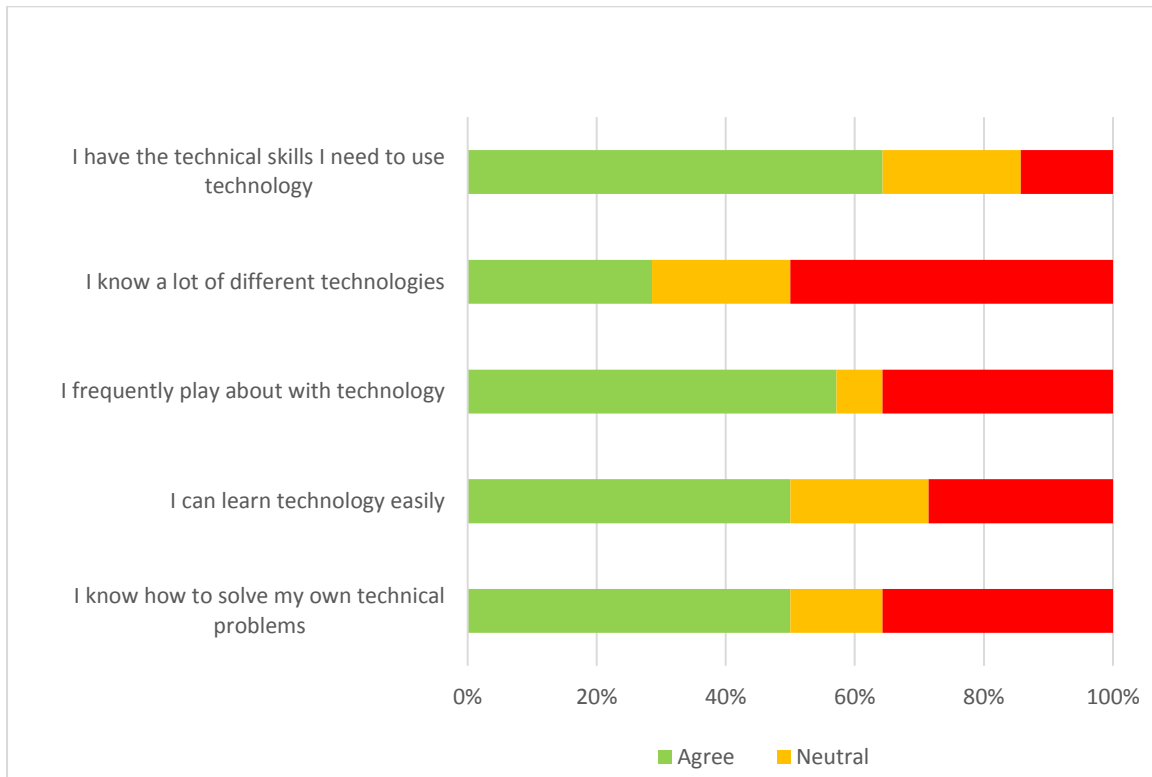


Figure 6.21. School B parental perceived levels of technological knowledge. The figure shows that parents think that they can easily learn new technologies.

Findings (Fig. 6.21) revealed that about half of the School B parents agreed with the statements which indicated that they had a level of confidence using technology but were aware that there were things that they did not know.

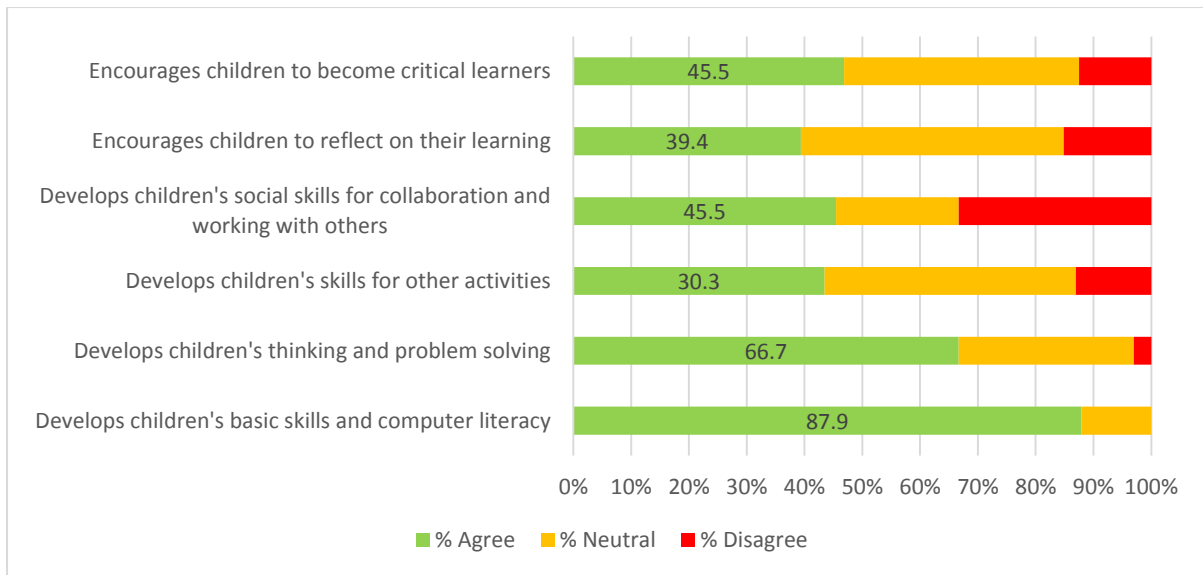


Figure 6.22. Parental views on mLearning at School B. The figure shows the positive views of the parents of School B.

Parental views on the value mLearning (Fig. 6.22) in early childhood education were mixed 88% agreed that mLearning develops computer literacy, and only 30% agreed that mLearning develops children’s skills for other activities.

Parents were asked in an open-ended question about their views on mLearning in early childhood education. Responses were coded using NVivo and grouped into four themes. The themes were positive and negative beliefs, concerned about children using mLearning and not concerned. Figure 6.23 illustrates the results, which show that were more parents (84%) who had concerns than those who did not have concerns (28%). Positive comments were expressed by 80% of parents and negative comments by 28%. The diamond shows the percentage of parental comments about positive and negative mLearning beliefs and parents who were concerned and not concerned about mLearning.

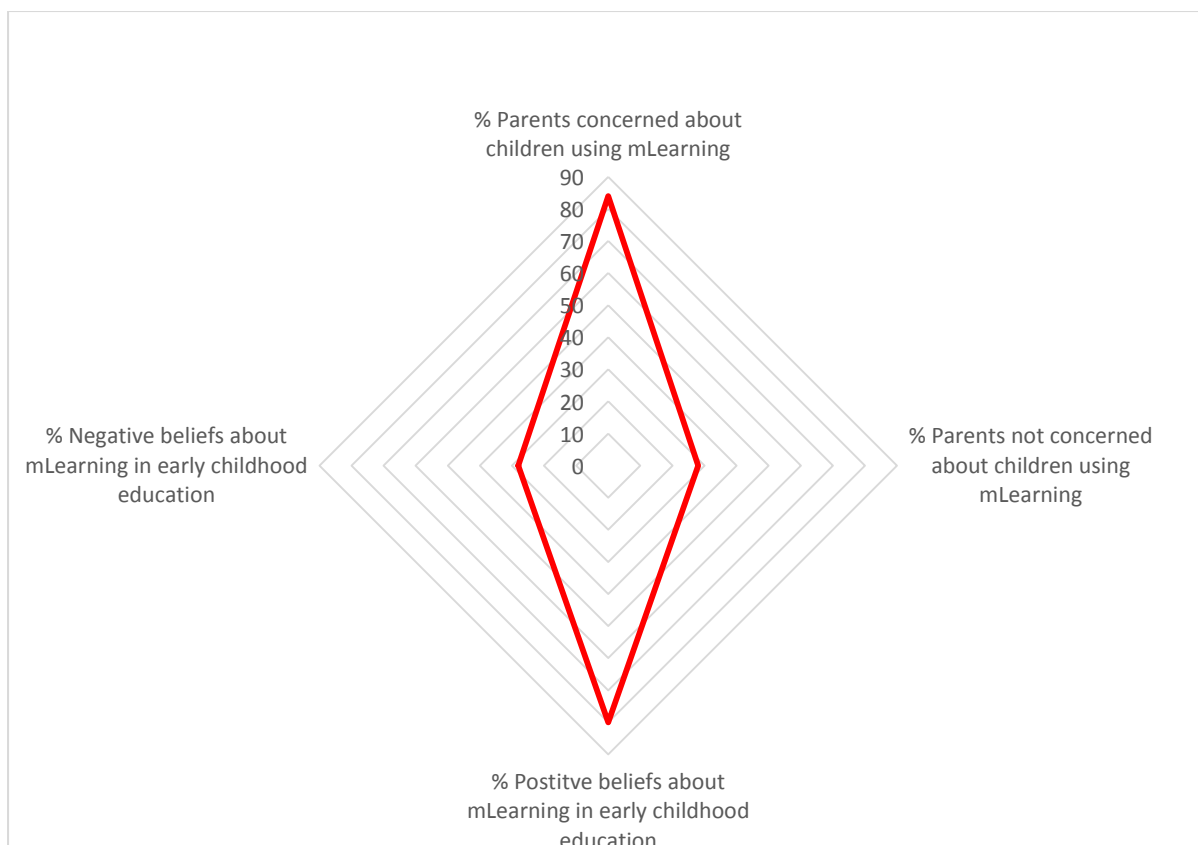


Figure 6.23. Parental views about children using mLearning tools. The results were from open-ended survey questions completed by parents at School B.

6.6.2.3 Partnership between School B and the University.

The value of mLearning in the School B parent community was illustrated by the willingness of the P & C Association to raise money and use funds to purchase mLearning resources. A partnership between a school and a University should include the whole school community, including parents and carers because parents are the primary educators of children (Booth & Dunn, 2013). The P & C Association at School B was active and willing to spend money on mLearning resources. The P & C Association purchased eight iPads in 2012, five more in 2014 and School B had 30 iPads in 2015. In 2014, the funding raising was technology focused, and the P & C Association organised an event called iRun for iPads that raised \$4,000 which was used to purchase additional iPads for the school. Anna’s comment

reflects the support given by the P & C Association: “The P & C are fantastic and raise about \$15,000 to \$20,000 each year, which is good for a small school. I want to work with the P & C Association to make fundraising for specific curriculum areas” (Anna, 2015). The P & C Association and parent community were valued by successive leaders at School B. The fact that the leadership was inclusive of the parent body enabled a high level of support from the parents. Figure 6.24 summarizes the partnership between School B and the University.

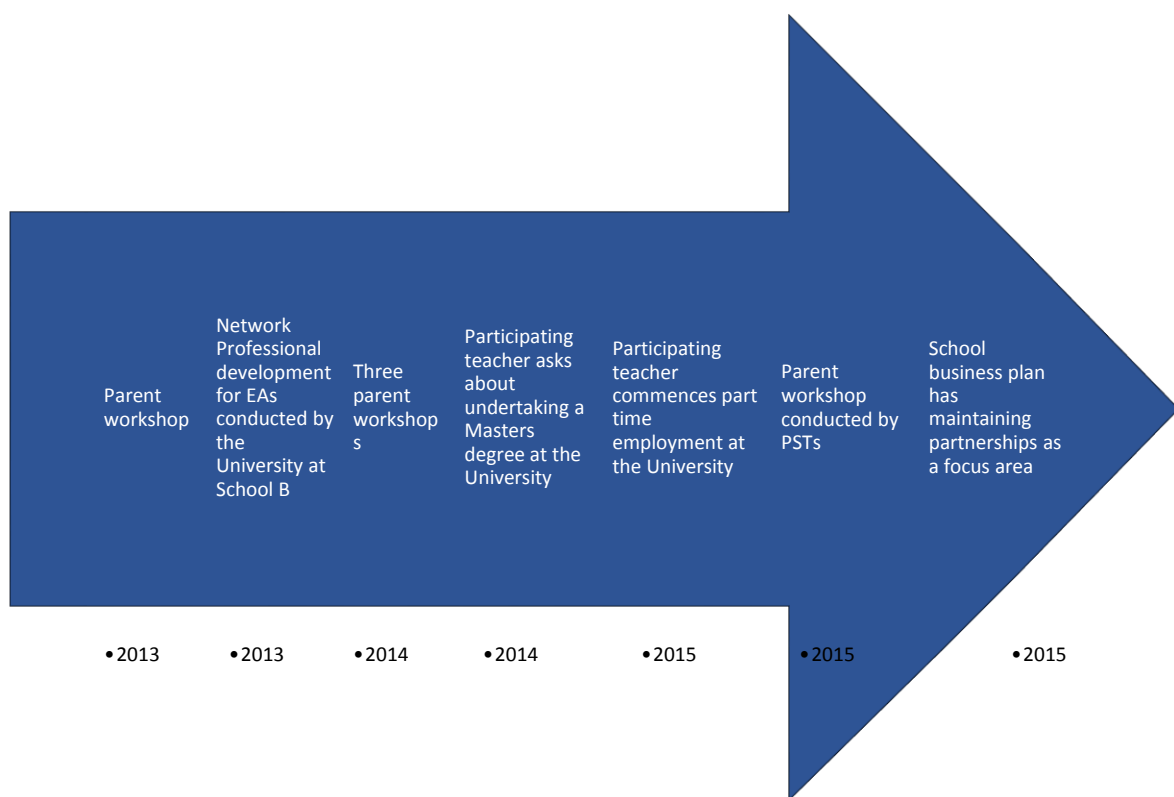


Figure 6.24. The partnership between School B and the University. The figure illustrates how the partnership developed over the research period.

Parents attending the parent workshops were asked questions using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5) about the value of school-university partnerships. Figure 6.25 illustrates that more than 80% of School B’s

parents agreed that the partnership was beneficial to parents, the school, the teachers and the children. The parents at School B placed a high value on school-university partnerships.

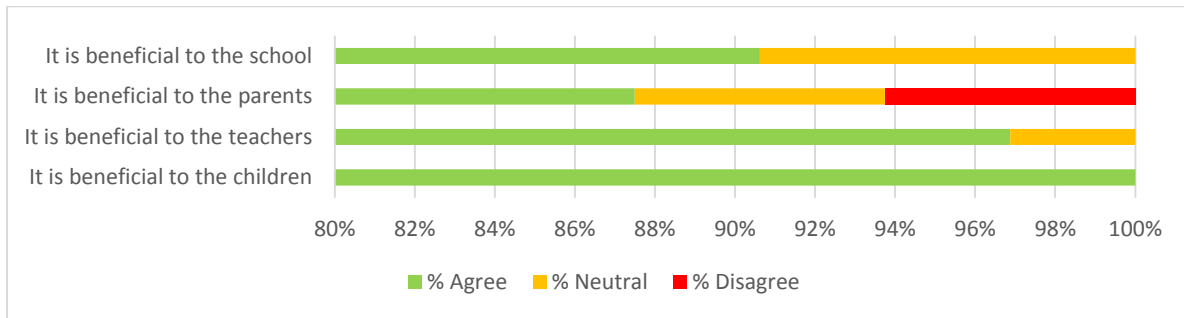


Figure 6.25. School B parental views on the benefits of school-university partnerships. The figure shows that the views were positive.

In summary, the partnership between School B and the University developed over the three-year research period. The strengthening of personal relationships between participants enabled School B to access professional development from the University and advice about hardware and software suitable for early childhood education. School B also borrowed mLearning resources from the University and teachers considered further studies and casual employment at the University. School B invited a member of the University staff to join the Board of School B, further strengthening the partnership.

6.7 Conclusion

This chapter presented findings about how the partnerships at both schools contributed to mLearning in the school communities. The school communities (teachers, parents and carers and school leaders) were crucial to the success of the partnerships. Feedback from the school communities indicated that participants saw value in school-university partnerships. School leaders at both schools personally provided relief for the participating teachers to visit the University to meet the PSTs in the second and third years of the study and partnerships were embedded in the business plans of both schools.

One of the challenges to mLearning implementation was the lack of teachers' technological knowledge. Teachers need time and mLearning resources to develop technological knowledge. As a result of the partnership, the University invited the participating teachers to attend free professional development alongside the PSTs. The cost of employing teacher relief meant that only three of the four teachers were able to attend one session only in the first year because the sessions fell in school time. In subsequent years, the teachers were invited to attend free professional development sessions in the summer holidays, alongside PSTs in an ICT intensive unit. However, only one teacher availed themselves of this offer. For a partnership to be successful, the teachers needed to increase technological knowledge to some degree. The partnership provided a way of overcoming the teachers' lack of technological knowledge.

The purpose of this study was to explore mLearning in early childhood education. To achieve such a purpose, PSTs needed the confidence to use mLearning in the classroom. The teachers also needed the knowledge and confidence to use mLearning in the classroom and to share this knowledge and skills with colleagues, so that the learning could go beyond individual classrooms. At the end of the three-year study, both principals decided to select future teachers for the mLearning partnership so that they could maximise the learning within their schools. In each case, the Principal was able to select teachers who would be willing and able to share acquired mLearning knowledge with colleagues.

The participants considered technological support a key consideration when implementing mLearning and technology integration in schools. Neither school had any ICT policies in 2013 or 2014. The school business plan written for School B at the end of 2014 had technology as a key focus area, and the plan contained a provision for teacher professional development and funding. All the teachers had experienced technology not working properly and also equipment failure. The partnership offered technical support to the

schools, and as the partnership progressed, the schools were more inclined to seek assistance from the University.

Educational change in a school requires the support of all stakeholders. All stakeholders must, therefore, support and believe in an initiative if it is to succeed. The purpose of the partnership in this study was to examine the impact of mLearning in early childhood education. For a partnership to succeed, there must be benefits for the children, staff, and parents and carers; and the benefits must outweigh the disadvantages. This chapter has shown this to be the case.

Chapter 6 presented the findings collected from the leadership and communities of the schools. Chapter 7 presents the findings regarding the leadership and staff within the SoE at the University.

Chapter 7 Findings from the University Staff

7.1 Introduction

The results of this research are divided into four chapters. Chapters 4 and 5 contain the results collected at the classroom level from the practising teachers and pre-service teachers (PSTs). Chapter 6 contains the results gathered from the school leaders and communities which include parents and carers and staff not directly involved in the mLearning partnership. This chapter considers the benefits and challenges of adopting mLearning in early childhood education (ECE) from the perspective of the staff participants from the School of Education (SoE) at the University and also the wider University community, including non-participating staff from the SoE and University staff members outside of the SoE. This chapter contains the results associated with the following research question:

What are the impacts of mLearning implementation in schools on school-university partnerships?

7.2 The SoE staff experience of the mLearning partnerships

The key participants at the University were: Julie the ICT coordinator; Victoria, an ICT lecturer, and, the researcher. Other participants included: Candice, the early childhood course coordinator; Delia, the special education coordinator; Kylie, the Dean of the SoE; and, Lois, a casual lecturer. The key staff involved in the research at the University remained constant over the three-year period. SoE staff not directly participating in the research were also affected because the mLearning resources used in the research were made available to them. A description of each participant's experience follows.

7.2.1 Julie.

Julie, the ICT coordinator, was involved in all aspects of the partnership. Considerable amounts of her time were spent attending partner schools when the PSTs visited, attending professional development workshops for parents and carers at both schools and staff professional development sessions at both schools. Julie was proactive in meeting with the school Principals and teachers to foster the partnerships. Julie was also involved in teaching the ICT intensive that one of the participating teachers attended. In addition to the time required for school visits, Julie was also responsible for researching, resourcing and maintaining the equipment used in the research. Julie was focused on a positive experience for the PSTs as illustrated by her comment: “I want to do the right thing for the pre-service teachers” (Julie, 2013). After a PST visit in the final year Julie indicated that it had been a positive learning experience for the PSTs when she commented:

As ICT coordinator, I have to say the ICT integration was almost perfect. Everything flowed beautifully. There was constant talking with the children about the lesson objectives at all the tables. (Julie, Authentic Focus Group, 2015)

For me from the technology aspect seeing everyone use technology wisely for a purpose, I was excited about that. (Julie, 2015)

I liked the fact that you were critical about selecting apps. Using the iPad’s camera brought in authenticity by getting photographs of real objects in the classroom. (Julie, 2015)

There were many challenges in managing the school-university mLearning partnerships for Julie. However, the benefits for the PSTs perceived by Julie outweighed the challenges and committed Julie to continuing with the mLearning partnerships in the future. At the end of the final year Victoria, the ICT lecturer, indicated that she was leaving the University. Julie stated that she needed to find an early childhood replacement with knowledge of ICT and the ability to continue the partnership. Julie reported that she was

surprised how strongly she felt about continuing the partnership and went to considerable effort to find a suitable replacement for Victoria. She now felt that the selection of an ICT lecturer with recent experience in the classroom, excellent interpersonal skills that would help with the school-university interface, and a strong background in ICT in an early childhood setting, was an important consideration for the SoE.

7.2.2 Victoria.

Victoria, the ICT lecturer, remained with the partnership throughout the research period. In addition to teaching the ICT unit in semester one, Victoria offered technological support to the PSTs during their professional experience. Victoria also provided professional development to the partnership schools and to individual teachers within schools. Victoria was extremely flexible and would quickly revise what she had planned to cope with sudden unexpected changes posed by one of the schools. During a presentation at a school, if a group of PSTs had insufficient activities, she would step in to assist them so that they could continue without disrupting the flow of the lesson. Victoria had an excellent rapport with the PSTs and quickly established good relationships with teachers and parents at workshops, and in the classrooms. Victoria had a friendly non-threatening approach. Each year the school visits became easier as familiarity with the participating teachers and schools increased. Victoria made the following comments about the lessons that the PSTs completed either in schools (authentic) or at the University (peer):

The standard of the presentations that were taught to the kids, I cannot put them in the same comparison. They were on a different level completely. An understanding of where the kids are, the way the ICT is embedded, the authentic nature of the environment. (Victoria, 2013)

Most of the peer group students ended up with passes and credits. They [the authentic group] ended up with all distinctions and high distinctions. It was a clear line in the sand. (Victoria, 2013)

The Thursday group [authentic] were in on Wednesday all freaking out about what was going to happen the next day. This would not have happened if they were just presenting to their peers. (Victoria, 2013)

Pushing them [PSTs] out of their comfort zone. I think they have benefited a lot more than the peer group. (Victoria, 2014)

You [PST] did an amazing job. Your planning and collaboration were one hundred per cent. The kids really loved all the activities. (Victoria, Authentic Focus Group, 2015)

It was more time consuming and stressful for Victoria to include authentic ICT experiences for PSTs because the PSTs required more scaffolding and guidance. The first year was quite challenging for Victoria as lessons taught by PSTs had to be sequential from one week to the next, and she was responsible for ensuring that the lessons ran smoothly. In the second and third years, the structure of the PST school visits was modified so that they were more manageable for University staff and PSTs. The additional workload experienced by the PSTs was high as they knew their lessons had to work. The PSTs' stress was at times conveyed to Victoria who at one point stated: "At this point, it is causing so much anxiety with the PSTs. I am feeling that the experience is turning them off ICT rather than building capacity" (Victoria, 2014). Despite the stress, Victoria spoke of taking more PSTs from her other (primary) tutorial groups to schools for an authentic mLearning experience in 2015: "I am thinking about extending the program to all my primary PSTs next year" (Victoria, 2014). Victoria stated that the authentic groups had more exposure to the technology and spent more time preparing for the lessons. Victoria included other tutorial groups in the program by introducing a new school in 2015 so that more PSTs could have an authentic ICT teaching experience.

7.2.3 The researcher.

The researcher was the point of contact between the schools and the participating SoE staff at the University. The researcher passed on information from the teachers regarding curriculum ideas for the PSTs to use for lesson planning. The researcher exchanged more than 300 emails with the schools throughout the study, sharing information about PST visits, and other things arising as a result of the partnership such as parent workshops and professional development. The researcher visited the schools on 67 occasions over the three years for interviews, professional development sessions, mLearning visits with the PSTs and to meet with teachers.

7.2.4 Candice.

As early childhood course coordinator, Candice was involved in the initial planning and implementation of the mLearning partnerships. In the early planning stages, the two schools requested more contact than the two PST visits scheduled each year, which were part of the ICT unit in semester one. Candice demonstrated leadership when she volunteered to include an additional two PST visits within a second-semester unit that she coordinated, called Planning and Evaluation. Although the focus of her unit was assessment, Candice modified an assignment, to make it more contemporary, with PSTs being required to create an assessment using technology. She stated, “It brings the unit up-to-date” (Candice, 2013). Only two out of the three early childhood tutorial groups participated in the authentic school visits. Candice viewed the inclusion of the Planning and Evaluation unit as beneficial because it provided the PSTs with additional teaching practice and meaningful assessment.

Candice placed value on the authentic visits, and her preference was that all PSTs in the future be given the opportunity to participate in an authentic experience because she thought the challenge encountered led to richer learning experiences. The value Candice

placed on the authentic visits is indicated by the following comment: “The PSTs, who delivered their lessons in the schools gave the assessment tasks and children much more thought and related to the needs of the children better” (Candice, 2015). In addition to teaching practice, the authentic PSTs had the opportunity to view practising early childhood teachers with their classes. Candice regarded this as an opportunity for the PSTs as indicated by her statement: “In addition to the teaching opportunity for the PSTs, it has been great to see the start of the day with the great mat session in pre-primary last week and this week seeing all the parent teacher interactions in the Year 1 class” (Candice, 2015).

Candice expressed concern that the peer group missed an opportunity by not participating in an authentic teaching experience. She stated that the peer group lessons were of a lower standard and stated: “Many of the peer PST lessons would not have worked well with children” (Candice, 2015). Candice reflected that the PSTs in the peer group observed each other’s presentations in one tutorial and stated that they would not have gained anything from this process, whereas the authentic PSTs learnt from their lesson and had the opportunity to observe and take part in lessons delivered by each other.

Candice did not want to make any significant changes to the structure of the school visits for the following years. The Planning and Evaluation unit’s focus was on assessment, an area that Candice felt PSTs struggled with on professional experience. Candice said, “The PSTs in the authentic groups who used the mLearning tools had a much deeper understanding of a wider variety of assessment tools and had the opportunity to see assessment in action” (Candice, 2014). Candice was comfortable with technology and, as a result of incorporating technology into her unit, felt that her knowledge of mLearning resources increased as shown by her comments: “The Bee-Bot is good. I also liked the Story Sequencers although the PSTs were not that fussed about them” and “I like the fact that it is mobile, and the learning is not limited to the classroom” (Candice, 2013).

Candice stated that the school visits informed her about current practices in schools, and she was more conscious of providing technology as an option for PSTs to use in other units that she taught. Candice stated that the huge benefits of the partnerships accrued to the PSTs, for example: “They got more thorough training and gained confidence in a safe and supportive environment” and “You [PSTs] plan better lessons because you know you have to deliver them. You think more about the children” (Candice, 2014). Candice indicated that the PSTs in the authentic groups were more conscious of using technology and realised that it was not necessary to have one device per child. Candice stated that some of the PSTs regarded the technology as an “add-on” and delivered lower quality lessons, but those PSTs, who used the mLearning purposefully, prepared high-quality lessons. Candice hoped that the experience enabled PSTs to become more critical about using technology. She stated: “I think in early childhood we need to be critical of the use of anything new that comes into our classrooms, and if we incorporate technology, it must be for specific outcomes and not as a tack on” (Candice, 2015).

The challenges described by Candice in the first year were that the authentic visits were more draining and time-consuming. In the first year, Candice was involved in the visits to both schools. Four school visits took place in one week for two consecutive weeks. In the second and third years, other casual tutors were included so that Candice was personally only involved with one of the schools. Time to reconfigure her unit to incorporate school visits was a challenge for Candice. In the first year, Candice was supported by the researcher and ICT coordinator, Julie so that she could focus on content. The researcher and Julie assisted with the logistics of the school visits.

7.2.5 Delia.

Delia was the special education coordinator in the SoE. When School B requested an iPad professional development session for a group of education assistants, Delia agreed to deliver the professional development session because she had a personal interest in professional development for education assistants through her own research and had the necessary expertise. Delia spent considerable time developing an up-to-date workshop. The challenges faced by Delia when delivering the workshop at School B were the lack of Wi-fi, a large group, and a fixed interactive whiteboard, which did not face the participants. However, Delia was supported by the ICT coordinator and researcher. Delia received positive feedback from the participants and so strengthened the partnership between the school and the University as a result of her participation.

7.2.6 Kylie.

The Dean of the SoE, Kylie, was accountable for ensuring that the SoE met the University's strategic goals and that degree programs met accreditation requirements. One of the University's strategic goals for 2013-2016 was active community engagement. The SoE's strategic plan for 2016-2018 included consolidating and further developing engagement with the wider community. The partnerships in this study aligned with these strategic goals. A Teacher Education Ministerial Advisory Group (TEMAG) recommendation for future accreditation of teacher education programs in Australia was that PSTs be given the opportunity to engage effectively and communicate with students and families (TEMAG, 2014). When the PSTs presented mLearning workshops to parents at School B, they had the opportunity to engage with parents as professionals, and provided the SoE with evidence supporting on-going accreditation and meeting both University and SoE strategic objectives.

The SoE now has partnerships with schools involving PSTs in literacy, numeracy, ICT and Indigenous education.

Although Kylie did not participate at the operational level of most partnerships, she valued the benefits that the partnerships brought to the PSTs. Kylie recognised the leadership qualities in her staff who were able to cement partnerships without her direct involvement as illustrated by her comment: “I work with some very intelligent people. I do not have to try diligently to distribute leadership. Everyone here is a leader in their own right, and he or she willingly takes on the role, and he or she does pretty well” (Kylie, 2014).

Kylie demonstrated her support of partnerships and staff within the SoE by viewing research projects in action on a regular basis as illustrated by her comment: “I think it is important. My presence is necessary, it sends a signal to a school that I think it is important, and I hope it affirms the staff that I am interested in what they are doing” (Kylie, 2013). Kylie described school visits as time consuming: “Now, that [visiting schools] takes time, my average day is extremely busy” (Kylie, 2014). However, Kylie also described school visits as enjoyable and a worthwhile part of her role. She said “In your project [mLearning partnerships], I came away with the biggest grin on my face. It was just sensational. It was amazing, and I loved it” (Kylie, 2014). Kylie’s position was that partnerships had to be mutually beneficial. The advantages for the University perceived by Kylie were additional classroom teaching practice for PSTs, the ability for staff to reflect on theoretical perspectives and how they worked in practice as shown by her comments:

Your evaluation of devices and evaluation of their worth is feeding back into your course design at the University level. We now have extraordinarily collegial and friendly relationships with three or four teachers in these schools. We might even get one or two of those teachers thinking about doing a course at our University. It is complex, and it is multi-layered, but the benefits of it [the partnerships] are indisputable. (Kylie, 2014)

The greatest benefit is it adds to the experience of our students in terms of exposure time in a classroom, and already our students are getting the most exposure time of many, many programs in this country. But now, over and above programs like this, they are getting additional hours in the classroom. Now, that is the greatest benefit. (Kylie, 2014)

Kylie valued the personal relationships that developed between staff in schools and the University. Interpersonal relationships raised the profile of the University in the community, encouraged teachers to think about undertaking study at the University and made schools more inclined to take PSTs for professional experience. Good personal relationships within the partnerships enabled the University to do a promotional photography shoot at short notice at one of the partner schools.

As a leader of the SoE, Kylie was supportive but cautious of new partnerships. Although supportive of this research, Kylie was not an expert in the area of ICT and expressed mixed views about using mLearning in early childhood education as illustrated by the following statements:

I have often felt that it [mLearning] is not researched enough, and there is no hard evidence to prove that the effects that are claimed are valid. (Kylie, 2013)

Do they need ICT in pre-primary? I think there are tangible questions to be raised around the negatives related to ICT. (Kylie, 2014)

I think kids can become disconnected from other human beings. My real belief is that I think social and interpersonal skills in the early years of education are paramount. (Kylie, 2014)

I believe that they [mLearning tools] have a place, but I think there has to be a balance, and I sometimes think you can do things better without them. (Kylie, 2014)

By viewing mLearning in action in early childhood classrooms, Kylie experienced first-hand the engagement of the children and observed developmentally appropriate

technologies integrated effectively into the curriculum as illustrated by the following quotations:

I was stunned at the level of engagement that the activities were able to produce in the children. (Kylie, 2013)

I've changed over time. I really see the benefits of the use of ICT, and I've been lucky because I've been exposed to thoughtful practitioners who think about when, and why, and where you will use devices appropriately. I think that is the key. (Kylie, 2014)

During a discussion about ANZAC iMovies that children had made under the guidance of the PSTs, Kylie remarked: "Writing is more important than making movies" (Kylie, 2015). Kylie was unaware that the children had collaboratively written two or three pages of script before recording the movies and using mLearning had not removed the need for children to write. Kylie's views on literacy are consistent with research by Miller (2015) who posits that traditional teachers focus on literacy as a paper-based activity denying children access to multi-modal literacies.

7.2.7 Lois.

Lois was a casual early childhood lecturer at the SoE. Lois taught two early childhood Planning and Evaluation groups. One of these groups was partnered with School B, so Lois became involved in the partnership and her students presented lessons in the authentic setting. The other group presented lessons to peers which was the normal practice at the University. At the conclusion of the semester, Lois wanted to continue with the authentic visits and wanted to include all groups in the future as she believed that those PSTs presenting to peers missed out on a valuable experience, as illustrated by her comments:

The only thing I would change about the unit is not to have that peer group. The peer group did not get as much out of it, and it was hard to assess them as it was such a different experience. (Lois, 2015)

I think the authentic group delivered higher quality lesson preparation and delivery; they were also more creative. There was a huge difference in the standard of the authentic and peer groups. The authentic groups got so much out of it. It was brilliant to see. (Lois, 2015)

Although ICT was not the focus of the Planning and Evaluation unit, mLearning resources were used to enhance the PSTs' learning. Lois indicated that she learnt from the experience:

It was very exciting and beneficial for me to see how they [mLearning tools] work in the classroom. It is very different modelling a tool to actually seeing it used in the classroom. (Lois, 2015)

It was an learning curve for me too. I was not familiar with Bee-Bots or Story Sequencers. (Lois, 2015)

Lois' desire to continue with the authentic experiences and include more groups was a sign of a successful experience. Lois stated: "It is such a wonderful learning experience for our students" (Lois, 2015). When asked about how she scaffolded the two tutorial groups, Lois indicated that she treated them both the same, and there was no additional workload or stress for her. One possible reason for the smooth facilitation of this unit was its location in the third year and lessons learnt from previous years enabled the researcher and ICT coordinator to provide better support for Lois and the PSTs. The support included providing the PSTs with suggested mLearning tools to match the curriculum chosen.

Lois indicated that she would be using more mLearning resources in other units that she taught indicating an increased awareness. She reported that viewing the mLearning resources in action enabled her to integrate them into other areas of her teaching. Knowing about mLearning resources does not ensure application as teachers need time to work out how to integrate new mLearning resources. Keengwe and Onchwari (2009) found that teachers need time to plan for successful technology integration. Lois's comment supports

this view: “It takes time, and I am a step ahead as I saw them all used in this unit” (Lois, 2015).

7.2.8 Other SoE staff not participating in the mLearning partnerships.

The SoE purchased 16 iPads, Bee-Bots, Talking Butterflies, Recordable Pegs, Story Sequencers, digital microscopes and metal detectors in 2013. The SoE purchased four additional iPads in 2014 along with three programmable cars and robotic Lego. In 2015, an additional set of 20 iPads was acquired. These mLearning resources were available for all SoE staff to use. Figure 7.1 shows the mLearning resource acquisition within the SoE at the University.

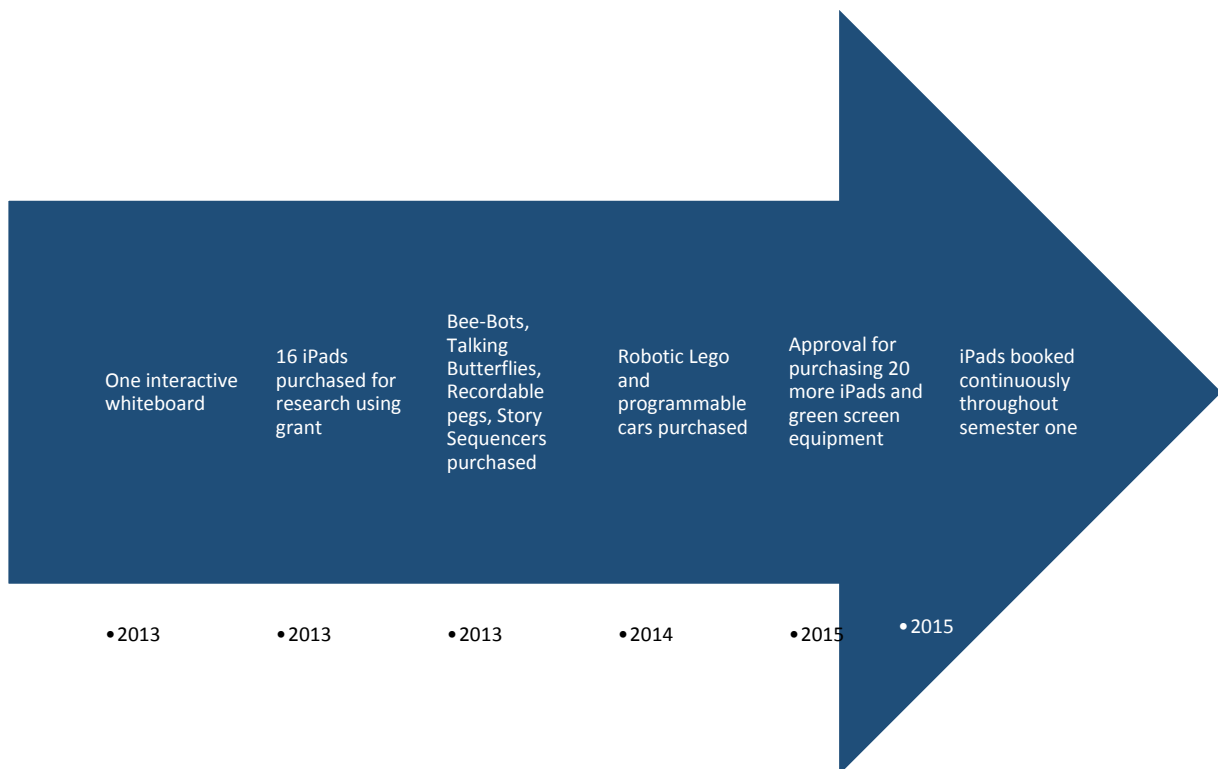


Figure 7.1. Technology resources at SoE (The University). This figure illustrates the mLearning resources available over the course of the study.

In the first year of the research, the iPads purchased for the research were booked 59 times by fifteen staff and PSTs from the SoE. In the second year, the iPads were booked on 88 occasions by eighteen staff. In the final year of the study, the iPads were used in the semester one ICT unit over a nine-week period from 08:30 until 19:30 every weekday. Lecturers introduced iPads apps in mathematics and literacy education units. The iPads were used in several other units and across the Bachelor of Education Early Years, Primary, Secondary, and Health and Physical Education courses. Lecturers were keen to use the iPads in specific subject areas. The iPads were used each semester, including during winter and summer intensives.

The SoE had limited provision for the technological support of staff in general, and mLearning was used in limited ways or not at all by some staff. Progressive schools utilise technology coaches to help teachers use new technologies in the classroom (Mourlam & Montgomery, 2015) but there was no such support readily available in the SoE to encourage progressive teaching using ICT.

Table 7.1 summarizes the benefits and challenges of the mLearning partnerships for the participants. The next section discusses some of these key benefits and challenges.

Table 7.1

Benefits and Challenges of the mLearning Partnerships to the SoE Participants

Participant	Benefit	Challenge
Candice	More informed about current mLearning in schools	Time to reconfigure unit
	Up-to-date unit	Time to prepare for school visits
	Improved learning experience for early childhood PSTs	Stress associated with school visits
	Better knowledge about mLearning resources	
Delia	Strengthened partnership with local school	Time to prepare professional development workshop
	Engaged with education assistants which was an area of personal interest	
Julie	Improved learning experience for PSTs	Time to research and purchase mLearning resources
	Additional mLearning resources available for use by staff and PSTs	Time for school visits with PSTs
		Time for school visits for professional development workshops
		Stress managing mLearning resources, staff and school visits
		Lack of technical support
	Poor Wi-fi at schools	
Kylie	University strategic goal: Active community engagement demonstrated	Time to view PSTs at partner schools
	Provided PSTs with opportunity to work with parents meeting a TEMAG requirement for further accreditation	Personal philosophy not fully supportive of mLearning in ECE
	Additional professional experience places offered by partner schools	
	Opportunity to view developmentally appropriate use of mLearning in early childhood setting	
	Participants considering study at the University	
Lois	Improved learning experience for PSTs	
	More informed about mLearning resources available	
Researcher	More informed about current mLearning in schools	Time
	Improved learning experience for PSTs	Stress
		Lack of technical support
		Poor Wi-fi at the University
Victoria	Improved learning experience for PSTs	Stress
		Time to prepare PSTs for school visits
		Time to deliver professional development workshops
Other SoE members not involved in partnerships	mLearning resources available to borrow by staff and PSTs including PSTs not involved in the partnerships	Time to explore new mLearning resources
		Lack of experience and knowledge about using mLearning in the classroom
		Traditional teaching spaces
		Poor Wi-fi
		Lack of professional development opportunities to learn about new mLearning resources
	Lack of suitable mLearning resources	

7.3 Benefits and challenges of adopting mLearning partnerships for the SoE

The experiences of the SoE academics revealed key benefits and challenges. The main benefit identified by all SoE participants was the enhanced learning experience for the PSTs, which was considered in chapter 4. The SoE participants made a total of 38 comments about the benefits for the PSTs over the three-year research period. Additional benefits were greater access to mLearning resources, more information about current mLearning practices in schools, meeting strategic goals about community partnerships, additional professional experience places offered by partner schools (n=34) and participants considering further study at the University (n=2). On 28 occasions school participants (teachers and school leaders) commented on a lack of mLearning resources, but only four comments were made by SoE participants.

The challenges to mLearning in early childhood education identified by the participants were a lack of time, lack of technical support, lack of professional development in mLearning, and additional stress associated with the school visits. Participating SoE staff made comments on 12 occasions about the stress related to the school visits. The PSTs mirrored the stress experienced by the participating staff, making 24 comments about the stress associated with the preparation for the school visits. On 21 occasions school participants commented on issues associated with lack of technical support. The technical support comments at the University were made more by the PSTs (n=13) than the SoE participating staff (n=5). School participants made comments on 28 occasions about a need for professional development and a lack of technological knowledge. The PSTs made a similar number of comments (n=29). However, no SoE staff participant made a comment about a lack of professional development or technological knowledge within the SoE.

7.3.1 Professional development.

The SoE strategic plan 2016-2018 included a goal of providing professional development opportunities for staff, although there was no specific mention of any focus areas. Since recent developments in the use of mLearning in schools have been rapid (Erstad, Eickelmann, & Eichhorn, 2015) it is unlikely that many staff within the SoE had the necessary skills to model effective use of mLearning in their teaching. Research by Haydn (2014) identified effective modelling by University tutors as a key factor determining the effective use of technology by PSTs.

The SoE strategic plan for 2013-2015 mentioned the auditing of all units and degrees to ensure there was evidence that they met the AITSL graduate professional standards. The strategic plan made explicit mention of ICT resources and exploring electronic portfolios:

The School will examine its capacity to integrate learning technologies across its curriculum recognizing this as an AITSL priority area. It will also work with the University to access funding to purchase a high-quality electronic whiteboard for the training of students. In addition, the implementation of an e-portfolio will be explored to support students in their applications for employment. (SoE Strategic plan, 2013-2015)

The SoE strategic plan for 2016-2018 included the continued auditing of all units to ensure that they meet the AITSL standards. The AITSL graduate standards relating to ICT are, “Implement teaching strategies for using ICT to expand curriculum learning opportunities for students” and “Demonstrate knowledge of a range of resources, including ICT, that engages students in their learning” (AITSL, 2012). The strategic plan 2016-2018 reflected the TEMAG’s finding that teacher education providers need to provide evidence that graduating teachers meet the AITSL standards (TEMAG, 2014). The fact that the two strategic plans contained auditing of units and degrees indicated that the audit remained important.

The acquisition of mLearning resources and auditing of units and degree programs showed that the SoE was committed to meeting the AITSL ICT standards; however, without the specific professional development for staff, it might be difficult for staff to model ICT integration effectively. The SoE provided limited professional development opportunities for staff in the area of technology integration. The staff directly involved had a chance to see a variety of mLearning resources utilized in a developmentally appropriate manner and gained technological knowledge as a result. The benefits for the SoE at the University were making staff more aware of the mLearning resources available for PSTs to use, and keeping staff up-to-date with mLearning resources available in schools.

7.3.2 Time.

Maintaining the iPads was time-consuming because they were used extensively by a variety of staff and PSTs, who took videos, photographs, and downloaded apps. After the authentic visits, work created by children on University iPads was shared with the teachers electronically. The researcher ensured that the work reached the teachers quickly to maintain relevance for the children. In most cases, this meant taking the iPads home and uploading to a private YouTube account for sharing with the teachers. The Wi-fi in the SoE at the University was not robust enough to upload multiple video files, although in late 2015 the Wi-fi was upgraded.

Time was required for the provision of technical support for the partnership. The ICT coordinator, ICT lecturer, and the researcher provided technical assistance for the mLearning resources used in the partnership. The ICT coordinator was responsible for purchasing and maintaining mLearning resources. The ICT lecturer had an in-depth knowledge of technology in early childhood classrooms and was able to foresee potential technical problems during the PST visits.

Management of mLearning resources was sometimes time-consuming. Issues also arose with ordering equipment, removing passwords, extracting data from shared devices and deciding what equipment to purchase. On occasions, the iPads were not charged, apps were rarely closed, and the Wi-fi constantly dropped out.

7.3.3 Leadership.

Leadership played an important part in the success of the school-university partnerships. Chapter 6 discussed the role of the school leaders. The leadership within the SoE associated with the partnerships in this research was distributed amongst participants. The Dean of Education held the overall responsibility for managing the SoE including staff, students and the degree programs offered. This role was busy and required the juggling of multiple projects at any given time. The findings suggested that Kylie as Dean of the SoE placed value in partnerships and was willing to delegate the leadership of partnerships to the staff involved. Kylie's personal views about mLearning in early childhood education were cautious, but she was still supportive of the partnership and the staff involved.

Within the partnership, Candice the early childhood coordinator, Julie, the ICT coordinator and Victoria, the ICT lecturer held positions of leadership. Without the leadership of these participants, the partnerships may not have survived. Candice demonstrated her leadership when she agreed to include authentic teaching experiences at the partner schools in an early childhood unit that she taught. Following these authentic teaching experiences, Candice made the decision to continue with the authentic visits in her early childhood unit because she believed they were beneficial to the PSTs.

Julie demonstrated her leadership throughout the partnerships but particularly at the end of the third year when she made the decision to continue with the authentic teaching experiences for the early childhood PSTs. Despite the additional workload for her personally,

she deemed the effort to be worthwhile because of the benefits to the PSTs. To continue the partnership beyond the original three-year plan, Julie had to find a new ICT lecturer who not only had the expertise and knowledge of early childhood education but was also able to work with teachers and school leaders in the partner schools.

Victoria's leadership was pivotal to building the success of the partnerships. Victoria had effective interpersonal skills and quickly developed positive relationships with the teachers and school leaders. Victoria's interpersonal skills and expertise in the use of mLearning in schools enabled the school-university partnerships to gain the respect of the schools. Victoria led many well received professional development workshops to staff, parents, carers and individual teachers at both schools. Victoria's knowledge and passion for the effective use of mLearning led to one of the school Principals wanting to employ her as an ICT consultant. Victoria also demonstrated the value she placed in the partnerships when she included a group of primary PSTs in authentic school visits because of the perceived benefits for the PSTs.

In summary, the leadership of the SoE participants was a benefit to the mLearning partnerships. The aforementioned leaders worked together to help and support each other enabling the partnerships to succeed for the benefit of the PSTs and ultimately children in the early childhood classrooms in the future. Although there were challenges presented along the way, the SoE leaders remained committed to the success of the mLearning partnerships.

7.4 What are the impacts of the partnerships on the University community?

The University community included members of the University not directly participating in the research. As the partnerships developed, the schools and the University were able to share many rewards. The media department of the University needed suitable

schools for a photography shoot with some PSTs. The partnership with School B enabled a photography shoot to take place at short notice. One participating teacher and one school leader considered undertaking studies at the University. The teacher and school leader were both considering undertaking a Master's degree and the school leader expressed interest in becoming a school-based supervisor of PSTs undertaking a professional experience in his school.

The University extended the partnerships to include long-term professional experience places at both schools at the end of the first year without any prompting. Both schools offered professional experience places as a result of the partnership, and when the Principal of School B moved to a new school in 2014, the new school offered the University professional experience places. School A offered four long-term professional experience places to the University in 2014 for the first time in five years without any prompting and subsequently offered eight professional experience places for 2015 and ten for 2016. School B offered seven places in 2014, five in 2015 and due to an almost entirely new staff none in 2016.

To accommodate the partnerships with the schools, the University timetabled units with PST visits so that they fitted into the school day. As a result, the timetabling of other units in the SoE were affected by the partnerships with the schools. The University also had to accommodate requests made by the schools. An example was when School B requested a professional development session for the education assistants within their school district. The education assistant ICT network session was a very popular choice, with 27 education assistants attending, with many others being turned away due to lack of space. This workshop was viewed by SoE staff as a valuable partnership building exercise. Feedback from participants included: "I have learnt a lot, thank you; I am impressed by how much can be

covered in one session” and “Very useful” (EA workshop, 2013). Figure 7.2 summarizes the impact of the partnerships in the SoE community.

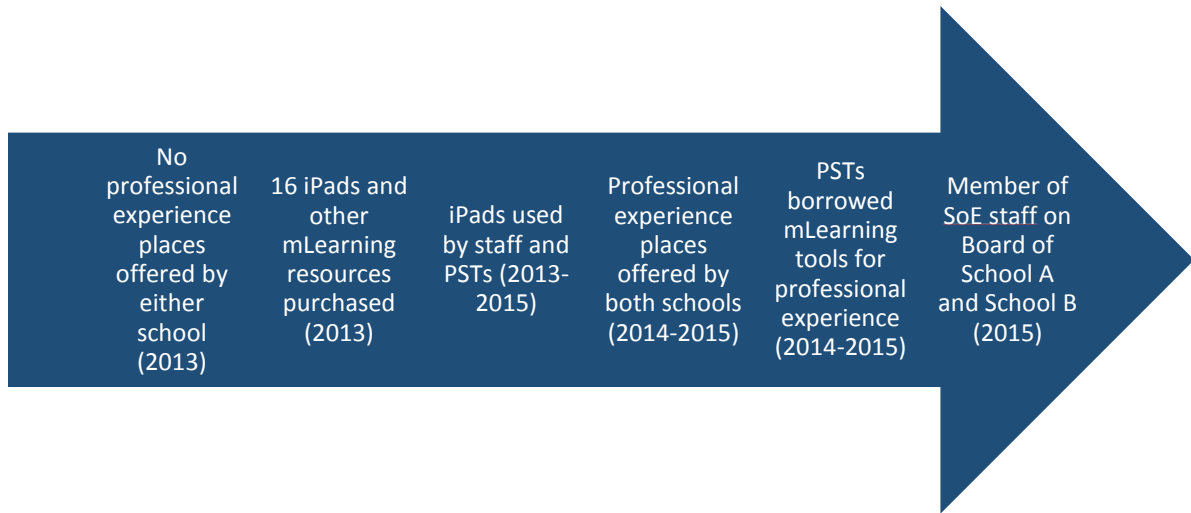


Figure 7.2. The partnership between the University and the Schools. The figure illustrates the impact of the partnership on the University community throughout the research period.

The PSTs in the peer group in the second year were part of the ICT intensive group. Feedback from these PSTs prompted the University to keep future early childhood PSTs from completing an ICT unit in the intensive mode as delivery was not early childhood specific and, as a result, did not offer the best learning opportunity for early childhood PSTs. Figure 7.3 illustrates the benefits of and challenges to the SoE participants and wider SoE and University community not directly participating.

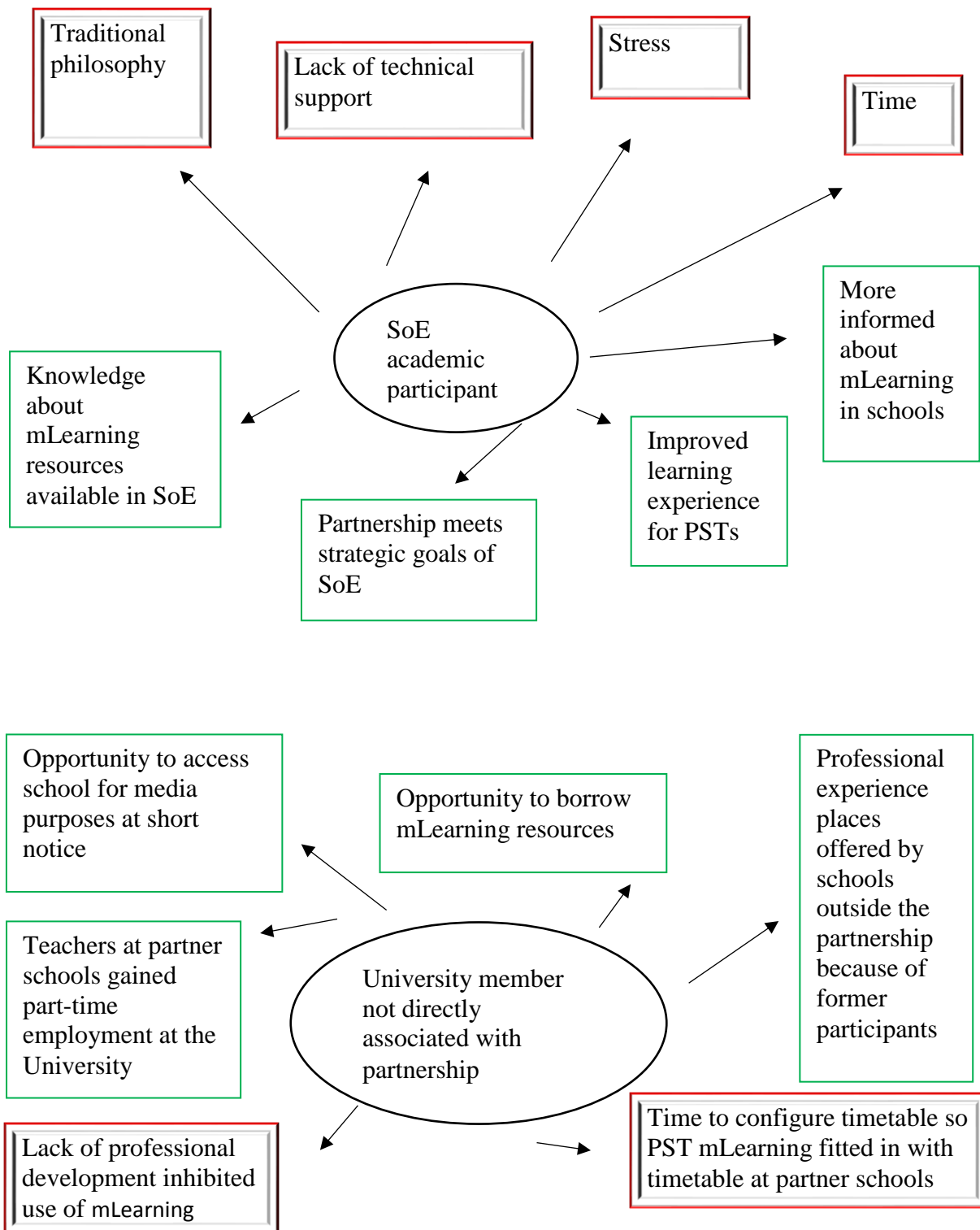


Figure 7.3. The benefits and challenges to the participants within the SoE and other members of the University not directly involved in the mLearning partnerships. The red bevelled boxes represent the challenges and the green boxes represent the benefits.

7.5 Conclusion

These specific results articulated in this chapter emerged from an mLearning partnership study that took place between 2013 and 2015 between the SoE at the University and two public schools. The key finding from the participating staff was that the authentic mLearning teaching experiences were superior to the peer mLearning experience, with PSTs in the authentic groups gaining a richer learning experience than peers who did not participate in an authentic mLearning experience. The chapter revealed that mLearning implementation in the SoE was in its infancy possibly because of limited mLearning resources, the prevalence of traditional philosophies and a lack of technological knowledge amongst staff. No specific means existed to ensure that the staff was meeting the AITSL standards, in preparing PSTs to use ICT across the curriculum as a tool to enhance learning. The mLearning partnerships in this study did provide professional development opportunities for participating SoE staff, including learning about mLearning resources and being exposed to the developmentally appropriate use of mLearning devices. Some of the participating staff benefitted from the partnerships by increasing their technological knowledge and ability to use mLearning across the curriculum. The benefits and challenges to mLearning in schools were mirrored at the University level.

Chapter 8 contains the Discussion of the findings from the previous four chapters. Some themes from the findings are presented to answer the two research questions. A model is presented to conceptualize the findings.

Chapter 8 Discussion

8.1 Introduction

The purpose of the research was to explore mLearning in early childhood education. This discussion chapter synthesises the key themes from the findings reported in the previous four chapters. Two research questions directed this study: the first concerned the benefits and challenges of adopting mLearning in early childhood education (ECE) for the schools and the University; the second concerned how mLearning implementation in schools impacted on school–university partnerships. This chapter considers the key findings from each research question and presents a model via which to conceptualise the findings.

8.2 Key findings

The study involved early childhood practising teachers and pre-service teachers (PSTs), school leaders, parents and carers, and university academics working together to gauge the benefits and challenges of mLearning in early childhood education. The impacts of mLearning implementation on school–university partnerships, in general, were also considered. A case study approach was used, and data were collected over a three-year period. Tables 8.1 below and 8.2 (p. 284) summarise the key findings, which are then discussed.

Table 8.1

Key Findings from Research Question 1

What are the benefits and challenges for schools and the University of adopting mLearning in ECE?
Children exhibited engagement when using mLearning.
Practising teachers and PSTs engaged in learning.
Beliefs of practising teachers and PSTs about using mLearning in ECE became more positive after the authentic mLearning teaching experience.
A lack of mLearning resources and technical support inhibited the use of mLearning in the classroom.

8.2.1 Children exhibited engagement when using mLearning.

The findings of this study showed that children working with mLearning were highly engaged and more able to use mLearning tools than the practising teachers and PSTs expected. When children were asked which activities they had enjoyed the most, their responses were about the content of the lesson and not the mLearning tools used. This focus indicates that the novelty value of the tools was not what had engaged them. Having school and university leaders observe children's engagement with mLearning was important because leaders have the ability to initiate change. Leaders observed that mLearning was an effective tool in early childhood education despite the negative media associated with young children and technology (F. Simon et al., 2013). The high level of engagement of children in this study was consistent with the existing literature (Boyce et al., 2014; Ciampa, 2014; Chiong, Ree, Kazakoff & Bers, 2014). Jonassen and Kim (2009) state that meaningful learning occurs when there is deep engagement with ideas and that meaningful learning is essential for problem-solving and higher order thinking skills. Common concerns about the distracting nature of mLearning (Boyce et al., 2014) did not arise. No participant indicated that any children were off-task, suggesting that the mLearning activities planned for the children were engaging.

8.2.2 Practising teachers and PSTs engaged in learning.

The PSTs were divided into peer and authentic groups, enabling comparisons to be made about their use of mLearning in the classroom and the extent to which their pedagogical knowledge and technological knowledge were enhanced. The peer groups presented mLearning lessons to their peers in the mode traditionally used in the University, whilst the authentic group presented their mLearning lessons to children in the partner primary schools. The research findings showed that the authentic groups had a richer learning experience than the peer groups and were more able to design lessons to meet the needs of children. This finding is consistent with the Kolb and Kolb (2009) model of experiential learning where concrete experiences followed by reflection enables the learner to conceptualise and actively experiment with new knowledge. The School of Education (SoE) ICT coordinator continued with the authentic mLearning teaching experiences beyond the intended three-year period and removed the peer group so that no PST missed the authentic experience. This continuation of the authentic mLearning teaching experiences for the PSTs indicated that the SoE was satisfied with the outcomes of the mLearning experiences for the PSTs.

The opportunity for the PSTs to present mLearning-rich lessons in an authentic classroom setting gave them increased pedagogical experience, particularly in the use of mLearning. The PSTs also received feedback from the teachers about their teaching. The PSTs made 50 comments reflecting increased personal pedagogical experience. These PSTs in the authentic groups valued the teaching practice that the mLearning implementation gave them. PSTs copied cues from the teachers and lecturers, and commented that it was good for PSTs to see early childhood practices modelled in the classroom. The practising teachers embraced the chance to provide the PSTs with feedback on their lessons and supported them during the lessons. The findings revealed many examples of PSTs lacking pedagogical knowledge. This finding was not unexpected as the PSTs were less than halfway through

their degree. The pedagogical feedback from the practising teachers was valued by the PSTs, as illustrated by the 55 comments they made highlighting the value they placed on such feedback. The authentic mLearning teaching experiences were expected to have an impact on the PSTs, but an unexpected finding was that the difference in the standard of the lessons between the peer and authentic groups was so great. The lessons presented by the peer groups lacked clear explanations, creative resources and were often not age appropriate. The lessons presented by the authentic groups were age appropriate, engaging, supported by creative resources and explicit. The authentic PST lessons were deemed by the SoE staff to be of a superior standard throughout the three-year period.

All the participating teachers increased their technological knowledge and ability to integrate technological, pedagogical, and content knowledge (TPACK) as a result of the mLearning partnerships. The teachers made 40 comments regarding the benefits of the mLearning implementation. The findings revealed that some teachers rated their initial technological knowledge highly because they associated it with knowledge of software programs. Teaching with technology requires teachers to modify their pedagogy. Findings revealed a lack of teacher understanding about how pedagogy needs to be modified to facilitate learning using new technologies. After the PST visits, practising teachers were found to use mLearning in ways demonstrated by the PSTs, indicating that they had gained technological knowledge and were able to apply mLearning in a student-centered manner. This finding highlighted the TPACK learning that occurred through the synergy of the practising teachers and PSTs.

8.2.3 Beliefs of practising teachers and PSTs about using mLearning in ECE became more positive after the authentic experience.

The authentic groups' teaching experience changed the views of those PSTs who took part. The authentic groups expressed fewer concerns about mLearning than the peer groups

did after the mLearning lessons. The peer groups' view reflected a general opinion that mLearning is a passive activity (Carson, Tremblay, Spence, Timmons, & Janssen, 2013; Hinkley, Salmon, Okely, & Crawford, 2013). The authentic PSTs made 44 comments about mLearning, which highlighted a positive orientation towards mLearning in the early childhood classroom.

Teacher beliefs shifted through the study. Findings revealed that many teachers initially viewed the PST visits as “computing” sessions and did not have an understanding about integrating mLearning as a tool to support the curriculum. In the beginning, teachers commented about the barriers to mLearning; however, as the research progressed, there were fewer comments about barriers to mLearning. The study showed that the opportunity to observe children engaged and learning using mLearning tools changed the perspectives of practising teachers and PSTs from a view of caution to a view seeing the potential educational value of mLearning.

8.2.4 A lack of mLearning resources and technical support inhibited the use of mLearning in the classroom.

There was an initial lack of mLearning resources, including hardware and software in the partner schools and the University. All participants thought that the lack of mLearning resources was a challenge to mLearning in early childhood education and inhibited the use of mLearning. The amount of mLearning resources in both schools increased as time passed. Some of the teachers borrowed Bee-Bots (1), iPads (1), and digital microscopes (1) from the University, and some PSTs (6) borrowed mLearning resources for professional experience. Resources at the University before the research commenced consisted of one IWB (interactive whiteboard) and a computer laboratory with clusters of desktop computers. The iPads (16) purchased for this research were used extensively by the SoE community, which led to the purchase of another set of iPads and discussions about ongoing maintenance of the

devices. The mLearning interventions are likely to have expedited the acquisition of mLearning resources in both schools and the University, as illustrated by the following examples:

- A Principal applied for an iPad grant and installed Wi-fi when the feedback from parents about the mLearning implementation was positive.
- A Principal ordered the school's first set of iPads a week after observing a PST visit.
- A Principal purchased all the mLearning tools modelled by the University including Bee-Bots, digital microscopes, Story Sequencers and Recordable Butterfly devices.
- The Parents & Citizens (P & C) Association approved the purchase of a set of iPads following a parent workshop.
- The University purchased an additional set of 30 iPads.

The PST visits possibly raised the profile of mLearning in a positive manner in both schools and the University, which encouraged leaders to purchase additional mLearning resources. Although the research focused on the synergy between the practising teachers and PSTs, University and school leaders were regularly invited to view the research in action because leaders had the authority to make decisions regarding the acquisition of mLearning resources. The iPads purchased by the University for the research were used so extensively that from an mLearning perspective they became indispensable. At a time when increasing numbers of schools were considering 1:1 iPad programs and digital literacy had become mandated in the Western Australian curriculum, teacher educators needed to ensure that PSTs were prepared and had access to mLearning resources.

Lack of technical support is a blocker for technology integration (C. Clark et al., 2015). New technologies always present new challenges, and proper support can help teachers overcome such barriers. Careful management of mLearning resources enables teachers to use them more effectively. In the final year of the study, both principals had

systems in place so that all the iPads were synchronised, had hard cases and there was a process for charging, booking, and adding apps.

The findings of this study showed a lack of technical support at both schools and the University. In the first year, there were problems with iPads not working and Wi-fi connectivity. The connectivity issues improved in the second year. In the final year, the Principals had the greatest understanding of these connectivity barriers and were proactive in providing rapid technical support. Without ongoing support and maintenance, mLearning integration is difficult in schools. Principals needed to be aware of the barriers to mLearning in the classroom and to be proactive in providing fast technical support to overcome problems. The following list gives examples of where technical support was lacking:

- IWB was not working for six months at School A.
- Wi-fi would not support more than four iPads at School B in the first two years.
- No system for collecting and recharging the iPads at School B in the first year.
- School B had no cases for carrying iPads in the first year.
- iPads were not numbered at School B in the first two years, so children's work was often lost.
- Wi-fi was not working in some classrooms in School B at the start of the third year.
- Wi-fi was unreliable at the University.
- No system at the University or schools to easily add apps to the iPads.

Good technical support reduced the barriers to mLearning. This study revealed that teachers made fewer negative comments about mLearning when technical support was in place and problems were resolved rapidly. Teachers also appeared to increase their self-efficacy and became more likely to troubleshoot technical problems when fewer problems arose.

Research Question 1, *what are the benefits and challenges for schools and the University of adopting mLearning in early childhood education*, revealed three main challenges and three main benefits. Children's engagement, practising teachers' and PSTs' learning (technological and pedagogical), and mLearning beliefs becoming more positive were the key benefits. A lack of mLearning resources, poor technical support, and limited time were identified as the key challenges.

Children's engagement in the classroom was a benefit well documented in the findings. The fact that there was no evidence that the mLearning tools were a distraction to children indicated that distraction was not an issue if activities were well planned and developmentally appropriate. However, mLearning resources were a challenge to mLearning implementation because at the start of the research one school had no mLearning resources available to use in the classrooms. Technical support was a challenge also, because when mLearning resources were available, poor support gave teachers a reason not to use them. The findings revealed a lack of teacher technological knowledge about the effective use of mLearning in early childhood education. In many cases, teachers used mLearning to replace traditional tools, such as electronic worksheets, as they were unaware how to use mLearning to transform and enhance children's learning.

The enhanced mLearning teaching experience for the PSTs was documented in the findings and was found to be a key benefit of the mLearning implementation for the University. A key challenge for the University was finding the time to research, purchase and maintain resources. It was also a challenge managing the PSTs as they needed support to plan appropriate lessons that would work in a classroom setting. As a result of the mLearning implementation, the University purchased mLearning resources that were available for other staff to use. The mLearning resources purchased for the research were used extensively by staff within the SoE resulting in the purchase of additional resources. mLearning resources

available for all staff and PSTs within the SoE as a result of the research was a benefit of the mLearning implementation.

Figure 8.1 illustrates the benefits and challenges of adopting mLearning in early childhood education for the schools and the University. Time, resources and technical support are shown in red as challenges, and children’s engagement, beliefs about mLearning becoming more positive and enhanced expertise for PSTs and school staff are shown in green as benefits.

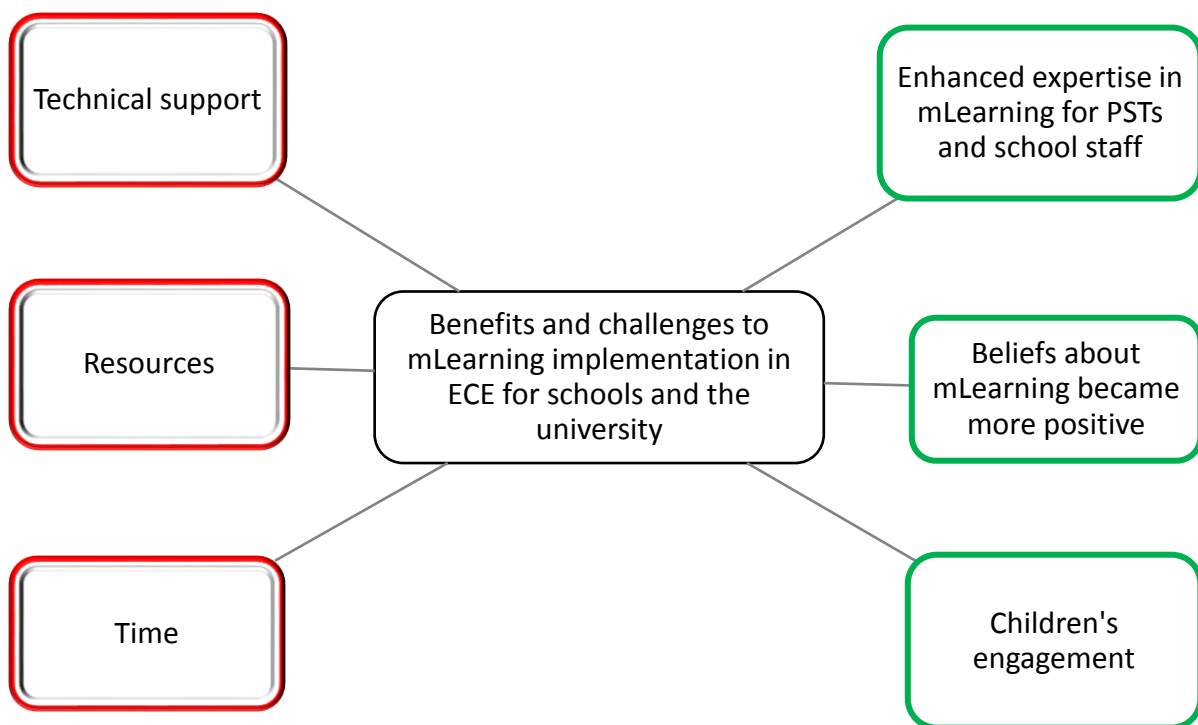


Figure 8.1. Research Question 1: The benefits and challenges for schools and the University of adopting mLearning in early childhood education.

Table 8.2

Key Findings from Research Question 2

How did the mLearning implementation in schools impact on school–university partnerships?

Both mLearning implementation and school–university partnerships were affected by leadership.
The role of parents and carers was important in the implementation.
The maintenance of partnerships was time-consuming and had to be beneficial for both partners.

8.2.5 mLearning implementation and school-university partnerships were affected by leadership.

The school leaders at both schools were enthusiastic about cultivating mLearning partnerships to support teaching and learning. This finding was consistent with existing literature about the characteristics of effective school leaders (Woods, Husbands, & Brown, 2013). The fact that all the Principals agreed to release teachers to visit the University to meet the PSTs at the start of each school year, visited the classrooms during PST visits, and offered professional experience placements for PSTs from the University showed a positive disposition towards the mLearning partnership. In the final year, both Principals purchased the mLearning resources that had been used by the PSTs.

The University understood that careful selection of teachers for the mLearning intervention was an important factor, but it was not until the school leaders valued the importance of having the right teacher that school leaders selected the teachers themselves. When the Principals took the initiative to select teachers for the partnership they chose teachers who had the potential to become technological leaders within their schools. Such teachers needed to be open to using mLearning, exploring new pedagogies, and willing to share their acquired knowledge with colleagues, which is consistent with the findings of Winslow et al. (2012) concerning the qualities of good technological leaders. In the final year

of the study, both schools had leaders who selected the participating teachers. The longitudinal nature of this research enabled the partnerships between the University and the schools to grow because it was possible to adapt to meet the needs of the respective partners.

To maximise the benefits of the partnership, principals needed to be proactive in seeking opportunities for the school. One Principal spontaneously released additional early childhood teachers during a PST visit in order to maximise the learning opportunities for other teachers. The action of this Principal is consistent with findings by Akcaoglu et al. (2014) about how good school leaders find ways to upskill staff. In the fourth year, this Principal rearranged teachers' planning time so that all staff would have the opportunity to observe the PST visits.

The key findings indicated that good leadership maximised the outcomes of the partnership and leadership lacking support for technology stalled mLearning integration. Poor technological leadership was evident in the study when a leader remained at a school for a short period and when a leader lacked interest in technology and consequently did nothing to prepare under-skilled staff for technology integration.

8.2.6 The role of parents and carers was important in the implementation.

Parent associations are an important source of income for small schools and enable the purchase of additional mLearning resources (Fabricant & Fine, 2012). At both partner schools, the P & C Association purchased a set of iPads and raised considerable funds each year. At School A, the P & C Association raised an average of \$20,000 each year. At School B, the P & C Association raised an average of \$12,000 each year, with the amount raised increasing each year. The P & C Association's decision to purchase iPads at School A was influenced by parents who attended a University-delivered parent mLearning workshop,

had children in classes that were part of the mLearning intervention, and were members of the P & C Association.

The use of mLearning in early childhood education is said to be a concern of parents and carers (DeLoache et al., 2010; Siraj-Blatchford & Siraj-Blatchford, 2006). Some of this concern may relate to knowledge gaps about the educational benefits of using mLearning in the classroom. Parents and carers may fear that mLearning will have a negative impact on language development (McCarrick & Li, 2007). There may be a perception that children use ICT excessively, and that there are limited benefits if children passively use technology rather than use it in a more socially constructive teacher-initiated way (Napier, 2014). Some parents may find it difficult to untangle the complex relationships between education, gaming, and social networking (Granic, Lobel, & Engels, 2014). A. Simon et al. (2014) suggested that parents need to work with teachers to guide and support children. Parent workshops such as those in this study gave parents and carers access to more information so that they could make informed decisions. All parents who attended mLearning workshops indicated that their views about mLearning became more favourable as they saw how mLearning tools were used to support the curriculum. This is consistent with existing literature by L. Emerson, Fox, and Fear (2012) who found that engaging parents has the greatest impact when it is focused on specific learning outcomes.

At both schools, many of the parents placed more importance on arts and music than on technology. When a Science, Technology Engineering and Mathematics (STEM) specialist replaced the music specialist teacher at School A, some parents complained indicating that they did not place value on STEM. The parents who complained had not attended any of the mLearning parent workshops, which might have enabled them to see the educational benefits and make a more balanced judgement. Pegrum (2009) found that informing educators, including teachers and parents, enabled them to figure out the real

dangers and make informed decisions. The findings of this research showed that the common parental view about mLearning was one of concern, but this view changed when parents were informed about the developmentally appropriate use of mLearning through parent workshops such as those in this research. The research showed that parental views could change as a result of positive hands-on exposure to mLearning.

The growing interest in the BYOD (bring your own device) model of technology integration means that parental support of mLearning is vital (Australian Government Department of Education, Employment and Workplace Relations, 2013; US Department of Education, 2010). If a school places tablet computers on booklists for children, then tablet computers become a factor for parents to consider when choosing a school for their children. Small schools such as those in this study are trying to grow and so losing enrolments is not desirable. Investigating the BYOD model of technology integration was in School A's business plan, which indicated that the Principal and school board were open to the idea.

The findings of this research showed that parents influenced a school Principal at School A to apply for an iPad grant after the Principal stated that he had no intention of purchasing any iPads for the school. This finding addressed the second research question showing that mLearning interventions can have an impact on school communities, which can lead to changes in a school. One Principal misjudged the impact of a school community when he stated that the P & C Association was not engaged. The research found that, on the contrary, the P & C Association was highly engaged and had raised \$20,000 each year. The impact on the school communities was found to be significant in this research because of the influence they had on the direction and leadership of the schools.

8.2.7 The maintenance of partnerships was time-consuming and had to be beneficial for both partners.

Sustainable partnerships require time to develop (Killion, 2011). Time and shared experiences build trust so that positive experiences outweigh negative ones. The findings showed that all participants were committed to continuing the partnership at the end of the third year. The longitudinal nature of this research meant that the relationships formed had time to develop and became personal with school and university participants greeting each other warmly and sharing personal experiences beyond the partnership. The findings revealed that participants deemed the additional time required to sustain the partnerships worthwhile. This finding was consistent with the existing literature (Walsh & Backe, 2013).

Time was required at the beginning of each year to liaise with schools to set up a workable timeframe for the PST visits. In addition to the PST visits, time was needed to release the practising teachers to visit the University, meet the PSTs, and provide curriculum support. Releasing the teachers to come to the University meant that the schools had to organise cover, and the teachers had to think about the content that would be relevant when the PSTs visited to teach lessons. Time was required to introduce the teachers to the ICT lecturer and PSTs, and explain the partnership to the participants. The school leaders needed to select teachers with the potential to become technological leaders and liaise with them about their role in the mLearning partnership. It also took time to research, purchase and maintain mLearning resources that were developmentally appropriate, usable across the curriculum, and cost effective. Although mLearning resources from the University were available for the participating teachers to borrow, few teachers took up the offer, which supports the literature that teachers are unlikely to explore new mLearning resources to which they have not been previously exposed (C. Hill, 2010).

At the onset of the partnerships, the SoE staff were concerned that PSTs in the peer groups would feel that they had missed out on an mLearning teaching experience in a real classroom. The authentic groups indicated that preparation for the school visits was time-consuming but worthwhile. An unexpected outcome of the study was that the PSTs in the peer groups indicated they were glad that they had not undertaken an authentic experience because of the associated time commitment that it required.

Considerable time was spent attending, planning and organising professional development workshops. It was time-consuming to meet the needs of the schools on occasions, particularly when some requests did not meet the partnership goals of the University. However, meeting the needs of the schools was an important way for the University to demonstrate a commitment to the partnerships and develop relational trust. Although the partnerships became easier to manage and organise as they progressed, time was still needed because invariably there were new participants. Schools are busy places and initiatives such as the mLearning partnership in this research competed with many school priorities. Powell (2014) supports this finding, saying that teachers are overwhelmed with choices and often do not have time to look at new mLearning resources.

The findings revealed that principals who invested time in the partnership tended to maximise outcomes. In the final year, one busy new Principal took the time to ask many detailed questions about the partnership. When the University attended her school, she always extended an invitation to share the mid-morning break and engaged in discussions about avenues for the partnership. She was particularly interested in professional learning opportunities for her staff.

By the final year of the study, the connections between the schools and the University were well established, and the partnerships were mutually beneficial. Both school business plans contained the words *partnership* and *community*, illustrating the importance of

community connectedness at the schools. The findings revealed that children, practising teachers, and PSTs could learn concurrently. This finding was consistent with the existing literature about maximising opportunities from a mutually beneficial partnership (Chorzempa et al., 2010).

Independent Public Schools (IPS) are reviewed every three years and need to demonstrate outcomes from their business plans. A partnership with a University was a measurable outcome for the schools. Likewise, universities need to demonstrate partnerships within the community because good school–university partnerships can result in quality professional experiences for PSTs (Australian Government Department of Education and Training, 2015a). Teaching degrees at Australian universities are regularly accredited by Australian Institute for Teaching and School Leadership (AITSL, 2014) and need continual evidence of excellent practice. Partnerships with schools provide beneficial evidence for a University. An unexpected outcome of the study was a University representative becoming a member of both school boards. Such an association was mutually beneficial because it demonstrated a connection with the local community for the schools and the University.

The decision to continue the partnership beyond the original three-year plan was a positive outcome of this research, demonstrating that the mutual benefits deemed by key stakeholders were worth maintaining. Benefits of the partnerships were professional development offered by the University, additional teaching practice in the schools for the PSTs, the synergy between practising teachers and PSTs and a community connection. These benefits align with the Australian government’s Students First policy, which focuses on improved student performance and states that universities must work more closely with schools (Australian Government Department of Education and Training, 2015b).

The high cost of teacher relief made attendance at ICT workshops for practising teachers, alongside the PSTs, financially prohibitive for schools, so the University provided

alternative opportunities for the teachers through an ICT intensive unit during the school holidays. However, in the three-year study, only one teacher attended the ICT intensive, even though both schools expressed an interest. Providing opportunities for teachers in the school holidays meant that the teachers needed to give up personal time. The finding revealed that few teachers were able to commit personal time for mLearning, which is consistent with the current literature (Bubb & Earley, 2013; Ritzhaupt, Dawson & Cavanaugh, 2012). Schools were not able to pay for teacher relief so that teachers could attend the ICT unit at the University in work time and teachers were not prepared to attend the ICT intensive at the University in their own time. A possible solution made by a Principal at School B was a compromise where teachers attended the ICT intensive in the school holidays and the time was traded for a school professional development day so that teachers did not have to give up additional time and schools did not incur the cost of teacher relief.

In the final year, parent workshops became mutually beneficial when an idea suggested by a school of having PSTs deliver a parent workshop eventuated. Using PSTs to deliver the parent workshop gave PSTs, who were only in the second year of a four-year teaching degree, the opportunity to engage with parents as technological experts. Parents who attended this workshop were positive and indicated how their views on mLearning had changed.

The schools valued the workshops delivered to teachers, parents and carers, and education assistants. The University provided such workshops at no cost as a way of raising the profile of mLearning in the schools and gaining insight into parental perceptions. The parent workshop delivered by the PSTs aligned with the Australian government's Teacher Education Ministerial Advisory Group report, which recommends that PSTs build skills and confidence to raise learning outcomes for children and work with parents to achieve this (Australian Government Department of Education and Training, 2015a). The ICT coordinator

and researcher were doubtful that the PSTs would be able to deliver a workshop to parents at an appropriate standard because of the support that the PSTs required earlier in the year. Having PSTs deliver a successful parent workshop at School B was an unexpected positive outcome from the research. The opportunity to deliver an mLearning workshop to parents at School B provided the PSTs with a unique opportunity within their degree, and therefore enhanced their PST training. Having parents visit the school meant that the Principal was also present for the workshop. The Principal viewed many mLearning resources, such as Recordable Butterflies, Bee-Bots, and Story Sequencers, for the first time at the parent workshop and subsequently decided to purchase them all.

PSTs need more time in schools to connect what they learn at university with real-world practice (Australian Government Department of Education and Training, 2015a). The University teacher-training courses all exceeded the required number of professional experience days, demonstrating the importance placed by the University on practical experience for PSTs. The partner schools offered more professional experience placements to the University, and there was an offer from one Principal for PSTs to liaise with the school for help with assignments or classroom observations. The level of support offered by the schools was an unexpected benefit of the partnership for the University.

Figure 8.2 illustrates how the mLearning interventions in schools impacted on school-university partnerships. The key factors identified were leadership, the importance of parents and carers, and the need for time to develop mutually beneficial partnerships.

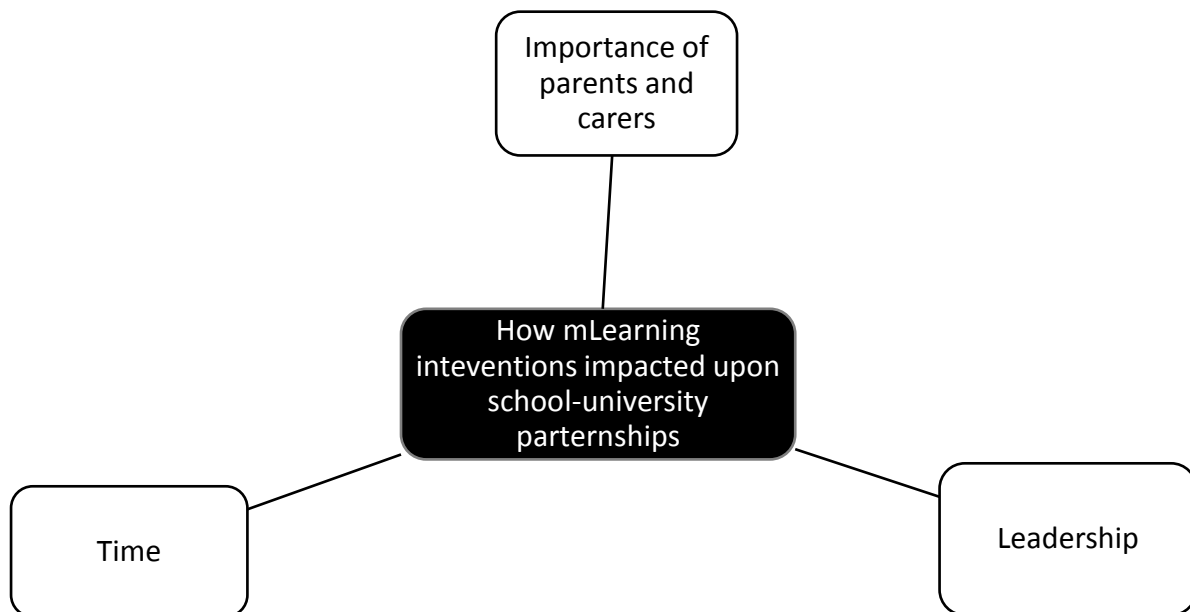


Figure 8.2. Research Question 2: What are the impacts of mLearning implementation on school-university partnerships?

8.3 The chain model

Five themes have emerged from the results of research as improving the quality of school–university mLearning partnerships and partnerships more generally. These themes are discussed as a set of links in a chain including that of community, cross-fertilisation, leadership, professional knowledge, and relationships and are presented diagrammatically as a chain model in Figure 8.3. The chain model has been a useful framework in which to conceive sustainable mLearning partnerships between schools and universities. Each link of the model requires planning and continuous nurturing to both strengthen the link and help protect it against possible destabilisation.

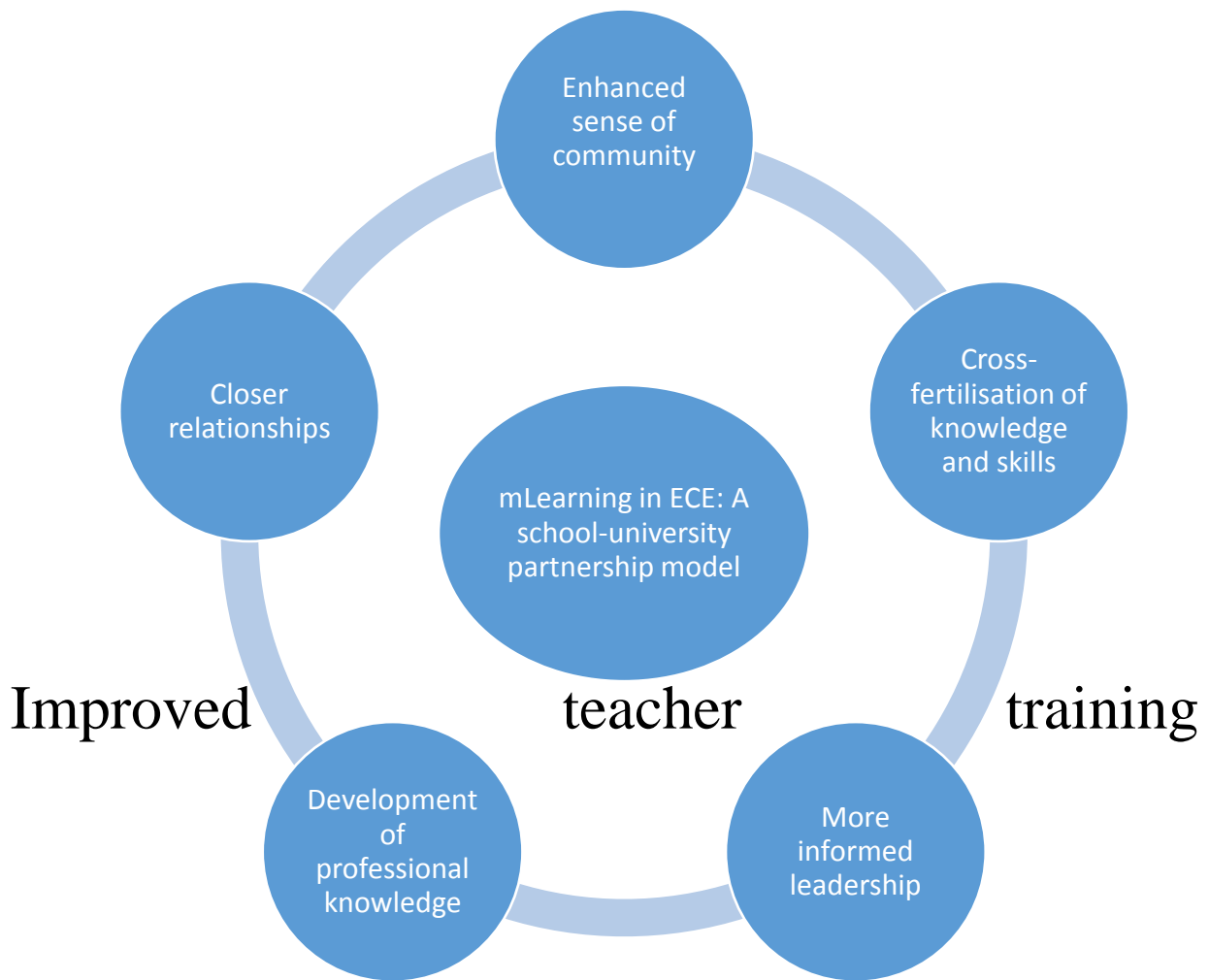


Figure 8.3. mLearning in early childhood education.

The school-university partnership model is conceived as links in a chain. Each link strengthens the next, adding to the overall success of the partnerships and improves the overall quality of the teacher training received by the PSTs. The chain model is now discussed in detail.

8.3.1 Enhanced sense of community.

Ensuring that the partnerships were community-based involving all stakeholders helped to create ongoing momentum. The school and University communities included children, teachers, school leaders, EAs, parents and carers, PSTs, and academic staff from the SoE at the University. Involvement of parents and carers was important because research has shown that parents see mLearning tools as educational but do not know what they should buy or how to use the mLearning resources (Henderson & Yeow, 2012). Increasing numbers of children have access to and use mLearning tools at home, so parents and carers as the primary educators of the children need the skills to help their children (Statista, 2014). Members of a school community (apart from children) are potential members of school boards and P & C Associations with the ability to make decisions regarding mLearning in a school. In this study, more than 95% of children had access to an mLearning device at home and the most common use (76%) was for playing games. However, parental views (44%) reflected a wider community perception that mLearning can be socially isolating. The parental view indicates that parents are not happy with how the devices are used by their children.

The growing interest in BYOD means that parental support is required (New South Wales Department of Education and Communities, 2014). If parents have only been exposed to media about the risks of cyberbullying and excessive screen time they are not in a position to support mLearning. While cyberbullying and excessive screen time are legitimate concerns, they are negative aspects associated with technology that need to be balanced with the positive effects of mLearning on children's learning. Integration of developmentally appropriate mLearning requires careful planning so that teachers can use it appropriately and parents can gain an understanding of the benefits of using mLearning in a well-balanced curriculum. One of the schools requested a professional development workshop on

cyberbullying, reflecting concerns in school communities (Pegrum, 2009). The ICT lecturer from the University delivered a workshop preferring to call it active citizenship rather than cyberbullying, couching cyber-safety in a positive manner. A show-and-tell mLearning workshop delivered by PSTs at the request of one of the Principals focused on the positive aspects of mLearning. While both cyberbullying and creative use of mLearning need consideration, it was important to balance traditional negative views with the positive aspects of mLearning. The parents who attended the show-and-tell mLearning workshop started by sharing their concerns surrounding excessive screen time. However, at the end of the session they were reluctant to leave and wanted details about the mLearning resources demonstrated, which indicated a change in disposition towards mLearning. They had experienced first-hand young children using mLearning devices in an outdoor setting engaged and actively learning.

Maintaining or increasing student enrolments was a goal of both schools. One of the schools took part in a performance review in 2010 and, as a result, there was a loss of community confidence, and many families left the school. A new Principal was brought to the school to restore community confidence. The support of a school community is important to maintain or grow a school (L. Emerson et al., 2012). If the number of enrolments falls, then the funding available is reduced. A school Principal needs to ensure that the community has confidence in the way that the school operates. New initiatives such as mLearning partnerships, therefore, need the support of the parent community and can also be used as marketing strategies to promote schools as contemporary and innovative.

The research took steps to be inclusive of the parent communities by planning parent workshops at each school each year. Research by L. Emerson et al., (2012) has shown that positive parental engagement in learning, which is distinct from engagement in schooling, improves children's academic achievement and well-being. Existing research supports the idea that parental engagement should be resourced and is essential to educational reform in

Australia (L. Emerson et al., 2012). The parent mLearning workshops were not priorities for the schools and few parents attended. However, the parents who did attend indicated that the workshops were valuable and shared information about the workshops with friends, who requested details about the mLearning resources used in the workshops. Ultimately, the desired outcome would be for the schools to deliver parent mLearning workshops either with or without the support of the University. Providing parents with a balanced view about mLearning in early childhood education is likely to gain their support and better enable them to support the needs of their children in a technological world.

The parent bodies at both schools were supportive and involved with their children's education even though attendance at workshops was poor. When one school made STEM a focus area and replaced the music teacher with a science and technology teacher, the parents indicated their displeasure at the loss of the music teacher and did not acknowledge the gain of the science and technology teacher. Parents needed opportunities to see the benefits of innovations such as mLearning implementation to gain their support.

8.3.2 Cross-fertilisation of knowledge and skills.

Cross-fertilisation of ideas and practices between practising teachers and PSTs provided the partnerships with a sense of purpose. According to Chorzempa et al., (2010), successful relationships can bridge the gap between theory and practice. The practising teachers and PSTs had the opportunity to learn from each other. The PSTs gained valuable classroom experience and received pedagogical feedback in a supported environment. The classroom teachers had the opportunity to observe a variety of mLearning tools used purposefully in the classroom and gain technological expertise. Cross-fertilisation arising from this research included practising teachers' and PSTs' levels of confidence rising using mLearning in the classroom, practising teachers' and PSTs' beliefs regarding mLearning in

early childhood education becoming more positive, teachers' technological knowledge increasing and PSTs' pedagogical knowledge increasing. The synergy between participants, all of whom had different skill sets and who were at various stages of development in integrating mLearning, required constant attention to optimise benefits for participants. For example, each new participating teacher needed guidance with how PST lessons ran, so that PSTs with limited pedagogical knowledge could manage, the children could have a rich learning experience, and the teacher had the opportunity to learn about the mLearning tools used.

There were some unexpected findings relating to increased technological knowledge of the participating teachers. One teacher used newly acquired mLearning skills to seek a new position; another teacher used her connections with the University to secure a part-time position at the University. The teacher who used mLearning skills to seek a new job had limited technological skills at the start of the study. Two years later, her mLearning skills enabled her to create a movie that she used at a job interview, indicating that her technological skills had significantly increased.

Cross-fertilisation between practising teachers and PSTs was a desired outcome of this research. During each PST school visit the practising teachers were asked to provide pedagogical feedback. The pedagogical feedback was valuable to the PSTs with limited teaching experience but also forced the practising teachers to observe all of the mLearning activities and therefore gain personal technological knowledge from the experience. Teachers provided feedback in writing in the first two years and in the final year the teachers were invited to attend debriefings with the PSTs immediately after the mLearning lessons and give their pedagogical feedback in person. The cross-fertilisation between the practising teachers and PSTs was revealed in the findings. However, on occasions, some of the PSTs did not deliver educationally sound lessons and did not demonstrate appropriate use of mLearning. In

these circumstances, there was no cross-fertilisation as there was little for the practising teachers to gain. The SoE staff learnt from these poor lessons and discussions took place in advance with the PSTs to avoid a reoccurrence of poor delivery. Despite such care, each year one group of PSTs delivered a weak lesson; however, for each poor lesson, there were several at a very high standard, which ensured cross-fertilisation.

8.3.3 More informed leadership.

School leadership affected the acquisition of mLearning resources, technical support available, and opportunities for teacher professional development in the area of mLearning. Leaders with the most positive dispositions towards mLearning made the greatest steps towards implementation in their schools. Integration of mLearning needs a leader who is open to exploring mLearning as an enabler for student learning, and can lead a school along the journey of technology integration.

At both schools, the Principals handled the acquisition and maintenance of mLearning resources and monitored usage. The appointment of an interim Principal for six months at School A stalled technology integration because the Principal was not supportive of mLearning. Despite the approval for the purchase of mLearning resources and Wi-fi installation before her arrival, it was not a priority for the interim Principal. She noted that staff were not ready to implement mLearning but did nothing to prepare the staff. This finding supports C. Clark et al.'s (2015) assertion that a leader needs to be supportive of mLearning for implementation to occur.

The loss of all the key participants posed a threat to one of the partnerships in the final year, but the partnership survived because the new Principal was a strong supporter of mLearning. One Principal was tech savvy and passionate about integrating mLearning, but did not have the same effect as her successor, possibly because she did not have a permanent

position, was not the Principal of an IPS, and lacked leadership experience. In the final year, one of the Principals was knowledgeable about teaching with technology, which enabled her to observe how technology was used and to know what support teachers needed. Another Principal had not personally taught using technology but was aware that he needed upskilling alongside his staff, and he employed new teachers who had good mLearning skills.

The research revealed that both schools were at an early stage in their journey of mLearning integration. There was a lack of technological knowledge among staff at both schools. All principals indicated that staff needed professional development. Principals at both schools sought professional learning opportunities from the University.

The Principals at both schools used the school's business plan as a way of embracing technology in the school in the final year. Each business plan was created in conjunction with each school board, comprising school and community members. Strong support from principals was required to drive mLearning in the schools but the support of the teachers and school communities were also advantageous.

This research draws on the work of Crevani, Lindgren and Packendorff (2007; 2010) and Gronn (2008) to present an emergent view of leadership that focuses on the collective rather than the individual. The shared view of leadership challenges traditional management and leadership literature that focuses on charismatic, heroic figures, rather than acknowledging the collective knowledge and skills that reside within an organisation. Shared leadership centres on the ability of individuals in universities and schools to value and embrace the various collaborative initiatives (e.g. classroom activities, workshops) that comprise the partnerships. Further, leaders inspired others to become involved in these initiatives at different levels.

The participating teachers demonstrated their technological leadership in a variety of ways, which included attending an ICT intensive course during the school holidays, borrowing mLearning resources, sharing professional knowledge with colleagues, organising parent workshops, and inviting the University staff to visit classrooms to talk to parents about mLearning. The level of technological leadership exhibited by the teachers varied. Of all the teachers, Jessica was considered by the University staff to be the best technological leader. She came to the partnership with very limited technological knowledge but gained more than the other teacher participants and was prepared to share her acquired knowledge.

Jessica immersed herself in the partnership when she gave up her leave to attend the five-day ICT intensive course at the University, which empowered her with knowledge and skills. Immersing herself in the partnership to such an extent also gave her the type of professional capital that perhaps influenced the school Principal. Later the Principal covered for her, so she could attend additional professional development. Jessica's actions and practices demonstrated her leadership in the partnership regarding direction, alignment, and commitment, as defined by Crevani et al. (2010). Jessica appeared to think beyond personal gain toward the partnership as a whole and the gains for the school community. Jessica demonstrated this by organising parent workshops, sharing her acquired technological knowledge with colleagues, giving up personal time to attend professional development on mLearning at the University, and frequently communicating with the University.

Arranging professional development activities may be an example of what Crevani et al. (2007, p. 62) describe as "inverted delegation", or the tendency for tasks to be delegated upwards rather than downwards. There certainly was a sense that the needs of participants were driving the partnership rather than being directed by leaders in positions of authority at both the schools and the University. This is demonstrated by the fact that in the final year of the study, no parent workshop took place at School A – because Jessica was not there to

organise and promote it. Losing Jessica at School A was more than losing a participant, as she was a technological leader with the ability to influence others.

The participating staff and some of the PSTs at the University exhibited leadership by delegating responsibility. For example, the Dean of the SoE distributed leadership allowing staff to oversee and manage partnerships. Maintaining effective school–university partnerships is time-consuming, therefore distributing leadership among several stakeholders ensures the success of a partnership (Greenfield, Braithwaite, Pawsey, Johnson, & Robinson, 2009; Hudson, English, Dawes, & Macri, 2012). The leadership at the University associated with the mLearning partnerships was distributed among several lecturers. Leadership at the University was associated with being flexible to the needs of the schools because of the perceived benefits of the partnerships to the PSTs. University staff rewrote unit outlines to accommodate school visits, prepared and delivered professional development for schools, and took PSTs to schools.

Distributed leadership centres on the ability of individuals in universities and schools to value and embrace the various collaborative initiatives (e.g. classroom activities, workshops) that comprise partnerships. The role of leaders is to inspire others to become involved in these initiatives at different levels (Searle & Hanrahan, 2011). At the two schools and the University, distributed leadership was exhibited at different levels and at different times. Two unexpected but positive outcomes of the study that reflected distributed leadership within the SoE were the ICT lecturer's decision to extend the partnership by including more schools and PSTs in authentic mLearning-rich classroom experiences and the ICT coordinator's decision to continue the partnership beyond the proposed three-year period.

In summary, a good leader is required to implement change successfully in a school (Clarke & Zagarell, 2012). For changes regarding mLearning, a leader needs good

technological skills and staff who are willing to become technological leaders and share technological knowledge within the school. The leader needs to be aware of the barriers to mLearning and provide good and rapid technical support to resolve problems that arise. In addition, the leader needs to gauge and meet the professional learning requirements of staff. The leader needs to dedicate time to any partnership for it to be successful. The findings indicated that the level of support a Principal gave to the partnership affected the learning opportunities within the school.

The mLearning partnerships needed technological leaders in the schools to maximise the synergy between practising teachers and PSTs, engagement of the community, enhanced technological knowledge of teachers, and relationships between the school and the University. The technological leadership would ideally be distributed between participating teachers and the school Principal so that the workload was not too great for any one individual and the partnership was not dependent upon one individual. Technological leaders need to share knowledge in the school community. This research attempted to encourage leadership among the participating teachers by accommodating their needs such as borrowing mLearning resources, providing technical support and one-on-one professional development sessions. Providing the participating teachers with as much support as possible made them more likely to use ideas and mLearning resources used by the PSTs after the PST visits.

The frequent change in leadership at both schools highlighted the importance of having participating teachers, or other members of the school leadership team, involved for the continuity of the partnership. The University maintained a stable team in the mLearning partnerships over the three-year research period. At the end of the third year, there was a change in one of the key University participants: the ICT lecturer. Forewarning of this participant change and having other staff remain constant enabled the partnership to continue without disruption.

8.3.4 Development of professional knowledge.

The professional knowledge theme is about the professional learning of teachers, school leaders, community members, University staff and PSTs. Teachers need both technological and pedagogical knowledge to use mLearning in the classroom (Perrotta, 2013). Teaching with mLearning requires teachers to change the way they teach (Mantei, Kervin, & Latham, 2010). A commitment to professional knowledge and evidence-based decision-making, particularly about pedagogical approaches and the purchase and deployment of equipment and mobile applications, ensured that the partnership was using credible ICT and had a proper audit trail. Professional development for teachers is most effective when conducted in an authentic context where teachers have the opportunity to view and provide feedback (King & Newmann, 2000). Authentic learning for PSTs is associated with authentic achievement. PSTs who actively engage with real children in a genuine classroom setting can have substantive conversations with children to build an understanding of how children learn (Newmann, Marks & Gamaron, 1996).

For participants to gain professional knowledge, it was important to embed the partnerships within an established theoretical framework and link it to contemporary literature to enhance credibility and provide participants with a sense of purpose. It was decided to anchor all decision-making in evidence-based research. For example, when purchasing equipment or recommending mobile apps, ensure that these purchasing decisions considered age-appropriate learning theory (Powell, 2014). The University spent considerable time researching the most appropriate mLearning resources for early childhood education and made sure that the mLearning resources used had a purpose and were not used as tack-on activities. As the partnership grew, schools took the advice offered by the University (suggested apps and mLearning resources) and the University embraced suggestions made by the schools (PSTs delivering professional development in schools).

Professional knowledge included the professional development that occurred through the synergy between the practising teachers and PSTs (cross-fertilisation), the professional development workshops run by the University for school staff, parents and individual teachers, and the ICT intensive course. The synergy between the practising teachers and PSTs provided professional learning through differentiated learning experiences in authentic classroom settings, which have been shown to be more important than mLearning resources and support in mLearning implementation (Lydon & King, 2009).

The synergy between the practising teachers and PSTs was the starting point for teachers to learn about the developmentally appropriate use of mLearning. However, without teachers who were willing to share, and principals willing to encourage and support sharing, the knowledge could remain with the participants and not spread throughout the schools. Sharing with the school community was considered to be important so that a balanced educational view was presented to counteract negative media perceptions. The Principals' decision to select the participating teachers at the end of the third year was a positive outcome as it indicated that the Principals could see that suitable participants would be more likely to share technological knowledge within the schools. Pamuk et al. (2013) found that effective teachers shared knowledge within their professional networks.

Early in the partnerships, the University realised that access to professional knowledge on mLearning for schools was costly and scarce, so provision of mLearning workshops was a benefit of the partnership for the schools. The provision of mLearning workshops was a way for the schools to gain a measurable outcome. The University planned opportunities for the schools to maximise professional knowledge from the partnership. The University nurtured partnerships by providing professional development outside the scope of the partnership when requested by a school. Professional knowledge opportunities took place in the form of professional development workshops for staff, parents, carers, and education

assistants. Such workshops enabled all staff, not just those participating in the mLearning implementation, to take part. The findings revealed that these workshops provided an opportunity for teachers with a negative disposition towards mLearning to engage in activities and become more positive in their disposition towards mLearning.

8.3.5 Closer relationships.

Relationships were primarily concerned with the interactions between the participants in the schools and the University, and, in particular, the desirability of personal relationships, particularly at the leadership level, to be secure and lasting. The process of developing partnerships was concurrent with the development of relationships between participants. The research found that trust was a non-transferable currency, and was consistent with current literature that the best way to preserve trust was through stable governance (Manna, McGuinn, & Finn, 2013). Partnerships require stakeholders to collaborate with a shared purpose, accomplished through hard work, open communication, trust, and mutual respect (Parker et al., 2012). Partnerships are created by strong and sustained trust-building behaviours at all levels, and sometimes take the time to grow and develop. According to R. Clark (1999), mistrust is the natural state of the relationship between schools and universities, and Killion (2011) refers to relationships between schools and universities as a struggle, with universities regarding themselves as superior to schools. Relationships had the potential to weaken between the two schools in this study and the University because of changes in staff from year to year.

The research acknowledged the significant risks associated with aspects of human resource management such as participants' career aspirations, or teaching staff being on short-term contracts, and sought to minimise these risks by broadening the reach of the research to include the entire school community. At each school in the study, there were three

principals in the three years. The small size of the schools made them stepping-stones for promotion for aspiring principals. A critical mass of willing participants, committed to the mutual goals and supported by their institutions, is a necessary precondition for a partnership to be successful (R. Clark, 1999). The partnerships were strongest in both schools in the final year, despite there being a new Principal at both schools. The human relationships established between university staff and teachers were strong enough to sustain the partnerships so that they could grow. A stable partnership requires the right person with the right attitude, and preferably not too many changes in participants (Jones et al., 2014).

The minimum number of participants at each school would have been the same two teachers and Principal for the three-year period, i.e. three participants. At the end of the three years, the number of teachers and school leaders in the partnership at School A was eight, and at School B was five. Reasons for the high staff turnover were staff being on fixed term contracts and staff seeking promotion or positions elsewhere. Having participants who could commit to a partnership for two or three years would be ideal. However, even with the best intentions, partnerships cannot avoid unexpected change, and so to survive they must be flexible.

The stability of the parent communities was an important factor in this study. Several parents had children involved in the partnership for more than one year. The feedback the parents received from their children was passed on to school Principals and P & C Associations. The positive feedback from parents is likely to have influenced a Principal and P & C Association to consider purchasing mLearning resources. Parental stability enabled parents and carers to be exposed to the mLearning partnership multiple times and, therefore, increased the likelihood of gaining their support.

When a leadership change occurred, a handover including participating teachers, or other members of the leadership team, was beneficial for ongoing partnerships. When the

leadership changed at School B, the Deputy Principal was able to convey information from one Principal to the next to provide continuity and a smooth start to the beginning of the school year, ensuring that the early childhood practising teachers were able to come to the University and meet the PSTs. The succession planning was useful in sustaining the partnership because newly appointed teachers or school leaders are busy in a new job and have less time available to explore a partnership. Research by Bauer and Brazer (2010) found that new principals struggle with role ambiguity, stress overload, and isolation, which suggests that exploration of new partnerships could be limited.

Having participating teachers for consecutive years was desirable, but teachers needed to be willing to remain engaged. The teachers at School B remained with the partnership throughout and a good rapport developed between these teachers and the University staff, which made the PST visits much easier in successive years. The stability of the participating teachers at School B was useful in the establishment of the partnership, but after three years these teachers had benefitted from the partnership but not shared their knowledge with the wider school community as much as they could. When the Principal actively selected specific teachers who would act as technological leaders for the future PST mLearning visits, these original teachers were not selected. Having a Principal actively select the most appropriate teachers was an initial recommendation of the partnership, but it took time for leaders to make this a priority. Two of the teachers at School A were in the partnership for two consecutive years, but the relationship did not develop with both to the same extent. While having stability in the participants was important, the participants had to be willing to engage fully in the partnership for the school to maximise the benefits. Selection of participating teachers was important to secure teachers with a desire to engage in the partnerships, and the support of school leadership enables this to happen.

The key University staff involved in the partnership remained constant throughout the research, and this level of stability in human resources contributed to the formation of strong and successful partnerships. At the end of the third year of the partnership, the ICT lecturer left the University, and the ICT coordinator went to considerable effort to find a suitable replacement that would be able to take on a new teaching position at the University and manage the complexity of classroom visits at the partner schools with PSTs. The University staff worked together to ensure that the partnerships would continue seamlessly the following year.

The actions of the University staff indicated the value they placed on the partnerships. The partnerships took three years to become fully established, and the University staff did not want them to fade away. The fact that both school Principals decided to select the future participating teachers was a sign that the partnerships were truly collaborative and had reached a sustainable point. The University initiated the partnerships in this study, so it was vital to have stability at the University to establish the relationships that enabled the partnerships to grow. Establishing the partnerships took time and effort to visit schools, source and purchase mLearning resources, and prepare participants. The stability of the University staff was deemed vital to the establishment of the partnerships.

The University placed importance on establishing good relationships with the partner schools. When opportunities arose to strengthen relationships, the University staff nurtured these opportunities by listening to and acting upon ideas suggested by school participants. Such ideas included conducting workshops for EAs, increasing the number of visits to each school and joining school boards. When a participating teacher attended a five-day ICT intensive at the University, a member of the SoE staff remained with this teacher to make sure she gained as much as possible from the intensive course and to nurture the relationship between school and University staff. The inclusion of parents in the partnerships was also

important because the parent body remained relatively constant when the leadership within the schools changed frequently. Parents and carers had the ability to influence principals, so good relationships between the parents and the University enabled parents to view the mLearning partnerships in a more positive manner.

A poor lesson in the first year of the partnership was a disappointment to one participating teacher who conveyed her views to her Principal. As a result of this poor lesson, staff at the University took extra care to ensure that lessons delivered by the PSTs explicitly met the needs of this teacher. Carefully nurturing the relationships enabled subsequent glitches to have less effect on the partnerships.

8.4 Conclusion

Five themes, have emerged from the results as critical to the effective use of mLearning in early childhood education and the success of school–university partnerships more generally. Research Question 1, concerning the benefits and challenges for schools and the University of adopting mLearning in early childhood education, affected Research Question 2, concerning the impacts of mLearning implementation in schools on school-university partnerships. The mLearning implementation in the schools played a role in establishing the school–university partnerships more generally. To optimise the benefits and manage the challenges around mLearning implementation, a chain model is proposed.

This chapter discussed the benefits and challenges to mLearning for schools and the University, followed by how mLearning implementation in schools impacted on school-university partnerships. The five themes of community, cross-fertilisation, leadership, professional knowledge, and relationships, like links in a chain, emerged through the experiences encountered and shared by the University and two partner schools over a three-year research period. Establishing a successful school–university partnership required

each of these five links, which took time to establish. Hence, successful partnerships take time to become sustainable.

Chapter 9, the final chapter, concludes this thesis and includes recommendations that arise from the study.

Chapter 9 Conclusion and Recommendations

9.1 Introduction

The final chapter of the thesis summarises the key findings from the research questions and offers implications and suggestions for future research. The purpose of this research was to explore the implementation of mLearning in early childhood education (ECE) at two public schools in the metropolitan area of Perth, Western Australia through the lens of school-university partnerships. A collective case study methodology was chosen for this longitudinal research which took place over a three-year period. This study prioritised qualitative methods to generate insights about relationships within contexts on multiple levels, but at the same time captured quantitative data regarding the participants and cases studied. Data were collected using surveys, individual interviews, small focus group interviews, field observations and school websites. The qualitative data were analysed by open, axial and selective coding using NVivo software as a coding tool. Quantitative data was collected using Survey Monkey and from school and University websites.

The research examined benefits and challenges of mLearning in two school-university partnerships using the following two research questions:

1. What are the benefits and challenges for schools and the University of adopting mLearning in ECE?
2. What are the impacts of mLearning implementation in schools on school-university partnerships?

The following five considerations were used to guide the study:

1. The level of engagement that children exhibited in working with mLearning.
2. How the partnership contributed to the practising teachers' technological knowledge.
3. How the authentic mLearning experiences contributed to PSTs' learning.
4. How synergy between practising teachers and PSTs helped each other to master mLearning for the benefit of student learning.
5. How the partnership contributed to the school and University communities.

The implications of the findings are considered under each of these five considerations.

9.2 The level of engagement that children exhibited in working with mLearning.

Findings from the practising teachers and PSTs indicated that children were motivated to participate in activities that included mLearning. When using mLearning tools, children were noted by participants to be engaged. mLearning tools were not found to distract children from learning. In this research, children were observed engaging with mLearning tools by practising teachers, PSTs, school leaders, University staff and parents and carers. Observers commented that the level of engagement exhibited by the children was high and that they were surprised how engaged and on task children were when using mLearning. The implication is that mLearning is engaging to children and when used in a developmentally appropriate manner, it is a tool that can enhance children's learning.

9.2.1 How the partnership contributed to the practising teachers' technological knowledge.

The mLearning partnership enabled the participating teachers to see first-hand, developmentally appropriate use of mLearning in the early childhood setting and develop their personal technological knowledge. The view of the University staff was that most of the participating teachers had low levels of technological knowledge and limited knowledge about integrating mLearning into their teaching and learning programs. Some of the teachers

rated their personal levels of technological knowledge highly but this translated into knowledge about hardware and software rather than how to integrate mLearning in the classroom to transform and enhance children's learning. As a result of engaging in the partnership the participating teachers all stated that their levels of technological knowledge and confidence using mLearning in the classroom increased. The gain in technological knowledge of the individual teachers varied depending upon the amount of personal time they were prepared to dedicate to mLearning. The implication of this finding is that teachers need to be selected to participate in an intervention such as the one in this research, and expected to share their new knowledge amongst peers. Participating teachers need to become technological leaders in their schools so that they can help colleagues understand how mLearning can be used to transform learning. Without specific professional development, many teachers do not know what they do not know and use mLearning in limited ways, if at all.

9.2.2 How the authentic mLearning experiences contributed to PSTs' learning.

According to all PSTs and University staff the mLearning experiences provided a rich learning experience for the PSTs. The level of effort the authentic PSTs put into their lessons exceeded that of the peer group. The PSTs gained practical experience in a real classroom and they gained real knowledge about integrating mLearning into their lessons. PSTs also had the opportunity to observe experienced early childhood teachers model tasks such as grouping children and rotating children from one group to another. The PSTs gained pedagogical experience and valuable feedback from the practising teachers on the lessons they delivered. The implication of this finding was that PSTs did not seem able to consider the needs of real children unless they were actually presenting a lesson to real children. The authentic teaching experience provided PSTs with an opportunity to use mLearning in the classroom with the support of University staff. The experience changed the views of many

PSTs about the use of mLearning in early childhood education because they saw first-hand that the children were engaged, motivated and learning. The PSTs had the potential to start an early childhood teaching career with real-world knowledge about using mLearning in the classroom setting.

9.2.3 How synergy between practising teachers and PSTs helped each other to master mLearning for the benefit of student learning.

For a partnership to be successful and ongoing, there have to be benefits for both partners. The synergy between the practising teachers and PSTs was an example of a mutually beneficial relationship. The teachers had the opportunity to observe mLearning being used purposely in the classroom and to observe the children in their classes whilst the PSTs were teaching. Most of the teachers sat with groups of PSTs and children, taking notes and asking many questions about the mLearning resources used. The PSTs had the support and guidance of the teachers to assist with class management if required. The meeting of the practising teachers and PSTs prior to the school visits made the experience more meaningful for both teacher groups. The PSTs gained knowledge about the children they would be teaching and the content the teacher wanted them to deliver. The practising teachers were reminded that the PSTs were only in the second year of a four-year degree. The practising teachers were able to provide a supportive environment for the PSTs having met them and gained an understanding of their prior knowledge and experience. The implication of this finding is that practising teachers and PSTs can learn from each other and partnerships between schools and universities provide valuable two-way learning opportunities.

9.2.4 How the partnership contributed to the school and University communities.

For the partnerships to be successful, they had to involve the school and University communities. In the schools, communities included parents and carers, staff not directly involved in the research and school Principals. School Principals were responsible for making

decisions regarding the purchase and use of mLearning resources. Staff, parents, and carers were members of the school communities with the ability to influence school Principals about future directions of the schools. Both of the participating schools became Independent Public Schools (IPS) in the final year, so the Principals needed the support of their school boards and Parents & Citizens (P & C) Associations to make changes and purchase mLearning resources. Both schools used business plans created by school boards to drive the implementation of mLearning. The success of the partnership at the classroom level was high but did not lead to significant changes in either school until a supportive Principal was appointed. Supportive principals selected staff to participate in the partnership so that these teachers could become technological leaders in their schools and share acquired knowledge with colleagues. The support of the wider school community enabled the mLearning partnerships to grow.

The partnerships took three years to develop to the point where they were self-sustaining and equally valued by the schools and the University. The themes discussed as ‘links in a chain’ in the previous chapter provide readers with key components that are vital for establishing school-university partnerships. The three-year duration of the research enabled the partnerships to develop and spread further than the classrooms directly involved. The schools contributed to the direction of the partnerships in the final year, but in the first two years, the direction and activities of the partnerships were directed mainly by the University. The research demonstrated that schools and universities could work together to implement mLearning in early childhood education. In the final year when the PSTs presented an mLearning workshop to parents, the partnership became a collaborative community partnership between the School B and the University. The idea was instigated by the school, delivered by the PSTs and mutually beneficial.

Early in the research, the researcher thought that the participating teachers would become technological leaders in their schools and share new knowledge with colleagues and school communities. The teachers did not become technological leaders during the research period, possibly because the school leadership did not realise the potential of the partnership or the teachers were not passionate enough to share new knowledge.

The mLearning partnerships led to the purchase of mLearning resources including iPads, Bee-Bots, and digital microscopes. These mLearning resources were used by PSTs and School of Education (SoE) staff involved in the partnerships and also by other SoE staff. The digital microscopes and Bee-Bots were used by SoE staff who had participated in the partnership in other teaching units. SoE staff who were not associated with the partnership used iPads but no other mLearning resource. Without direct exposure or knowledge about new technologies SoE teachers did not explore new technologies.

The implications of these findings are that the benefits of partnerships can go beyond the initial goals and bring additional benefits to both partners. For this to happen supportive leadership is necessary. Regular contact between partners is necessary to maintain the relationships developed and provide opportunities for partners to collaborate on future ideas.

9.3 Summary: Benefits of mLearning in early childhood education

The findings of this research support current literature that mLearning is beneficial to children's learning (Boyce et al., 2014; Ciampa, 2014; Chiong et al., 2012). The fact that mLearning is beneficial to children's learning and a requirement of many Australian government policies means that schools, teachers, and parents need to work together to ensure that children have the opportunities to engage in mLearning. Implementing mLearning in early childhood education can be beneficial for the following reasons:

- Enhanced learning experiences for children.

- mLearning supports the Australian Digital Technologies curriculum.
- mLearning can be used to support the Early Years Learning Framework (EYLF) (DEEWR, 2012) that sees Information and Communications Technology (ICT) as part of the multi-literacies environment that children will need, for full participation in the 21st century.
- mLearning can be used to support the National Professional Standards for Teachers in Australia. ICT is embedded into the standards (AITSL, 2012).
- ICT competence is embedded into the general capabilities of the Australian Curriculum (ACARA, 2013) and indicates that children at all stages need to use ICT effectively to investigate, create, and communicate across all learning areas.
- mLearning is well suited to early childhood education and allows children to investigate, create and communicate.
- Children appear to be motivated to engage in mLearning.

The implication of the benefits of mLearning for children, together with the importance placed on mLearning by educational policy documents, means that teachers will need to up-skill in order to gain the necessary technological knowledge for effective implementation of mLearning. Teachers need time, support and professional development to gain the skills to use mLearning in developmentally appropriate ways to enhance children's learning. Partnerships between schools and universities provide an affordable way for teachers to gain technological knowledge.

9.4 Summary: Challenges to mLearning in early childhood education

The challenges to mLearning in early childhood education are related to a lack of time for teachers to explore mLearning resources and learn how to implement these mLearning

resources into teaching programs. Time is needed for teachers to attend professional development modules, research new mLearning resources, as well as, experiment with and manage mLearning resources. The training of teachers in the use of mLearning needs to be supported by school leadership. Teachers also need to have a positive disposition toward mLearning and be willing and open to new ideas. The key challenges comprise:

- Lack of opportunities for teacher professional development.
- Lack of teacher technological knowledge.
- Lack of mLearning resources in schools.
- Lack of support for managing and maintaining mLearning resources.

9.5 School-University partnership

The partnerships in this research had a specific purpose (mLearning implementation in early childhood education). There were benefits for the schools and the University in terms of schools gaining technological knowledge and PSTs gaining valuable teaching experience. As the relationships within the partnerships grew the partnerships expanded beyond mLearning. The key factors for establishing partnerships are:

- Partnerships need time to develop.
- Partnerships need to be mutually beneficial.

The challenges for the University were timetabling units to fit in with the school day, ensuring that PSTs could travel from the University to the schools to teach without affecting learning within other units, and a lack of mLearning resources and staff technological knowledge to model mLearning across all units within degree courses. Another challenge for both schools and the University was addressing negative dispositions towards mLearning in early childhood education. If opportunities are not provided for members of the school and University communities to see first-hand the benefits of mLearning, then negative

dispositions will remain. An implication of this finding was that despite the need to include members of the school and University communities, in reality, it was difficult getting parents, carers and teachers to attend workshops after school hours. A supportive principal and ongoing commitment to try different approaches to entice community engagement were valuable. An area of this research that requires further investigation is the engagement of the SoE staff in mLearning implementation across a range of teaching units.

9.6 Recommendations

Employing technological leaders in schools and universities is an area worthy of future research. Technology in education is in a state of rapid change, with educators struggling to keep up with best practices (Delgado, 2015). Tracking the work of technological coaches in schools and universities who are trying to establish best practice would be worthwhile. Further recommendations include:

- Informing parents and carers about the educational use of new mLearning technologies.
- Providing information such as a handbook for participating teachers and school leaders so they know what to expect and how they can contribute to the partnership.
- School leaders selecting teachers prepared to engage in the partnership and share new knowledge.
- Allowing time for partnerships to develop.
- Schools and universities in partnerships need to be flexible to ensure that the partnership is mutually beneficial.
- Universities providing on-going support and professional learning opportunities for teachers, teacher educators and pre-service teachers.

- Continued authentic learning experiences for both practising and pre-service teachers in schools.
- Tracking alumni participating pre-service and practising teachers to see how they use mLearning following the authentic mLearning experiences.
- Supporting participating pre-service and practising teachers to become technology leaders and recording their developmental journeys.

9.7 Conclusion

Further research would be to track how specific teachers in a school or university use mLearning in the classroom over an extended period. In particular, efforts could be focused on how teachers and students use mLearning in different learning areas and the type of use of the mLearning tool. Furthermore, teacher's use of mLearning and its effect on mLearning in a school or university would be an area for additional research.

9.8 Final comments and personal impact statement

The three-year research has yielded many positive outcomes in terms of children's learning. As schools increase spending on mLearning resources, it is important that evidence-based research is used to justify such spending and ensure that the potential benefits to children's learning are maximised.

This project had a considerable impact on me as the researcher. I observed many PSTs delivering well thought out lessons that used mLearning to enhance the learning outcomes for their students. These lessons impressed the classroom teachers, school leaders and other SoE staff. I was surprised at the difference in the standard of the lessons produced

by the PSTs in the peer and authentic groups. The authentic lessons encouraged the PSTs to go beyond their normal efforts and thus, I believe, helped them gain much more from the partnership experience. I trust that they will be able to go forward in their teaching careers better informed about how to use mLearning as a creative tool for enhancing children's learning.

It was a privilege observing PSTs in the second year of a four-year degree delivering professional development to parents and carers. I witnessed how parents' and carers' dispositions towards mLearning changed as they gained an understanding about mLearning, being used in a developmentally appropriate manner, and how it can be harnessed as a tool to enhance children's learning. It was heart-warming to be part of the shared excitement between the PSTs, teachers, leaders, parents and carers and children who participated in the authentic mLearning experiences involved in this research.

References

- Akcaoglu, M., Gumus, S., Bellibas, M. S., & Boyer, D. M. (2014). Policy, practice, and reality: Exploring a nation-wide technology implementation in Turkish schools. *Technology, Pedagogy and Education, 24*(4), 477- 491.
doi:10.1080/1475939X.2014.899264
- Alliance for Childhood. (2004). *Tech tonic: Towards a new literacy for technology*. Retrieved from
http://www.allianceforchildhood.org/sites/allianceforchildhood.org/files/file/pdf/projects/computers/pdf_files/tech_tonic.pdf
- Ally, M. (2009). *Mobile learning: Transforming the delivery of education and training*. Edmonton: Athabasca University Press.
- Alper, M. (2013). Developmentally appropriate new media literacies: Supporting cultural competencies and social skills in early childhood education. *Journal of Early Childhood Literacy, 13*(2), 175-196. doi:10.1177/1468798411430101
- Andrews, T. (2012). What is social constructionism. *Grounded Theory Review, 11*(1), 39-46.
- Apple. (2016). *iPad in education*. Retrieved from
<http://www.apple.com/au/education/ipad/apps-books-and-more/>
- Arthur, L., Beecher, B., & Downes, T. (2001). Effective learning environments for young children using digital resources: An Australian perspective. *Information Technology in Childhood Education Annual, 139-153*.

- Ash, K. (2010). Teachers testing mobile-learning methods: Best practices are emerging as educators begin to figure out how to incorporate mobile devices into classroom learning. *Education Week*, 29(26), 26-27.
- Australian Bureau of Statistics. (2010). *Internet activity Australia June 2010*. Retrieved from <http://www.abs.gov.au/AUSSTATS/abs@.nsf/0/>
- Australian Bureau of Statistics. (2015). *Internet activity Australia June 2015*. Retrieved from <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8153.0/>
- Australian Curriculum and Reporting Authority [ACARA]. (2013). *Effective and sustainable university-school partnerships: Beyond determined efforts by inspired individuals*. Retrieved from http://www.aitsl.edu.au/docs/default-source/default-document-library/effective_and_sustainable_university-school_partnerships
- Australian Institute for Teaching and School Leadership [AITSL]. (2012). *National professional standards for teachers and school leaders*. Retrieved from <http://www.teacherstandards.aitsl.edu.au/>
- Australian Institute for Teaching and School Leadership [AITSL]. (2014). *Accredited programs list*. Retrieved from <http://www.aitsl.edu.au/initial-teacher-education/accredited-programs-list>
- Australian Government Department of Education, Employment and Workplace Relations [DEEWR]. (2008). *Strategic plan to guide the implementation of the digital education initiative and related initiatives*. Retrieved from http://foi.deewr.gov.au/system/files/d11_210892_digital_education_revolution_strategic_plan20110419.pdf

Australian Government Department of Education, Employment and Workplace Relations [DEEWR]. (2012). *Belonging, being and becoming: The early years learning framework for Australia*. Canberra: Early Childhood Australia.

Australian Government Department of Education, Employment and Workplace Relations. (2013). *Beyond the classroom: A new digital education for young Australians in the 21st century*. Retrieved from https://docs.education.gov.au/system/files/doc/other/deag_final_report.pdf

Australian Government Department of Education and Training. [DEEWR] (2015a). *Action now: Classroom ready teachers*. Retrieved from https://docs.education.gov.au/system/files/doc/other/action_now_classroom_ready_teachers_print.pdf

Australian Government Department of Education and Training. (2015b). *Inspiring all Australians in digital literacy and STEM*. Retrieved from <https://www.education.gov.au/inspiring-all-australians-digital-literacy-and-stem>

Australian Government Department of Education and Training. (2015c). *Students first*. Retrieved from <https://www.studentsfirst.gov.au/>

Australian Government Department of Education and Training. (2016). *Independent public schools*. Retrieved from <https://www.education.gov.au/independent-public-schools>

Bakir, N. (2015). An exploration of contemporary realities of technology and teacher education: Lessons learned. *Journal of Digital Learning in Teacher Education*, 31(3), 117-130. doi:10.1080/21532974.2015.1040930

- Baran, E. (2014). A review of research on mobile learning in teacher education. *Educational Technology & Society, 17*(4), 17-32.
- Barnes, M. (2010). Solving the problem of childhood obesity within a generation. *White House Task Force on Childhood Obesity Report to the President. Washington, DC.*
- Bartolini Bussi, M., & Baccaglioni-Frank, A. (2015). Geometry in early years: Sowing seeds for a mathematical definition of squares and rectangles. *ZDM, 47*(3), 391-405.
doi:10.1007/s11858-014-0636-5
- Basit, T. (2003). Manual or electronic? The role of coding in qualitative data analysis. *Educational Research, 45*(2), 143-154.
- Bate, F. (2010). A bridge too far? Explaining beginning teachers' use of ICT in Australian schools. *Australasian Journal of Educational Technology, 26*(7), 1042-1061.
- Bate, F., & Maor, D. (2010, November). TPACK and the real world: How useful is the framework? Paper presented at the *European Association for Practitioner Research on Improving Learning (EAPRIL) Conference*. Lisbon, Portugal.
- Bauer, S., & Brazer, D. (2010). New Principal isolation and efficacy. In S. Conley, & B. Cooper (Eds.), *Preparing and orienting tomorrow's school leaders: Critical issues, useful solutions* (pp. 89-112). Lanham: Rowman & Littlefield Education.
- Beetham, H., & Sharpe, R. (2013). *Rethinking pedagogy for a digital age: Designing for 21st century learning* (2nd ed.). New York: Routledge.
- Berg, B. (2001). *Qualitative research methods for the social sciences* (4th ed.). Boston: Allyn and Bacon.

- Bickel, W. E., & Hatrup, R. A. (1995). Teachers and researchers in collaboration: Reflections on the process. *American Educational Research Journal*, 32(1), 35-62.
doi:10.2307/1163212
- Binboga, E., & Korhan, O. (2014). Posture, musculoskeletal activities, and possible musculoskeletal discomfort among children using laptops or tablet computers for educational purposes: A literature review. *Journal of Science Education and Technology*, 23(5), 605.
- Birks, M., Chapman, Y., & Francis, K. (2008). Memoing in qualitative research: Probing data and processes. *Journal of Research in Nursing*, 13(1), 68-75.
doi:10.1177/1744987107081254
- Bird, J., & Edwards, S. (2015). Children learning to use technologies through play: A digital play framework. *British Journal of Educational Technology*, 46(6), 1149-1160.
doi:10.1111/bjet.12191
- Bittman, M., Rutherford, L., Brown, J., & Unsworth, L. (2011). Digital natives? New and old media and children's outcomes. *Australian Journal of Education*, 55(2), 161-175.
- Blackwell, C. K., Lauricella, A. R., & Wartella, E. (2014). Factors influencing digital technology use in early childhood education. *Computers & Education*, 77, 82-90.
- Booth, A., & Dunn, J. F. (2013). *Family-school links: How do they affect educational outcomes?* New York: Routledge.
- Boyce, C., Mishra, C., Halverson, K., & Thomas, A. (2014). Getting students outside: Using technology as a way to stimulate engagement. *Journal of Science Education and Technology*, 23(6), 815-826. doi:10.1007/s10956-014-9514-8

- Boyce, C., & Neale, P. (2006). *Conducting in-depth interviews: A guide for designing and conducting in-depth interviews for evaluation input* (pp. 3-7). Watertown, MA: Pathfinder International.
- Boyle, R. (2001). Gary Stager: A progressive educator. *Practising Administrator*, 23(2), 36-37.
- Bowen, G. A. (2008). Naturalistic inquiry and the saturation concept: A research note. *Qualitative Research*, 8(1), 137-152.
- Brantley-Dias, L., & Ertmer, P. A. (2013). Goldilocks and TPACK: Is the construct 'just right?' *Journal of Research on Technology in Education*, 46(2), 103.
- Brown, A., Mulligan, D., Altmann, T., Christakis, D., Clarke-Pearson, K., Falik, H.,...Noland, V. (2011). Media use by children younger than 2 years. *Pediatrics*, (128)5, 1040-1045.
- Brown, A., Shifrin, D. L., & Hill, D. L. (2015). Beyond 'turn it off': How to advise families on media use. *AAP News*, 36(10), 54-54.
- Bubb, S., & Earley, P. (2013). The use of training days: Finding time for teachers' professional development. *Educational Research*, 55(3), 236-248.
doi:10.1080/00131881.2013.825161
- Buchanan, E., & Hvizdak, E. (2009). Online survey tools: Ethical and methodological concerns of human research ethics committees. *Journal of Empirical Research on Human Research Ethics*, 4(2), 37-48.

- Buckingham, D. (2013). *Beyond technology: Children's learning in the age of digital culture*. Cambridge: Polity Press.
- Burns, R. (1994). *Introduction to research method*. Melbourne: Longman.
- Butcher, J., Bezzina, M., & Moran, W. (2011). Transformational partnerships: A new agenda for higher education. *Innovative Higher Education*, 36(1), 29-40. doi:10.1007/s10755-010-9155-7
- Cahill, M., & McGill-Franzen, A. (2013). Selecting “App” ealing and “App” ropriate book apps for beginning readers. *The Reading Teacher*, 67(1), 30-39. doi:10.1002/TRTR.1190
- Campaign for a Commercial-Free Childhood & Alliance for Childhood. (2012). *Facing the screen dilemma: Young children, technology and early education*. Retrieved from <http://www.commercialfreechildhood.org/screendilemma>
- Campbell, A., & Scotellaro, G. (2009). Learning with technology for pre-service early childhood teachers. *Australasian Journal of Early Childhood*, 34(2), 11-18.
- Campbell, C., & Macnish, J. (2010,). Pre-service teachers using The Le@rning Federation's digital resources. In J. Herrington & C. Mortgomerie (Eds.), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications* (pp 47-51). Toronto, Canada.
- Castle, J. (1997). Rethinking mutual goals in school-university collaboration. In H. Christiansen, L. Goulet, H. Krentz, & C. Maeers (Eds.), *Collaboration and educational reform* (pp. 59-67). New York: State University of New York.

- Carson, V., Tremblay, M. S., Spence, J. C., Timmons, B. W., & Janssen, I. (2013). The Canadian sedentary behaviour guidelines for the early years (zero to four years of age) and screen time among children from Kingston, Ontario. *Paediatrics and Child Health, 18*(1), 25-28.
- Cavanaugh, C., Hargis, J., Kamali, T., & Soto, M. (2013). Substitution to augmentation: Faculty adoption of iPad mobile learning in higher education. *Interactive Technology and Smart Education, 10*(4), 270-284.
- Center for Digital Education. (2010). *Chicago public schools launches iPad trials*. Retrieved from <http://www.centerdigitaled.com/classtech/CPS-iPad-trial.html>
- Chadwick, S. (2014). *Impacts of cyberbullying, building social and emotional resilience in schools*. DE: Springer Verlag. doi:10.1007/978-3-319-04031-8
- Chen, J., & Chang, C. (2006). Using computers in early childhood classrooms: Teachers' attitudes, skills and practices. *Journal of Early Childhood Research, 4*(2), 169-188. doi:10.1177/1476718X06063535
- Chiong, C., Ree, J., Takeuchi, L. & Erickson, I. (2012). *Print books vs. e-book: Comparing parent-child co-reading on print, basic and enhanced e-book platforms*. Retrieved from www.joanganzcooneycenter.org/upload_kits/jgcc_ebooks_quickreport.pdf
- Chiu, T. K. F., & Churchill, D. (2016). Adoption of mobile devices in teaching: Changes in teacher beliefs, attitudes and anxiety. *Interactive Learning Environments, 24*(2), 317-11. doi:10.1080/10494820.2015.1113709

- Chorzempa, B. F., Isabelle, A. D., & de Groot, C. (2010). Our quest for mutualism in university–school partnerships. *Educational Forum*, 74(4), 306-317.
doi:10.1080/00131725.2010.507084
- Christie, A. (2000). A collaborative technology partnership. In D. Willis, J. Price & J. Willis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2000* (pp. 1470-1473). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).
- Ciampa, K. (2014). Learning in a mobile age: An investigation of student motivation. *Journal of Computer Assisted Learning*, 30(1), 82-96. doi:10.1111/jcal.12036
- Clark, C., Zhang, S., & Strudler, N. (2015). Teacher candidate technology integration: For student learning or instruction? *Journal of Digital Learning in Teacher Education*, 31(3), 93-106.
- Clark, R. W. (1999). School-university partnerships and professional development schools. *Peabody Journal of Education*, 74(3), 164-177. doi:10.1207/s15327930pje7403&4_13
- Clarke, G., & Zagarell, J. (2012). Teachers and technology: A technological divide. *Childhood Education*, 88(2), 136.
- Clausen, J. M., Britten, J., & Ring, G. (2008). Envisioning effective laptop initiatives. *Learning & Leading with Technology*, 36(1), 18-22.
- Cochrane, T., & Bateman, R. (2010). Smartphones give you wings: Pedagogical affordances of mobile web 2.0. *Australasian Journal of Educational Technology*, 26(1), 1-14.

- Cochran-Smith, M., & Lytle, S. L. (1993). *Inside/outside: Teacher research and knowledge*. New York: Teachers College Press.
- Collins. (2014). *Collins English Dictionary*. London: Harper Collins Publishers Limited.
- Common Sense Media. (2014). Zero to eight: Children's media use in America 2013. *Education Digest*, 79(6), 59-63.
- Couse, L., & Chen, D. (2010). A tablet computer for young children? Exploring its viability for early childhood education. *Journal of Research on Technology in Education*, 43(1), 75-98.
- Crawford, P. A., Roberts, S. K., & Hickmann, R. (2009). All together now: Authentic university-school partnerships for professional development. *Childhood Education*, 85(2), 91-95. doi:10.1080/00094056.2009.10523070
- Creswell, J. (2005). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.
- Crevani, L., Lindgren, M., & Packendorff, J. (2007). Shared leadership: A post-heroic perspective on leadership as a collective construction. *International Journal of Leadership Studies*, 3(1), 40-67.
- Crevani, L., Lindgren, M., & Packendorff, J. (2010). Leadership, not leaders: On the study of leadership as practices and interactions. *Scandinavian Journal of Management*, 26(1), 77-86.

- Crompton, H. (2013). A historical overview of mobile learning: Toward learner-centered education. In Z. Berge & L. Muilenburg (Eds.), *Handbook of mobile learning* (pp. 3-14). Florence: KY: Routledge.
- Crotty, M. (1998). *The foundations of social research: Meaning and perspectives in the research process*. London, UK: Sage.
- Curriculum Corporation. (2006). *Statements of learning for ICT*. Retrieved from http://www.curriculum.edu.au/verve/_resources/SOL06_ICT.pdf
- Cutter-Mackenzie, A., & Edwards, S. (2013). Toward a model for early childhood environmental education: Foregrounding, developing, and connecting knowledge through play-based learning. *The Journal of Environmental Education*, 44(3), 195-213.
- Dawson, K., & Norris, A. (2000). Preservice teachers' experiences in a K-12/university technology-based field initiative: Benefits, facilitators, constraints, and implications for teacher educators. *Journal of Computing in Teacher Education*, 17(1), 4-12.
- de Lange, C. (2014). *Children benefit from the right sort of screen time*. Retrieved from <https://www.newscientist.com/article/dn25297-children-benefit-from-the-right-sort-of-screen-time/>
- Delgado, A. (2015). Educational technology: A review of the integration, resources, and effectiveness of technology in K-12 classrooms. *Journal of Information Technology Education*, 14 (1), 397-416.
- DeLoache, J. S., Chiong, C., Sherman, K., Islam, N., Vanderborght, M., Troseth, G. L., ... O'Doherty, K. (2010). Do babies learn from baby media? *Psychological Science*, 21(11), 1570-1574. doi:10.1177/0956797610384145

- Denzin, N., & Lincoln, Y. (1998). *Collecting and interpreting qualitative materials*. Thousand Oaks, CA: Sage.
- Denzin, N., & Lincoln, Y. (Eds.). (2005). *The Sage handbook of qualitative research* (3rd ed.). Thousand Oaks, CA: Sage.
- Department of Education. (2013). *National curriculum for England: Computing programmes of study*. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/239033/PRIMARY_national_curriculum_-_Computing.pdf
- Dolasia, D. (2015). *Taiwan's new law imposes fines on parents that allow kids to spend "excessive" time on electronic devices*. Retrieved from <http://www.dogonews.com/2015/2/15/taiwans-new-law-imposes-fines-on-parents-that-allow-kids-to-spend-excessive-time-on-electronic-devices>
- Dunaney, D. (2001). Teacher education: Preparing teachers to integrate technology. *International Journal of Instructional Media*, 28(1)
- Ebbeck, M., Yim, H. Y. B., & Lee, L. W. M. (2013). Play-based learning. In D. Pendergast & S. Garvis (Eds.), *Teaching early years: Curriculum, pedagogy and assessment* (pp. 185-200). Sydney, New South Wales: Allen & Unwin.
- Education Services Australia. (2011). *Teaching teachers for the future*. Retrieved from <http://www.esa.edu.au/projects/teaching-teachers-future>
- Education Services Australia. (2016). *Scootle*. Retrieved from <https://www.scootle.edu.au/ec/p/about>

- Education World. (2012). *Encouraging teacher technology use*. Retrieved from http://www.educationworld.com/a_tech/tech159.shtml
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532-550.
- Elliott-Hall, G. (2013). Learning together with iPads. *Every Child*, *19*(4), 22-23.
- Emerson, L., Fox, S., & Fear, J. (2012). *Options to promote parental engagement in school education: A preliminary systems analysis*. A report by the Australian Research Alliance for Children and Youth (ARACY). Retrieved from https://www.aracy.org.au/publicationsresources/command/download_file/id/7/filename/Parental_engagement_in_learning_and_schooling_Lessons_from_research_BUREAU_ARACY_August_2012.pdf
- Emerson, R. M., Fretz, R. I., & Shaw, L. L. (2001). Participant observation and fieldnotes. In P. Atkinson, A. Coffey, S. Delamont, J. Loftland & L. Loftland (Eds.), *Handbook of Ethnography* (pp. 352-368), London, UK: Sage.
- English, A. M. (2013). Partnerships with academic departments. *New Directions for Adult and Continuing Education*, *2013*(140), 27-37. doi:10.1002/ace.20071
- Erickson, F. (1986). Qualitative methods in research on teaching. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 119-161). New York: Macmillan.
- Erstad, O., Eickelmann, B., & Eichhorn, K. (2015). Preparing teachers for schooling in the digital age: A meta-perspective on existing strategies and future challenges. *Education and Information Technologies*, *20*(4), 641-654.

- Evans, R. (2004). Strategies for effective partnership. *The RUSI Journal*, 149(2), 60-62.
doi:10.1080/03071840408522969
- Fabricant, M., & Fine, M. (2012). *Charter schools and the corporate makeover of public education: What's at stake?* New York: Teachers College Press.
- Fenty, N. S., & Anderson, E. M. (2014). Examining educators' knowledge, beliefs, and practices about using technology with young children. *Journal of Early Childhood Teacher Education*, 35(2), 114-134. doi:10.1080/10901027.2014.905808
- Flewitt, R., Messer, D., & Kucirkova, N. (2014). New directions for early literacy in a digital age: The iPad. *Journal of Early Childhood Literacy*, 15(3), 289-310.
- Foote, C. (2012). iPads for everyone. *School Library Journal*, 58(10), 30.
- Froebel, F., & Jarvis, J. (2003). *Friedrich Froebel's pedagogics of the kindergarten, or, his ideas concerning the play and playthings of the child*. Honolulu, Hawaii: University Press of the Pacific.
- Fullan, M. (2014). *A rich seam: How new pedagogies find deep learning*. Retrieved from http://www.michaelfullan.ca/wp-content/uploads/2014/01/3897.Rich_Seam_web.pdf
- Gallo, M. (2007). *Learning at the centre—Under what terms: How does the convergence of care and education terminology in the Irish early childhood sector present an opportunity for learning at the centre of policy?* Retrieved from <http://www.childhoodstoday.org/download.php?id=10>
- Gardiner, V., & Cumming-Potvin, W. (2015). Conceptual and contextual contradictions: How a group of primary school teachers negotiated professional learning in a

- multiliteracies book club. *Australian Journal of Teacher Education*, 40(7), 15-31.
doi:<http://dx.doi.org/10.14221/ajte.2015v40n7.2>
- Geist, E. A. (2012). A qualitative examination of two year-olds interaction with tablet based interactive technology. *Journal of Instructional Psychology*, 39(1), 26-35.
- Gentile, M. (2012). The importance of managing iPads in the classroom. *Education Digest: Essential Readings Condensed for Quick Review*, 78(3), 11-13.
- Getting, S., & Swainey, K. (2012). First graders with iPads? *Learning & Leading with Technology*, 40(1), 24-27.
- Gill, L., Dalgarno, B., & Carlson, L. (2015). How does pre-service teacher preparedness to use ICTs for learning and teaching develop through their degree program? *Australian Journal of Teacher Education (Online)*, 40(1), 36-59.
- Gómez, F., Nussbaum, M., Weitz, J. F., Lopez, X., Mena, J., & Torres, A. (2013). Co-located single display collaborative learning for early childhood education. *International Journal of Computer-Supported Collaborative Learning*, 8(2), 225-244. doi:10.1007/s11412-013-9168-1
- Goodlad, J. I. (1991). School-university partnerships. *The Education Digest*, 56(8), 58.
- Goodwin, K., & Highfield, K. (2012, March). iTouch and iLearn: An examination of 'educational' Apps. Paper presented at the *Early Education and Technology for Children Conference*. Salt Lake City, Utah.
- Government of Western Australia. (2015). *Investment in mobile classrooms for the future*. Retrieved from

<https://www.mediastatements.wa.gov.au/Pages/Barnett/2015/12/Investment-in-mobile-classrooms-for-the-future.aspx>

Government of Western Australia. (2016). *Independent Public Schools*. Retrieved from <https://www.education.wa.edu.au/web/our-schools/independent-public-schools>

Granic, I., Lobel, A., & Engels, R. (2014). The benefits of playing video games. *American Psychologist*, *69*(1), 66.

Greenfield, D., Braithwaite, J., Pawsey, M., Johnson, B., & Robinson, M. (2009). Distributed leadership to mobilise capacity for accreditation research. *Journal of Health Organization and Management*, *23*(2), 255-267. doi:10.1108/14777260910960975

Gronn, P. (2008). The future of distributed leadership. *Journal of Educational Administration*, *46*(2), 141-158.

Guba, E., & Lincoln, Y. (1994). Competing paradigms in qualitative methods. In N. Denzin, & Y. Lincoln. (Eds.), *Handbook of qualitative research* (pp. 105-118). Thousand Oaks, CA: Sage.

Halfpenny, P. (1987). Laws, causality and statistics: positivism, interpretivism and realism. *American Sociological Review*, *50*, 288-391.

Hall, J., & Ryan, K. (2011). Educational Accountability: A qualitatively driven mixed-methods approach. *Qualitative Inquiry*, *17*(1), 105-115.

Handal, B., Campbell, C., Cavanagh, M., Petocz, P. & Kelly, N. (2012). Integrating technology, pedagogy and content in mathematics education. *Journal of Computers in Mathematics and Science Teaching*, *31*(4), 387- 413.

- Handal, B., Ritter, R. & Marcovitz, D. (2014). Implementing large scale mobile learning school programs: To BYOD or not to BYOD. In J. Viteli & M. Leikomaa (Eds.), *Proceedings of World Conference on Educational Media and Technology* (pp. 47-51). Tampere, Finland: AACE.
- Hargreaves, A., & Goodson, I. (2006). Educational change over time? The sustainability and nonsustainability of three decades of secondary school change and continuity. *Educational Administration Quarterly*, 42(1), 3-41.
- Harris, J., & Hofer, M. (2011). Technological pedagogical content knowledge (TPACK) in action: A descriptive study of secondary teachers' curriculum-based, technology-related instructional planning. *Journal of Research on Technology in Education*, 43(3), 211-229.
- Haydn, T. (2014). How do you get pre-service teachers to become 'good at ICT' in their subject teaching? The views of expert practitioners. *Technology, Pedagogy and Education*, 23(4), 455-469. doi:10.1080/1475939X.2014.892898
- Hays, P. A. (2004). Case study research. In K. deMarrais, & S. Lapan (Eds.), *Foundations for research: Methods of inquiry in education and social sciences* (pp. 217-234). Denmark: Lawrence Erlbaum Associates.
- He, M., Irwin, J., Bouck, L., Tucker, P., & Pollett, G. (2005). Screen-viewing behaviors among preschoolers: Parents' perceptions. *American Journal of Preventive Medicine*, 29(2), 120-125.
- Heikka, J., & Waniganayake, M. (2011). Pedagogical leadership from a distributed perspective within the context of early childhood education. *International Journal of Leadership in Education*, 14(4), 499-512. doi:10.1080/13603124.2011.577909

- Henderson, S., & Yeow, J. (2012, January). iPad in education: A case study of iPad adoption and use in a primary school. Paper presented at the *45th International Conference on System Science*. Hawaii, USA.
- Henry, J. J., & Barnett, M. (2004). Enriching the early childhood expertise of elementary school Principals: Can a one-shot college course make a difference? *Journal of Early Childhood Teacher Education*, 25(1), 61-65. doi:10.1080/1090102040250109
- Hernandez, I., & Preston, J. L. (2013). Disfluency disrupts the confirmation bias. *Journal of Experimental Social Psychology*, 49(1), 178-182.
- Hesterman, S. (2011a). A contested space: The dialogic intersection of ICT, multiliteracies, and early childhood. *Contemporary Issues in Early Childhood*, 12(4), 349-361. doi:10.2304/ciec.2011.12.4.349
- Hesterman, S. (2011b). Multiliterate star wariars: The force of popular culture and ICT in early learning. *Australasian Journal of Early Childhood*, 36(4), 86-95.
- Hesterman, S. (2013). Early childhood designs for multiliteracies learning. *The Australian Journal of Language and Literacy*, 36(3), 158-168.
- Highfield, K. (2010). Robotic toys as a catalyst for mathematical problem solving. *Australian Primary Mathematics Classroom*, 15(2), 22-27.
- Hill, C. (2010). Speaking my mind: Giving Mrs. S more time to teach. *The English Journal*, 99(5), 111-112.
- Hill, J. A. (2011). Endangered childhoods: How consumerism is impacting child and youth identity. *Media, Culture & Society*, 33(3), 347-362.

- Hinkley, T., Salmon, J., Okely, A. D., & Crawford, D. (2013). The correlates of preschoolers' compliance with screen recommendations exist across multiple domains. *Preventive Medicine, 57*(3), 212-219. doi:10.1016/j.ypmed.2013.05.020
- Hirsh-Pasek, K., Zosh, J. M., Golinkoff, R. M., Gray, J. H., Robb, M. B., & Kaufman, J. (2015). Putting education in “educational” apps: Lessons from the science of learning. *Psychological Science in the Public Interest, 16*(1), 3-34.
doi:10.1177/1529100615569721
- Holloway, D., Green, L., & Livingstone, S. (2013). *Zero to eight: Young children and their internet use*. LSE London: EU Kids Online.
- Hudson, P., English, L. D., Dawes, L., & Macri, J. (2012). Contextualizing a university-school STEM education collaboration: Distributed and self-activated leadership for project outcomes. *Educational Management Administration & Leadership, 40*(6), 772-785. doi:10.1177/1741143212456915
- Hutchison, A., & Beschoner, B. (2015). Using the iPad as a tool to support literacy instruction. *Technology, Pedagogy and Education, 24*(4), 407-422.
doi:10.1080/1475939X.2014.918561
- Hutchison, A., Beschoner, B., & Schmidt-Crawford, D. (2012). Exploring the use of the iPad for literacy learning. *Reading Teacher, 66*(1), 15-23.
- Hutchison, A., Nadolny, L., & Estapa, A. (2016). Using coding apps to support literacy instruction and develop coding literacy. *The Reading Teacher, 69*(5), 493-503.
doi:10.1002/trtr.1440

- Independent Schools Council of Australia. (2016). *Autonomy and accountability*. Retrieved from <http://isca.edu.au/about-independent-schools/autonomy-and-accountability-of-independent-schools/>
- Iyer, E. (2003). Theory of alliances: Partnership and partner characteristics. *Journal of Nonprofit & Public Sector Marketing*, 11(1), 41-57. doi:10.1300/J054v11n01_04
- Jackson, R., Drummond, D., & Camara, S. (2007). What is qualitative research? *Qualitative Research Reports in Communication*, 8(1), 21-28.
- Janka, P. (2008). Using a programmable toy at preschool age: Why and how. In N. Ando, S. Balakirsky, T Hemker, M Reggiani & O. von Stryk (Eds.), *Proceedings of International Conference on Simulation, Modeling and Programming for Autonomous Robots* (pp. 112-121). Venice, Italy.
- Jarvis, P. (2013). *Universities and corporate universities: The higher learning industry in global society*. New York: Routledge.
- Jauhari, V., & Thomas, R. (2013). Developing effective university-industry partnerships: An introduction. *Worldwide Hospitality and Tourism Themes*, 5(3), 238-243.
doi:10.1108/WHATT-02-2013-0006
- Jeong, H. I., & Kim, Y. (2016). The acceptance of computer technology by teachers in early childhood education. *Interactive Learning Environments*, 1, 1-17.
doi:10.1080/10494820.2016.1143376
- Jonassen, D. H. (2008). *Meaningful learning with technology* (3rd ed.). Upper Saddle River, NJ: Pearson Education.

Jonassen, D., Howland J., Moore, J., & Marra, R. (2003). *Learning to solve problems with technology: A constructivist perspective* (2nd ed.]. Upper Saddle River, N.I: Merrill Prentice Hall

Jonassen, D., & Kim, B. (2010). Arguing to learn and learning to argue: Design justifications and guidelines. *Educational Technology Research and Development*, 58(4), 439-457. doi:10.1007/s11423-009-9143-8

Johnson, R., & Onwuegbuzie, A. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.

Jones, M., Ryan, J., & Eckersley, B. (2014). *Successful teacher education: Partnerships, reflective practice and the place of technology*. Rotterdam, Netherlands: Sense Publishers. doi:10.1007/978-94-6209-677-6

Judson, E. (2006). How teachers integrate technology and their beliefs about learning: Is there a connection? *Journal of Technology and Teacher Education*, 14(3), 581-597.

Kazakoff, E., & Bers, M. (2014). Put your robot in, put your robot out: Sequencing through programming robots in early childhood. *Journal of Educational Computing Research*, 50(4), 553-573.

Kazakoff, E., Sullivan, A., & Bers, M. (2013). The effect of a classroom-based intensive robotics and programming workshop on sequencing ability in early childhood. *Early Childhood Education Journal*, 41(4), 245-255. doi:10.1007/s10643-012-0554-5

- Keane, T. (2008). Lead on: ICT leadership in schools. *Teacher*, 197, 14-17.
- Keengwe, J., & Onchwari, G. (2009). Technology and early childhood education: A technology integration professional development model for practicing teachers. *Early Childhood Education Journal*, 37(3), 209-218. doi:10.1007/s10643-009-0341-0
- Kehrwald, B., & McCallum, F. (2015). Degrees of change: Understanding academics experiences with a shift to flexible technology-enhanced learning in initial teacher education. *The Australian Journal of Teacher Education*, 40(7), 43-56.
- Kervin, L., Vialle, W., Herrington, J., & Okely, T. (2015). *Research for educators*. (2nd ed.). South Melbourne, Victoria: Thomson Social Science Press.
- Kiger, D., Herro, D., & Prunty, D. (2012). Examining the influence of a mobile learning intervention on third grade math achievement. *Journal of Research on Technology in Education*, 45(1), 61-82.
- Kiili, K. (2003). Technology access: Resources wasted in computer laboratories. In C. Dowling, L. Kwok-Wing (Eds.), *Information and Communication Technology and the Teacher of the Future* (pp. 251-255). Springer US.
- Killion, J. (2011). The perfect partnership: What it takes to build and sustain relationships that benefit students. *Journal of Staff Development*, 32(1), 10-12.
- King, M. B., & Newmann, F. M. (2000). Will teacher learning advance school goals? *The Phi Delta Kappan*, 81(8), 576-580
- Kitzinger, J. (2000). Media templates: patterns of association and the (re) construction of meaning over time. *Media, Culture & Society*, 22(1), 61-84.

- Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education (CITE Journal)*, 9(1), 60-70.
- Koh, J., Chai, C., & Tsai, C. (2014). Demographic factors, TPACK constructs, and teachers' perceptions of constructivist-oriented TPACK. *Journal of Educational Technology & Society*, 17(1), 185.
- Kolb, A., & Kolb, D. (2009). The learning way: Meta-cognitive aspects of experimental learning. *Simulation & Gaming*, 40(3), 297.
- Korat, O., & Shamir, A. (2012). Direct and indirect teaching: Using e-books for supporting vocabulary, word reading, and story comprehension for young children. *Journal of Educational Computing Research*, 46(2), 135-152.
- Krueger, R. A., & Casey, M. A. (2000). *Focus groups: A practical guide for applied research*. Thousand Oaks, CA: Sage.
- Lafton, T. (2012). How early childhood practitioners build, shape, and construct their digital practices: The search for an analytical space. *Nordic Journal of Digital Literacy*, 7(3), 172-186.
- Larson, L. (2015, May). The learning potential of e-books. *Teaching with Mobile Tech*, 72, 42-46.
- Ledoux, M. W., & McHenry, N. (2008). Pitfalls of school-university partnerships. *The Clearing House*, 81(4), 155-160. doi:10.3200/TCHS.81.4.155-160

- Liu, F., Ritzhaupt, A., & Cavanaugh, C. (2013). Leaders of school technology innovation: A confirmatory factor analysis of the change facilitator style questionnaire (CFSQ). *Journal of Educational Administration, 51*(5), 576-593. doi:10.1108/JEA-01-2012-0011
- Liu, M., Scordino, R., Geurtz, R., Navarrete, C., Ko, Y., & Lim, M. (2014). A look at research on mobile learning in K–12 education from 2007 to the present. *Journal of Research on Technology in Education, 46*(4), 325-372.
doi:10.1080/15391523.2014.925681
- Lock, J. V. (2015). Designing learning to engage students in the global classroom. *Technology, Pedagogy and Education, 24*(2), 137-153.
doi:10.1080/1475939X.2014.946957
- Luke, C. (2000). What next? Toddler netizens, playstation thumb, techno-literacies. *Contemporary Issues in Early Childhood, 1*(1), 95-100. doi:10.2304/ciec.2000.1.1.10
- Luparenko, S. (2014). The negative influence of technical means on children's development. *Bulgarian Journal of Science and Education Policy, 8*(1), 70.
- Lydon, S., & King, C. (2009). Can a single, short continuing professional development workshop cause change in the classroom? *Professional Development in Education, 35*(1), 63-82.
- Lynch, J. & Redpath, T. (2012). 'Smart' technologies in early years literacy education: A meta-narrative of paradigmatic tensions in iPad use in an Australian preparatory classroom. *Journal of Early Childhood Literacy, 14*(2), 147-174.

- Male, T., & Burden, K. (2014). Access denied? Twenty-first-century technology in schools. *Technology, Pedagogy and Education, 23*(4), 423-437.
doi:10.1080/1475939X.2013.864697
- Manna, P., McGuinn, P. J., & Finn, C. (2013). *Education governance for the twenty-first century: Overcoming the structural barriers to school reform*. Washington, D.C: Brookings Institution Press. doi:10.7864/j.ctt4cg877
- Mantei, J., Kervin, L., & Latham, G. (2010). Dear readers. *Practically Primary, 15*(3), 3-4.
- Marsh, J. (2004). The techno-literacy practices of young children. *Journal of Early Childhood Research, 2*(1), 51-66. doi:10.1177/1476718X0421003
- Martin, K. (2011). *Electronic overload: The impact of excessive screen use on child and adolescent health and wellbeing*. Retrieved from [http://www.natureplaywa.org.au/library/1/file/Resources/research/K%20Martin%202011%20Electronic%20Overload%20DSR%20\(2\).pdf](http://www.natureplaywa.org.au/library/1/file/Resources/research/K%20Martin%202011%20Electronic%20Overload%20DSR%20(2).pdf)
- Masters, G. N. (2012). *National school improvement tool*. Retrieved from <https://www.acer.edu.au/files/NSIT.pdf>
- Mazzoni, E., Nicolò, E., Sapio, B., & Isaias, P. (2015). Children, multimedia content and technological artefacts: An exploratory study using text analysis tools. *Interactive Technology and Smart Education, 12*(3), 202-221.
- McArdle, F., & Prowse, S. (2010). Media play: New (and old) pedagogies with young children. *Australian Art Education, 33*(2), 45-61.

- McCarrick, K., & Li, X. (2007). Buried treasure: The impact of computer use on young children's social, cognitive, language development and motivation. *AACE Journal*, 15(1), 73-95.
- McCarthy, J. P., & Anderson, L. (2000). Active learning techniques versus traditional teaching styles: Two experiments from history and political science. *Innovative Higher Education*, 24(4), 279-294.
- McCombs, S., & Liu, Y. (2011). Channeling the channel: Can iPad meet the needs of today's M-Learner. In M. Koehler, & P. Mishra (Eds.), In *Proceedings of Society for Information Technology & Teacher Education International Conference 2011* (pp. 522-526). Chesapeake, VA: AACE.
- McGarr, O., & Kearney, G. (2009). The role of the teaching Principal in promoting ICT use in small primary schools in Ireland. *Technology, Pedagogy and Education*, 18(1), 87-102. doi:10.1080/14759390802704139
- McGuire, G. (2008). Shared leadership shared results. *Leadership*, 37(3), 35-38.
- McKenney, S., & Voogt, J. (2012). Teacher design of technology for emergent literacy: An explorative feasibility study. *Australasian Journal of Early Childhood*, 37(1), 4-12.
- McMahon, G. (2009). Critical thinking and ICT integration in a Western Australian secondary school. *Educational Technology & Society*, 12(4), 269-281.
- Menon, V. (2013). Developmental pathways to functional brain networks: Emerging principles. *Trends in Cognitive Sciences*, 17(12), 627-640.
- Merriam, S. (1998). *Case study research in education*. San Francisco: Jossey-Bass.

- Metcalfe, P., & Metcalfe, R. (2015). *Design technology*. (2nd ed.). Melton, Australia: Ibid Press.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2013). *Qualitative data analysis: A methods sourcebook*. Thousand Oaks, CA: Sage.
- Miller, S. (2015). Teacher learning for new times: Repurposing new multimodal literacies and digital-video composing for schools. In J. Flood, S. Brice Heath, & D. Lapp (Eds), *Handbook of research on teaching literacy through the communicative and visual arts: A project of the international reading association*, 2, 441-454. New York: Routledge.
- Ministry of Education. (2005). *The role and potential of ICT in early childhood education: A review of New Zealand and international literature*. Wellington: New Zealand: Council for Educational Research.
- Moore, H. C., & Adair, J. K. (2015). "I'm just playing iPad": Comparing prekindergarteners' and preservice teachers' social interactions while using tablets for learning. *Journal of Early Childhood Teacher Education*, 36(4), 362-378.
doi:10.1080/10901027.2015.1104763
- Moorefield-Lang, H., & Meier, C. (2014). A tale of three libraries: Management of tablet computers and other devices in libraries. In H. Moorefield-Lang, C. Meier & K. Miller (Eds.), *Tablet computers in school libraries and classrooms* (pp. 1-16). Chicago: American Library Association.
- Morrison, K., & Camargo-Borges, C. (2016). The opportunities and challenges of using digital learning environments in educational organizations. In A. Montgomery & I.

- Kehoe (Eds.), *Reimagining the purpose of schools and educational organisations* (pp. 161-172). doi: 10.1007/978-3-319-24699-4
- Morrow, R. A., & Brown, D. D. (1994). *Critical theory and methodology* (Vol. 3). London, UK: Sage.
- Mourlam, D. J., & Montgomery, S. E. (2015). iPads and teacher education: Exploring a 1:1 initiative in a professional development school partnership. *Journal of Digital Learning in Teacher Education*, 31(3), 107-116.
- Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education*, 9(3), 319-342. doi:10.1080/14759390000200096
- National Association for the Education of Young Children [NAEYC]. (1996). *Technology and Children 3 Through 8: A position statement of the National Association for Education of Young Children*. Washington, DC: NAEYC.
- NAEYC. (2012). *Technology and interactive media as tools in early childhood programs serving children from birth through age 8*. Retrieved from <http://www.naeyc.org/content/technology-and-young-children>
- NAEYC. (2015). *New AAP guidance for families on digital media compliments NAEYC's position statement*. Retrieved from <http://www.naeyc.org/blogs/new-aap-guidance-families-digital-media-compliments-naeyc-position-statement>
- Napier, C. (2014). How use of screen media affects the emotional development of infants. *Primary Health Care*, 24(2), 18-25.

- Nell, M., Drew, F., & Bush, D. (2013). *From play to practice: Connecting teachers' play to children's learning*. Washington, DC: NAEYC.
- Neuman, W. (Ed.). (2003). *Social research methods: Qualitative and quantitative approaches*. (5th ed.). Boston: Allyn and Bacon.
- Neumann, M. M., & Neumann, D. L. (2014). Touch screen tablets and emergent literacy. *Early Childhood Education Journal*, 42(4), 231-239. doi:10.1007/s10643-013-0608-3
- Newman, L., Biedrzycki, K., Patterson, J., & Baum, F. (2011). Partnership in knowledge creation: Lessons learned from a researcher-policy actor partnership to co-produce a rapid appraisal case study of South Australia's social inclusion initiative. *Evidence and Policy*, 7(1), 77-96. doi:10.1332/174426411X553025
- Newmann, F., Marks, H., & Gamoran, A. (1996). Authentic pedagogy and student performance. *American Journal of Education*, 104(4), 280-312. doi:10.1086/444136
- New Media Consortium. (2013). *Horizon report: 2013 K-12 edition*. Retrieved from www.nmc.org/pdf/2013-horizon-report-k12.pdf
- New Media Consortium. (2014). *Horizon report: 2014 K-12 edition*. Retrieved from www.nmc.org/pdf/2014-horizon-report-k12.pdf
- New Media Consortium. (2015). *Horizon report: 2015 K-12 edition*. Retrieved from <http://cdn.nmc.org/media/2015-nmc-horizon-report-k12-EN.pdf>
- New South Wales Department of Education and Communities. (2014). *Bring Your Own Device (BYOD) in Schools: 2013 literature review*. Retrieved from

https://www.det.nsw.edu.au/policies/technology/computers/mobile-device/BYOD_2013_Literature_Review.pdf

Nielsen, W., Miller, K. A., & Hoban, G. (2014). Science teachers' response to the digital education revolution. *Journal of Science Education and Technology*, 24(4), 417-431. doi:10.1007/s10956-014-9527-3

Nikolopoulou, K., & Gialamas, V. (2009). Investigating pre-service early childhood teachers' views and intentions about integrating and using computers in early childhood settings: Compilation of an instrument. *Technology, Pedagogy and Education*, 18(2), 201-219.

Noss, R. (2012). 21st century learning for 21st century skills: What does it mean, and how do we do it? In A. Ravenscroft, S. Lindstaedt, C. Delgado Kloos, D. Hernández-Leo (Eds.), *European Conference on Technology Enhanced Learning* (pp. 3-5). Berlin, Germany: Springer. doi: 10.1007/978-3-642-33263-0_1

Novak, L. (2009, January 29). Teachers missing the tech upheaval. *The Advertiser*, p. 13.

Oberg De La Garza, T., & Kuri, L. M. (2014). Building strong community partnerships: Equal voice and mutual benefits. *Journal of Latinos and Education*, 13(2), 120-133. doi:10.1080/15348431.2013.821064

Officer, S., Grim, J., Medina, M., Bringle, R., & Foreman, A. (2013). Strengthening community schools through university partnerships. *Peabody Journal of Education*, 88(5), 564.

Oldridge, L. (2010). *Digital foundations: A study of perceptions and practices surrounding the use of ICT in ECE centres*. (Unpublished Doctoral dissertation). Massey University,

Auckland. Retrieved from

http://mro.massey.ac.nz/xmlui/bitstream/handle/10179/1705/02_whole.pdf?sequence=1&isAllowed=y

Olney, I., Herrington, J., & and Verenikina, I. (2008). iPods in early childhood: Mobile technologies and story telling. *Annual Conference of the Australasian Society for Computers in Learning and Tertiary Education* (pp.696-700). Melbourne, Australia.

Opendakker, R. (2006). *Advantages and disadvantages of four interview techniques in qualitative research*. Retrieved from <http://www.qualitative-research.net/index.php/fqs/article/view/175/391>

Organisation for Economic Co-operation and Development. (2015). *Students, computers and learning: Making the connection*. [OECD]. Retrieved from <http://www.oecd.org/edu/students-computers-and-learning-9789264239555-en.htm>

Østerud, S., Smørdal, O., & Sandvik, M. (2012). Exploring iPads in practitioners' repertoires for language learning and literacy practices in kindergarten. *Nordic Journal of Digital Literacy*, 7(3), 204-221.

Palfrey, J., & Gasser, U. (2013). *Born digital: Understanding the first generation of digital natives*. New York, NY: Basic Books.

Pamuk, S., Ergun, M., Cakir, R., Yilmaz, H. B., & Ayas, C. (2013). Exploring relationships among TPACK components and development of the TPACK instrument. *Education and Information Technologies*, 20(2), 241-263. doi:10.1007/s10639-013-9278-4

- Parker, M., Templin, T., & Setiawan, C. (2012). What has been learned from school-university partnerships. *Journal of Physical Education, Recreation & Dance*, 83(9), 32-35.
- Parnell, W. A., & Bartlett, J. (2012). iDocument: How smartphones and tablets are changing documentation in preschool and primary classrooms. *Young Children*, 67(3), 50-59.
- Parsons, D., Ryu, H., & Cranshaw, M. (2007). A design requirements framework for mobile learning environments. *Journal of Computers*, 2(4), 1-8.
- Pegrum, M. (2009). *From blogs to bombs: The future of digital technologies in education*. Crawley, WA: UWA Pub.
- Pegrum, M., Oakley, G., & Faulkner, R. (2013). Schools going mobile: A study of the adoption of mobile handheld technologies in Western Australian independent schools. *Australasian Journal of Educational Technology*, 29(1), 66-81.
- Pereira, S., & Pereira, L. (2015). Digital media in primary schools: Literacy or technology? Analyzing government and media discourses. *Educational Policy*, 29(2), 316-341.
doi:10.1177/0895904813492378
- Perrotta, C. (2013). Do school-level factors influence the educational benefits of digital technology? A critical analysis of teachers' perceptions. *British Journal of Educational Technology*, 44(2), 314-327. doi:10.1111/j.1467-8535.2012.01304.x
- Pinner, R. (2016). The smart way to use smartphones in the language classroom. *Modern English teacher*, 25(3), 43-45.

- Powell, S. (2014). Choosing iPad apps with a purpose: Aligning skills and standards. *Teaching Exceptional Children, 47*(1), 20-26. doi:10.1177/0040059914542765
- Prensky, M. (2012). *From digital natives to digital wisdom: Hopeful essays for 21st century learning*. Thousand Oaks, CA: Sage.
- Pudaruth, S., & Bahadoor, B. (2011). Integrating ICT in pre-primary education: The case of Mauritius. *International Journal of Education, 3*(2), E6-E6. doi:10.5296/ije.v3i2.475
- Punch, K. (2014). *Introduction to social research: Quantitative and qualitative approaches* (3rd ed.). Thousand Oaks, CA: Sage.
- Radinsky, J., Bouillion, L., Lento, E. M., & Gomez, L. M. (2001). Mutual benefit partnership: A curricular design for authenticity. *Journal of Curriculum Studies, 33*(4), 405-430. doi:10.1080/002202701300200902
- Radesky, J. S., Schumacher, J., & Zuckerman, B. (2015). Mobile and interactive media use by young children: The good, the bad, and the unknown. *Pediatrics, 135*(1), 1-3.
- Raffles, H. (2003). Intimate knowledge. *International Social Sciences Journal, 53*(3), 325-335.
- Ritzhaupt, A. D., Dawson, K., & Cavanaugh, C. (2012). An investigation of factors influencing student use of technology in K-12 classrooms using path analysis. *Journal of Educational Computing Research, 46*(3), 229-254. doi:10.2190/EC.46.3.b
- Robson, C., & McCartan, K. (2016). *Real world research*. London: John Wiley & Sons.
- Rose, H. (1991). Case studies. In G. Allan, & C. Skinner (Eds.), *Handbook for research students in the social sciences* (pp. 191-203). London: The Fulmer Press.

- Rosen, D. B., & Jaruszewicz, C. (2009). Developmentally appropriate technology use and early childhood teacher education. *Journal of Early Childhood Teacher Education*, 30(2), 162-171. doi:10.1080/10901020902886511
- Roth, W., & Metha, J. (2002). The Rashomon effect: Combining positivist and interpretivist approaches in the analysis of contested events. *Sociological Methods & Research*, 31(2), 131-173.
- Rubin, H., & Rubin, I. (2005). The responsive interview as an extended conversation. (2nd ed., pp. 108). Thousand Oaks: SAGE Publications, Inc. doi:10.4135/9781452226651.n6
- Schmidt, D., Baran, E., Thompson, A., Mishra, P., Koehler, M., & Shin, T. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education*, 42(2), 123-149.
- Schneider, J. J. (2015). iText, but iDon't teach with it: An essay on i-Literacy in teacher education. *Action in Teacher Education*, 37(2), 120-137.
doi:10.1080/01626620.2014.969850
- School Curriculum & Standards Authority [SCSA]. (2015). *Digital technologies*. Retrieved from <http://k10outline.scsa.wa.edu.au/home/p-10-curriculum/curriculum-browser/technologies/digital-technologies2>
- Schugar, H. R., Smith, C. A., & Schugar, J. T. (2013). Teaching with interactive picture e-books in grades K–6. *The Reading Teacher*, 66(8), 615-624.

- Schutt, R. K. (2003). *Investigating the social world: The process and practice of research* (4th ed.). Thousand Oaks, CA: Sage.
- Searle, G. D., & Hanrahan, S. J. (2011). Leading to inspire others: Charismatic influence or hard work? *Leadership & Organization Development Journal*, 32(7), 736-754.
doi:10.1108/01437731111170021
- Shepherd, D., & Woods, C. (2011). Developing digital citizenship for digital tots: Hector's world limited. *Emergence: Complexity and Organization*, 13(3), 1-20.
- Shin, W. (2014). Teachers' use of technology and its influencing factors in Korean elementary schools. *Technology, Pedagogy and Education*, 24(4), 461-476.
doi:10.1080/1475939X.2014.915229
- Shulman, L. S. (1986). Those who understand: A conception of teacher knowledge. *American Educator*, 10(1).
- Simon, A., Gingold, J., & Schoendorf, K. (2014). Excess screen time in US children: Association with family rules and alternative activities. *Clinical Pediatrics*, 53(1), 41-50.
doi:10.1177/0009922813498152
- Simon, F., Nemeth, K., & McManis, D. (2013). Technology in ECE classrooms: Results of a new survey and implications for the field. *Classroom Technology*, 1, 68-75.
- Simons, H. (2015). Interpret in context: Generalizing from the single case in evaluation. *Evaluation*, 21(2), 173-188.
- Siraj-Blatchford, I., & Siraj-Blatchford, J. (2006). *A guide to developing the ICT curriculum for early childhood education*. Stoke-on-Trent: Trentham books.

- Smirnova, L., Bordonaro, L. (2014). Exploring the use of iPads for engaged learning in the elementary classroom: A survey of teachers. In J. Viteli & M. Leikomaa (Eds.), *Proceedings of World Conference on Educational Media and Technology* (pp. 47-51). Tampere, Finland: AACE.
- Snowden, D. (2002). Complex acts of knowing: paradox and descriptive self-awareness. *Journal of Knowledge Management*, 6(2), 100-111.
- Soto, M., & Hargis, J. (2014). Students explain everything using iPads. *Learning & Leading with Technology*, 41(7), 32.
- Stake, R. (2007). Qualitative case studies. In N. Denzin, & Y. Lincoln (Eds.), *The Sage handbook of qualitative research* (3rd ed., pp. 443-446). Thousand Oaks, CA: Sage.
- State Government of Victoria Department of Education & Training (2016). *iPads for learning*. Retrieved from <http://www.ipadsforeducation.vic.edu.au/education-apps>
- Statista. (2014). *Most popular Apple App Store categories in March 2014, by share of available apps*. Retrieved from <http://www.statista.com/statistics/270291/popular-categories-in-the-app-store/>
- Statista. (2017). *Number of available apps in the Apple app store from July 2008 to January 2017*. Retrieved from <https://www.statista.com/statistics/263795/number-of-available-apps-in-the-apple-app-store/>
- Stringer, E. (2008). *Action research in education* (2nd ed.). New Jersey: Pearson Education.

- Swan, K., van 't Hooft, M., Kratcoski, A., & Unger, D. (2005). Uses and effects of mobile computing devices in K-8 classrooms. *Journal of Research on Technology in Education*, 38(1), 99-112.
- Teacher Education Ministerial Advisory Group. (2014). *Action Now: Classroom Ready Teachers*. Retrieved from https://docs.education.gov.au/system/files/doc/other/action_now_classroom_ready_teachers_accessible.pdf
- The Government of Hong Kong Special Administrative Region. (2016). *2014 Digital 21 Strategy: Smarter Hong Kong smarter living*. Retrieved from <http://www.digital21.gov.hk/eng/>
- The Telegraph. (2012, March 17). *Don't let the screens turn my children into zombies*. Retrieved from <http://www.telegraph.co.uk/technology/9149924/Dont-let-the-screens-turn-my-children-into-zombies.html>
- The White House. (2015). *ConnectED Initiative: Education, knowledge and skills for the jobs of the future*. Retrieved from <https://www.whitehouse.gov/issues/education/k-12/connected>
- Thomas, H. J., Connor, J. P., & Scott, J. G. (2015). Integrating traditional bullying and cyberbullying: Challenges of definition and measurement in adolescents – A Review. *Educational Psychology Review*, 27(1), 135-152. doi:10.1007/s10648-014-9261-7
- Thompson, A. D. (2015). Preparing our teacher education students for new schools. *Journal of Digital Learning in Teacher Education*, 31(3), 83-84.
doi:10.1080/21532974.2015.1059710

- Tondeur, J., van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). *Computers & Education*, 59, 134.
- Traxler, J. (2005, June). Defining mobile learning. In P. Isaias, C. Borg, P. Kommers & P. Bonanno (Eds.), *Proceedings of the IADIS International Conference Mobile Learning* (pp. 261-266). Malta: IADIS Press.
- Traxler, J. (2010). Distance education and mobile learning: Catching up, taking stock. *Distance Education* 31(2), 129-138.
- Traxler, J., & Vosloo, S. (2014). Introduction: The prospects for mobile learning. *Prospects*, 44(1), 13-28.
- US Department of Education. (2010). *Transforming American education: Learning powered by technology. National education technology plan, office of educational technology*. Retrieved from <http://tech.ed.gov/wp-content/uploads/2013/10/netp2010.pdf>
- Van Hoorn, J., Nourot, P. M., Scales, B., & Alward, K. R. (2014). *Play at the center of the curriculum* (6th ed.). New York, NY: Pearson Higher Ed.
- Veitch, J., Timperio, A., Crawford, D., Abbott, G., Giles-Corti, B., & Salmon, J. (2011). Is the neighbourhood environment associated with sedentary behaviour outside of school hours among children? *Annals of Behavioral Medicine*, 41(3), 333-341.
- Verenikina, I., & Kervin, L. (2011). iPads, digital play and pre-schoolers. *He Kupu*, 2(5), 4-19.
- Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

- Wahyuni, D. (2012). The research design maze: Understanding paradigms, cases, methods and methodologies. *Journal of Applied Management Accounting Research*, 10(1), 69-80.
- Walsh, M. E., & Backe, S. (2013). School–university partnerships: Reflections and opportunities. *Peabody Journal of Education*, 88(5), 594.
- Wastiau, P., Blamire, R., Kearney, C., Quittre, V., Van de Gaer, E., & Monseur, C. (2013). The use of ICT in education: A survey of schools in Europe. *European Journal of Education*, 48(1), 11-27. doi:10.1111/ejed.12020
- West, D. M. (2013). *Mobile learning: Transforming education, engaging students, and improving outcomes*. Retrieved from:
<http://www.scienceisaverb.com/Mobile%20Learning%20Transforming%20Education,%20Engaging.pdf>
- Willis, J. W., Jost, M., & Nilakanta, R. (2007). *Foundations of qualitative research: Interpretive and critical approaches*. Thousand Oaks, CA: Sage.
- Winslow, J., Dickerson, J., Lee, C., & Geer, G. (2012). Mobile technologies: Tools for organizational learning and management in schools: iPrincipals: Analyzing the use of iPads by school administrators. *International Education Studies*, 5(4), 188-195.
- Wood, E., Zivcakova, L., Gentile, P., Archer, K., De Pasquale, D., & Nosko, A. (2012). Examining the impact of off-task multi-tasking with technology on real-time classroom learning. *Computers & Education*, 58(1), 365-374.
- Woods, D., Husbands, C., & Brown, C. (2013). *Transforming education for all: The Tower Hamlets Story*. London, UK: Tower Hamlets Council's Communications Unit.

Yin, R. (2009). *Case study research: Design and methods* (4rd ed.). Thousand Oaks, CA: Sage Publications.

Yin, R. (2013). Validity and generalization in future case study evaluations. *Evaluation*, *19*(3), 321-332. doi:10.1177/1356389013497081

Yong, A. G., & Pearce, S. (2013). A beginner's guide to factor analysis: Focusing on exploratory factor analysis. *Tutorials in Quantitative Methods for Psychology*, *9*(2), 79-94.

Zimmerman, F., Christakis, D., & Meltzoff, A. (2007). Associations between media viewing and language development in children under age 2 years. *The Journal of Pediatrics*, *151*(4), 364-368. doi:10.1016/j.jpeds.2007.04.071

Appendix A Matrix for Selecting mLearning Tools

	Bee Bot					iPad					Digital Microscope					Recording Pegs					Talking Butterflies					Chatter block					Metal Detectors					Story Sequencer																			
	Score 1-5					Score 1-5					Score 1-5					Score 1-5					Score 1-5					Score 1-5					Score 1-5																								
Ease of Use	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Value for money	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Appeal to ECE students (Motivation)	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Developmentally appropriate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Can be used to enhance teaching and learning (Curriculum connection)	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Differentiation (can meet needs of differing students)	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Students are actively engaged	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Students can work collaboratively	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Tool is used to build understanding	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Tool used in a meaningful way	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Awards	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Reviews	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					
Overall rating	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5					

Appendix B Pre-Service Teacher Survey 1

1. Which Early Childhood Education (ECE) ICT tutorial are you attending?

Summer School

Wednesday

Thursday morning

Thursday afternoon

2. What type of high school did you attend?

Government

Catholic

Independent

3. Which age group * do you fall into?

17-25

26-40

41-50

50+

4. Rate your level of technological knowledge as: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree or Strongly Agree

- I know how to solve my own technical problems
- I can learn technology easily
- I keep up with new technologies
- I frequently play about with technology
- I know a lot of different technologies
- I have the technical skills I need to use technology

5. Rate the following statements about teaching using mLearning-rich lessons to early childhood students: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree or Strongly Agree

- I know how to organize and maintain classroom management
- I can adapt my teaching style to different learners
- I am nervous about being observed by the classroom teacher
- I am worried about the technology not working properly
- I lack pedagogical knowledge
- I lack technological knowledge

- I lack content knowledge
- I know about mLearning technologies that I can use for understanding and teaching several learning areas
- I can use mLearning technologies that enhance the content of a lesson
- I critically think about how to use mLearning in the classroom

6. What are your beliefs regarding the use of mobile technologies in the early childhood classroom?

Other (please specify)

7. What do you use technology for?

- Social networking
- Study
- Assignments
- Word processing
- PowerPoint
- Gaming
- Research on the Internet
- Journal access
- Listening to music
- I use technology as a teaching tool and integrate it into lessons that I plan

8. What are the benefits and disadvantages associated with presenting lessons for this ICT unit to children?

9. Please rate the following statements about your views and intentions regarding integrating and using mLearning in ECE using: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree or Strongly Agree

- mLearning in ECE degrades the role of the teacher
- The use of mLearning by children does more harm than good
- mLearning is only useful for playing games
- The role of the teacher is not affected by integration of mLearning in ECE
- I would not like to use mLearning with children unless it is imposed from 'above'
- The use of mLearning motivates children
- The use of mLearning is complementary (and not essential) to the whole educational process
- The role of the teacher in ECE is that of the facilitator and coordinator
- The use of mLearning promotes passive learning

- To the fullest extent possible, I intend to use mLearning with the children
- Using mLearning in ECE may lead to new pedagogical methods and approaches
- I would not like to use mLearning because learning becomes mechanical
- The use of mLearning promotes children's active participation in the learning process
- The use of mLearning by children promotes their social isolation
- I am sceptical about using mLearning in my teaching
- mLearning restricts children's imagination and creativity
- I am not interested in integrating mLearning with children; there are other priorities for ECE
- The use of mLearning is only useful for processes that cannot be accomplished otherwise
- mLearning is a useful tool to support and enhance children's learning
- I intend to use mLearning, sometimes, because it familiarizes children with technology
- mLearning integration in ECE restricts the role of the teacher
- The integration and use of mLearning in ECE is necessary

Appendix C Pre-Service Teacher Survey 2

1. Which ICT tutorial group were you in prior to the practicum?

2. What year level do you have for your current practicum?

K

PP

Year 1

Year 2

Year 3

3. What mobile learning (mLearning) tools are available for you to use in your school?

Please explain what is available in practicum school, what you have used on this practicum and what your mentor has used this term.

- iPod touch
- iPads/tablets
- Bee Bots
- IWB
- Other - please explain

4. How often is mLearning used in your classroom?

- Not at all
- Less than once a week
- 2-4 times a week
- Daily

5. How do children use mLearning devices in your class?

- They do not use them
- Mainly In a teacher centred way
- Mainly in a student-centred way

6. Have you experienced any of the following barriers to using mLearning on practicum? (tick all those which apply to you)

- Lack of resources
- Lack of technological support
- The parents do not want technology
- I do not see any value added by mLearning
- The classroom philosophy prohibits the use of technology
- Lack of technological knowledge

7. What are your beliefs regarding mLearning in early childhood education?
8. Have your beliefs regarding the use of mLearning in early childhood education changed because of the Transforming Learning Trough ICT unit that you completed prior to this practicum?
9. Has the amount of time that you spend exploring mLearning tools changed since you completed the ICT unit this semester?
- It has increased
 - It has decreased
 - It has not changed
10. What have you used mLearning for?
- As an investigation tool
 - As a creation tool
 - To communicate and share ideas
 - To develop strategies for problem-solving
11. In which type of school are you completing your practicum?
- Catholic
 - Independent
 - Government

Appendix D Pre-Service Teacher Survey 3

1. I give my consent to take part in this early childhood mLearning research project. I understand that I can withdraw my consent at any point. I understand that my name will not be used and my identity will be protected

Yes, I agree to take part

No, I do not wish to take part

2. Did you complete an authentic learning experience in semester 1 this year, at either School A or School B?

Yes

No

3. What have you used mLearning for this year?

4. Rate your level of technological knowledge as: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree or Strongly Agree

- I know how to solve my own technical problems
- I can learn technology easily
- I keep up with new technologies
- I frequently play about with technology
- I know a lot of different technologies
- I have the technical skills I need to use technology

5. Rate the following statements about teaching using mLearning-rich lessons to early childhood students: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree or Strongly Agree

- I know how to organize and maintain classroom management
- I can adapt my teaching style to different learners
- I am nervous about being observed by the classroom teacher
- I am worried about the technology not working properly
- I lack pedagogical knowledge
- I lack technological knowledge
- I lack content knowledge
- I know about mLearning technologies that I can use for understanding and teaching several learning areas
- I can use mLearning technologies that enhance the content of a lesson
- I critically think about how to use mLearning in the classroom

6. What are your beliefs regarding the use of mobile technologies in the early childhood classroom?

7. What are the benefits and disadvantages associated with presenting lessons for this unit to children in local schools as opposed to presenting lessons to peers at University?

8. Please rate the following statements about your views and intentions regarding integrating and using mLearning in ECE using: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree or Strongly Agree

- mLearning in ECE degrades the role of the teacher
- The use of mLearning by children does more harm than good
- mLearning is only useful for playing games
- The role of the teacher is not affected by integration of mLearning in ECE
- I would not like to use mLearning with children unless it is imposed from 'above'
- The use of mLearning motivates children
- The use of mLearning is complementary (and not essential) to the whole educational process
- The role of the teacher in ECE is that of the facilitator and coordinator
- The use of mLearning promotes passive learning
- To the fullest extent possible, I intend to use mLearning with the children
- Using mLearning in ECE may lead to new pedagogical methods and approaches
- I would not like to use mLearning because learning becomes mechanical
- The use of mLearning promotes children's active participation in the learning process
- The use of mLearning by children promotes their social isolation
- I am sceptical about using mLearning in my teaching
- mLearning restricts children's imagination and creativity
- I am not interested in integrating mLearning with children; there are other priorities for ECE
- The use of mLearning is only useful for processes that cannot be accomplished otherwise
- mLearning is a useful tool to support and enhance children's learning
- I intend to use mLearning, sometimes, because it familiarizes children with technology
- mLearning integration in ECE restricts the role of the teacher
- The integration and use of mLearning in ECE is necessary

Appendix E Parent and Carer Survey

1. The purpose of this survey is to gather, from parents and guardians of young children, information about their beliefs regarding the use mobile learning in early childhood education. By completing this survey, I give my consent to take part in a mobile learning in early childhood education study.

2. Do you have the internet at home?

3. What mobile learning devices do you have at home?

- None
- Smartphone
- iPod
- iPad
- Android tablet
- Other

4. How frequently do your children use mobile learning devices?

- Never
- Every day
- 1-3 times / week
- 4-6 times /week
- Less than once /week

5. What do your children use mobile learning tools for?

- Playing games
- Reading digital stories
- Listening to music
- Taking photos or videos
- Social media
- Talking/Skype
- Texting
- Drawing/creative activities
- Research/ Investigation

6. How do you supervise and regulate your children when they are using mobile learning tools?

7. Do you have any concerns about what your child might be doing when they are using mobile learning?

8. What are your beliefs regarding the use of mobile learning in early childhood education?

9. Why do you think mobile learning is not more widely used in early childhood education?

Please use the following ratings: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree or Strongly Agree

- Lack of resources
- Lack of technological support
- No need for it
- The classroom philosophy prohibits the use of technology
- Lack of teacher professional development
- The parents do not want it
- Other (please specify)

10. Rate your level of technological knowledge. Please use the following ratings: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree or Strongly Agree

- I know how to solve my own technical problems
- I can learn technology easily
- I keep up with new technologies
- I frequently play about with technology
- I know a lot of different technologies
- I have the technical skills I need to use technology

11. Please state whether you agree or disagree with the following statements. Please use the following ratings: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree or Strongly Agree

- mLearning in early childhood education develops children's basic skills and computer literacy
- mLearning in early childhood education develops children's thinking and problem-solving
- mLearning in early childhood education develops children's skills for other activities
- mLearning in early childhood education develops children's social skills for collaboration and working with others
- mLearning in early childhood education encourages children to reflect on their learning
- mLearning in early childhood education encourages children to become critical learners

12. What value do you see in this school-university partnership? Please use the following ratings: Strongly Disagree, Disagree, Neither Agree or Disagree, Agree or Strongly Agree

- It is beneficial to the student teachers
- It is beneficial to the children
- It is beneficial to the teachers
- It is beneficial to the parents
- It is beneficial to the school

Appendix F Focus group questions (pre-service teachers)

1. What mLearning resources did you like?
2. What mLearning resources did you not like?
3. What would you change next time?
4. What did you like about participating in this project this year?
5. What impact do you think working with early childhood teachers and their students has had on your learning?
6. To what extent do you feel more equipped to integrate mLearning into your future lessons?
7. Did your relationship with the classroom teacher change throughout this process?
8. What did you learn from the experience?
9. How did you think this experience will assist you for mLearning integration in the future?
10. How did you feel about the practising teacher visiting your tutorials at University?
11. What are the benefits and disadvantages associated with presenting lessons for this ICT unit to early childhood students as opposed to presenting the lessons to peers at University?
12. What are your beliefs regarding the use of mLearning in early childhood education?
13. How do you intend to integrate mLearning into your teaching?
14. How would you describe your level of technological knowledge on a scale of 1-5?
15. What did you find difficult about planning and delivering the mLearning rich lessons for this ICT unit? Was it more or less stressful? Was it easier or more difficult?
16. What type of pedagogical input did the practicing teacher contribute to your learning?
17. Were you able to offer any technological knowledge to your practicing teacher?
18. Do you think the class dynamics changed when the technology was introduced?
19. Has there been any change in the amount of time you spend using mLearning tools this year?

Appendix G: Field Observations

Adapted from Judson's (2002) instrument

Name of pre-service teacher: _____ School _____

Date _____ Number of Students _____

Year level: _____ Location: _____

Number and type of mLearning tools _____

Description of the technology incorporated into the lesson including hardware and software specifications, student to media ratio, locus of control in terms of technology

Learning Area-----Lesson Objectives-----

Amount of use (i.e. proportion of the lesson) _____

Kinds of use (e.g. instructional game, drill and practice, presentation, exploration, creative work, productivity tool etc)

Context for use (e.g. independently for students, in the context of the learning situation, as a reward etc)

Sketch of physical layout of classroom (i.e. placement of technology, teacher and students; indicate mobility)

*To what extent was the following present? Please score the items on the following page from 0 to 3. 3= to a great extent, 0 = no evidence.

Design of mLearning integration

*

1 The design of the mLearning integration allowed children to learn in ways not otherwise possible. 0 1 2 3

2	mLearning was a means for supporting curricular objectives, as opposed to being a separate curricular focus.	0	1	2	3
3	This lesson embedded basic student operation of mLearning.	0	1	2	3
<hr/>					
Classroom dynamics					
4	The children were engaged.	0	1	2	3
5	Interaction with mLearning provided children with a sense of independent control and mastery over an environment (student centred).	0	1	2	3
6	The pre-service teacher provided appropriate assistance to guide child activity.	0	1	2	3
<hr/>					
Meaning and purpose					
7	Students took pride in new learning and/or work produced with the aid of mLearning.	0	1	2	3
8	mLearning was used to investigate real phenomena and real world situations.	0	1	2	3
9	Integration of mLearning enhanced meaning and purpose of the lesson	0	1	2	3
<hr/>					
Content and knowledge					
10	The integration of mLearning into the lesson promoted strong, coherent conceptual understanding.	0	1	2	3
11	The pre-service teacher had a solid grasp of the subject matter content and the use of mLearning.	0	1	2	3
12	Children used mLearning to aid the construction of meaningful knowledge.	0	1	2	3
<hr/>					
Use of mLearning tools					
13	As an investigation tool.	0	1	2	3
14	As a creation tool.	0	1	2	3
15	To communicate and share ideas.	0	1	2	3
16	To develop strategies for problem solving.	0	1	2	3
<hr/>					

Appendix H Participant Information



Mobile Learning in Early Childhood

CHIEF INVESTIGATORS: Jean MacNish & Frank Bate

Dear Participant,

You are invited to participate in the research project described below.

The use of mobile learning has been shown to have a positive impact on student learning particularly in the early years of education. However, research also suggests a slow uptake of these technologies in the classroom. This longitudinal study is designed to examine the appropriateness and effectiveness of mobile learning in early childhood settings. The study will involve working with pre-service and practicing teachers in a collaborative way with the overall aim of developing collective knowledge on mobile learning in this important educational context. The study will run over a three-year period.

This project is being conducted by Dr Frank Bate, Dr Jean MacNish and Serena Davie and will form the basis for the degree of Doctor of Philosophy at The University of Notre Dame Australia, under the supervision of Dr Jean MacNish.

To help generate knowledge, interviews, surveys, focus groups and classroom observation will be the primary methods of data collection. It is estimated interviews and focus

groups will typically take 30 minutes. Observations will be conducted in the classroom and will be non participatory. Interviews will be audio recorded. The data will be collected in the partnership schools and at the University of Notre Dame.

At all times the identity of participants will be confidential and protected through the use of a unique code. All data will be stored in a secure environment in the School of Education at The University of Notre Dame and kept for a period of five years. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals.

The project has received clearance through the University of Notre Dame Human Research Ethics Committee (HREC). The protocol adopted by the University of Notre Dame HREC for the protection of privacy will be adhered to and relevant sections of the Privacy Act are available at <http://www.nhmrc.gov.au>

This is a low level intervention and risks to participants are minimal. Two possible risks are (a) teachers' lack of inclination to participate in the research and (b) damage to mobile learning technologies by young children. Every effort will be made to encourage participation by schools. This includes visiting the schools to make contact with senior staff, mentoring teachers and attending staff/professional development sessions on request. Hard wearing ICT will be purchased that is purpose-built for an early childhood audience.

The benefits of this research are for example, practicing teachers will have the opportunity to develop their knowledge and skills in harnessing mobile technologies in a long-term, supportive environment; academics and pre-service teachers at the University of Notre Dame will have access to authentic classrooms that will help to underpin their knowledge of mobile learning in real world educational environments; parents will be afforded opportunities to

access expertise on contemporary mobile learning tools and applications; and children will benefit by engaging in technology-rich learning.

Participation in this study is completely voluntary. You are not under any obligation to participate. If you agree to participate, you can withdraw from the study at any time and withdraw unprocessed data previously supplied.

An Executive Summary will be provided to stakeholders, i.e. the Schools involved in the project, the Department of Education and the School of Education Notre Dame.

If you would like to discuss any aspect of this study with a member of the research team, please contact Dr Jean MacNish. Jean.macnish@nd.edu.au

The study has been approved by the Human Research Ethics Committee at The University of Notre Dame Australia. If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

Please sign the attached consent form if you would like to participate in this study.

Yours sincerely,
Serena Davie
School of Education
University of Notre Dame
Ph: 94330156
serena.davie@nd.edu.au

Appendix I Interview 1: ICT Lecturer

1: Can you tell me about your teaching experience?

2: Do you think it is important to use ICT in teaching and learning and if so what is the overall purpose?

3: Do you think early childhood is the right context for mobile learning?

4: How have you modified the course for the groups presenting in local primary schools as opposed to those presenting to peers?

5: Do you think those presenting in the authentic environment will have missed out on any important content in your ICT course because of the preparation for the authentic task?

6: Do you think there will be any difference in the standard of presentations between the two groups?

7: Do you think any groups will be more or less prepared for the task of mLearning integration in their future teaching?

8: What do you see as the advantages and disadvantages of this research project?

9: What do you see as the benefits and disadvantages of having school teachers and principals in your tutorials at the University?

Appendix J Interview 2: ICT Lecturer

1: What worked?

2: How much initial scaffolding did they need?

3: Do you think those presenting the authentic environment missed anything?

4: Was there a difference in the standard of the presentations between the control and authentic groups?

5: What do you predict the experience might affect the students on future practicum?

6: Do you think your teaching in other units has changed as a result of this project?

7: What were your impressions of the authentic visits? Did they go as you expected?

8: What did not work?

9: Is there anything else you think we should change regarding the school visits in the future?

10: Do you think your level of technological knowledge has changed as a result of this project?

11: What do you see as the advantages and disadvantages to; pre-service teachers, practicing teachers, children and yourself of this project?

12: What impact, if any did the experience have on your future planning and teaching

Appendix K Interview 1: Early Childhood Teachers

1. What types of technology do you personally use at home and at school?
2. How many years have you been teaching?
3. How long have you been teaching early childhood?
4. Do you work full time?
5. Do you have an assistant in your class?
6. When did you receive your teaching qualification?
7. What year are you currently teaching and how many children do you have in your class?
8. How many computers, mobile learning devices do you have in your classroom or access to in your school? Which do you use and how frequently? How up to date are these devices?
9. Do you have internet access in your classroom? (wireless or broadband)
10. What do you mostly use mLearning for in your classroom
11. How often do you use mLearning as a teaching tool in your classroom?
12. Have the children in your class used mLearning in the last two weeks and if so what have they used it for?
13. How do the children in your class respond to the use of mLearning? Do they have a favourite activity?
14. Would you like to use more mLearning in your teaching?
15. What stops you using more mLearning? (cost, time, technology, knowledge, support, teaching philosophy, lack of interest)
16. How would you rate your mLearning skills 1-5?
17. How would you rate your confidence using mLearning 1-5?
18. Do you learn new technologies easily?
19. Can you solve your own technological problems?
20. Do you have the technical skills required to use mLearning?
21. Do you keep up with new mLearning? (new apps and educational software)
22. How well can you integrate mLearning into the curriculum?
23. Do you actively incorporate mLearning into your teaching?
24. Do you ever help colleagues with mLearning?
25. What are your beliefs regarding mLearning in ECE education?
26. Choose from the following statements the one that describes you best:
27. I see opportunities for integrating mLearning into my teaching
28. I have favourable attitudes towards using mLearning in my teaching
29. I make conscious decisions to adopt mLearning in my teaching
30. I actively integrate mLearning into my teaching
31. I continuously evaluate the results of integrating mLearning into my teaching and make appropriate improvements
32. What do you see as the benefits and disadvantages of pre-service teachers visiting your class to present mLearning rich lessons?

33. Current research states that mLearning is not widely used in early childhood education. Do you agree with this statement and if so what do you think the reasons might be?
34. Do you see yourself using more or less mLearning technologies in your classroom in the future?
35. How much professional development have you had in the last three years on mLearning?
36. How effective was this professional development in helping you to integrate mLearning into the curriculum?

Appendix L Interview 2: Early Childhood Teachers

1. What are your beliefs about mLearning in the early childhood classroom? Have these beliefs changed since you became involved in this project?
2. What do you mostly use mLearning for?
3. How often do you use mLearning as a teaching tool in your classroom?
4. How do the children in your class respond to the use of mLearning? Do the dynamics change?
5. Would you like to use more mLearning in your teaching?
6. What stops you using more mLearning?
7. How would you rate your mLearning skills (on a scale of 1 – 5)?
8. To what extent have your skills in using mLearning changed since you became involved in this research?
9. Has your confidence in using mLearning grown, diminished or stayed the same? What factors affect your confidence?
10. Have you discerned any changes in the dispositions of others at your school towards integrating mLearning into the curriculum? If so what sort of changes have you seen?
11. Do you think using mLearning has led to any improvements in the classroom? (e.g. motivation, classroom management, learning)
12. How have your class responded to the use of the mLearning in your classroom?
13. Did some children engage better than others?
14. Which children benefited the most from this project?
15. What you see as the benefits and disadvantages of pre-service teachers visiting your class teach mLearning rich lessons? How could these visits be improved?
16. Do you see yourself using more or less mLearning in your classroom in the future?
17. What worked?
18. What did not work?
19. What would you change next time?
20. What did you like about participating in this project this year?

Appendix M Interview Questions School Leaders

1. What types of technology do you personally use at home and at school?
2. What do you mostly use mLearning for?
3. How would you rate your mLearning skills?
4. Do you learn new technologies easily?
5. Can you solve your own technological problems?
6. Do you have the technical skills required to use mLearning?
7. Do you have the technical skills necessary to assist your staff?
8. What mLearning tools do you have in the early childhood classrooms in your school? How old are they? (1–2, 3-5, 6-10 years old) Where did they come from? (donated, school budget, P & C)
9. How are mLearning technologies currently used in the early childhood classrooms in your school? What do the teachers and children use them for and how frequently?
10. How do the early childhood children in your school respond to the use of mobile technologies? What do they particularly like or dislike?
11. How would you rate the level of mLearning currently used in the early childhood classes in your school? Choose from the following statements:
12. Not a high priority
13. Teachers are willing but struggle to adopt
14. Steady progress and increasing use
15. Routine use on a daily basis
16. Would you like to see more mLearning in your early childhood classrooms?
17. Current research states that mLearning is not widely used in early childhood education. Do you agree with this statement and if so what do you think the reasons might be?
18. How proficient is your ECE staff with the use of mLearning?
19. What stops your teachers using more mLearning technologies?
20. What could improve the use of ICT/ mLearning devices in early childhood classrooms in your school?
21. What mLearning strategies/policies do you have in the school?
22. Do you have wireless/broadband connectivity in ECE classrooms?
23. What type of mLearning support does your school have?
24. What mLearning changes/goals you foresee in the next five years in your school?
25. How important do you see mLearning for teaching and learning in early childhood education?
26. Do you have an ICT coordinator in the school?
27. Do you see mLearning in ECE as a priority and if so what strategies have you adopted to maximise its effectiveness in the classroom?
28. What benefits do you see for your school in having a partnership with a University?
29. Choose from the following statements the one that describes you best:
30. I see opportunities for integrating mLearning into ECE classrooms in my school
31. I have favourable attitudes towards using mLearning in ECE classrooms in my school

32. I make conscious decisions to adopt mLearning in ECE classrooms in my school
33. I actively integrate mLearning into ECE classrooms in my school
34. I continuously evaluate the results of integrating mLearning into ECE classrooms in my school and make appropriate improvements
35. How much professional development have your ECE teachers had in mLearning in the last 3 years?
36. What do you perceive your role to be in the integration of mLearning in ECE?
37. What mLearning/ICT resources does the school now have?
38. How are these resources managed? Technical support?
39. Funding of resources??
40. What are the ICT plans/goals for the future?
41. How proficient is your ECE staff with the use of mLearning? Developmentally appropriate use/for the 4Cs?? To create rather than consume. SMAR? Substitution, modification, augmentation, redefinition
42. What PD have staff/you undertaken this year? How do you plan to build staff capacity?
43. Which teachers if any are the drivers of ICT integration? How do you capitalize on this? Shared leadership?
44. How is network going/Wi-fi?
45. Would you like to see more mLearning in your early childhood classrooms?
46. What stops your teachers using more mLearning technologies?
47. What could improve the use of ICT/ mLearning devices in early childhood classrooms in your school?
48. What mLearning strategies/policies do you have in the school?
49. How important do you see mLearning for teaching and learning in early childhood education?
50. Do you see mLearning in ECE as a priority and if so what strategies have you adopted to maximise its effectiveness in the classroom?
51. What do you think of the partnership with the University?
52. What would you change about mLearning partnership?
53. What benefits do you see for your school in having a partnership with a University?
54. What do you perceive your role to be in the integration of mLearning in ECE?
55. What role do you think parents lay in mLearning integration?
56. How do you think parents at this school view technology? ECE parents??
57. Parent workshop did not happen this year. Do you think this is not a good idea, timing wrong? How are parents informed/upskilled...newsletter????

Appendix N Dean Interview

1. How many school-university partnerships is the SOE currently involved in?
2. What do you see as the purpose of school-university partnerships?
3. What are your beliefs regarding the use of mLearning g in early childhood education?
4. What are the difficulties associated with school-university partnerships?
5. Who benefits from the partnerships?
6. What is your role in these partnerships?
7. Do you think shared leadership plays a role in effective partnerships?
8. What are the costs and benefits to both pre-service teachers and staff of the mLearning ECE partnership?
9. What are your beliefs regarding mLearning in teacher education?
10. What do you think you can do (if anything) to optimise the effectiveness of the partnerships?

Appendix O Informed Consent Form

Mobile Learning in Early Childhood Education to promote School-University

Partnerships

I, (*participant's name*) _____ hereby agree to being a participant in the above research project.

I have read and understood the Information Sheet about this project and any questions have been answered to my satisfaction.

I understand that I may withdraw from participating in the project at any time without prejudice.

I understand that all information gathered by the researcher will be treated as strictly confidential, except in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals.

Whilst the research involves small sample sizes I understand that a code will be ascribed to all participants to ensure that the risk of identification is minimised.

I understand that the protocol adopted by the University of Notre Dame Australia Human Research Ethics Committee for the protection of privacy will be adhered to and relevant sections of the *Privacy Act* are available at <http://www.nhmrc.gov.au/>

I agree that any research data gathered for the study may be published provided my name or other identifying information is not disclosed.

I understand that I will be audio taped.

Participant's signature:		Date:	
Researcher's full name:	Serena Davie		
RESEARCHER'S SIGNATURE		DATE	

If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, email research@nd.edu.au

Appendix P Ethics



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CRICOS PROVIDER CODE: 01032F

11 August 2011

Dr Frank Bate
School of Education
The University of Notre Dame Australia
Fremantle Campus

Ref: #011063F

Dear Frank,

I am writing to you in regards to your Low Risk Application for Ethics Clearance for your proposed research project to be undertaken as a staff member at the University of Notre Dame Australia. The title of the project is *"Using mobile learning technologies to promote school-university partnerships in early childhood education"*.

Your proposal has been reviewed by the University's Human Research Ethics Committee, and based on the information provided the project has been assessed as meeting all the requirements as mentioned in the *National Statement on Ethical Conduct in Human Research* (2007). I am therefore pleased to advise that ethical clearance has been granted for this proposed study.

Please note the following conditions of approval which apply to your research project:

- Ethics approval for this project is valid for 3 years. Under the *National Statement* you are required to report on the project's progress on an annual basis and the first annual report is therefore due in August 2012. Once your project is completed you are required to complete the Annual Report as a Final Report on your project. You are also required to notify the HREC Executive Officer in writing if this project is abandoned. The Annual Report form can be found at: <http://www.nd.edu.au/research/hrec/apply.shtml>.
- As a researcher you are required to immediately report to the HREC Executive Officer anything which might warrant review of ethical approval of the project, including unforeseen events that might affect continued ethical acceptability and any complaints made by participants regarding the conduct of the project.
- If the design of the study, the choice of instrument, or its manner of administration is altered in any significant way as the study progresses, you are required to submit an amendment in regards to the changes for ethical consideration to the HREC. The Amendment Form can be found at: <http://www.nd.edu.au/research/hrec/apply.shtml>.

On behalf of the Human Research Ethics Committee, I wish you well with what promises to be a most interesting and valuable study.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Natalie Giles'.

Dr Natalie Giles
Executive Officer, Human research Ethics Committee
Research Office

cc. Dr Jean MacNish, School of Education;
Professor Michael O'Neill, Dean, School of Education;
Professor Richard Bertach, Chair, SRC.

Appendix Q Focus group questions (parents and carers)

1. What mLearning resources did you like?
2. What mLearning resources did you not like?
3. What support (if any) do you give to your children to help them use mLearning?
4. What did you like about participating in this project this year?
5. What impact do you think mLearning partnership has had on your child's learning?
6. What value do you see in school-university partnerships?
7. What did you learn from the mLearning workshop?
8. What are your beliefs regarding the use of mLearning in early childhood education?
9. How would you describe your level of technological knowledge on a scale of 1-5?
10. Do you think mLearning has a place in the early childhood classroom?
11. How much time you spend using mLearning tools?
12. Do you feel better informed about the place of mLearning in the classroom as a result of this mLearning partnership?