Conceptualisations, beliefs and practices: Investigating technology integration in Australian early learning environments through practitioner inquiry

Kelly Johnston

Department of Educational Studies

Faculty of Human Sciences

Macquarie University

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Dedication

Lovingly dedicated to my quirky little family.

For my beautiful boys who remind me daily of the wonder, surprise and magic in the world.

For my sweet Don. The pattern in my chaos and the chaos in my pattern.

Acknowledgements

My deepest thanks to the communities of people who have supported me throughout this research both as an academic and in my roles of mother, wife, friend, daughter, sister, and colleague.

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My final acknowledgement is to the Australian Government for recognising the value of research and supporting students with grants. Receiving the Australian Postgraduate Award turned PhD research from an imaging and a hope to a reality for me. May this support for research abide!

Declaration

I certify that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy in the Department of Educational Studies, Faculty of Human Sciences, Macquarie University, does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university, and to the best of my knowledge and belief it does not contain any material previously published or written by another person where due reference is not made in the text.

This is also to certify that this thesis meets the *Macquarie University's Human Research Ethics Committee (HREC)* requirements for the conduct of research (Reference no. 5201200902 on the 20th December 2012), following the *National Statement on Ethical Conduct in Human Research (2007)* (Appendix A).

Kelly Johnston (Student No. 31142966) 5 June 2017

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Abstract

Digital technologies are becoming more prevalent every day and increasingly impact upon childrens lived experiences (Chaudron, 2015; Palaiologou, 2014). However, research indicates that diverse yet interrelated factors create an antipathy towards the integration of technology in play-based curriculums which poses a challenge for early childhood educators (Nikolopoulou & Gialamas, 2015a; Palaiologou, 2016).

This study investigated educator beliefs and practices in relation to technology integration in their early learning services. Additionally, this research investigated practitioner inquiry as a professional learning model to support educators to integrate technology within a play-based curriculum. Rogoff's (1990; 1995) sociocultural framework underpinned the study and was utilised to examine understandings of technology and how these impacted upon pedagogical practice.

The research comprised of a collective case study of educators at three early learning services in New South Wales, Australia. At each of the early learning services one group took part in the study. This predominantly included two educators and the cohort of children they worked with as well as the service director or manager. Children were three to five years of age, and each group accommodated up to 20 children per day with regular, ongoing attendance pattern. The case studies included two phases, implemented over a 10-month period. The first phase examined the beliefs and practices of educators. This knowledge of educators and their specific contexts then informed the practitioner inquiry projects conducted in the second phase of the study.

Findings from this research indicated that technology integration can be a paradox within early learning services and continues to be dichotomised between those who support it and those who disapprove of technology use by young children in early learning curriculums. A number of complex and interwoven factors impact upon educator beliefs and practices, and the subsequent integration of technology in their curriculums. Concomitant viewing of these factors acknowledged the relationships and connections that impact on educator beliefs and practices at personal, interpersonal and contextual levels.

Findings also highlighted the importance of defining and reconceptualising technology integration—moving beyond more limited ideas of technology to consider the broader experiences children and educators have in their everyday lives. Acknowledgement of variations in educator conceptualisations of technology underpinned the practitioner inquiry process. Accordingly, professional learning content was adapted to be contextually relevant and responsive to interests, abilities, needs and resources within each service. A number of factors were identified as supports and inhibitors to technology integration with the practitioner inquiry process.

This study identifies a need for further opportunities for professional discourse, critical reflection and professional learning to support educators to consider diverse conceptualisations of technology and to investigate possibilities for integrating technology within play-based pedagogies.

Chapter 1: Introduction and Background to the Study

> *[…] ask questions, but not questions where you already know what you want to find out. So ask questions about your wooden blocks, your Lego blocks, and your Tetris blocks. These questions should be asked by the communities that imagine digital childhoods, in whatever rosy or gloomy light. (Gibbons, 2015, p.124)*

The ubiquity of technology and its associated implications for children invoke diverse and inconsistent reactions within early learning services and broader societal contexts. The above quote by Gibbons (2015) applies to the current juncture where the integration of technology across early learning services must be considered equitably with the use or abandonment of more traditional teaching and learning resources. Families and educators alike are questioning the positive and/or negative aspects of integrating technology in contemporary early learning services. There is value in early childhood educators engaging in professional discourse to consider these questions as well as to pursue these conversations amongst themselves and with families. These discussion could include definitions and conceptualisation of technology help create broader and shared understandings. For the purposes of this thesis technology is conceptualised to include digital toys or other devices such as personal computers, cameras and tablets (Palaiologou, 2016) as well as less tangible forms of technology, such as the Internet (Knight & Hunter, 2013); imaginary technologies such as those that are used in dramatic play (Edwards, 2015; Howard, Miles & Rees-Davies, 2012); and non-digital technologies that require an external power source such as light tables and overhead projectors (See Glossary). These descriptions and delineations underpin all uses of the term ‘technology’ throughout this thesis.

As such this thesis seeks to unpack insights on educator beliefs and practices about the integration of technology in early learning services. It was anticipated that through these insights new understandings and conceptualisations of technology could be further explored through practitioner inquiry as a professional learning strategy to sustain educator learning and development over time. Engagement with practitioner inquiry as a professional learning strategy supported and maintained questioning and critical reflection by the educators who participated in this research.

This chapter provides an outline of issues pertaining to the integration of technology within early learning services and how this relates to the technological context experienced by children. These findings are then considered in terms of the Australian context and the candidate's previous postgraduate research, which served as an impetus and inspiration for this thesis. Identification and explanation of the research aims and questions occurs within a sociocultural framework. This chapter also outlines the significance of the research, and the major gaps in the research literature explored during this study.

1.1 The Significance of Technology Integration in Early Childhood Education

The presence of technology is pervasive, persistent and consistently increasing (Marsh, Plowman, Yamada-Rice, Bishop, & Scott, 2016; Palaiologou, 2016). Technology is now commonplace in children's everyday lives in Australia and embedded in their ways of knowing, understanding and responding to the world (Parette, Quesenbury & Blum, 2013). This is a relevant consideration given that contemporary early childhood policy, philosophy and research supports the provision of curriculums[1] and learning experiences that reflect children's individual interests and needs as well as being relevant to their social contexts (Barblett, 2010; Palaiologou, 2016). In considering family and societal factors that influence children, research indicates that they are now experiencing a wide range of digital media and other technologies in their everyday lives. This can include television, computers, DVDs, gaming consoles, mobile phones, digital toys, iPods, iPads and electronically driven household appliances, as well as resources within the community such as automatic teller machines, vending machines and self-scanners in supermarkets (Blackwell, Lauricella, Wartella, Robb & Schomburg, 2014; Fleer, 2011; Nikolopoulou & Gialamas, 2015b; Palaiologou, 2016; Plowman, Stevenson, Stephen & McPake, 2010). Additionally, 'popular culture', a term referring to cultural items that are widely popular and influential within a society, country or globally (Marsh, Brooks, Hughes, Ritchie, Roberts and Wright, 2005), is largely interrelated with technology and has a significant impact on children's development and understanding of the world (Fleer, 2011; Marsh et al., 2005).

Despite its ubiquity, the view that technology is an inappropriate resource for young children, both in homes and in early learning settings, prevails (Blackwell et al., 2014; NAEYC & Fred Rogers, 2012; Sims, 2015). This is often a product of limited understanding and conceptualisations of technology, and can reflect a degree of moral panic over the perceived 'newness' of this resource (Alper, 2011; Gibbons, 2015). Tabloid-style newspapers that are widely accessible to people either in print or online often fuel this panic response. Consider for example headlines from recent news articles that included emotive language focusing on the potential negative aspects of children's interactions with technology. These

[1] The term 'curriculum' is used throughout this thesis in alignment with the definition in the EYLF, which is all of the events and experiences that children have throughout the day including resources, features of the environment, planned and unplanned experiences, the educator's pedagogical practices, and the child's interactions with others (DEEWR, 2009).

included: “How to unplug your child from their addiction to technology” (Chander, 2016); “Children losing language skills due to large technology use” (Adamski, 2014); “Junior digital detox: Get your child back” (Carlyle, 2016); and “It’s ‘digital heroin’: How screens turn kids into psychotic junkies” (Kardaras, 2016).

These kinds of sensationalised headlines are often largely based on opinion rather than robust research findings. However, such headlines can provoke a reaction with families who are often already anxious about their children’s engagement with technology and find it difficult to access consistent, reliable advice (Palaiologou, 2014) on managing their children’s use of digital media. Overly dramatic reporting in print and online media are further exacerbating issues relating to the appropriateness of technology. Gibbons (2010) notes that news media, along with other sources, help formulate community opinions on technology use which creates a need for educator knowledge of the issues giving rise to these debates. Enabling early childhood educators to challenge misconceptions, extend understandings and critically reflect on the types of technology that are socially and culturally relevant to young children in their early learning services requires access to suitable information and support.

To support children’s understandings of the technology they experience in their everyday lives, early childhood educators can develop an awareness of children’s broader experiences with technology. It is also beneficial for educators to consider how extending integration of technology within early learning pedagogies supports children’s learning (Edwards, 2005; Palaiologou, 2014; Yelland, 2007). Recent research however indicates that technology integration is not consistent in early learning curriculums. Possible reasons identified for reluctance or avoidance of including technology in the curriculum include limited professional learning opportunities for educators, inadequate resources and funding, issues with educator confidence and competence, and lack of recognition of the importance and relevance of technology as a resource to support children's play, explorations and learning (Campbell & Scotellaro, 2009; Gialamas & Nikolopoulou, 2010; Lindahl & Folkesson, 2012a; Nikolopoulou & Gialamas, 2015a; Palaiologou, 2016).

Contextualising technology in early childhood education

The National Association for the Education of Young Children (NAEYC) is a well-respected and the oldest non-government, professional agency dedicated to advocacy for young children and early childhood professionals based in the USA. In 2012, the NAEYC, in cooperation with the Fred Rogers Center for Early Learning and Children's Media at St Vincent's College, released a revised position statement on *Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Eight Years*. This statement replaced the previous position statement that had remained in effect since 1996 (NAEYC & Fred Rogers Center, 2012).

The revised NAEYC and Fred Rogers Center position statement (2012) demonstrated a shift in thinking about technology, and recognised the need to support educators in harnessing the potential value and opportunities technology integration presents within early learning environments. As yet, there is no similar position statement for Australian educators. Early Childhood Australia (ECA), a peak advocacy group in Australia, have developed the Digital Policy Group who are working together to develop a statement that provides support and guidance relevant to the Australian context (ECA, 2016). However, the NAEYC and Fred Rogers Center position statement (2012) includes valuable insights and information that can easily be applied and critiqued in relation to the Australian context due to similarities in both social and pedagogical aspects of each country.

The American position statement acknowledges that the technology surrounding children in modern society is significantly different to that which their parents and grandparents experienced as children (NAEYC & Fred Rogers Center, 2012). This aligns with the discussion above which highlights the ever changing and progressing nature of technology. Extending on this idea, the NAEYC and Fred Roger's Center (2012) note the interactive and social nature of technology and the potential this presents in fostering relationships between children as well as with educators. This idea signifies a progression away from previously held beliefs of technological resources as solitary or adjunct experiences (Mantei & Kervin, 2007). The NAEYC and Fred Rogers Centre position statement (2012) makes important distinctions between interactive media and non-interactive media, discouraging the use of non-interactive media within early learning settings.

Highlighting the relevance of interactive technology for social engagement may reduce current biases against the use of technology, especially if these biases are based on ideas of solitary, inactive play and engagement (Shifflet, Toledo & Mattoon, 2012). The way that people communicate and organise their lives has also changed in response to the technology available (NAEYC & Fred Rogers Center, 2012). This includes the use of social networking media, email, instant messaging and other online resources (Grey, 2011; NAEYC & Fred Rogers Center, 2012). From a very young age children observe these resources in use in their homes, their communities and their early learning services, which influences their understandings of everyday life and cultural tools.

The inclusion of diverse technological resources for communication and other interactive purposes in television programs aimed at early childhood audiences reflects its normalcy in children's lives. As an example, various forms of technology such as smartphones, messaging applications and social media features are an integrated part of the plot in the popular Australian children's televisions program 'Play School', providing a reflection of the way children see these forms of technology in everyday life (Duck, 2012). Research acknowledges Play School as an example of high quality early childhood television programming that is innovative and responsive to social and community change (Hill, 2009).

While it is not suggested that children should access social media forums such as Twitter, it must be acknowledged that a wide range of technologies for communication, including online resources, have become a part of everyday life for many children (Danby, 2013; Edwards, Nolan, Henderson, Skouteris, Mantill, Lambert & Bird, 2016; Grey, 2011). As such, providing opportunities to explore these technologies is important in supporting children to develop an understanding of their world, and to develop foundation skills and knowledge to extend over time (Grey, 2011; Parette et al. 2010).

The continual development and sophistication of technology for communication and social networking suggests that children's experiences within these realms will also increase (Schurgin-O'Keeffe & Clarke-Pearson, 2011). However Edwards (2015) notes a lack of research investigating support for and extension of children's experiences with technology within early learning services. With the plethora of changes presented by increased availability of diverse technologies, educators also have to reflect on their changing roles and responsibilities with technology integration in early learning services (NAEYC & Fred Rogers Center, 2012). Not only is it important to support children's efficacy in using technological tools and resources to be active participants in society, they also need to be made aware of the potential challenges and safety considerations associated with online communications and experiences (Grey, 2011; NAEYC & Fred Rogers Center, 2012).

Educators have a role to play in supporting children's successful navigation of digital environments, as well as advocating ways for families to support their children to have safe and effective experiences with technology (NAEYC & Fred Rogers Center, 2012; Palaiologou, 2014). Changes in technology therefore also mean changes in the skillset needed by educators. The NAEYC and Fred Rogers Center (2012) suggest that early childhood educators need a strong understanding of pedagogical theory to create an understanding of the relevance of technology in early learning curriculums, as well as needing to be technologically literate.

In considering how to support educators it is important to understand the current context for education and early learning. The *Early Years Learning Framework (EYLF)* is the first mandatory national early learning framework developed and implemented within Australia (DEEWR, 2009; Sumsion, Barnes, Cheeseman, Harrison, Kennedy & Stonehouse, 2009). It provides educators with general direction and overarching guidelines for the preparation of appropriate programs and learning experiences offered within early learning services. There is flexibility for educators to create curriculums that are responsive to the unique attributes of their contexts, families and communities. The term ‘curriculum’ as used in the *EYLF* was adapted from *Te Whãriki*, the Aotearoa/ New Zealand curriculum policy for early childhood education (DEEWR, 2009; Ministry of Education, 1996). This interpretation of curriculum is more open ended than in traditional conceptualisations and extends to include all experiences, events and interactions, both planned and unplanned, that occur within an early learning setting (DEEWR, 2009). The *EYLF* recognises the importance of the early years for children’s development, the importance of culturally relevant intentional teaching, and also the value of establishing reciprocal relationships with families and connections with the wider communities (DEEWR, 2009; Leggett & Ford, 2013).

The United Nations Convention on the Rights of the Child (the Convention) (United Nations, 1990) also underpins the *EYLF* (DEEWR, 2009), and has a strong focus on children’s social and cultural rights and responsibilities. Contemporary thinking in relation to early learning in Australia suggests that children learn best in play-based situations that reflect their home cultures and experiences (Barblett, 2010; Ebbeck & Waniganayake, 2016; Yelland, 2007). This approach also features strongly in the *EYLF* (DEEWR, 2009), which defines play-based learning as “[…] a context for learning through which children organise and make sense of their social worlds, as they engage actively with people, objects and representations" (p. 6). Support for play-based learning exists within the within the context of intentional teaching, where educators are encouraged to engage children in active discussions about their experiences and thinking processes, to further extend their understanding and learning (DEEWR, 2009, Siraj-Blatchford & Sylva, 2004). Respecting and incorporating children's views and voices in this way aligns with sociocultural theory, one of the four main theoretical perspectives that underpin the EYLF, and highlights the importance of scaffolding as well as the promotion of social interactions to support children's learning and development (DEEWR, 2009; Rogoff, 1990; Vygotsky, 1978; Yelland, 2007). The key notions of 'belonging', 'being' and 'becoming' as conceptualised within the EYLF reinforce the idea that children have strong connections to their families, communities and cultures, and that it is within these contexts they develop a sense of identity, personal interests and knowledge of their world (DEEWR, 2009).

Published research that focuses specifically on integrating technology within play-based pedagogies is still emerging (Palaiologou, 2016). The incipient nature of research on this topic is a concern as previous research indicates that many educators are not necessarily confident in using technology (Gialamas & Nikolopoulou, 2009; Gibbons, 2010; Mantei &Kervin, 2007; Nikolopoulou & Gialamas, 2015a) or may feel that it contradicts early childhood pedagogy (Edwards, 2005; Sims, 2015; Zevenbergen & Logan, 2008). Lack of educator knowledge presents a range of issues given the value of providing children with experiences that build on their already established ways of knowing and being, as highlighted by sociocultural theory (Rogoff, 1990). An additional question then arises regarding whether the general antipathy educators feel towards integrating technology impacts upon their inclination to engage with technological tools and resources (Palaiologou, 2016). These issues exist alongside the previously mentioned concerns regarding understanding what the term 'technology' can encompass, as well as being aware of the new terminology and approaches within the *EYLF*. As such, this highlights the need for further investigation of educator understanding of technology as well as their beliefs, practices, and level of confidence. It also demonstrates the need to investigate professional learning opportunities for educators that promote the relevance and value of integrating technology in early learning curriculums.

1.2 Research Questions and Aims

The purpose of this research was twofold:

1. To gain in-depth understanding of educator beliefs in relation to technology integration in early childhood curriculums, as well as to develop an understanding of how this presents in praxis.

2. To engage a group of educators in flexible ongoing professional learning that focused on integrating technology in contextually relevant ways within a play-based early childhood curriculum.

Essentially, this research investigated how educators used technology in their early learning services and the factors that influenced their practices. This work centred on 'integration' rather than just 'inclusion' of technology. In keeping with the philosophy of play-based learning, the focus on the integration of technology reflected the importance of adopting holistic approaches in early learning curriculums (DEEWR, 2009). More generally, integration referred to connections that exist beyond the individual, with a focus on the relationships between children and their peers, families and the wider community (DEEWR, 2009: Rogoff, 1990). Additionally, Gibbons (2010) notes that integration is a key concept to consider in relation to early childhood education, and should involve technology based experiences and resources being available in a seamless, non-disruptive way.

This thesis set out to address three key research questions within three early learning services:

1. What are the beliefs of early childhood educators about integrating technologies in early childhood services?
2. How was technology integrated in early childhood educators' practices?
3. What supports and inhibits practitioner inquiry as a strategy to integrate technology in early childhood services?

The investigation of these questions was framed within a sociocultural theoretical framework that supported the exploration of the holistic nature of integrating technology within early childhood curriculums. The following section outlines the researcher's study background to provide a foundational understanding for this current recent.

1.3 Study Background and the Researcher's Story

The concept of 'digital immigrants' is difficult to define, and is often associated with those who are reluctant to engage with digital technology (Helsper & Eynon, 2009). The researcher, as a member of Generation X, is not a millennial, or a digital native (Zevenbergen & Logan, 2008). However, the researcher acknowledges a long-held interest in 'new' technologies as they emerged over the last three decades—from the first television gaming consoles and handheld games in the 1980s, early home personal computers in the 1990s, and through to the connected world required as a researcher and academic within the field of education. This section outlines the personal narrative of the researcher to explain the impetus for the current research project.

1.3.1 The Researcher's Story.

In 1995 as an undergraduate early childhood education student, I read a book titled The *Diamond Age: Or, a Young Lady's Illustrated Primer* (Stephenson, 1995)—an award-winning science fiction novel. The theme of this story was, amongst other things, the power of technology to support learning across social class systems and beyond privilege and entitlement. At the time of reading this book, the Internet had only just become publicly available, and Stephenson's description of a digital interactive book ('the Primer') that allowed connection with other people and sources of information was both fantastic and awe-inspiring. Despite my love of science fiction and acknowledgment that it often foresees future developments in society (Lombardo, 2008), I could not imagine what this form of technology could look like, and how it could be harnessed to support social, academic and moral education as it did in the book. Reading this novel also raised compelling questions within me around whose knowledge the children using the digital book assimilated, and how powerful human interaction could be in altering experiences with technological devices - such as by encouraging critical thinking and question asking rather than letting children passively consume information.

Stephenson's (1995) ideas percolated within as I embarked on my teaching career in early childhood education. Over many years, I explored the value and the drawbacks of new technologies both in social and educational contexts—an area that proved a constant source of fascination and interest. My toddler aged son received an iPod as a gift in 2011, closely followed by an iPad at only three years of age. As I watched him interact with the iPad parallels with the Primer, of Stephenson's fictional book, were abundantly clear. My son was playing with very similar technology, which meant that many of the themes and concerns of the story in terms of the impact of such technologies on education, growth, communication, ethics and equity were now very real issues for children in contemporary society. Without human interaction, outcomes for children using the Primer were fraught with challenges in terms of social justice, education and developmental issues. Comparisons of the Primer with the iPad my son was using brought home to me the importance of human interaction and the need to guide learning so that it is responsive to every child's individual abilities, interests and needs.

This research is the ongoing exploration of my many years of ruminating on the benefits afforded by technology, but also on ideas of power and agency with technology provision and children's play. I do not come to this research as an avid and unbridled supporter of technology. Nor do I adopt the stance of Luddite, or succumb to the moral panic that often accompanies technology and its ubiquity (Alper, 2011; Gibbons, 2015). My research interest was born from an interest in supporting children and educators to critically reflect on learning with technology, to understand its place as a socially and culturally relevant tool, but to also maintain the utmost agency it can afford children's learning. I am in agreement with Gibbons' (2015) statement in the epigraph for this chapter, as I believe we must continue to create a culture of question asking when we consider digital childhoods.

1.3.2 Previous postgraduate research by the candidate.

The research in this thesis builds on findings from previous postgraduate research undertaken by the candidate. The previous study employed a mixed methods approach to gain insights into facilitators and barriers to the integration of technology in early learning services in New South Wales, Australia. A large proportion of early childhood teachers who completed the survey in the previous study (i.e. 94.6 percent or n=27) indicated they felt confident and competent in integrating technology into their early learning curriculum. However, contrary to their reported self-efficacy, information gained through open ended responses in the questionnaire as well as follow up interview questions highlighted that many educators were not comfortable with the integration of technology, and felt the value of embedding technology in early childhood services was negligible. Additionally, 46 percent of participants (n=13) also indicated that lack of funding and available resources were a significant hindrance to integrating technology at their services. The low response rate to this survey in the previous postgraduate study—comprising 28 educators participating out of a random sample of 380 services in NSW—limited the generalisation of results.

Ratings in relation to educator self-confidence and competence were high, and additionally 93 percent (n = 26) of participants felt that computers and technology were valuable for supporting and extending children’s interests relating to technology. This may also suggest that the educators who chose to participate in this research had an interest in technology. However, given that just under eight percent of services contacted chose to complete the survey, there was a strong possibility that lack of interest in, or confidence relating to technology may have been a factor in explaining why 352 services did not complete the survey. Other factors identified via email correspondence from educators who declined to take part were lack of time, and no staff members at the service that met the selection criteria (university level teaching qualifications). This previous research, combined with the researcher’s employment as a lecturer teaching preservice teachers at university, was a catalyst for this thesis. These experiences highlighted to the researcher the need for case-study research that allowed time to understand and investigate educator beliefs and practice about technology integration in-depth and to explore ways to support understandings, confidence and practice. The following section outlines the relevance of sociocultural theory as a relevant and beneficial framework for anchoring this research.

1.4 Theoretical Framework

Traditionally, the reproduction of social practices is based on familiarity, security and comfort (Lindahl & Folkesson, 2012a; 2012b). Rogoff (1990) explains this process as children learning through observing and participating with other, more capable community members, thereby developing an understanding of important cultural practices, as well as how to use culturally relevant resources, approaches and tools. Currently, the rapid advancements of technology have included the embedding of digital tools and resources in everyday life; however, the use of technology is not necessarily completely familiar or comfortable for all community members (Plowman & McPake, 2013). Children and educators may learn about technology contemporaneously, sharing and alternating between the roles of an apprentice and a more capable other (such as a teacher, an older sibling, or for educators, a colleague). A sociocultural lens corresponds with this as it facilitates and supports collaborative, context specific learning and teaching (Rogoff, 1990).

Sociocultural theory emerged initially from Vygotsky's work relating to cognitive functioning (Wertsch & Tulviste, 1992) where he claimed that development first occurred on an interpsychological, or social plane, and was then transferred by the child to an intrapsychological or internalised plane (Vygotsky, 1978). This work was further extended by Rogoff (1990), who stated that not only were interactions and contexts important, but that individual thoughts could not be separated from contextual influences. Sociocultural theory suggests that there are inextricable links between the individual and the social and cultural contexts within which they exist (Rogoff, 1990; Rogoff, Topping, Baker-Sennett & Pilar, 2002; Wertsch, 1991).

This theoretical approach builds on past notions of child development being individualistic, and serves to recognise the importance of external influences such as family, community and culture (Rogoff, 1990, Vygotsky, 1978). Therefore, children respond to what they perceive as valued by significant people in their communities and assimilate this into their ways of being and knowing. Vygotsky (1978), a pioneer of sociocultural theory, stated that children are not passive in this process, and are able to control their behaviour, drawing on the social and cultural tools available to them. This thinking also applies to educators in their learning and development, and has significant implications for creating professional learning strategies that acknowledge the sociocultural influences. Put simply, and adapted to the aims of this study, the experiences and cultural capital of the individual child, as well as individual educators, impacts upon how they incorporate new knowledge and experiences.

1.4.1 Sociocultural theory in investigating educator beliefs, practices and professional learning.

Both Vygotsky (as cited in Davydov, 1995) and Rogoff (1982) draw on three distinct factors or planes to demonstrate the complex and interrelated ways that people learn and develop. These factors reinforce that professional learning models for early childhood educators should reflect the skills and knowledge that participants bring with them, as well as the individual characteristics of the setting that will impact upon practice. Vygotsky identified these as the student, the teacher and their social environment (Davydov, 1995). Subsequently Rogoff (1998) consolidated and extended on these by conceptualising three planes, as outlined in Table 1.1. Relationships and interactions are central to these planes and are core aspects of sociocultural theory (Edwards, 2003). Vygotsky presents that even individual cognitive functions are social in nature as they rely on cultural tools that have been organised, and have evolved in social contexts (Wertsch & Tulviste, 1992). A sociocultural framework inextricably links the learner with social and cultural contexts. From this perspective, the learner does not internalise information, rather sociocultural theory posits that individuals are involved in “appropriating or mastering patterns of participation in group activities” (Sawyer, 2005, p. 284).

Table 1.1

Planes of analysis

	Vygotsky	**Rogoff**
Plane 1	Student/ Individual	• Subjective • Personal • Participatory appropriation
Plane 2	Teacher/ Intersubjectivity	• Interpersonal • Guided • Guided participation
Plane 3	Milieu/ Classroom	• Community • Institution • Apprenticeship

Note: Adapted from Vygotsky (Davydov, 1995) and Rogoff (1998; 1995).

Rogoff’s planes (1995) are a particularly valuable tool as they enable the investigation of the sociocultural activity on personal, interpersonal and community planes contemporaneously. These three elements of sociocultural activity influence practices in terms of the three planes of analysis—participatory appropriation, guided participation and apprenticeship. The interrelated nature of Rogoff’s planes is outlined in Figure 1.1 and further discussion of the planes is included in the section that follows.

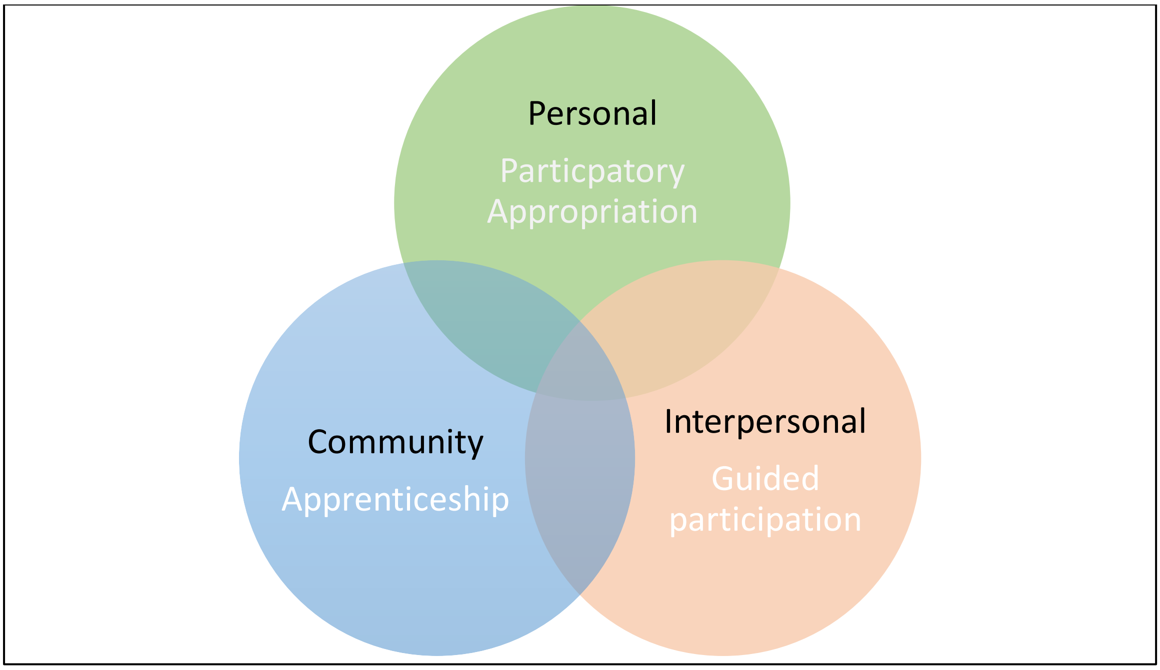

Figure 1.1: Rogoff's planes of analysis.

Plane 1: The individual: subjective/ participatory appropriation

Vygotskian theory presents that an individual's cognitive processes are born from social experiences (Wertsch & Tulviste, 1992). Rogoff (1995) extended on Vygotsky's thinking, introducing the idea of 'participatory appropriation'—defined as the way in which children develop as a result of their engagement in certain experiences within their contexts and how these then shape the way children participate in later experiences. This approach to learning assumes that each person comes to a situation with previously acquired knowledge, and their experiences with the new situation can build on this knowledge and be internalised to create new knowledge (Rogoff, 1998). Moreover, each person's pre-existing understandings can help to interpret and apply new information in different ways (Rogoff, 1998).

In terms of the integration of technology in early learning curriculums, a participatory appropriation or a subjective approach draws upon previous experiences of educators as well as educator perceptions of children's previous experiences. It also focuses on the way that educators and children observe, assimilate and understand how technology features in everyday life as a tool, resource or form of entertainment. This learning occurs through participation in socially and culturally relevant experiences, which has implications for professional learning approaches (Rogoff, 1998).

Plane 2 - The teacher/ intersubjectivity: interpersonal/ guided participation

From a Vygotskian perspective, the sociocultural processes that occur between people—or ‘intersubjectivity’—are critical to cognitive development, and involve an overlap between information passed between people and information assimilated from social contexts (Rogoff, 1998; Vygotsky, 1978). The plane of guided participation is explained by Rogoff (1995) as encompassing interpersonal processes, including the interactions that support and promote learning such as the benefits from investigating and exploring in collaboration with peers. This plane involves interpersonal exchanges that may occur within direct guidance and/or observation of another person, or may occur within collaborative team or group endeavours (Rogoff, 1995). This is an important shift from a dyadic or transmission approach to learning (Carter & Fewster, 2013; Hall, 2007) and demonstrate a theoretical, rather than prescriptive approach to teaching and learning (Eun, 2010). Guided participation includes assimilating the knowledge and practices that are favoured by educators, families or the wider community (Rogoff, 2003). Similarly, undesired skills or ways of thinking are also assimilated through guided participation.

Plane 3: Milieu: community/ apprenticeship

Vygotsky presented the ‘milieu’ as the basis and foundation of development, rather than merely the location or place where development occurs (Davydov,1995). This recognition of the social environment underpins Rogoff’s (1995) plane of apprenticeship.

This plane focuses on cognitive and mental development within the community and the enhanced learning that can occur when engaged in experiences with more capable peers (Rogoff, 1995). The plane of apprenticeship, and also participatory appropriation (see Figure 1.1), links closely with Vygotsky's zone of proximal development, where children are able to extend their abilities and understanding through guidance and support from an adult, or a more capable peer (Vygotsky, 1978). Rogoff (1998) explains the symbiotic nature of the zone of proximal development as follows:

> The concept of the zone of proximal development is not a characterisation of what the more expert partner does to the other. It is a way of describing an activity in which someone with greater expertise assists someone else […] to participate in sociocultural activities in a way that exceeds what they could do otherwise. Sociocultural approaches to the study of experts assisting novices focus on examining how participants mutually contribute to learning, with attention to institutional, historical aspects of how the activity functions in the communities in question. (p. 699)

The next section includes further discussion on the relevance of understanding the concept of the zone of proximal development.

1.4.2 Sociocultural theory and research on the integration of technology in early learning services.

As discussed throughout this chapter, Technology integration is prevalent in everyday life. Children develop an understanding of technology based on their individual experiences and their perceptions of the importance of these experiences, and as valued by significant others (Fleer, 2011; Lindahl & Folkesson, 2012a). Edwards (2014) provides further perspectives on the relevance of sociocultural perspectives when investigating early learning.

Whereas Vygotsky's ideas were born from a school-based academic focus (Rogoff, 1990), Edwards (2014) applied a sociocultural perspective to current early learning contexts—specifically in relation to the value of play-based learning in early childhood programs. Within this research, Edwards (2014) introduces the idea of 'contemporary play' and acknowledges the importance of considering children's current social and cultural contexts. She states:

> Rather than positioning technologies, media and products as causes of deficiencies in children's play it is suggested instead that digital-consumerist context promotes a form of direct cultural participation for young children (0-8 years of age) with the potential of realising multiple pathways of participating in a continuum of digital to non-digital experiences. (Edwards, 2014, p. 219)

In further developing sociocultural theory, Rogoff (1990) extended the zone of proximal development to include the concept of guided participation. Vygotsky's (1978) approach tended to focus on dyadic interactions between a child and a more capable other, whereas Rogoff (1990) took into account that guidance is not always face-to-face—it can be proximal and distal, and therefore applicable in the use of digital technology.

A number of other studies focusing on technology in early learning services which also adopted a sociocultural framework were informative and influential during the design and analysis phases of this research. This included Lindahl and Folkesson (2012a; 2012b) as well as Plowman and Stephen (2010), whose studies demonstrated the relevance and value of using a sociocultural framework to examine the integration of technology in early learning services. Lindahl and Folkesson (2012a; 2012b) drew on the work of Giddens' (1984) structuration theory, with the aim of highlighting the intercession between what is occurring socially and culturally, and to question how this is perceived by the subject —the variation between the objective and the subjective (Werlen, 1993). Like Rogoff (1990), Giddens

(1984) posits that individuals and communities cannot be considered separately as they are interdependent: each requires the other as an antecedent and must always be considered within the context of the other. Lindahl and Folkesson (2012a; 2012b) opted for this theoretical approach as it contends that the systems that exist within societies pivot on relationships between people. These relationships may be ordered and rearranged before being replicated in the everyday ways of being, knowing and experiencing the world (Lindahl & Folkesson, 2102a, 2012b).

Understanding personal perspectives is important as the individual plays a significant role in reproducing social practices and introduces a degree of variation and adaptation (Vygotsky, 1981). Moreover, Rogoff (1994) argues that underpinning this reproduction of social practices is an understanding of the accepted rules as well as resources that are available within that community or society. These parameters influence the speed of change implementation. Central to this premise is the belief that familiarity plays an important role in the social practices of community members as it is within this zone of familiarity that they find a sense of security. To move beyond the familiar, community members need to understand the value, reason and repercussions relating to change. This challenge to security is an important consideration with technology due to the increasing speed of advancement and the often-prevalent lack of understanding that accompanies it (Alper, 2011). Lindahl and Folkesson (2012b) note the relevance of the concept of "expert knowledge" (p.425) in the integration of technology in early learning curriculums.

Drawing on Giddens' structuration theory (1984), Lindahl and Folkesson (2012b) further state that expert knowledge exists as a divergence from that which is familiar, secure, or an accepted cultural norm. The relevance here in relation to early learning curriculums is that integration of technology often creates concerns as the educators may not understand or accept the technological resources and experiences that could be introduced, despite their prevalence (Lindahl & Folkesson, 2012b). Sociocultural theory as a framework for the topic of technology enables examination of social and cultural norms, as well as those aspects that instigate change.

In the past, older generations held the expert knowledge that exists within society (Rogoff, 1990). However, the use of technology presents a significant conundrum in knowledge construction between today's generations. Children learn through observation, experience, cultural practices, available resources and language used. Technology is ubiquitous and is something that children are assimilating and interacting with directly in their everyday lives. Rapid advances and changes in technology (Palaiologou, 2016), it creates situations where digital resources and other technological resources are present and relevant culturally, but not necessarily well understood by adults such as educators, families or providers of early learning services (Blackwell et al., 2013; Gibbons, 2015; Plowman, 2014). This lack of understanding challenges adults' confidence and interest in integrating technology (Lindahl & Folkesson, 2012a; 2012b). This situation can be compounded when there is little or no support or endorsement from management or those in decision-making positions at early learning services, to facilitate technology integration in the curriculum.

Perception of change as being either good or bad can influence reception and implementation (Lindahl & Folkesson, 2012a). Understanding reactions to change is an important consideration as guidance on including technology in early learning curriculums can encounter challenges of resistance and widespread concern (Blackwell et al., 2013). There may be a blanket response pivoting on fears such as reduced physical activity and reduced social interaction (Louv, 2010), rather than considering it as a socially and culturally relevant tool that is prevalent in children's lives in contemporary Western societies such as Australia. Later research by Plowman and McPake (2013) addresses this topic:

> Parents and educators tend to have lots of questions about young children's play with computers and other technologies at home. They can find it difficult to know what's best because these toys and products weren't around when they were young. Some will tell you that children have an affinity for technology that will be valuable in their future lives. Others think children should not be playing with technology when they could be playing outside or reading a book (p. 27).

This is one of a number of misconceptions relating to technology use identified by Plowman and McPake (2013) that families and educators commonly believe. Without access to current research and opportunities for professional learning for educators, it can be difficult to challenge these beliefs.

1.4.3 Critiquing of sociocultural theory.

Critics of Vygotskian philosophy claim that his theories are "not social enough" and that he is reductive in his discussions of how cultural tools effect the internalisation of knowledge in children (Liu & Matthews, 2005, p. 391). Other critiques of Vygotsky's theories reinforce this belief, claiming that his perspectives require separate viewing of the individual and society, therefore overlooking their mutual impact and interconnectivity (Liu & Matthews, 2005; Sawyer, 2002). However, Liu and Matthews (2005) challenge this criticism noting Vygotsky's approach includes a focus on intersubjectivity between the mind and the associated cultural group. Vygotsky suggests that development occurs across two planes—the social and the psychological:

> Any function in the child's cultural development appears twice, or on two planes. First it appears on the social plane, and then on the psychological plane. First it appears between people as an interpsychological category, and then within the child as an intrapsychological category. This is equally true with regard to voluntary attention,

> logical memory, the formation of concepts, and the development of volition […] [I]t goes without saying that internalization transforms the process itself and changes its structure and functions. Social relations or relations among people genetically underlie all higher functions and their relationships. (Vygotsky, as cited in Wertsch & Tulviste, 1992, p. 163)

Thus, in challenging criticisms of Vygotsky Liu and Matthews (2005) argue that his theories do not focus on the individual as such, but on recognising that the consciousness of an individual directly relates to the enculturation process they experience. They further suggest that Vygotsky's idea of collective subjectivity moves beyond the concept of separate individuals to reinforce that each person gains social and cultural knowledge through interaction and collaboration with other community members (Liu & Matthews, 2005). Rogoff's (1982) work reinforces this perspective (with Rogoff recognised as one of the foremost advocates of the interrelated nature of individuals and their social and cultural contexts). This study builds upon the sociocultural concept of collaboration and how this impacts on the knowledge of individuals within community systems. The study also applied this focus to co-learning and thereby moving thinking and learning beyond dyadic exchanges. Rogoff's planes (1995) provide a foundation to examine collaboration, co-learning and the impact of being part of a community of learners for children and educators.

Lewis and Birr Moje (2003) identify that the role of language and discourses between individuals is an under-researched area of sociocultural theory. This corresponds with findings from Plowman and Stephen (2010) who noted areas of incongruence, observing that verbal interactions were not at the core of teaching and learning experiences when educators moved beyond proximal to distal interactions. This was contrary to what they expected to find, and also contrary to assumptions from a sociocultural perspective (Plowman & Stephen, 2010). However, this thesis identifies that engaging other socioculturally relevant strategies such as working with educators to promote dialogue and to engage in implicit scaffolding, could facilitate the relevant integration of technology in early learning curriculums. Within this study practitioner inquiry was utilised as a strategy to support dialogue, communication and reflection drawing on the familiarity, collegiality and sense of collaboration, fostered within a sociocultural framework, further developing the ideas of Lewis and Birr Moje, and Plowman and Stephen.

Alternatively, Mangen (2010) specifically argues against the use of sociocultural frameworks in research that focuses on technology in early learning contexts. She claims that such approaches do not focus on the primarily important factors such as psychological, sensorimotor and phenomenological experiences. Mangen claims that with a sociocultural approach the focus is on external factors rather than on cognitive, sensorimotor and psychological aspects of the individual. Yet researchers such as Stephen and Plowman (2008) argue that stances such as the one presented by Mangen underestimate the ability to use guided interaction in understanding children’s engagement with technology. By adopting a sociocultural approach, investigations can focus on interactions with children while also exploring a range of digital tools and resources. In this way, this research adds to the body of knowledge relating to technology and early learning by providing insights into how educators use technology as a tool to support children’s investigations.

1.4.4 Application of sociocultural theory for the current research.

The purpose of this study was two-fold. Firstly, there was a focus on gaining insights on educator beliefs in relation to technology and how their beliefs influenced pedagogical practice and early learning curriculums within their early learning services. The second aim was to explore factors that supported and hindered practitioner inquiry as a strategy to support the integration of technology. These processes were non-linear and included focussing on how various beliefs impacted practice, and how elements of practice and professional learning shaped beliefs. Identification of a sociocultural approach as the most appropriate theoretical framework to investigate the research aims drew on underpinning, implicit links between educator beliefs and practices (Rogoff, 1990).

Contemporary research reinforces the connections between educator beliefs and practice in technology integration (Flannery Quinn & Manning, 2013) and more specifically between agency and attitudes around technology and curriculum inclusions (Palaiologou, 2016). It is therefore important to understand educator beliefs as they potentially influence knowledge, preference and ways of being that present in practice, which in turn influence the knowledge, understanding and the practices of fellow educators. Understanding links between the individual and their contexts in terms of experiences and learning was pivotal to gaining insights about connections with practice where technology integration was involved.

Eun (2010) discusses that Vygotsky used the Russian term *obuchenie* to underpin his theory – but that the common translation of ‘learning and teaching’ is not comprehensive enough. Learning and teaching exists within a complex and ever changing relationship with the process of development. As such sociocultural theory emphasises the bi-directionality of theory and practice (Eun, 2010). Rogoff’s (1995) three planes or sociocultural activity and analysis provided a valuable lens through which to investigate educator beliefs and practices in relation to integrating technology in early learning environments (Phase 1 of this research). It was also valuable for investigating the many inter-related factors that impacted upon suitable and effective professional learning opportunities for educators that focus on technology integration in play-based curriculums (as explored in Phase 2). These factors need to be understood and taken into consideration when planning and implementing professional learning strategies. Carter and Fewster (2013) as well as Hadley, Waniganayake and Shepherd (2015) state that professional learning for early childhood educators is more effective when it is collaborative, context specific, and also responsive to the skills, experiences and knowledge that individuals and groups of educators bring with them. Sociocultural theory supports this approach as it purports that learning is more effective when there is a shift from an individual focus to group collaboration (Rogoff, 1998). During the research process any one of the three planes can be the main areas of focus. However, the other two planes remain consistently influential and relevant to the plane in the foreground, recognising their inherent links and interrelated nature (see Figure 1.1).

While Rogoff (1998) refers mainly to children's learnings she also notes parallels with adult learning. Hall (2007) reinforces this stance noting that sociocultural theory posits that learning involves more than just the individual, and acknowledges that additional factors such as context and input from others impact upon learning. Hall specifically considered this in terms of adult learners, however her view complements and overlaps with the focus on children that dominate the theories of Vygotsky (1978) and Rogoff (1990; 1995). One of the difficulties of sociocultural theory in research is the "inextricable nature of the individual and multi-layer contexts" (Eun, 2010, p. 16). This current study aims to unpack and explore these layers and consider them as part of the diverse and unique context through which each educator learns.

Additionally, this current study further explores Rogoff, Bartlett and Goodman Turkanis' (2001) consideration of communities of learners, specifically in relation to how working collaboratively is different to engaging in a novice/ expert dyad. Groundwater-Smith, Mitchell, Mockler, Ponte, and Rönnerman's (2013) notion of adult learning partnerships and practitioner research were synthesised with Hall's and Rogoff et al.'s ideas discussed above with a focus on exploring the role of the 'critical friend' and how this role associates with zone of proximal development. In this way, the research can also investigate how sociocultural frameworks apply to adult learners.

Sociocultural theory suggests that inclusion of new members to a community provides opportunities for learning and development. Rogoff (1998) reinforces this connection and contribution, stating that “cognitive development occurs as new generations collaborate with older generations in varying forms of interpersonal engagement and institutional practices” (p. 680). Interactions and collaborations between educators are an important consideration for the professional learning element of this research. Here community members included the educators, the service directors/ managers and the researcher, with each member adding to the professional learning of the others. Rogoff (2011) delineates community as occurring when people have shared goals, where they are working together to achieve an acknowledged outcome. Building on Rogoff’s presentation of community members this research considers how professional learning can provide opportunities for existing community members to be part of the ‘new generation’ by contributing information and knowledge that they have. Within this study the notion of collaborative communities of learners extends to adult learners and also includes a focus on how children learn from each other.

Rogoff (1998) identifies that the interrelated nature of the individual, interpersonal and community as planes of sociocultural activity are apparent settings that accommodate young children and educators. Each educator’s beliefs add to curriculum development and implementation, which are, in turn, influenced by curriculum content. This may include content added by others such as other educators, families or children. This is just one example of how the three planes are interrelated. As such, these three planes were a key underpinning factor of the design of this research, including the use of practitioner inquiry projects to test the benefits of collaborative learning opportunities.

Additionally, one of the outcomes of educators participating in practitioner inquiry is that the curriculums often become more socially and culturally relevant, due to the consideration of multiple perspectives (Vossler, Waitere-Ang & Adams, 2005). Thus, adoption of a sociocultural framework has benefits for both children and educators. The plane of guided participation extends beyond interactions to include how the environment supports and enhances learning; it is here that the cultural values placed upon certain experiences, resources and ways of learning becomes apparent (Rogoff, 1995). Plowman and Stephen (2007) reinforce and elaborate upon on these theories with a particular focus on the integration of technology in early learning services. They note the importance of proximal and distal guided interactions, where there is a focus not only on guidance and interaction, but also in the way that technological resources and equipment encourage genuine engagement from children (Plowman & Stephen, 2007). Practices and provisions within early learning services strongly communicate the cultural value of specific resources and experiences (Rogoff, 1995), and it is important that educators reflect on the messages their curriculums convey in relation to the value and role of technology. As such, observations of guided participation featured strongly in data collection and analysis for this research project to support educators to reflect on and understand their beliefs, knowledge and personal preferences in relation to technology and early learning.

The concept of zone of proximal development is particularly relevant in considerations of integrating technology. Research by Plowman and Stephen (2010) further clarify this by using the broader term “more competent partners” (p. 78) to add to the idea of more a capable peer or scaffolding from an adult. This allows children to be the more knowledgeable other: to be the ones bringing understanding, experience and knowledge to their educators. Plowman and Stephen (2010) also explain the need for interactions and “explicit scaffolding” (p.78) when technology is included, drawing on the premise that children and adults develop an understanding of resources through observation or direct interaction.

Stephen and Plowman (2008), in earlier research, focussed on the use of technology by preschool aged children. This research provided different insights into the importance of interactions in integrating technology in young children's curriculums. They identified interrelated components being: the child, educators, and the technology or resource. These three components show clear parallels with the sociocultural planes of activity and analysis identified by Vygotsky (1978) and Rogoff (1995), as detailed in Table 1.1 and reinforce the relevance of sociocultural theory as a framework to explore technology in early learning services. Similarities with Rogoff's (1995) three planes are also evident in Lindahl and Folkesson's (2012a; 2012b) discussion of technology and sociocultural theory—particularly their emphasis on the relevance of the relationships and 'expert knowledge'. Research conducted by Stephen and Plowman (2008) also enables examination of the educator as a facilitator or a barrier to the integration of technology and relates to sociocultural concepts of learning through observation, provision of resources, explicit scaffolding, and through the values of the dominant culture (Plowman & Stephen, 2010). Their research also highlights the need for 'implicit scaffolding', which links with the beliefs of the educators and the expectations of families. These elements therefore underpin investigation of educator beliefs and practices within this study and were also influential when considering the elements that impacted practitioner inquiry as a professional learning strategy to support the integration of technology in early learning services.

1.5 Importance of this Study

Children have access to a diverse, broad range of technologies. They also observe others using technology as an everyday resource (Nikolopoulou & Gialamas, 2015b). In this way technology becomes a cultural tool that carries significance in their understanding of the world (Rogoff, 1990). While research acknowledges the rapidly changing field of technology

(Bird & Edwards, 2015; Blackwell et al., 2014), Gibbons (2015) suggests that responses to the idea of 'newness' within technology in relation to early childhood need to be tempered. That is not to say that there are not new elements, but to recognise that fast-paced change within short timeframes is not a new phenomenon (Gibbons, 2015). Reflecting on available research resulted in the surmising that discussions with early childhood educators about technology are paramount in moving forward. These discussions, however, need to move beyond the concept of 'newness' and potential moral panics to deconstructing broader beliefs, conceptualisations and understandings of how they impact on practice. Gibbons (2015) talks of the importance of asking questions as a way of investigating what is known as well as what is assumed. This approach highlights the need for interactive professional learning opportunities.

In terms of newness, the types of technology available to children have shifted. Zrim (2015) reports on Australian media research, noting that tablets are the preferred digital device for children aged two to nine years due to portability, ease of use and convenience. Tablet devices are where children start on their journey of using digital media, and as such these devices are considered foundational, or a starting point. Zrim also identifies that interaction with these devices shifts the child's experiences within their world and increases their position as a consumer and a customer. This adds to other bodies of research that suggest that understandings of children as digital natives (Zevenbergen and Logan, 2008) will continue to evolve and change. Edwards, Nolan et al. (2016) in their pilot research project examining Internet cognition in children aged four to five years, note that children of preschool age have only ever experienced a world where Internet accessibility through touch screen devices is a common, everyday resource. This provides a strong example of children's digital citizenship and the foundational knowledge they will need to be safe and effective as members of twenty-first century society. This creates an interesting juncture where technology is advancing, and as such children's needs, interests and experiences with technology are changing too. Educators need to consider their own positioning, their beliefs and their experiences in relation to technology and to reflect on what this means in terms of early childhood pedagogy.

Early guidance on how to use computers and other technologies responsibly and safely will help to equip children for the increasing contact and reliance they will have on these resources throughout their lives. Palaiologou (2014) in a study of technology use by children under the age of five in their home contexts identifies that research now needs to focus on the extent to which early childhood educators are "ready to accept the 'digital child' of the twenty-first century" (p. 19). Supporting children in their digital citizenship is a diverse and complex issue that can focus on connections between home and early learning contexts (Palaiologou, 2014) or through recognising that there is a "digital difference" between these two contexts which can influence educators' pedagogical decisions (Edwards, Henderson et al., 2016). There is a need for further research that investigates educator perspectives, considers these within their specific contexts, and further deliberates what it means to support digital citizenship.

Additionally, educators would benefit from opportunities to engage in thoughtful, intentional and authentic integration of technology in play-based curriculums. Further research focusing on how this is occurring in practice and how to support educators to consolidate and extend on their skills in these areas would add to understandings in the field. Blackwell et al. (2014) identify this as a gap in the research, noting a need for greater insights into what effective technology integration looks like in practice and whether provisions are available to support educators. Additionally, Nikolopoulou and Gialamas (2015a) suggest that future research needs to focus on educator definitions and conceptualisations of technology and how they alter over time, as well as the links between educator beliefs and their pedagogical practices. This research examined these ideas and addresses the gap in research identified by Palaiologou (2016), as being the need to investigate reconceptualisations of technology in play-based curriculums. This research also aims to add qualitative findings to further illustrate and elaborate on quantitative findings, noted as an important future research need by Nikolopoulou and Gialamas (2015b).

Additionally, there is a paucity of research focusing specifically on the integration of technology in Australian early learning services. Across a wide range of countries, government policies recognise that the success of the education system is underpinned by the effectiveness of educators (Ingvarson, Reid, Buckley, Klenhenz, Masers & Rowley, 2014; Mueller, Wood, Willoughby, Ross & Specht, 2008). However, Guskey’s (2002) seminal work acknowledges that educators are not usually willing to change their pedagogical practices until they see new approaches working effectively. To further support the professional learning and abilities of educators it is imperative that future research gains insights into factors that influence their practices (Mueller et al., 2008).

Edwards (2013) notes that efforts are necessary to support educators to extend their understanding of technology as a cultural tool and how to integrate it within a play-based curriculum. There is a dearth of research investigating professional learning to support educators in integrating technology. Research also suggests that at this juncture there is a lack of understanding in how technology can feature in play-based curriculums (Bird & Edwards, 2015; Palaiologou, 2016). Professional learning needs to be contextually relevant and acknowledge educator beliefs as well as other factors that impact on proclivity to integrate technology. There is significant value in professional learning strategies that adopt a sociocultural approach (Demetrion, 2000), and Edwards, Henderson et al. (2016) identify the need to gain an understanding of early learning contexts before exploring their practices around integration of technology. Practitioner inquiry is an effective way to provide contextually relevant professional learning opportunities that draw on the strengths and experiences of individual educators (Groundwater-Smith, et al., 2013). Practitioner inquiry includes a level of subjectivity, where educators can identify issues within their services to investigate and create context appropriate change (Brooks-McNamara & Pedersen, 2006; Demetrion, 2000; Groundwater-Smith et al., 2013). Additionally, social and cultural context of children and families involved with the services are important considerations when developing professional learning strategies for educators. Such an approach can enable provisions for and guidance of professional learning that is appropriate to the individual contexts.

1.6 Organisation of the Thesis

This thesis comprises of six chapters. **This first chapter** provides a background to the study and outlines previous research undertaken by the candidate at a post graduate level. The researcher's postgraduate research enabled identification of gaps in defining, conceptualising and integrating technology in early learning services. This included the dichotomous debate about whether technology has a place in early learning curriculums. This previous study also identified that one-off professional learning would not be able to meet the diverse needs of educators in relation to the integration of technology, and that there was a dearth of professional learning that focused on technology within the context of play-based pedagogies. **Chapter 1** also outlines Rogoff's (1990, 1995) sociocultural theory as the theoretical framework that underpins all aspects of the study. **Chapter 2** provides an up-to-date review of current literature relating to technology in early learning services and considers implications in terms of beliefs, practices and professional learning, and the range of influential and intertwined factors that identified as significant and contributory. **Chapter 3** details the research design and methodology for both phases of the study and explains the practitioner inquiry professional learning phase. Reporting of data analysis and discussions is presented across two chapters with **Chapter 4** focused on findings related to research questions one and two and investigating the interrelated nature of factors that influence educator beliefs and how this impacts upon technology integration in practice. **Chapter 5** provides the analysis and discussion pertaining to the practitioner inquiry projects in addressing the third research question. The final chapter, **Chapter 6**, provides a summary of the key findings to emphasise the new knowledge this thesis contributes to the advancement of understanding educator integration of technology in early learning services and factors that will further facilitate professional learning and development in this area. It also discusses the limitations of the study, implications for early childhood practice, and suggestions for further research to consolidate and extend on these findings.

1.7 Summary

This chapter provided a discussion on the ubiquity of technology in everyday life and what this can mean for early childhood educators. Discussion in this chapter identified and acknowledged that further conversations with educators about the place of integrating technology in play-based pedagogies and the provision of ongoing, contextually relevant professional learning opportunities may help to create opportunities for more socially and culturally relevant technology integration in early learning curriculums. Connections with educator beliefs, knowledge and preferences align this research with a sociocultural framework, which supports investigating the relationships between the individual, community and contexts. As intimated by Gibbons (2015) in the epigraph for this chapter, supporting educators to effectively integrate technology in early learning services involves creating a culture of independent thinking, questioning and critical reflection. Discussions in this chapter identify practitioner inquiry as a professional learning strategy that supports critical thinking and empowers educators as question askers rather than passive receivers of information. The next chapter presents a detailed discussion and critique of relevant literature relating to technology integration in early learning services, leading to the identification of research gaps that are addressed through this study.

Chapter 2 – Literature Review

"All it amounts to is that you must be ready to learn from sources other than your magic book"

"But what use is the book then?"

"I suspect it is very useful. You want only for the knack of translating its lessons into the real world."

Neil Stephenson, The Diamond Age: Or the Young Lady's Illustrated Primer (1995, p. 281-282)

Chapter 1 provided a summary of the impetus for this thesis in terms of literature and research. This included current social and policy implications that demonstrate a need for new research that investigates integration of technology in early learning services. This chapter presents an overview of relevant research literature relating to the conceptualisation and inclusion of technology in early learning services. The review examined research from a diverse range of countries, which specifically focused on 'early childhood' (between the ages of birth and eight years). The literature review identifies and discusses themes relating to technology and integration, educator beliefs and explores professional learning models to support the integration of technology in early learning services.

Findings from the literature review highlighted the ubiquitous nature of technology in children's lives (Chaudron, 2015; Manches, Duncan, Plowman & Sabeti, 2015; NAEYC & Fred Rogers Center, 2012; Nikolopoulou & Gialamas, 2015b), yet also identified challenges experienced by educators in authentically integrating technology into play-based pedagogies (Blackwell, et al., 2013). The epigraph for this chapter, quoting Stephenson's (1995) novel, provides a sound and relevant insight into some of the deeper issues currently faced with technology integration in early childhood education. It is not enough to provide children with access to technology—whether it is the magic book in terms of the Primer or whether it is contemporary iPad applications. Findings from this literature review reiterate Stephenson's (1995) contention that interactions with people are pivotal to the successful integration of technology within social and educational contexts. However, this literature review identified that guidance and inclusion of technology in early learning curriculums is contingent upon the educator's understandings of the relevance and appropriateness of technology to support early learning. This discussion also includes a focus on considering the importance of technology integration in early learning services in terms of children's digital citizenship. Finally, the chapter outlines identified factors that can serve as facilitators or barriers to the integration of technology in early learning services, including professional learning opportunities.

2.1 Ubiquity of Technology

Technology continues to advance and develop at a rapid pace and is increasingly prevalent in almost all facets of life (Marsh et al., 2016; Palaiologou, 2016). Many argue that engagement with technology is no longer an optional activity, but instead has become something that most people are dependent on, and need to gain competency with for daily living, as well as for schooling and work purposes (Parette et al., 2010; Turja, Endepohls-Ulpe & Chatoney, 2009). For over a decade most children have experienced some degree of immersion in technology and digital culture from infancy and it is usually an easily accessible, normal, natural part of their everyday lives (Oblinger, 2003; Parette, et al. 2010). Current Australian early childhood policy, philosophy and research supports the provision of curriculums and experiences for children that reflect their individual interests and needs as well as being relevant to their social contexts (Barblett, 2010). Sociocultural theory echoes this notion and considers technology as a cultural tool (Rogoff, 1990; Vygotsky, 1978). As such, technology integration in early learning curriculums should reflect children's everyday experiences.

In considering family and social factors that influence children, research indicates that they are now experiencing a wide range of digital media and other technologies as functional resources in their everyday lives, as discussed in Section 1.1. (Davidson, Danby, Given & Thorpe, 2016; Fleer, 2011; Palaiologou, 2016; Plowman et al., 2012; Zevenbergen & Logan, 2008). Additionally, popular culture viewed through digital media is largely interrelated with technology and has a significant impact on children's development and understanding of the world (Fleer, 2011; Marsh et al., 2005). This chapter provides further explanation of children's experiences with technology, and unpacks and discusses the relevance for early childhood educators.

2.2 Defining and Conceptualising Technology

The act of defining something is an action or process that is empowering. Coming from the Latin verb *definire* the act of defining something is the process of setting boundaries (English Oxford Living Dictionaries, n.d.a) or of making things clear. On reviewing the literature and research relating to technology integration in early learning services, educators have a diverse range of definitions, conceptualisations and understandings of what constitutes technology and also how technology could feature in early learning curriculums. These definitions must consider the broader notion of the positioning of technology within interactions and environments. As an example, Edwards (2015) discusses the blurring of boundaries between technological and more traditional play, and Plowman (2015) notes shifting boundaries and distinctions between 'home' and 'technology'. Therefore, undertaking the process of defining and conceptualising technology could enable educators to develop a shared meta-language; a boundary to focus discussion and a boundary to cross.

2.2.1 Known definitions and emerging conceptualisations of technology.

From a basic level the term 'technology' can relate to "machinery or devices developed from scientific knowledge" (English Oxford Living Dictionaries, n.d.b). This can include tools as diverse as toothbrushes, motor vehicles (Johnson, 2009), or engaging in construction play with cardboard boxes (Mawson, 2011). Fleer and Jane (2011) propose the distinction of 'high' or 'low' technology. Here high technology refers to technology that is screen-based, needs a power source, or includes programs and low includes those items that are not digital, or requiring power – such as a brush or spray can for example. However, the technology focus within early childhood research has largely been on digital resources such as computers and associated peripherals such as keyboards and printers (e.g. Lindahl & Folkesson, 2012a; Mawson, 2011; Nikolopoulou & Gialamas, 2015a; Parette et al., 2010; Wang, Kinzie, McGuire, & Pan, 2010). The umbrella term of information and communication technologies (ICTs) does not often extend to include diverse forms of technology beyond computers and screen media. Similarly, in reflecting on research relating to digital natives and digital immigrants Johnson (2009) notes that definitions tend to relate to an individual's immersion in, or introduction to technology in terms of personal computers. This raises the possibility that the range of resources and tools that an educator labels 'technology' may relate to their own experiences and understandings. However, these definitions and conceptualisations of technology may not reflect the diverse range of technologies children experience within their home and social contexts (Edwards, Henderson, et al., 2016) or the experiences with technology that children will need to support them in their digital citizenship (Fleer, 2011; Gibbons, 2007; Grey, 2011).

Definitions and conceptualisations of technology can be markedly different between social and early learning contexts. Technology may present as an integrated tool or resource in everyday life. However, technology integration within early learning curriculums has traditionally been as a specific, standalone tool or resource (Mantei & Kervin, 2007; Plowman & Stephen, 2007). Plowman et al. (2012) argue that technology must move beyond focussing on computers, and should be reflective of the everyday experiences that children are likely to have with technology. However, it is unclear whether early childhood educators—a term defined within the EYLF as all practitioners working with children in early learning services—have shared understandings of technology, let alone technology integration.

Technology itself continues to change and advance and will continue to do so at an indeterminable rate (Plowman & McPake, 2013). It is difficult to know or describe what technology will look like in 20 years. As outlined in the researcher's story in Chapter 1 (1.3.1) the fictional technology of the Primer (Stephenson) described in 1995 was, at the time, fantastical but with less than 20 years of technological development a very similar tool was a reality with the iPad. While it is possible to imagine future technologies, it is not possible to completely predict what it is that children need to be ready for. This suggests that it is more important to promote critical thinking skills and to build foundational skills in technology use, understanding and creation that children can continue to build upon.

Technological change is not instantaneous; it is a steady increase, with certain elements even slowing, as per the gradual decline of Moore's Law[2] (Keyes, 2008; Green,

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[2] Moore's Law, as proposed by Gordon Moore in 1965, predicted that that the number of transistors on an integrated circuit would double every two years up following trends from the late 1950s (Keyes, 2008; Moore, 1965). His theory has remained fairly consistent with ongoing increases in components, resulting in improvements in digital processing speeds and consequently rapidly expanding opportunities for technological

2015). The NAEYC and Fred Rogers Center (2012) position statement reinforces this notion, acknowledging that technology is advancing at such a rate that the disconnect between experience and understanding has been likened to the societal changes and subsequent reactions that occurred when written literature was introduced as an alternative to oral story-telling, and again when printed books made literature more accessible.

Alper's (2011) analysis of New Media Literacies and their impact on the relationships between digital and non-digital media use by children describes resistance to integrating technology as eliciting a similar level of moral panic, where limited understandings and conceptualisations of technology as a resource inhibits a willingness to include it in the curriculum. This argument is not new and is echoed repeatedly, for example through the work of Cordes and Miller (2000). This line of thinking is also reflected in questions raised by Gibbons (2015) in his review of debates regarding digital childhoods where he draws attention to the resistance people often demonstrate towards 'newness', as discussed in Chapter 1 (1.5), and encourages consideration of the preceding technologies as well as those that may develop in the future. Findings from Marsh et al. (2016) suggest that further research on this topic would assist in challenging the prevalent and persistent moral panics that exist in relation to technology integration in early learning services.

Further distinctions exist in definitions of technology as they relate to early learning services. Fleer (2011) describes two distinct contexts in which technology is experienced, noting both a "technology-constructed childhood through everyday life-support technologies (in real use or through play) or a technologically driven play world that is more imagined than real" (p. 16). Similarly, in defining technology within their review of technology relating

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advancement (Keyes, 2008). Recently, the expansion underpinned by Moore's law has begun to slow. This is identified as a shift in the direction of technology rather than a slowing of advancement (Green, 2015).

to developmentally appropriate practice, Parette et al. (2010) focus on the everyday aspects of technology in children's lives, drawing the distinction that technology features as an instrument to extend or enable experiences. This important specification aligns with the later position statement from NAEYC and Fred Rogers Center (2012), in acknowledging that digital technology should not replace non-digital technological approaches or resources but rather provide additional tools and resources that can support children's learning and development.

2.2.2 Conceptualising technology within imaginary play.

A consideration of technology integration in early learning services beyond the use of real tools and resources and toy-based versions of these resources will help to create broader definitions of technology that align more closely with children's experiences in the 21st century. Experiences in children's imaginary play such as pretending to swipe a credit card to purchase an item in the shop corner, or pretending to swipe through pages on a tablet are examples of children imitating actions and behaviours they observe in their lives (Plowman et al., 2012). Children observe adults and peers engaging with a range of technologies in everyday life for a wide variety of socially and culturally relevant purposes (Plowman et al., 2012). Through imaginary play experiences children are often unpacking, exploring and making sense of the technology in their worlds.

The *EYLF* clearly recognises the value of technology and imaginary play (DEEWR, 2009). However, given the limited definitions of technology that often prevail in early childhood education settings it may not necessarily be at the forefront of early childhood educator's minds. Edwards (2014) and Plowman et al. (2012) both discuss the importance of technology within dramatic play to help children make sense of their worlds and their lived experiences. However, this is an area that is under-researched and under-represented in considerations of technology in play-based curriculums. Imaginary play experiences could include non-functioning technology as props (keyboards for example) or children including imaginary technological props in their dramatic play. Either example provides opportunities for children to explore their experiences with, and understanding of technology.

This discussion on technology within imaginary play highlights the learning potential for children when educators think of technology less in terms of physical resources in the curriculum and more in terms of how technology features as an integrated part of a play-based curriculum (Palaiologou, 2016). Broader conceptualisations of technology integration in early learning curriculums should then focus on play-based learning as well as how children's experiences with technology and digital resources are often the impetus for non-digital play (Chaudron, 2015).

2.2.3 Digitisation.

Marsh et al. (2005) refer to 'digitisation' as being a pivotal consideration in defining technology. This paper, despite being over a decade old, is seminal in re-examining notions of technology. By integrating a definition of digitisation, Marsh et al. draw a distinction between old technologies, and newer, more advanced versions in terms of operation and capabilities—such as television and radio that have moved from analogue to digital signals. Grey (2011) provides an example of this, explaining that toys and other items that were previously inanimate can now have interactive qualities, such as a toy doll that can express feelings or needs. Such changes can have a significant impact on the nature of play, and therefore must be considered when defining and conceptualising technology. Thus, in defining technology for early learning contexts, it is important to think how 'new' technologies (such as those that are modernised or significantly altered by digital advancements) are present within children’s lives and how they feature in early learning curriculums.

The diverse range of literature you reviewed for this chapter helped to develop a definition as to the meaning of technology and its boundaries, which has been adopted in this thesis. Throughout this thesis, the term ‘technology’ refers to a diverse range of tools and resources, reflecting the prevalence of technology in everyday life. This includes electronic devices such as tablets, computers (Palaiologou, 2016) and cameras (Blagojevic & Thomes, 2008), digital toys (such as those requiring batteries or a power source), as well as other potentially technological devices (that require a power source, but may be analogue rather than digital). It also includes non-physical forms of technology such as Internet use (Knight & Hunter, 2013) and imaginary use of technology that features in children’s dramatic play (Edwards, 2015; Howard, Miles & Rees-Davies, 2012). The term ‘digital technologies’ is not used because it does not adequately encompass non-digital forms of technology that may still impact upon children’s experience with, and foundational understandings of technology and it is not possible to exhaustively predict the types of technologies as well as the definitions and conceptualisations of technology that may emerge throughout the research project. These are the boundaries of understanding in relation to what constitutes technology and how it features in play-based curriculums, and also the boundaries to cross, as noted in Section 2.2.

In providing a definition of technology that encompasses diverse modes of technology, it is not to say that all technologies are suitable or appropriate for early learning services. Nonetheless, supporting the development of more diverse understandings and conceptualisations of technology may act to empower educators with the knowledge necessary to challenge their personal biases and other professional barriers that may exist in relation to technology. This is an important consideration as educator values and beliefs in relation to technology in general as well as to the position of technology in play-based pedagogies strongly influence technology inclusion in the curriculum (Gibbons, 2007). Professional discussion, engagement with current research and literature and opportunities for critical reflection may support educators to make informed decisions about options for relevant technology integration within their curriculums.

2.3 Technology and Children's Lived Experiences

In terms of ubiquity, Manches et al. (2015) found that technology was pervasive and that both children and families were unaware of how children were interacting with and experiencing technology in all its forms—particularly in relation to the interrelated nature of technology with non-technological resources through the Internet of Things[3]. Chaudron (2015) also states that children were not always using technological tools directly, but that they were aware of multifarious uses and possibilities from watching significant others using the devices and tools. Again, this reinforces that the ubiquity of technology in society makes it a relevant and significant cultural tool for consideration within early learning curriculums (Davidson, et al., 2016; NAEYC and Fred Rogers Center, 2012).

2.3.1 Children's experiences with technology.

A recent survey of Australian homes found that 47 percent have a tablet device (Regional TAM, OzTam, Nielsen, 2015). The same organisation provided a more detailed analysis of their 2011 data which showed a slightly lower rate, with 45 percent of households having a tablet device. However, they linked these findings with household age ranges and

[3] Manches et al. (2015) define the Internet of Things as a phenomenon used to explain how many digital technologies are embedded in everyday experiences to collect and transmit data. They can also create connections between an activity and an item. For example, removing an item from the refrigerator could trigger its addition to a digital shopping list through connected devices.

found that 81 percent of households with children aged birth to four, and 86 percent of households with children aged five to nine, had tablet devices (Regional TAM, OzTam, Nielsen, 2011). The same data revealed that 74 percent of households had smartphones[4], with an age breakdown of 61 percent for families with children aged birth to four and 67 percent with children aged five to nine. Additionally, 80 percent of households have Internet access and on average, households with children have 4.2 Internet connected mobile devices (Regional TAM, OzTam, Nielsen, 2011).

These findings indicate that touch screen devices and other technological resources such as the Internet are a substantial presence in Australian households with young children. Studies from the United States of America (Common Sense Media, 2013) and the United Kingdom (Marsh et al., 2015) reveal similar findings. While some of these data do not indicate whether children use the devices (of if they do, how they use them), it still demonstrates the significance of these devices as cultural tools (Rogoff, 1990). Whether children use the devices or not they will see other household members using them for a variety of purposes and this will therefore form part of the child's lived experience (Rogoff, 1990).

Findings from Chaudron's (2015) research, reporting on an extensive study of child (birth to eight years) and family use of digital technologies across seven European countries adds further reinforcement to the prevalence of touch screen technologies in young children's lives. Key findings from this study indicated that children had interacted with, experienced and observed a wide range of digital technologies in their everyday lives including tablets and smartphones, but that their preferred digital tools were touch screen tablets. This also

[4] 2015 data from Regional TAM, OzTam, Nielsen shows a slight increase to 75 percent. Analysis for this data did not include a break down in relation to specific age groups.

aligns with findings from Manches et al. (2015) who note that using a mouse and keyboard were often developmentally beyond the capabilities of younger children and that touch screen devices are more accessible and engaging than other devices. An implication of this is that as technology becomes more accessible to children in terms of ease of use and potential benefits, it is important for early childhood educators to continually and critically reflect on how this should influence their curriculum.

However, research indicates that children's experiences in early learning services may not correspond with their home exposure to, and use of, technology and that these connections must be considered critically (Edwards, Henderson et al., 2016). While there is a strong focus on creating continuity and connection between home and early learning services, with curriculums designed to consolidate and extend on children's experiences (Rogoff, 1990), research indicates that the nuances of this thinking need to be further unpacked in relation to the issue of technology. As an example, Edwards, Henderson, et al. (2016), in their study of technology use in various contexts by children between the ages of three and six years, draw a distinction between a 'digital disconnect' between home and service technological inclusions to a 'digital difference'. Edwards, Henderson, et al. explain that a digital disconnect' means that there is a lack of connection between what children experience in terms of their experiences with technology between their home and early learning services. Conversely, they argue that the concepts of 'digital difference' acknowledges that there is no benefit in complete consistency between home and early learning services in terms of access to technology and the focus should instead be on how technology fits within each specific learning context (Edwards Henderson et al., 2016).

In a similar vein, Yelland (2011) suggests children often come to their early learning service with new knowledge that may be unfamiliar and even intimidating for their educators and as such educators must think carefully and critically about what they choose to integrate, and how their choices can best align with children's social and cultural experiences. To understand the complex and interwoven experiences and beliefs that impact upon the integration of technology it is important to understand the service context and to explore ideas alongside educators. Working collaboratively with educators enables the researcher to gain insights into their understandings of both technology and pedagogy as well as any contextual factors that may influence their approaches and provisions for integrating technology (Edwards, Henderson et al. 2016).

2.3.2 Access to technology.

An additional consideration here in terms of ubiquity of technology is in relation to children who do not have access to technologies at home. Research findings (Campbell & Scotellaro, 2009; Mantei & Kervin, 2007) support the importance of interventions, indicating that children who do not have access to computers or the Internet at home may not be as competent in using technology as their peers, which can have later negative repercussions in educational services. Research by Alper (2011) further unpacks concerns in terms of equity by describing this as a digital divide, with four core problems. The first is the 'participation gap' which refers to inequity in the progressive access children have to technologies that they need, in order to develop strong and effective digital citizenship. Secondly the 'transparency problem' includes ongoing challenges children will face in learning to deconstruct media and the ideologies it creates. Alper notes the next problem as the 'ethics challenge' and highlights the new forms of social interaction and professional learning that children will experience as a result of new technologies. The fourth component is that of a 'scaffolding gap', which develops the debate beyond mere access to technology to consider the interactions that children have with more knowledgeable others whilst using technology (Alper, 2011).

Alper’s (2011) four core elements explain that equity is different to equality, and therefore integration of technology cannot look the same for every early learning curriculum. In this way, the ‘have versus have not’ debate extends beyond mere access to technology to considering the types of technology to which children have access and the guidance they experience from adults and more knowledgeable others (Alper, 2011; Davidson et al., 2016). To this end, findings from Judge, Puckett, and Cabuk in 2004 still hold true, positing that adapting pedagogical practices will help to support children to develop the skills and abilities that may be necessary for later learning and for their place in 21st century society. The issue of equity identified above (Alper, 2011; Davidson et al., 2016; Judge et al., 2004) further highlights the need for early childhood educators to critically reflect on the needs of children and families within their specific context in determining technology integration that is socially and culturally relevant.

2.4 Technology and Early Childhood Pedagogy

As technology is such a prominent feature of everyday life in Australia, integration within play-based early learning curriculums can support children to make sense of their experiences, extend their understandings and foster an awareness of how things work in the 21st century (Edwards, 2005; Gibbons, 2007; Palaiologou, 2016; Yelland, 2006). However, when it comes to integrating technology, there is often a reticence among educators in seeing these tools as a suitable resource for use in early learning. This section discusses this reticence, with a focus on understanding conceptualisations of education, curriculum and learning in early childhood contexts.

2.4.1 Conceptualisation of educational resources.

A number of studies reinforce that research relating to technology and education predominantly focuses on technology in school contexts (such as Blackwell et al., 2013; Plowman et al., 2012; Zevenbergen & Logan, 2008). This focus serves as a barrier to integrating technology in early learning services and highlights the distinct difference between the perceived value and acceptance of technology between school and early learning services. Indeed, research indicates that there is a need to challenge stereotypes and biases that exist in relation to technology in early learning curriculums rather than identifying technology as something that will have a detrimental effect on children's play (Edwards, 2014; Marsh et al., 2016). Educators could consider opportunities to use technological resources contemporaneously with non-technological resources to supplement and complement children's previous experiences, ongoing investigations and play (Yelland, 2011). An important starting point in considering educator perspectives on the appropriateness of integrating technology into early learning curriculums is to create a discourse and build common understandings around definitions and conceptualisations of technology.

Producers of software and applications for children exacerbate issues with conceptualising technology by advertising their resources as 'educational' despite providing little evidence of how measurement of value is undertaken and by whom (Hirsch-Pasek, Zosh, Michnick, Golinkoff, Gray, Robb, & Kauffman, 2015; Radesky, Schumaker & Zuckerman., 2015). Therefore, it is important for educators to be familiar with the software that children access, and to assess its suitability. Software aimed at young children can be largely entertainment based or only offer limited opportunities for exploration (Wang et al., 2010). Plowman and McPake (2013) also ask questions about the nature of software and digital games. They note that there should not be an assumption that all interactive games are educational. In this way drill and practice applications or games are often perceived to be educational, rather than more open-ended manipulable or constructive software or applications (Highfield & Goodwin, 2013; Hirsch-Pasek et al., 2015). Positioning technology as a structured and prescriptive activity does not recognise or support its inclusion in a play-based curriculum due to a conflict in underpinning pedagogy. The structured and often reward-based elements of a drill and practice game do not align with common features of play-based learning – such as being child-led, voluntary, self- motivating, and process-based (Barblett, 2010).

An additional area of contention in terms of technology integration relates to educator understandings around the significance of providing concrete experiences in facilitating children's learning (Zevenbergen, 2007). Seminal research by Clements (1999) identified that as computers became more prevalent debates emerged on whether manipulating digital resources provided the same sensory-concrete experiences for children as manipulating physical objects. The debates continued to form over more than a decade with no clear consensus. Lindahl and Folkesson (2012a) argue that computers and technology continue to be conceptualised as an intangible resource within that require complex operational thought and therefore are not viewed as offering concrete experiences. Research suggests that a shift needs to occur in educator's conceptualisations and beliefs regarding what constitutes concrete experiences will help to align technology inclusion in early learning curriculums with the technological advances that exist in modern society (Yelland, 2007). Sarama and Clements (2009), building upon their earlier seminal works, reported that use of computer manipulatives had the potential to support students to build concrete knowledge by making their understandings explicit. Further to this they identified that whether resources are physical or computer-based, the guidance and support received from educators is more important than the actual tools in developing children's concrete thinking (Sarama &

Clements, 2009). These arguments further reinforce the need for conceptualisations of technology integration within early learning curriculums to move beyond the inclusion of physical objects and resources to thinking about how broader and more foundational understandings of technology can be developed, and the pedagogical approaches that can support these developments.

Taking the debate about technology as a concrete or virtual resource further, research also suggests that educators need to focus on teaching children how to use and manage technology in the same way that they teach children how to use other resources such as books and puzzles (NAEYC, Fred Rogers Center, 2012). In recent years, sociocultural theory has come to the forefront of this debate. Vygotsky's (1978) theory emphasises the importance of social interactions and while research indicates that this can enhance the integration of technology in early learning services, Zevenbergen (2007) found that there was little indication that this is occurring. Plowman and McPake (2013) suggest social play and technology integration with young children is a more complex phenomenon. Their research with three and four-year old children found that technology did not diminish social interaction; moreover, the content in children's television and media supported and bolstered social interaction. Whilst previous research had suggested that children's technology experiences within early learning services did not provide them with the benefits of social interaction (Edwards, 2003; Plowman & Stephen, 2007), more recent research reports that children actually interact in a collaborative and cooperative way when using touch screen devices within an early learning curriculum (Shifflet et al., 2012). The potential for technology to be used in interactive experiences again highlights the need for integration of technological resources as part of a play-based curriculum rather than as technology presented as a stand-alone activity.

2.4.2 Technology and early learning pedagogy.

Within the early childhood field, a widespread belief persists that computer use and broader technologies are counteractive to traditional concepts of best practices (Danby, 2013; Gibbons, 2015; 2010; Zevenbergen & Logan, 2008). Pivotal arguments against the inclusion of computers in early childhood education tend to relate to inadequate software, exposure to violence in video games and the possibility of children accessing inappropriate material through the Internet (Yelland, 2006). Such arguments do not acknowledge the capacity for integrated technology to extend children's interests and abilities when educators actively scaffold and guide experiences (Plowman & Stephen, 2007). Children's interactions with educators and more capable peers have long been valued as a way to extend their thinking (Siraj-Blatchford, 2009; Yelland, 2007); early childhood educators are therefore in a strong position to extend children's thinking through the guided use of technology. However, whilst educators could play a key role in extending children's thinking by integrating technology within their curriculums, Palaiologou (2016) suggests that educators are not doing so.

Understanding educator pedagogical beliefs is important in considering technology integration in early learning curriculums as these beliefs underpin all curriculum decisions. While some researchers indicate that the dichotomous academic debate on whether technology is suitable in early learning services is beginning to shift (Nikolopoulou & Gialamas, 2015a; Palaiologou, 2016), there is a paucity of research demonstrating that this shift is reflected in widespread pedagogical practice. The debate may have evolved at an academic level, however, despite the growth of technology use in many societies there is still be resistance and antipathy towards integrating technology within their curriculums from early childhood educators (Palaiologou, 2016). It is therefore important to ensure that educators have access to current research and information in order to counter educator and family exposure to the barrage of negative and agitated accounts about the dangers of technology for young children in mainstream media as noted in Section 1.1. At this juncture, it is essential to consider how to encourage and support educators to challenge their prevalent misconceptions about technology and its suitability in early learning curriculums.

2.4.3 Relevance of broader conceptualisations of technology in early childhood pedagogy.

The majority of research focusing on technology in early learning services focuses on computer use rather than broader conceptualisations of technology (such as Campbell & Scotellaro; Gialamas & Nikolopoulou, 2009; Lindahl & Folkesson, 2012a; Nikolopoulou & Gialamas, 2015a; Zevenbergen & Logan, 2008). Children are now digital citizens, residing in an increasingly digital world, yet much remains unknown about their use of and experiences with technology, as well as the long-term effects of the types of interactions they have with technology in their early childhood years (Chaudron, 2015). Research indicates that many families support their children's interest in popular culture and technology and feel that education on these topics should begin at a very young age (Marsh et al., 2005). More specifically, in research conducted by Marsh et al. (2005) families indicated that educators had a responsibility to equip children with the skills needed to exist within an increasingly digital society.

The NAEYC position statement defines digital citizenship as:

> […] The need for adults and children to be responsible digital citizens through an understanding of the use, abuse and misuse of technology as well as the norms of appropriate, responsible and ethical behaviours related to online rights, roles, identity, safety, security and communication. (NAEYC and Fred Rogers Center, 2012, p. 10)

This is important in highlighting the need for both adults and children to have a level of technological competency. Educators therefore have a responsibility to provide children with foundational understandings in relation to technology and online realms so that they become respectful citizens, as well as to provide them with agency in protecting themselves (Scheibe & Rogow, 2012). Technology often provides children with strong social messages and promotes cultural values (Gibbons, 2007) and it is important for educators, as well as parents to be aware of the messages that children gain through accessing digital media, and to work with children to deconstruct this information. Gibbons (2007) further emphasises the importance of adult guidance for children in relation to technology, given that integration of technology now occurs within play, and play underpins learning. Nikolopoulou and Gialamas (2015a) establish that there are links between educator confidence and competence with using technology and their inclination to include it as a focus in the curriculum. This highlights the importance of gaining deeper insights into educator understanding and to further consolidate and develop their knowledge in relation to safe and ethical use of digital resources for themselves and for children (NAEYC & Fred Rogers Center, 2012). Additional qualitative research could add further insights into the relevant and salient quantitative findings of Nikolopoulou and Gialamas.

Another area for consideration is supporting children to develop awareness and understanding of potential risks in online environments. Edwards, Nolan et al. (2016) note that the present generation of children have only ever experienced a society where Internet connections and mobile devices are ubiquitous. As such, an awareness of online safety is important, with Grey (2011) proposing a need for children to be informed about cyber safety as soon as they start to use any form of technology that has the potential to be connected to the Internet. From a sociocultural perspective, research suggests interactions with adults are an important foundational stage for children in developing an in-depth understanding of technology (Edwards, Nolan, et al., 2016). However, they will eventually explore this realm without adult guidance or monitoring (Fleer, 2011) and as such, foundational understanding and knowledge is needed.

For some children, Internet access may occur at a young age as many smart phones and tablets that they are able to access have connections to the Internet. Children often are unable to explain what the Internet is, or what ‘being online’ means and as such may have limited understandings of potential risks, may access inappropriate content or may not know how to navigate past pop-ups and advertisements (Chaudron, 2015). Edwards, Nolan et al. (2016) state that there is a paucity of research relating to children’s understandings of the Internet. Children’s access to the Internet creates a complex situation where early childhood educators therefore need to not only ensure they understand the technologies that children are engaging with, but also to develop an understanding of children’s conceptualisations of technology.

Plowman and Stephen (2007) reinforce many of these ideas relating to children’s access to technology and the supports needed to facilitate their understanding and emerging competence with technological resources. However, they provide another level of analysis in broadening the concept of technology beyond computer programs to include a range of technological resources and tools. In assessing the effectiveness of technology integration, they reinforce the importance of active discussion, guidance and interaction when children use technological resources. Plowman and Stephen (2005; 2007) define interactions as distal (such as the presence of technological resources, its integration into the curriculum, and whether planned experiences further extend children’s understandings), and proximal (such as the person to person interactions that take place, support and encouragement shown to children, and approaches that foster children’s enthusiasm for learning). The taxonomy or classification guidelines recommended by Plowman and Stephen provide a solid foundation for analysing the effectiveness of technology integration within early learning services.

Further research focusing more holistically physical resources, interactions and guidance, may inform more integrated approaches to technology inclusion in play-based curriculums. vices.

2.4.4 Play-based curriculums.

An equally important consideration in the effective integration of technology into early childhood curriculums is the re-conceptualisation of notions of play. This notion was introduced in Section 2.2.2, and is examined further in this section in relation to educator perceptions. Edwards (2014), in a critique of the pervasive nature of consumer-based products in digital media, suggests the term ‘contemporary play’. Technology has created new possibilities for learning and as such concepts of play are changing. Traditional understandings and beliefs of what constitutes play have shifted for generations who have grown up—or still are growing up—with an increasingly prevalent access and exposure to, as well as increased engagement with, technology (Edwards, 2015; Zevenbergen, 2007). Similarly, educator perceptions of the role of technology in learning may not always align with children’s expectations and preferences.

There is a need for new conceptualisations of play that align with children’s experiences with technology as well as with current understandings of child-led play and play-based curriculums (Edwards, 2015). Palaiologou (2016) further develops Edwards’ (2015) argument, stating that understandings of how technology features in play are often reductive and that they do not include reflection on or acknowledgement of what children gain from this sort of play. Palaiologou suggests that there should be a focus on why children are using technology and the nature of these interactions. However, consideration of educator pedagogical beliefs as well as their beliefs and knowledge in relation to technology are also important starting points in further supporting the integration of technology in socially and culturally relevant ways (Blackwell et al., 2013; Nikolopoulou & Gialamas, 2015a; Palaiologou, 2016).

The integration of technology may still be an area of uncertainty for many educators. Further research into effective professional learning opportunities may provide valuable insights into how to best support educators to extend their understandings of technology in play-based curriculums (Parette et al., 2013). There is a need for professional learning strategies and approaches that allow for in-depth understanding of the complex, interwoven ideas, beliefs and experiences that shape educator proclivity to include technology and that help challenge, affirm and extend thinking on the relevance of technology in play-based curriculums. To foster a more profound understanding, educators need opportunities to engage in reflective discourse that thoroughly examines theories and philosophies relating to play and that seeks "an evidence-based rationale" (Palaiologou, 2016, p. 3) to justify the value of technology in the curriculum. In this way technology integration is more likely to be pedagogically sound as well as socially and culturally appropriate.

More recent research by Edwards (2015, 2014) utilises a sociocultural framework to further develop discussions pertaining to the relevance of digital media and children's play-based learning. She states due to children's engagement with toys linked to popular culture and digital media it is increasingly difficult to create a clear distinction between digital technologies and non-digital technologies, in a process known as convergence. She notes that "convergence means that it is increasingly difficult to separate the digital from the analogue because the child's activity with a corporatised toy is semiotically connected to the digital media from which it derives" (Edwards, 2015, p. 3). Parallels are evident between Edwards' (2015) definitions of convergence and broader conceptualisations of traditional and technological resources in early learning services (Yelland, 2011). The focus on integration presented by Edwards and Yelland highlight the need to consider technology inclusion in early learning curriculums in terms of children's experiences. A barrier to inclusion here could be that technology historically has been conceptualised as the main focus of the experience (Chaudron, 2015), or a standalone experience (Mantei & Kervin, 2007; Plowman & Stephen, 2007) rather than as an integrated resource. This conceptualisation of technology is in stark contrast with how children experience technology in their everyday lives. Further understandings of how educators perceive and integrate technology may help to determine whether their practice reflects current research and recommendations of best practice and to consider opportunities to integrate socially and culturally relevant technologies in the curriculum.

Conceptualisations of technological play are further complicated when we consider outdoor and physical play, a notion which is discussed in Johnston and Highfield, (2017) (see Appendix B). Louv (2010) in his seminal work on the importance of outdoor play states that there is a "broken bond between children and nature" (p. 163) which the educator needs to work actively to remedy. In terms of physical play, Radesky et al. (2015) found that engaging with interactive media could diminish children's engagement with important sensorimotor play. However, Louv (2010) makes the salient point that the answer is not to demonise technology, noting that "the problem with computers isn't computers—they're just the tools; the problem is that overdependence on them displaces other sources of education, from the arts to nature" (p. 137). It is clearly important for children to engage in physical play and be present when experiencing nature, however, it is a false dichotomy to view technology use as a threat to outdoor play (Johnston & Highfield, 2017). The focus should instead be on building understanding of active and passive use of technology, and on the integration of technology in socially and culturally appropriate ways that also supports exploration and investigation. Such an approach may help to reflect children's experiences with technology in their everyday lives and potentially support them to be more effective digital citizens. Active and passive use of technology is an important but under researched topic in relation to children's autonomy, agency and development of digital citizenship.

2.4.5 Children's learning with technology.

Literature and research indicates that the often-multimodal nature of technology means that children are developing a wide range of literacies and understandings (Yelland, 2011). Additionally, technology provides rapid feedback which may result in faster processing of information and an increased capacity for multitasking (Zevenbergen & Logan, 2008). However, arguments exist against the belief that technology has changed the way children think and learn (Bennett, Maton, & Kervin, 2008; Helsper & Eynon, 2010). However, it is difficult to deny the ever-increasing presence of technology in children's lives, and therefore from a sociocultural perspective, it is highly probable that children will have a diverse range of experiences with technology from infancy (Edwards, 2005; Zevenbergen & Logan, 2008) and as such integration of technology is relevant within early learning environments. Educators require a comprehensive understanding of each child's knowledge and experiences with technology for effective integration in their early learning curriculums.

Concerns exist that the knowledge and skills that specific generations have in relation to technology should not be generalised or assumed (Bennett et al., 2008; Helsper & Eynon, 2010). Current early childhood pedagogical philosophies can address these apprehensions by creating learning environments that are responsive to individual children's interests and experiences. However, there is a need for additional research that critically reflects on the role technology plays in young children's lives and implications for pedagogical practice.

2.5 Facilitators and Barriers to Integrating Technology

A number of research projects have identified factors that support or hinder the integration of technology in early learning services. These include educator beliefs, educator confidence and competence with technology, resources available, characteristics of the context, and professional learning opportunities (such as Blackwell et al., 2013; Edwards, 2005; Gialamas & Nikolopoulou, 2010; Lindahl & Folkesson, 2012a, Nikolopoulou & Gialamas, 2015a; Nuttall, Edwards, Mantilla, Greishaber & Wood, 2015; Palaiologou, 2016; Plowman & Stephen 2007). While these topics may be well known by those in academia with an interest in this area of research, educators may not have knowledge of the complex and interwoven factors that impact upon their curriculum decision making. Further research investigating whether the dichotomous debate surrounding the integration of technology into early learning curriculums has broadened in practice would provide valuable insights into educator beliefs. Additionally, research focusing on the types of technology included in early learning curriculums as well as children's interactions with this technology would provide a more detailed picture of the connections between educator beliefs and practices.

2.5.1 Supporting the integration of technology in early learning curriculums.

Historically, research has indicated that Australia has a relatively low commitment to including computers in early learning services when compared to countries such as Finland and Hong Kong (Campbell & Scotellaro, 2009; Reade, 2002; Zevenbergen & Logan, 2008). While in early learning contexts it is common for educators to use technology such as digital cameras and computers in their programming and documentation (Blagojevic & Thomes, 2008; Campbell & Scotellaro, 2009; Edwards, 2005), it is less common to see educators supporting children utilising the same tools (Campbell & Scotellaro, 2009). The review of literature undertaken to develop this chapter highlighted a number of elements that can impact upon integration of technology into early learning services. A summary of the key contemporary articles are outlined in Table 2.1. Further research that investigates the diverse interrelations and interplays of these elements would create a more comprehensive understanding of factors that impact upon educator decisions to integrate technology within their early learning services.

Table 2.1

Factors that Impact upon Integration of Technology in Early Learning Services

	Educator beliefs in relation to technology	Educator beliefs in relation to technology and pedagogy	Educator confidence with technology	Support of management/ families (policy/ practice)	Support of management (financial)	Access to suitable resources and equipment	Access to technology related professional learning	Number of educators and children/ interactions
Quantitative								
Blackwell et al. (2014) USA		✓	✓	✓			✓	
Nikolopoulou & Gialamas (2015a) Greece			✓	✓		✓	✓	✓
Nikolopoulou & Gialamas (2015b) Greece	✓	✓	✓				✓	
Simon et al. (2013) USA		✓	✓	✓	✓	✓	✓	
Qualitative								
Danby (2013) Australia	✓	✓	✓					
Davidson et al. (2016) Australia		✓	✓					✓
Edwards (2015) Australia		✓	✓	✓				
Lindahl & Folkesson (2012a) Sweden	✓	✓	✓	✓				
Parette et al. (2010) USA		✓	✓				✓	
Plowman & Stephen (2007) Scotland		✓		✓				✓
Theobold et al. (2016) Australia						✓		✓
Turja at al. (2009) Austria, France, Finland, Germany and Scotland	✓	✓		✓			✓	
Mixed methodologies								
Edwards et al. (2016) Australia		✓					✓	
Palaiologou (2016) England, Luxemburg, Malta, Greece and Kuwait	✓	✓	✓	✓			✓	
Reviews of literature								
Gibbons (2010)	✓	✓	✓	✓			✓	
Plowman & Stephen (2013)	✓	✓	✓	✓			✓	
Plowman & Stephen (2010)		✓	✓			✓	✓	✓
Wang et al. (2010)		✓					✓	✓

To further understand the factors affecting the integration of technology in early learning services, it is important to understand what influences educator choices. Five of the research papers included in Table 2.1 focus specifically on educator proclivity to integrate technology in their early learning curriculums (Blackwell et al., 2013; Edwards, 2015; Nikolopoulou & Gialamas, 2015a; 2015b; Palaiologou, 2016). Nikolopoulou and Gialamas (2015a; 2015b) with Blackwell et al., (2013) reviewing findings from the specific viewpoint of barriers to technology integration. Alternatively, Palaiologou (2016) identifies that the interrelated nature of factors impacting educator decision making means that individual contexts and experiences influence whether the factors facilitate or hinder technology integration. Edwards' (2015) research elaborates upon arguments presented by Blackwell et al. as well as those of Nikolopoulou and Gialamas and Palaiologou, by stating that research needs to move beyond acknowledgement of factors that impact upon educators in their decisions to include technology. Instead, Edwards argues the need to consider the implications specifically for the provision of play-based curriculums that include technology. This shifts the focus from technology to play-based curriculums as the key focal point and further supports the move to recognise technology as an integrated part of a holistic early learning curriculum. Synthesising findings from all five studies highlighted the need for further research exploring the links between factors that influence and facilitate the integration of technology and how to support educators to view these through the lens of child-led, play-based learning. Additionally, qualitative research could provide more detailed insights (Johnson & Christensen, 2009) to further delineate the quantitative findings of Blackwell et al. and Nikolopoulou and Gialamas.

Educator beliefs, knowledge and competence are some of the most important factors in effective integration of technology in early learning services (Edwards, 2005; Mantei & Kervin, 2007; Lindahl & Folkesson, 2012b; McGrail, 2005; Plowman & Stephen, 2007;

Zevenbergen, 2007), which is directly related to their professional learning, formal training and personal experiences. This reinforces the claim made by Lankshear and Knobel (2003) that educators predominantly incorporate technology only at a level that reflects their own competency and provides an explanation for slow advancements in the field. Such an approach is evident where use of computers and other multimedia tools are in the scope of transmission approach to early learning, rather than integrating technology in a way that is responsive to the interests and abilities of individual children (Labbo, Reinking & McKenna, 1998; Lindahl & Folkesson, 2012a). The provision of computers, software and other technology in the environment is not enough to create positive outcomes for children. Educators need to have the commitment and confidence to integrate technology in ways that are more are socially and culturally relevant.

2.5.2 Beliefs, pedagogy and practice.

One of the key factors that underpins early childhood educator proclivity to integrate technology in their curriculums is their personal beliefs about technology. Nuttall et al. (2015) note that it is reductive to consider beliefs as the primary or sole influence in an educator's choice to consider the integration of technology, and this is a salient point to consider when reviewing literature and planning research. The broader discourses relating to the suitability of technology within a play-based curriculum require consideration. These elements could vary depending on specificities of each context. However, there are a number of factors identified in current research such as concerns with technology stifling creative and investigative processes (Palaiologou, 2016) or taking away from outdoor play and physical experiences (Louv, 2016).

Future research needs to build on knowledge of educator beliefs in conjunction with the diverse influential factors occurring at a persona, interpersonal and community level. This understanding can then inform investigation that impacts on curriculum decision making. This can then, in turn be utilised develop and provide context specific professional learning that can support, consolidate and extend thinking. The release of the NAEYC and Fred Rogers Center (2012) position statement presented a strong message that discussion should move beyond whether technology is appropriate or not, to thinking about opportunities for technology integration in early learning settings. Discussion should also consider the benefits of technology integration when active rather than passive use is encouraged, and when children experience guided interactions rather than solitary engagement (NAEYC & Fred Rogers Center, 2012). Further research on this topic may help reconceptualise the use of technology in early learning services—both in terms of the quintessence of technology as well as the nature of pedagogy (Edwards, 2015).

2.5.3 Implicit and explicit mediation.

In challenging entrenched beliefs in relation to technology integration in early learning settings, there is value in turning discussions to the contemporaneous and complementary use of traditional and technological resources (NAEYC & Fred Rogers, 2012; Yelland, 2011). Explicit mediation, as defined by Vygotsky, is where over time, cultural tools become inextricably linked with specific events or activities (Edwards, 2015). Implicit mediation occurs when these tools continue to be utilised as significant, valuable and pertinent when there are other resources available that could support people to reach their objectives more effectively (Edwards, 2015; Nuttall et al., 2015). In relation to the integration of technology this presents as implicit mediation, whereby new technological resources are available to early childhood educators but are not being utilised because traditional, non-technological resources are strongly entrenched as cultural tools. This example again highlights the diverse and intertwined nature of factors that impact upon the integration of technology in early learning curriculums.

In contemplating a way forward, it is valuable to reflect on Edwards' (2015) identification of the foundational problem. She notes research currently focuses on educator beliefs, attitudes and confidence in using technology rather than approaching it from a different, and perhaps more relevant perspective of underpinning beliefs and practices in relation to play-based curriculums. In reflecting on findings from her case study of web mapping as an intervention to investigate technology in early learning curriculums, Edwards further posits that research which focuses on factors that hinder the integration of technology are possibly not relevant or useful at this juncture. Future research could therefore focus on equipping educators with more foundational understandings of possibilities with technology in play-based curriculum and this may facilitate more contextually relevant approaches. Research could include a focus on how children learn through play and how technology can be integrated in the same way that other resources that are deemed socially and culturally relevant are integrated. This approach would serve as a contrast to technology being conceptualised as the main focus of the experience rather than an integrated tool (Plowman & Stephen, 2007).

In summarising research findings on the factors that impact educator beliefs and pedagogical practices in relation to integrating technology, the need for contextually relevant professional learning becomes apparent. Nuttall et al. (2015) encapsulate this position in the following quote:

> Teachers do wish to engage with digital technologies but the professional development they have received has not yet enabled them to mobilise digital technologies to focus on the object of their labour process that gives

> developmental force to their professional activity: supporting children's learning through the provision of play-based curricula. (p. 227)

Further research into professional learning models to support the integration of technology would increase understanding how to best support educators to extend their knowledge of technology and play-based pedagogies.

2.6 Professional Learning Opportunities as a Facilitator to the Integration of Technology

Recent studies have discussed the value of including technology in the curriculum for pre-service teachers to expand their personal confidence (Campbell & Scotellaro, 2009; Palaiologou, 2016; Yurt & Cevher-Kalburan, 2011). Increasingly educators will be required to provide play-based curriculums that support children in their use of technology (Palaiologou, 2016), and pre-service training is recognised as one way to increase educator awareness of the importance and relevance of technology in children's lives (Gibbons, 2010). As technology becomes increasingly integrated into children's everyday experiences, those working with children need to think critically about how technology features in children's lives and how to support their interest in and experience with technological resources (Manches et al., 2015).

Internationally, there is a focus on the need for professional competent educators within early childhood education (Sumsion et al., 2015). There are significant variations in the level of qualifications required by early childhood educators, and the pre-service training they receive (Blackwell et al., 2013), which creates a diverse and complex range of skills and skill deficits within each early learning service. As outlined in Table 2.1, a number of interrelated factors influence educators in their decisions to integrate technology into the curriculum. A large number of educators may not have had any access to training or study regarding technology depending on when they received their qualifications and the institution through which they achieved them. Additionally, technology is most commonly positioned with Science, Technology, Engineering and Mathematics/ STEM frameworks (Hudson, English, Dawes, King & Baker, 2015), however it is interesting to note that within the EYLF, technology discussion significantly focuses on communication, language and literacy (DEEWR, 2009). This inconsistency highlights the need for professional learning for educators that is responsive to the differing needs, experience and knowledge of educators.

2.6.1 Contemporary professional learning considerations.

Research and professional literature acknowledges the limitations that exist with the traditional 'one-off', transmission style approach to professional learning that has proliferated for decades, and identifies the need for professional learning that provides opportunities for ongoing engagement, collaboration and critical reflection (Carter & Fewster, 2013; Fleet & Patterson, 2009; Hadley et al., 2015; Nuttall, 2013). Sumsion et al. (2015) identified that there is a need for professional learning models that encourage educators to develop an "evaluative stance" (p.422), which encompasses the ability to engage in critical thinking and to evaluate beliefs and practices. These are particularly relevant considerations for professional learning involving technology given the dominance of traditional resources as accepted cultural tools, and the relative newness of technology, which means that the potential for concomitant integration is often overlooked (Nikolopoulou & Gialamas, 2015b). This raises the pertinent question of how professional learning strategies can be responsive to the differing skills, interests and beliefs of educators, and to directly accommodate these while also promoting the agency and ongoing learning of each participant. Additionally, it suggests that a sociocultural approach is needed, which by its nature, challenges traditional or prescriptive models of professional learning (Rogoff, 1990).

Educators need to be able to make sound professional decisions about what resources and experiences are suitable for their specific contexts as a precursor to effectively integrating technology (NAEYC and Fred Rogers Center, 2012). As such, professional learning opportunities are needed that support educators to increase their understandings of how technology can feature within a play-based curriculum. However, research indicates that educators are facing barriers in integrating technology into their curriculums (Edwards, 2005; Nikolopoulou & Gialamas, 2015a; Palaiologou, 2016; Parette et al., 2013). Gialamas and Nikolopoulou (2010), in a study of beliefs and practices of pre-service and in-service educators regarding the use of computers in early learning services, found that educators generally did not understand the significance or relevance of including technological resources. Later findings from the same researcher discuss that educators who were confident in using computers were less deterred by perceived barriers (Nikolopoulou & Gialamas, 2015a). Therefore, increasing educator confidence and competence could place them in a strong position to critically reflect on the value ad relevance of technology in play-base pedagogies and intentional teaching.

2.6.2 Educational leadership and professional learning.

Research acknowledges the role that service directors and managers play in supporting professional development opportunities for educators (Aubrey, Godfrey & Harris, 2012; Colmer, Waniganayake & Field, 2014 & Stampoulos, 2012). Professional development includes a focus both on building professional knowledge in terms of learning as well as developing educators' capacity for pedagogical understanding and capabilities (Stampoulos, 2012). Supporting educators to increase their understanding of the relevance of technology in play-based early learning curriculums as well as their confidence and competence in using and integrating technological resources may not be an area of confidence or expertise for a service director or manager. Aubrey et al. (2012) and Colmer et al. (2014) argue that a ‘distributed leadership’ approach is effective in shifting focus from individuals to the collective knowledge found in teaching teams within early learning services. A distributed leadership approach acknowledges the value in supporting all educators as pedagogical leaders who have agency in terms of decision making within the early learning service.

To facilitate professional leadership and in turn educator pedagogical capacity, professional learning strategies need to focus on including more opportunities for group collaboration or whole team involvement (Aubrey, 2012; Colmer et al., 2014). Such processes not only share professional knowledge, experience and perspectives, but also foster the development of relationships and collegiality between team members. Strong relationships and trust within teams are pivotal to successfully implementing and navigating change and progression. Research presented within this literature review suggests that the integration of technology in early learning services is, for many educators, a process of change, adjustment and realignment with many factors impacting upon educator willingness to integrate technology (Table 2.1). As such, reconceptualising and reimagining technology integration in early learning services needs a professional learning strategy that enables acknowledgement of differing beliefs and experience and provides opportunities for recognition and deconstruction of these ideas. Colmer et al. (2014) identify that the role of service directors, team leaders and educators exists as a hierarchy in early learning services. This hierarchy, often based on qualifications and position within the service often persists, even within distributed leadership structures. There is therefore a need for further research which explores overcoming this hierarchy to support reflection of the knowledge, perspective and beliefs of all educators in professional learning strategies— particularly in relation to exploring technology integration within early learning curriculums.

2.6.3 Critical reflection.

As noted by Gibbons (2015) in the opening epigraph of this thesis, creating a culture of questioning underpins successful navigation of integrating technology within early learning curriculums. In an earlier publication, Gibbons (2010) identified the value of critical reflection to create positive outcomes within early learning services. Critical reflection encourages educators to be aware of their thinking, their preferences and their ways of being, and to also look at alternative solutions and answers (Edwards & Nuttall, 2009). More specifically, in relation to technology integration and professional learning for early childhood educators, critical reflection allows for complex issues relating to beliefs, experiences and policy to be unpacked and understood at an individual as well as collaborative level (Gibbons, 2010). Such practices are pivotal in creating links between understandings of technology and understandings of pedagogy (Edwards, 2015). The seamless integration of technology, including diverse appearances within home and social contexts, creates a normalisation and routine like appearance to its presence which may mean that it is not necessarily identified as a technological resource. As an example, educators may not think of childrens' use of digital kitchen scales as an experience with technology though this is an everyday item that influence their experiences with, and understandings of the world. Overlooking the integrated and diverse nature of technology in everyday life can then impact upon the range of technological resources educators feel are suitable within their curriculum.

Sociocultural theory (Rogoff, 19991; Vygotsky, 1978) as well as the *EYLF* (DEEWR, 2009) emphasise the importance of educators understanding that learning is a social and interactive process, supported by both physical and human environments. Gibbons (2010) argues that the way in which educators perceive technology is reflected in the way they position technology within the curriculum, and that "transmission of values and beliefs [are] embedded in technology discourses" (p. 7). This demonstrates that technology is merely another aspect for curriculum integration in alignment with children's interests and experiences. However, this area also warrants critical reflection to identify and address potential biases and beliefs held by educators and other stakeholders. Such critical reflection would best take place in a collaborative professional learning context where educator beliefs and understandings could be identified, unpacked and further developed.

2.6.4 Practitioner inquiry.

Critical thinking and critical reflection are elements of practitioner inquiry—both at an individual and collaborative level (Fleet & Patterson, 2009; Groundwater-Smith et al., 2013). Gibbons (2010) reinforces the value of critical reflection as a professional learning strategy to support the integration of technology. He notes that "understanding and engaging with philosophy should not be considered a luxury or superfluous in early childhood education if we are to remain committed to the idea of the teacher as a reflective and critical pedagogue" (p. 2). In this way educators are supported to question their beliefs, ideas and preferences, but also have the agency to maintain their viewpoints. As such, the implementation of any changes would reflect the educators' knowledge and understanding of the context, which can be re-tested, and re-implemented as knowledge and experiences develops throughout the course of the practitioner inquiry project (Groundwater-Smith et al., 2013). Additionally, engaging in critical reflection and ongoing professional learning in a collegiate environment encourages educators to develop their sense of objectivity, to be cognisant of their own values and beliefs and to also acknowledge and include the perspectives of others (Gibbons, 2010; Groundwater-Smith & Mockler, 2006). Strong benefits often result when professional partnerships are formed between educators and academic colleagues, an approach that is supported by engagement in practitioner inquiry processes (Groundwater-Smith & Mockler, 2006).

Fleet, De Gioia and Patterson (2016) identify practitioner inquiry as an approach to professional learning that acknowledges the autonomy and capabilities of each educator, thus consolidating their strengths in a contextually relevant way. This approach addresses a diverse range of other documented issues in relation to professional learning, which also show value in terms of addressing the integration of technology. An example of this is that without contextually relevant professional learning that enables educators to see how suggested changes work in practice, they are not likely to deviate from their current approaches to incorporate technology (Edwards, 2005; Guskey, 2002, Yelland, 2006). Practitioner inquiry enables participants to identify the topic and focus of professional learning to align with their own interest and questions, and then to implement changes to practice over a period of time with the assistance of a facilitator (Groundwater-Smith, Mitchell, Mockler, Ponte, & Rönnerman, 2013). As such, practitioner inquiry aligns with the professional learning needs identified by the research reviewed in this chapter.

Additionally, reflecting and collaborating with colleagues as well as other professionals (such as academics) when considering and implementing pedagogical change provides collegiate opportunities (Groundwater-Smith et al., 2013; Groundwater-Smith & Mockler, 2006; Woodrow & Newman, 2015). Fleer and Patterson (2009) and Nuttall (2013) all highlighted this as an important approach. They noted that professional learning for early childhood educators should be collaborative and involve collective discussion and reflection. Gibbons (2010) in his reflections of technology and professional development for early childhood teachers further delineates the value of collaboration. He argues the need for professional learning approaches that provide educators with opportunities for active engagement with colleagues to share perspectives, whilst also respecting their own view point (Gibbons, 2010). Practitioner inquiry provides an effective model in allowing individual ideas to be respected, shared and expanded collaboratively (Groundwater-Smith et al., 2013; Rönnerman, 2015) and additionally, provides a safe space where it is acknowledged that there is no one right way or answer (Fleet et al., 2016). The need for flexibility is especially important in the context of technology, as professional learning models need to respect that technology integration will vary between contexts in terms of suitability and acceptance (Gibbons, 2010). Practitioner inquiry provides the opportunity to share information, guidance and insights, while maintaining respect for individual preferences (Fleet et al., 2016; Fleet & Patterson, 2009) and recognising the educator as the expert in their context (Groundwater-Smith, 2013).

The iterative nature of practitioner inquiry affords additional benefits in terms of supporting professional learning relating to the integration of technology. Turja et al. (2009) suggest that ongoing professional learning supports educators to develop skills and abilities, as well as helping to ensure that their knowledge is current. Mantei and Kervin (2007) note that many educators report a lack of confidence in integrating technology despite attending professional learning courses. This disconnect could be due to the course content not being adequate, or more specifically it may not help the educators create connections between technology and pedagogy. Nuttall et al. (2015) argue that professional learning should help educators to see the potential that technology presents, rather than using these new resources to maintain previous practices. Acquiring this perspective may present further challenges for some educators who are not comfortable with advances and changes in technology. Gialamas and Nikolopoulou (2010) and Gibbons (2010) acknowledge the value of ongoing professional learning for educators, even when educators feel confident or positive about using computers and other technology in their services. Ongoing professional learning opportunities help to maintain currency within an area that is constantly changing and advancing. Ongoing training has the potential to support educators to stay up-to-date with children who are often experiencing and interacting with these advances daily. Practitioner inquiry appears to hold many benefits as a professional learning model to support the integration of technology in early learning services. However, this literature review indicates this is largely an under explored area and further research is needed to understand this topic in greater depth.

2.7 Summary

This review of literature and research relating to technology and early childhood learning has identified that technology is increasingly prevalent in everyday life, though the its increasing ubiquity does not necessarily need to be viewed as a ‘newness’ to be met with moral panic or antipathy (Alper, 2011; Gibbons, 2016; Marsh et al., 2005; Palaiologou, 2016). Research shows that educators need guidance and support on how to integrate technology into play-based curriculums (Bird & Edwards, 2015). This literature suggests that focus on technology needs to move beyond narrow conceptualisation of ICTs to include broader conceptualisations. Additionally, reflecting on current research findings raises the question as to whether conceptualisations need to move beyond a focus on physical technological resources to also consider educators as a resource themselves. This shift in thinking is a salient issue for investigation given that the EYLF definition of curriculum includes educator interactions (DEEWR, 2009). This literature review identifies a wide range of factors that influence what educators choose to include in the curriculum and shows clear links and correlations between research findings in terms of factors that support of hinder the integration of technology (Palaiologou, 2016). Reflection on these findings highlights the need for further research that looks at creating a discourse on how technology can be integrated in early learning curriculums, why it is relevant to play-based learning and what the role of the educator is in supporting and facilitating its integration. This thesis draws on the extensive literature which reinforces the impact of teacher beliefs on integration of technology, and uses them as a foundation from which extend research scope, as well as findings

Practitioner inquiry was identified as a potential professional learning model to support the integration of technology in early learning services. One of the reasons for this is that practitioner inquiry affords opportunities for educators to develop their own research questions and topics for inquiry, which helps to ensure that professional learning and improvement is both relevant and context specific (Groundwater-Smith et al., 2013). The value of practitioner inquiry is further strengthened through opportunities to engage in collaboration, critical reflection and autonomy in effecting educational change (Gibbons; 2010; Groundwater-Smith & Mockler, 2006). The following chapter presents the methodology employed throughout this study to investigate educator beliefs and practices in relation to the integration of technology, as well as the factors that supported and hindered practitioner inquiry as a professional learning strategy to support the integration of technology in early learning curriculums.

Chapter 3 – Methodology

> *A problem with existing research efforts is that they direct attention to teachers' beliefs, attitudes and/ or confidence in using technologies, digital media and popular culture in early childhood education instead of the foundational concept used to drive curriculum provision in early childhood education—this being children's play (Edwards, 2015, p. 2)*

The previous chapter discussed literature and research relating to the ubiquity of technology in everyday life and the associated teaching implications for early childhood educators. The literature review identified a number of factors that could potentially impact on educator dispositions towards integrating technology in early learning settings. Consideration of these factors throughout the chapters involved analysis of significance of providing socially and culturally relevant early learning curriculums. As noted in Edwards' (2015) quote in the epigraph for this chapter, understandings of educator beliefs and attitudes in using technology need to extend into providing foundational understandings of how technology should feature as a socially and culturally relevant curriculum. This theme underpinned the study and highlighted the need for a methodological approach that enabled the collecting and collating of diverse data, then revisiting the data as themes emerged throughout the study and utilising it to support professional learning strategies. This chapter outlines the research design as a qualitative, design-based, collective case study. The sample and recruitment processes are explained as well as all stages of data collection and analysis. This chapter also includes a thorough discussion of ethical considerations, rigour and reliability.

3.1 Purpose of the Study and Research Questions

As outlined in Chapter One (Section 1.5), one of the purposes of this study was to gain insights into educator beliefs and practices in relation to technology integration in their early learning curriculums. The other aim of the study was to investigate facilitators and barriers experienced when practitioner inquiry was utilised as a professional learning strategy to support technology integration by the participating educators. Three key research questions underpinned the research:

1. What are the beliefs of early childhood educators about integrating technologies in early childhood services?
2. How was technology integrated in early childhood educators' practices?
3. What supports and inhibits practitioner inquiry as a strategy to integrate technology in early childhood services?

3.2 Research Design

Implementation of a qualitative collective case study strategy (Goddard, 2010) took place over a 12-month period, in two phases. The study was iterative (Bassett, 2010; Jones, 2011; Srivastava, & Hopwood, 2009), with findings from the first phase informing the content of the second phase. Phase 1 included interviews, observations and collection of artefacts[5]. Phase 2 also included observations, meetings and collection of artefacts as well as focus group discussions. Additionally, Phase 2 comprised of a practitioner inquiry project (Groundwater-Smith et al., 2013). Table 3.1 details data collection across the two phases of the study. A sociocultural framework underpinned all aspects of data collection and analysis.

[5] Artefacts included documentation recorded by educators of children's experiences for planning and assessment purposes.

Table 3.1

Phases of the Study

Phase 1: Collective case study • Individual interviews with each educator • Data collection in each early childhood service including observations and collection of artefacts.
Phase 2: Collective case study and practitioner inquiry projects • Initial meeting/ group discussion and professional learning session on practitioner inquiry • Data collection in each early learning service including observations and collection of artefacts • An initial meeting at each service to develop practitioner inquiry focus and questions • Monthly meetings with all educators/ service directors/ services managers at each service to discuss practitioner inquiry project • Educators journaling • Focus group discussion

Data analysis from Phase 1 identified a number of educator beliefs and practices as well as other contextual and individual factors that influenced the integration of technology in the curriculum. These findings from Phase 1 informed the practitioner inquiry projects in Phase 2. Figure 3.1 outlines the interrelated nature of the two phases of the study.

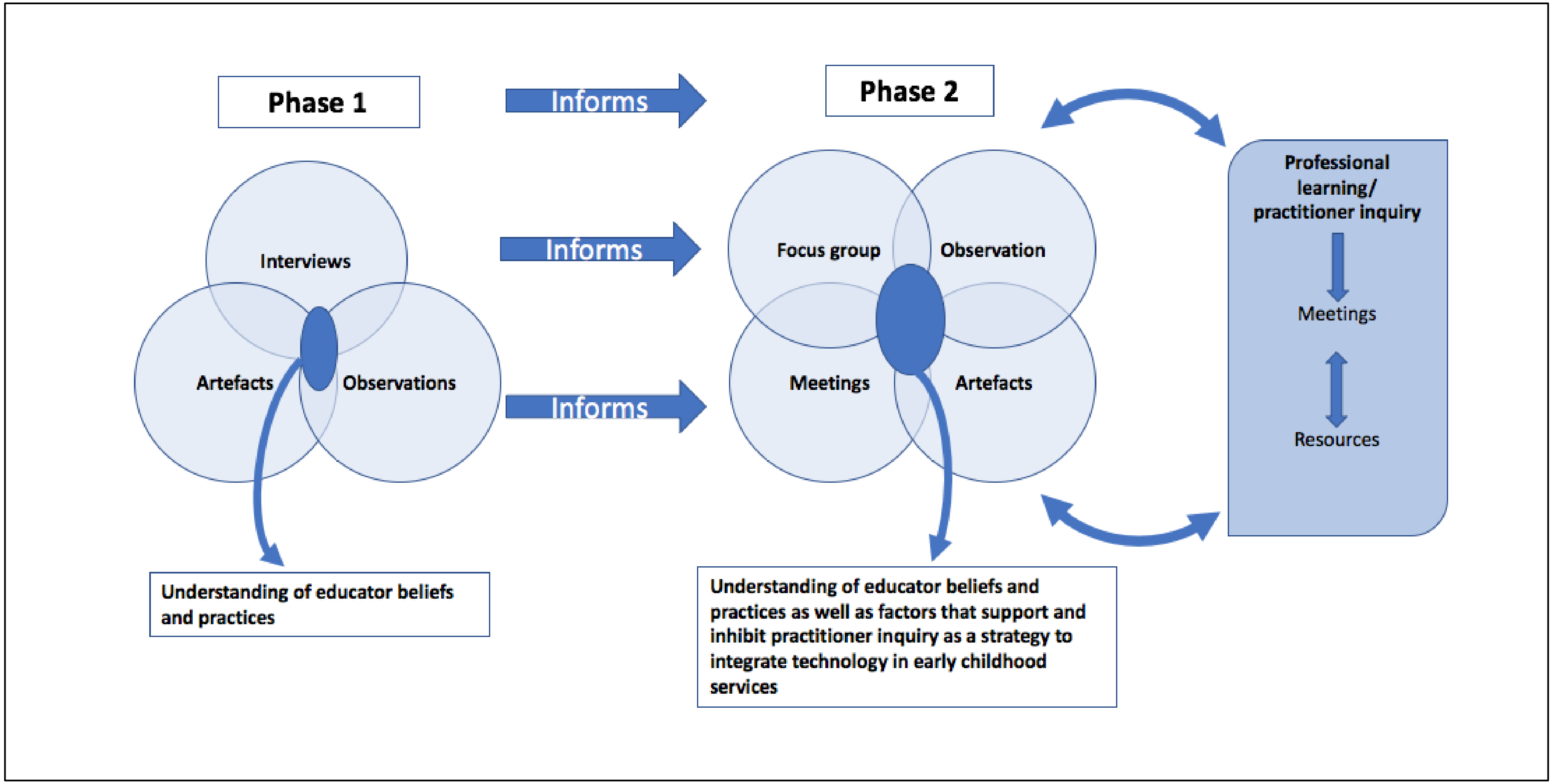

Figure 3. 1: Data collection across the two phases of the study.

The methodological approaches employed qualitative, designed-based research and collective case studies. The following sections outline these approaches.

3.2.1 Qualitative research.

This study employed qualitative research strategies. Such methods supported the collection of rich and detailed data which could more thoroughly identify the detail and nuances between educators and contexts (Johnson & Christensen, 2008). In this way variations and diversities across each service were observed, analysed and used to inform each stage of the research. Utilising qualitative research methods also enabled observation of educators in the everyday context of planning, implementing and evaluating their curriculum inclusions. Such an approach also acknowledged that context, situational factors and personal characteristics affects the way people behave (Johnson & Christensen, 2008; Mills & Birks, 2014). Naturalistic observation enabled the researcher to identify a wide range of factors at play and how they are interrelated or impact upon each other (Denizen & Lincoln, 2011; Johnson & Christensen, 2008).

At the commencement of this study there was a paucity of research available relating to educator beliefs and practices regarding technology integration in early learning curriculums. The research aimed to address this gap by gathering a broad overview of educator conceptualisations of technology, their beliefs about technology and also technology related praxis. A qualitative approach supported this focus as it allowed for observation of a wide range of experiences, resources, events, beliefs and attitudes in the data collection process (Creswell, 1998; Johnson & Christensen, 2008).

3.2.2 Design-based research.

In keeping with the aims and research questions this study employed a design-based research approach. Anderson and Shattuck (2012) define design-based research as:

> […] a methodology designed by and for educators that seeks to increase the impact, transfer, and translation of education research into improved practice. In addition, it stresses the need for theory building and the development of design principles that guide, inform, and improve both practice and research in educational contexts. (p. 16)

Design-based research is valuable when striving for innovation in educational services—such as in the case of this study. Data collection methods, analysis and practitioner inquiry projects incorporated both fixed and emerging individual characteristics and traits of each educator and service. A designs-based approach supported and facilitated effective change as educators and the researcher worked together with complementary understandings of the context and area of research. Additionally, the design-based methodology allowed tailoring of data collection methods and the professional learning strategies to the specificities of each service (Anderson & Shattuck, 2012). This was an important consideration in this study as each collected data set informed the next stage of the project, which helped to ensure that the practitioner inquiry projects were contextually relevant. Additionally, design-based research provides a strong foundation from which to develop connections between theory and practice, and is particularly useful when utilised within educational research (Brown, 1992). As noted in the epigraph, this is an important consideration in provision of curriculums that include technology in ways that are play-based and child-led.

While a number of current research studies have investigated educator beliefs in relation to integrating technology (see Table 2.1), it remains a developing area in terms of understanding the implications for pedagogical practice and professional learning (Palaiologou, 2016). Given the emerging nature of knowledge in this area, research methods need to be flexible and adaptable depending on the data to be gathered. Design-based research recognises that context is pivotal, with an understanding that there will be variation between services (Anderson & Shattuck, 2012). The design-based approach also aligns effectively with the sociocultural perspective that underpins this research (as discussed in Section 1.4 of Chapter 1) by being responsive to variations within early learning services in terms of individuals as well as contexts. This study included a strong emphasis on identifying educator beliefs in relation to technology, encouraging critical reflection on how this impacted on their pedagogical practices, and then collaboratively investigating ways to integrate culturally and socially relevant technological tools and resources within the curriculum. The process of designing the methodological approach for this study included an acknowledgment that each early learning service would contain diverse educators and bring different contextual influences. This created variations and nuances that made it difficult to predict the results that would emerge, hence the relevance of a design-based approach.

Additionally, Plomp (2007) notes that design-based research has at its centre a focus on developing or designing supports and resources that can assist in addressing specific educational issues. This can include development of professional learning strategies and resources that are relevant to the particular problem or area of interest identified. Technology is recognised as an area that can require the development of new knowledge and understandings by both educators and children, and thus a design-based approach is effective in supporting researchers to identify the professional learning strategies that would be advantageous (Majgaard, Misfedlt, & Nielsen, 2011). Furthermore Majgaard et al. (2011) identified that combining design-based research and action research models (such as practitioner inquiry) is effective as it supplements co-learning approaches with “a theoretical understanding of the learning envisioned problems [we] expected to encounter” (p.12). In this way design-based research and practitioner inquiry work together to effectively bridge theory practice and professional learning.

3.2.3 Collective case study approach.

A collective case study approach enabled extensive, authentic consideration of individual contexts (Goddard, 2010). Single case studies allow for detailed analysis and description of the phenomena of interest (Chadderton & Torrance, 2011; Johnson & Christensen, 2008). A collective case study approach was more advantageous in achieving the aims of this research as it provided the benefit of being able to gain insights into practices in more than one early learning service. Yin (2014) discusses replication logic as one of the benefits of conducting a collective case study. This includes comparing the similarity or differences in results between contexts (Thomas & Myers, 2015; Yin, 2014). Yin (2014), a long standing, accomplished author in case-study research, notes that some authors consider collective case studies to be a different methodology from single case studies. However, he states that there is no clear distinction between single and multiple case studies in terms of research design, and that while both have merit, collective case studies afford more detailed and more cogent findings that support a more robust study (Yin, 2014).

Case studies can accommodate a variety of data collection methods (Thomas & Myers, 2015). Use of multiple data collection methods facilitates triangulation of findings, a process which involves comparing and contrasting findings from different data sets to ensure that results are robust and reliable (Johnson & Christensen, 2008; Yin, 2011). Data collection methods within the case studies in this research project included interviews, focus groups, observational visits, meetings and reviewing of artefacts such as educators' observations, programming, evaluation and documentation records. Hammersly (2008), notes that interpretations of data triangulation can vary, and can challenges can arise when comparing different types of date. However, he also notes that triangulation is an effective method for mitigating the development of erroneous conclusions. Triangulation is recognised as an effective strategy to support validity within design-based research. Within design-based research triangulation extends beyond comparing and contrasting between data sets to include triangulation between theory, design and practice (Design Based Research Collective, 2003). This reduces concerns about only comparing between different forms of data.

3.2.4 Sociocultural framework.

This research utilised Rogoff's (1995) three planes of analysis to understand how educator's pre-existing experiences, skills and beliefs impacted upon technology integration within the curriculum as well as how interactions and the early learning service context impacted on practice. Rogoff's planes of analysis included focussing on the sociocultural activities (personal, interpersonal and community) and the associated developmental processes (participatory appropriation, guided participation and apprenticeship) (Rogoff, 1995; 1998) (See <ins>Figure 1.1</ins>). The following sections explain the relevance of these three planes of analysis to the aims of the study.

Plane 1: Personal/ Participatory appropriation

This study recognised educators as a resource, and a source of information and insights formed through previous experience (Rogoff, 1995). Consideration of appropriation, in terms of receiving new information, was informed by understandings of what the educators knew previously and how they could "stretch their common understanding to fit the new endeavour" (Rogoff, 1995, p.153). In this way, the plane of participatory appropriation served as a lens through which to consider how previous experiences impacted upon how they responded to new opportunities and inputs in relation to integrating technology.

Plane 2: Interpersonal/ guided participation

This element of sociocultural theory highlights the importance of ongoing, in-depth critical reflection by educators, and justifies the relevance of practitioner inquiry as a professional learning strategy. Within this research, guided participation as defined by Rogoff (1995) was an important process as it facilitated acknowledgement of the diverse skills and experiences with technology that children and educators brought to the setting. Additionally, applying this lens during group collaboration supported the development of new understandings and knowledge for each participant. From an adult learning perspective, the lens of guided participation supported exploration of how individual learning and providing leadership occurred contemporaneously (Rogoff, 1995).

Plane 3: Community/ Apprenticeship

The professional learning focus of this study involved acknowledgement of educator beliefs and practices examining ways to extend conceptualisations and understandings of technology and play-based learning. Rogoff's (1995) lens of apprenticeship supported this process by facilitating inclusion of the opinion, knowledge and skills of the novice and moving beyond a transmission approach to professional learning. Additionally, the lens of apprenticeship acknowledges that the role of the more knowledgeable other is dynamic, and that each team member may move between the roles of 'expert' and 'novice' (Rogoff, 1995). Collaboration between all individuals in the groups including educators, service managers/directors and the researcher was pivotal. Rogoff (1998) also notes that Vygotsky primarily focused on dyads when discussing zone of proximal development and that wider interactions are often an under investigated area. This study utilised Rogoff's planes of analysis (1995) to extend beyond the notion of learning dyads and to explore broader concepts of apprenticeship, particularly when participating in a culturally organised activity that contributes to the achievement of a collective goal.

3.2.4 Ethical considerations.

This study had ethical approval from Macquarie University[6] and written consent from all participants. Qualitative research requires close consideration of a diverse range of ethical concerns. Six core principles were adopted (Van Den Hoonaard & van Den Hoonaard, 2013) to ensure ethical principles were adhered to at all times throughout this research project including integrity and quality of the research, full disclosure about the project to participants, and assurance to participants of confidentiality, anonymity and the voluntary nature of being involved in the study. Disclosure of conflicts of interest was also a core principle for ethical consideration, however no conflicts of interest were identified for this this study.

Integrity and quality

The utmost effort was made to uphold academic integrity and ensure that all data gathered was reliable and correct. This included a strong research design, consultation with other academics and constant reflection and evaluation. Throughout data collection and analysis there was rigorous adherence to sampling criteria and the stated methodology, and critical reflection on previously published relevant research and articles including those that did not correspond with the data gathered (Johnson & Christensen, 2008).

[6] Macquarie University Human Research Ethic Committee reference number: 5201200902

Full disclosure about the research project to participants at each service

All participants were clearly and thoroughly informed of the purpose of the research, the processes involved and estimated time expectations for involvement, as recommended by Johnson and Christensen (2008). This enabled them to make an informed choice about whether they wanted to participate in the research or not. It also enabled them to determine whether they had the time and inclination to be involved with the project. Information and consent forms for service directors/ managers and educators are included in the Appendix (Appendices C and D respectively).

Confidentiality and anonymity

Confidentiality was maintained throughout the data collection, analysis and reporting stages. Participants were assured that only the researcher and three other supervising academic staff members at Macquarie University would observe any identifying information, with the possibility that transcription or analysis services may also be used. Any discussion of the data in the research report refers to services, educators, and management with unidentifiable number codes (Appendix E). Research data was stored in a separate location to the key that explains the coding system to further support confidentiality (Coady, 2010). All data and other related correspondence was stored in either a password secured computer, password protected hard drive and or locked filing cabinet, as per the recommendations from the National Health and Medical Research Council (NHMRC) (2009).

Voluntary participation

All participants were clearly and thoroughly informed of the purpose of the research, the processes involved and estimated time expectations for involvement, as recommended by Johnson and Christensen (2008). This enabled them to make an informed choice about whether they wanted to participate in the research or not. It also enabled them to determine if they had the time and inclination to be involved with the project.

Avoidance of harming educators

Physical harm for participants was unlikely as a result of taking part in this study, however the consideration was given to mental pressure when planning the research methods and in recruiting participants. Full disclosure of the research content, processes and time requirements assisted as a measure to avoid harming educators in terms of anxiety or stress. This was an important consideration as participants should not be put in a position where the research causes physical or mental stress or any other undue negative outcomes (Burton & Bartlett, 2009; Johnson & Christensen, 2008). Assurance of voluntary participation was also a measure to avoid harm to educators. It was anticipated that participants may have felt pressure to take part in the collective case studies as there would be involvement from several team members at the service. By reinforcing the need for voluntary consent the risk of coercion was mitigated (Van Den Hoonaard & van Den Hoonaard, 2013).

3.3 Participant Recruitment

Purposive sampling was used to select three early learning services to participate in the project. Such an approach was deemed suitable for this project as it supports selection of cases for a case study based on particular traits or characteristics (Johnson & Christensen, 2008). Educators in one room within each early learning service were invited to participate. The specific criteria used to identify suitable services comprised of:

1. Either a long day care centre or preschool

2. Located within Sydney or Central Coast regions of New South Wales, Australia

3. Educators working in a room with children over three years of age[7].

4. All educators within the room were willing to participate in the research.

Participation in the project involved all educators working within a specific room at the service. Educators received personal invitations to participate, along with information on the research project and consent letters. The researcher provided educators with consent forms directly to avoid any coercion or perceived coercion from the service director or service manager.

The geographical location of services was not an important consideration for the purposes of this research from a data analysis perspective. The aim of the research was not to compare specific locations or make generalisations, but to examine technology integration within individual services. Additionally, there was a need to collect case study data over a short period of time. Therefore, the services needed to be within reasonable proximity to ensure that access was manageable. As such, only early learning services from Sydney and the Central Coast regions of New South Wales were invited to participated in the study.

A level of interest in technology was not a selection criterion, and educators did not need to have a high level of competence or confidence with technology. Neither were they required to have a strong understanding of the potential value of technology within early learning services. The criteria choices were based on contemporary research which suggests early childhood educators often do not have a solid understanding of technology and how it relates to play-based learning (Edwards, 2014). Additionally, there was an assumption that many educators might not be cognisant of the types of technology-based experiences they are

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[7] This is due to the limited research available regarding the value and appropriateness of using technology with children under the age of three. The American Academy of Pediatrics (Brown, Shifrin & Hill, 2015) recently revised guidelines in screen time for children under two but this remains contentious.

already including in their curriculum given the diverse definitions and conceptualisations of technology that exist (as discussed in Chapter 2). While it is more likely that educators with an interest in technology are willing to include it in their curriculums, the perspectives and practices of educators with no interest in technology or who did not believe that it pedagogically appropriate were also relevant to the study aims. The inference was that focusing on either scenario would provide insights into alignments or disconnects between educator beliefs and practices, how this presented in praxis, and what professional learning opportunities would best support them.

Additionally, qualification levels were not a criterion for participation based on the current regulatory requirements for educator qualifications. Case study research aims to investigate phenomena in real life, authentic and realistic contexts (Johnson & Christensen, 2009). The Education and Care Services National Regulations (the Regulations) (2014) do not require specific qualification levels for each room in a prior-to-school setting, instead providing an outline of requirements across the whole service[8]. In interpreting and adhering to the Regulations, therefore, there is no requirement for early learning services to have tertiary trained early childhood teachers in a face-to-face teaching position or within any specific room within the service. Educator demographics are outlined in Table 3.2 and included a diverse range of qualifications ranging from those newly enrolled in a Certificate III course to those holding Bachelor of Education and enrolled in post graduate studies. Consideration of educator qualifications occurred during data analysis with the purpose of obtaining an understanding as to the impact of prior experience and knowledge of educators

[8] Due to Regulatory requirements, many Australian early learning services do not require early childhood teachers in attendance The Regulations state that at least half of the educators at a service need to have/ be working towards a diploma level education and care qualification. All other educators at the service must have/ be working towards a certificate III level education and care qualification.

Table 3.2

Demographic Information for Each Participant

Service 1 Participants	**S1P1**	**S1P2**	**S1P3**	**S1P4**	**S1P5**
Position	Early childhood Teacher	Diploma, advanced child care worker	Advanced child care worker (qualified)	Support worker	Educator
Role and responsibility	Room leader, programming and planning for children, Second in charge.	Programming, planning and day to day routines	Programming, planning and managing daily tasks and routines.	Supporting child with additional needs	Assisting with the care and education of the children
Permanent/ casual	Permanent	Permanent	Permanent	Casual	Permanent
Part time/ full time	Full time	Part time (4 days per week)	Full time	Casual	Full time
Years of experience	8 years	6 years	6 years	1 year	6 years
Qualification	Bachelor of Education (birth to five)	Diploma in Children's Services	Diploma in Children's Services	No qualifications	Certificate III in Children's Services
Service 2 Participants	**S2P1**	**S2P2**	**S2P3**		
Position	Room leader	Educator	Educator		
Role and responsibility	Adhere to regulations, policies and procedures. Maintain programs, observations, documentation. Ensure day- to- day running of the room.	Adhere to all regulations, policies and procedures.	Adhere to all regulations, policies and procedures.		

Permanent/ casual	Permanent	Permanent	Permanent		
Part time/ full time	Full time	Full time	Full time		
Years of experience	10 years	7 years	1.5 years		
Qualification	Cert III Children's Services (studying Diploma Children's Services)	Bachelor of Education	Certificate III Children's Services.		
Service 3 Participants	**S3P1**	**S3P2**			
Position	Room leader	Educator			
Role and responsibility	Planning and assessment, implementing the curriculum	Planning and assessment, implementing the curriculum			
Permanent/ casual	Permanent	Permanent			
Part time/ full time	Full time	Full time			
Years of experience	8 years	5 years			
Qualification	Bachelor of Teaching	Certificate III			

on technological integration in their services—at both an academic and social/ experience level. There were no clear benefits evident for focusing on a specific qualification level; indeed there was an assumption that diverse and various elements would impact upon educator beliefs and practices in relation to integrating technology, as identified in the literature review.

Recruitment of educators took place between December 2012 and May 2013. Three services chose to take part in the research project. The early learning services that took part are referred to as Service 1 (S1), Service 2 (S2) and Service 3 (S3). Service details are discussed below with more detailed information included in Table 3.3. The codes used for each participant throughout the study are included in Appendix E.

Table 3.3

Service Details

	Type of service	Age of children in participating room	Number of educators in room	Location	Hours of operation	Licensed places at service	Licensed places in room	Do children attending the service mainly come from surrounding community?
Service 1	University based	3-4 years	4 (Phase 1) 2 (Phase 2)	Sydney, NSW	7:30am-6:30pm	90	20	Some from the local area. Families are often staff and students of the University
Service 2	Privately operated	3-4 years	2	Central Coast, NSW	7am- 6pm	88	20	Yes
Service 3	Privately operated	4-5 years	2	Central Coast, NSW	6:30am - 6pm	90	20	Some are from the local area. The service is located near a main freeway and attracts families from a wider area who pass the service on their commute to Sydney.

3.4 Data Collection

Data collection included a number of complementary tools and approaches to support the integrity of the findings. Phase 1 took place over a four-month period (April – July) in the first half of 2013 and Phase 2, including the practitioner inquiry projects, took place immediately after Phase 1, over a five-month period (initially planned for July – November 2013, but extended into December). The research happened concurrently in all three services to limit the variables that would impact upon services. For example, the beginning of the year and end of the year are times of transition and therefore educators need to focus on supporting children and families through these transitions[9]. Studying one service during this period and another in the middle of the year would potentially impact upon the data collected and the analysis process. The data collection process is outlined in Table 3.1.

3.4.1 Phase 1 data collection.

Phase 1 data collection included individual interviews with educators, observational visits at each service and collection of artefacts, including planning and assessment records and other documentation of children's learning and experiences, as recorded by the educators. Discussion of data sets is in included in the following section.

Interviews

Initially, educators at each of the three services participating in the study took part in individual qualitative interviews (Yin, 2011). This included four educators at S1, two educators at S2, and two educators at S3. The purpose of these interviews was to gain

[9] Transitions can include new children starting at the service and children moving between rooms as children leave the service at the end of the year to go to school.

insights into their beliefs and practices in relation to technology in early learning services, as well as their personal confidence and competence with technology. Interviews were open-ended in nature and conducted in person. There was only one interviewer, which ensured consistency in question asking and prompting techniques used (Johnson & Christensen, 2008). Interviews were audio-recorded and transcribed by an external transcription service.

Interviews took between 10 and 30 minutes. While there was a set list of questions, these were not the only questions asked as the researcher looked to delve deeper into some of the ideas and information provided by each educator. Another benefit of the qualitative interview approach is that it is more conversational and supports the development of rapport with educators (Yin, 2011). This was an important consideration given the ongoing nature of the study and particularly the practitioner inquiry project in Phase 2.

There were nine questions in the Phase 1 interviews. These were:

1. In your opinion, what is the role of technology in early childhood services?
2. How confident do you feel using technology personally?
3. What sort of technology based resources/ experiences do you include in your early learning environment?
4. What are your thoughts on how technology relates to the Early Years Learning Framework?
5. What influences your decisions in including technology in your setting?
6. What factors prevent you from integrating technology into your early learning setting?
7. What factors support your integration of technology in your early learning setting?

8. What types of technology do children in your room (at the child care setting) have experience with from their home or social settings?

9. Any other comments?

Development of these questions was informed by previous research undertaken by the researcher as discussed in Chapter 1 (1.4.2)[10], as well as by key themes that emerged in an extensive analysis of research relating to technology in early learning services (Campbell & Scotellaro, 2009; Plowman & Stephen, 2005; Plowman & Stephen, 2007; Wang et al., 2010, Yelland, 2011, Zevenbergen & Logan, 2008).

Observations

Unstructured observations took place at the three early learning services. Observation visits involved the researcher as an inconspicuous presence in the room, recording notes on observations of educator practices and other elements of curriculum that were relevant to the research questions and aims (Jones & Somekh, 2011). Observations focused on how technology featured within the curriculum as well as educator interactions and practices with technological resources. Within an observational approach, documentation is from the researcher's perspective, with the researcher drawing on their prior knowledge of the research focus to choose what to record during the observation sessions (Jones & Somekh, 2011; Yin, 2011). This was an important process as researcher observations can add an additional level of information to compare, contrast and further delineate the self-reported data from educators (Yin, 2011) and to compare with other sources of information such as artefacts (Jones & Somekh, 2011).

[10] The previous research undertaken by the researcher was a mixed methods study which included an online questionnaire (n=28) and short telephone interviews (n=5).

Observations focused on technology integration within the curriculum and aimed to collect data that could be compared with educator interview responses. This approach supported the development of broader understandings of educator beliefs and conceptualisations of technology. Observations focused on elements included in the broad definition of curriculum detailed in the *EYLF*, including “interactions, experience, activities, routines and events, planned and unplanned, that occur in an environment designed to foster children’s learning and development” (DEEWR, 2009, p. 9). To examine the interplay between these diverse elements of curriculum, observations focused on three planes of analysis (Rogoff, 1995); these being personal (educator understandings and beliefs, children’s understandings and interests), interpersonal (interactions with educators and other children) and community (provision of resources including integration of technology in planned and spontaneous experiences for children).

The researcher also developed an observation checklist to assist with data collection and analysis. The checklist focused on technology and pedagogy including predetermined characteristics that were based on an extensive review of literature and research relating to technology in early learning services (Clements, 2002; Gibbons, 2010; Marsh et al., 2005; Plowman & Stephen, 2007; Plowman & Stephen, 2005; Plowman, Stephen & McPake, 2012; Lindahl & Folkesson, 2012a, 2012b; Roberts, Djonov & Torr, 2008; Wang et al., 2010). The checklist also included guidance on recognising the inter-related nature of the personal, interpersonal and community planes of analysis (Rogoff, 1995). These factors were developed into a list for guiding observations and data collection in Phase 1 and included interactions between educators and children and the use of technological tools and resources. The observation checklist comprised 13 aspects organised into four subcategories. Space was included on the checklist for comments and a link to the literature that had informed the specific aspect and subcategories. Table 3.4 lists the main elements and the full observation checklist is included in Appendix F. The observation check list was developed as a resource to support rigour and validity. This aligns with the use of instrument or system for measuring that is a criteria of design-based research (Design-Based Research Collective, 2013).

Table 3.4

Main Elements of the Observation Checklist

Guided Interactions - Indirect	1. Availability of technology 2. Educator practices 3. Resources 4. Programming and planning
Guided Interactions - Direct	1. Educator practices 2. Curriculum 3. Equity
Assessing technological tools and resources	1. Contexts 2. Resources available 3. Collaboration
Reactive supervision	1. Supervising rather than guiding 2. Equity 3. Curriculum

Rather than being a ‘checklist’ this tool was designed to be a list of factors that can be useful to consider when analysing the data collected through observations. That is, it was qualitative in nature, providing descriptive information rather than a measure where items were either ticked off as occurring or not occurring. Patton (2014) discusses the importance of ‘empathetic neutrality and mindfulness’ in the data collection stage. This is where the researcher observes openly and without bias, but is also aware of and able to respond to relevant phenomena. The checklist supported this approach by providing a wide range of possible considerations based on an extensive meta-analysis of research and literature relating to technology in early learning services (as discussed in the literature review). A summary of themes relating to integrating technology in early childhood services as identified in the research helped to delineate the spectrum of possibilities and to challenge any limited preconceived notions the researcher held.

Another aim of this tool was to highlight specific areas of focus, or topics to be aware of, for subsequent observation visits or other forms of data collection. It was also helpful in identifying areas of focus when entering the second phase of the research project, particularly in relation to the practitioner inquiry project. Immediately after the observation visit, the researcher recorded notes in the comment section of the checklist. Completing this checklist challenged the researcher to record observed practices as well as to use the checklist as a provocation in considering how observed practices and resources linked to the key issues identified by other researchers. As a working document, this also included links to the research questions to assist with analysis.

Observation visits occurred over a four-week period in June and July 2013. The observation schedule for each service included two visits for a period of two hours. Where possible, the visits took place in the indoor environment. This choice was based on research findings that argue that educators predominantly considered technology as an indoor resource (Stephen, 2013). There was an acknowledgement that educators may include more technological experiences in the curriculum on days that the researcher was observing. Data triangulation (Johnson & Christensen, 2008) provided the opportunity for data to be compared across sets to look for consistency in practice. S1 required an additional observation visit due to staff absence during the second scheduled observation visit, which resulted in the children being involved in a combined outdoor play experience with other classes at the early learning service. The visit schedule is outlined in Table 3.5.

Table 3.5

Schedule of Service Visits

	Observation visit 1	Observation visit 2	Observation visit 3
Service 1	11 June 2013	19 June 2013	10 July 2013
Service 2	13 June 2013	28 June 2013	N/A
Service 3	16 June 2013	4 July 2013	N/A

During the Phase 1 observation visits the researcher took the role of observer-as-participant (Johnson & Christensen, 2008). Within this approach, the participants are aware of the researcher's presence. Additionally, the participants know observations of practice are taking place, but interactions between researcher and educators are minimal (Johnson & Christensen, 2008). While this approach does not include the educator perspectives, it does support a neutral and objective approach to data collection (Johnson & Christensen, 2008). Utilisation of a time-sample approach (Johnson & Christensen, 2008) supported collection of comprehensive notes during the observation sessions. Observational note-taking involved recording a description of elements of the environment, curriculum provisions and of educator interactions and locations every 5-10 minutes depending on the activity. Observations also focused on educator supervision and interaction with children using technological resources with specific links to direct and indirect guided interactions, and reactive supervision (Plowman & Stephen, 2007; 2005). The researcher undertook all observational visits which supported consistency of data collected (Flick, 2007; Johnson & Christensen, 2008). However, as previously discussed, the checklist served as a tool for subjectivity as per the design-based research approach (Design-Based Research Collective, 2003).

Artefacts

The analysis and inclusion of artefacts as a data collection method refers to forms of data compiled by someone other than the researcher that provides an additional level of understanding to the research project (Johnson & Christensen, 2008). In this research, artefacts included copies of documentation recorded by the educators for programming, planning and assessment purposes, as well as information recorded in the daily communication diaries for families. The value of artefacts is that they enable cross referencing and triangulation with data collected from other data sets such as interview responses or the researcher's observations (Johnson & Christensen, 2008) as well contributing an additional source of rich data that reflects the educator's perspectives and aspects of the broader service context.

3.4.2 Phase 2 data collection.

Data collection across Phase 2 involved four concurrent processes occurring during the practitioner inquiry process. These included focus group discussion, observations, meetings and the collection of artefacts. The schedule of visits and meetings is outlined in Table 3.6.

Table 3.6

Observation Visits and Meetings Phase 2

S1		**S2**		**S3**	
Observation visits	**Meetings**	**Observation Visit**	**Meetings**	**Observation visit**	**Meetings**
1/11/13	28/10/13	29/10/13	29/10/13	31/10/13	15/10/13
14/11/13	17/10/13	8/11/13	5/11/13	6/11/13	31/10/13
26/11/13	1/11/13	22/11/13	19/11/13	27/11/13	6/11/13
	1/11/13				20/11/13
Evaluation meeting		**Evaluation meeting**		**Evaluation meeting**	
9/12/13		17/12/13		17/12/13	

Practitioner inquiry projects

Educators engaged in reflective thinking and discussion in relation to technology after the Phase 1 case study and these findings informed Phase 2 of the project. The purpose of the next phase of research was to support educators to identify a question relating to the integration of technology that they would like to explore further. Involvement in practitioner inquiry provided a context specific, guided professional learning opportunity. To commence the project educators engaged in focus group discussions, reflecting on findings from Phase 1, followed by a practitioner inquiry workshop.

Initial meeting and information session for educators

The practitioner inquiry projects commenced with a 30-minute group meeting with each service, with all educators in the room attending. This approach enabled deeper exploration of themes (Johnson & Christensen, 2008) that had emerged in the Phase 1 data collection and helped to create the collaborative approach that would be fostered throughout the practitioner inquiry project (Groundwater-Smith et al., 2013). The researcher shared Phase 1 findings with the educators and asked for their ideas, thoughts and feedback. While this time frame was shorter than the one-hour session initially planned, it proved difficult for the researcher to organise a time where all educators could leave their teaching duties to take part in the session. The meeting comprised of two parts. Part one included a group discussion on the integration of technology in their early learning settings and Part two involved an information session introducing the educators to the concept of practitioner inquiry.

The group discussion in the first part of the practitioner inquiry information session included four questions adapted from Gibbons' (2010) investigations of reflective practice and professional learning for early childhood educators and integration of technology. The questions were:

1. What is technology - what do we include in this definition?

2. How is technology included in your setting?

3. What impact does technology have in your lives and the lives of families at your centre?

4. Does technology use within your setting promote equity? Is it unbiased?

These questions, posed within a focus group setting, encouraged educators to think about technology objectively and within a range of contexts such as home and social environments, as well as to highlight its ubiquitous nature. The questions also drew attention to the very diverse conceptualisations and definitions people have about technology, as outlined in the literature review (2.2). However, the emphasis in all group discussions was on creating an awareness of technology as a socially and culturally appropriate tool to support learning. The focus group questions were in the same order for educators at all three services, however, the researcher drew on the findings from Phase 1 to make the discussions more relevant for each educator. Inclusion of findings from Phase 1 helped to revisit the beliefs and ideas held by the educators, as well as to facilitate critical reflection on some of the ideas and practices that were apparent from Phase 1 data.

Part 2 of the practitioner inquiry information session provided educators with an outline of practitioner inquiry (Groundwater-Smith et al., 2013) detailing its benefits as a form of professional learning, particularly within an early childhood setting as discussed in Chapter 2 (2.6). The workshop involved a 20-minute presentation delivered by the researcher, followed by a discussion on potential supports for practitioner inquiry and on areas of focus for each service. These discussions included consideration of key themes and ideas discussed earlier in the meeting, as well as other factors relating to the service, such as resources available and children’s interests. This stage of the practitioner inquiry process included consistent reinforcement of the importance of educators maintaining agency in choosing a topic for exploration, and in making changes throughout the practitioner inquiry process. This reinforcement of educator agency continued throughout subsequent meetings; goal setting and development of action plans were predominantly carried out with the educators rather than service directors or managers. Educators received printed versions of the practitioner inquiry workshop slides as a resource to refer to throughout their practitioner inquiry project, as practitioner inquiry was a new professional learning approach for all participants.

Educators received a reminder email within three days of the practitioner inquiry meeting which outlined their next steps in developing a practitioner inquiry focus and question. This included: thinking about an area of interest that relates to technology within the context of the *EYLF*; collecting data on this area of practice; and then analysing the data to see what it is telling them. Such correspondence continued throughout the practitioner inquiry project with the researcher scaffolding action plans and guiding educators on the practitioner inquiry process. Development of a practitioner inquiry area of focus evolved from educators collecting data in relation to technology within their curriculums and reflecting on and analysing their own curriculum decisions and practice. To facilitate this process educators were asked to consider six key questions which included:

1. If something is working really well could technology further enhance it?
2. Is there something not working well and if so could technology provide new insights or opportunities?
3. Are children showing an interest in technology while at the service and/ or outside of the service?
4. How do their interests with technology outside of the service link with their experiences at the service?

5. What do children already know and what else could they learn on the topic?

6. How is technology currently featuring in your curriculum/ program and what could be added to extend children's thinking and understanding on the topic?

Educators did not need to document responses to each of these questions specifically. The questions were to guide and inform thinking during the educator's data collection and analysis process. Involvement in the research aspects of practitioner inquiry may have been daunting for some educators. As such, educators were advised that the data collection and analysis process was a simple process of investigation, identification and implementation, much like their current planning and assessment cycles within the National Quality Standard (ACECA, 2010). Educators identified their practitioner inquiry questions and focus collaboratively. Table 3.7 outlines the practitioner inquiry, focus and resources for each service. A summary of the project for each service in included in the Appendix H.

Table 3.7

Practitioner Inquiry Question and Resources at Each Service

	Practitioner inquiry question	Common resources	Service specific resources	Staff changes	Professional learning focus
S1	"How can technology support children's exploration of space and the Solar System?"	- Laptop - MP3 voice recorder - Drawing software (Tux Paint) - Slideshow program (Photo Peach or Photo Story) - Professional resource folder	- iTunes card - Space learning workshop for children and educators - Symbaloo Webmix	S1P2, S1P3 and S1P4 leave room S1P5 joins project	- Supporting educators' understanding of how technology can feature in a play-based environment rather than being a stand-alone experience. - Developing educators' awareness of the topic of interest (Space and the Solar System) through professional learning workshops with children so that they could then use this knowledge to consider integration of technology to support children's explorations.
S2	"How can technology extend children's interest and engagement in story telling?"		No other resources	S2P2 leaves room S2P3 joins project	- Supporting educators to consider the value of technology in supporting children's explorations and investigations. - Developing educators' awareness of technology as an integrated tool in a play-based curriculum. - Supporting educators' confidence and competence in integrating technological resources that were relevant to their experiences and to children's experiences.
S3	"How can we use technology to document the children's voices in the transition to school process?"		- iPad and case - iTunes card - Online tutorials (Edublogs)	No staffing changes	- Supporting educators to find suitable resources to extend on children's interests and experiences, as well as those that align with the confidences and competencies of the educators. - Guidance on privacy and online safety - Supporting educators to advocate for change - Further supporting the critical reflection process by acknowledging skills and encouraging equity.

Meetings and observation visits

The initial scheduling for meetings and observation visits was once per month during Phase 2. The time between meetings was reduced and the meetings were often incorporated into the observation visits due to delays in starting the practitioner inquiry project as well as other time constraints. Four meetings and four observation visits took place at each service during Phase 2. Meetings positioned the researcher as a collaborator and colleague, leading the discussion in terms of the objectives of the practitioner inquiry project. This included sharing the researcher's interpretation of observed practice and asking their educators for their ideas and to share their expert knowledge of the context. The researcher also fulfilled the role of critical friend in facilitating critical reflection (Groundwater-Smith et al., 2013).

Additional communication throughout the project mainly took place via email, with the researcher responding to requests and questions from the educators and encouraging critical reflection. Email communication was on an ad hoc basis. Educators were encouraged to contact the researcher at any time during the project and were given mobile phone, office phone and email contact details[11]. Perry (2004) outlines steps to support teachers as researchers within their own teaching practices and contexts but providing a foundation for critical reflection. These steps were adapted to guide the practitioner inquiry process in Phase 2 (See Table 3.8). Guidance from Parette et al. (2013) on integrating technology (See Table 3.9) was used as a guide to encourage critical thinking (Gibbons, 2010) and context specific, relevant progress. After each observation visit, the researcher also gathered samples of the programming, planning and documentation that the educators had developed since Phase 1.

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[11] None of the educators contacted the researcher to ask questions. S3P1, S2P1 and S1P (room leaders at each service) responded to most emails form the researcher, though often with delay).

Table 3.8

Key Steps in the Practitioner Inquiry Process Adapted from Perry, 2004 pp. 145-146

	Step in the practitioner inquiry process
1.	Identifying and defining issue or specific questions relating to teaching and pedagogy
2.	Actively considering issues relating to the identified problem/question
3.	Developing comprehensive action plans and outlines of responses
4.	Providing insights and reasons for the outcomes

Table 3.9

Steps Required by Early Childhood Educators to Effectively Integrate Technology into their Curriculum As outlined by Parette et al. (2013, p. 172)

	Steps to effectively integrating technology
1.	Develop a basic understanding of technology and its potential contributions to education
2.	Demonstrate some proficiency in using [technologies] to create classroom instructional supports
3.	[…] Create and implement instructional activities and products using the technology.

Prior to development of the practitioner inquiry questions and focus areas, it was important to support educators to gain some knowledge on technology, and to develop an understanding of the current debates and opinions that exist in terms of technology and early learning education (Gibbons, 2010). The early childhood educators were provided with a range of readings in relation to technology in early childhood settings and were encouraged to conduct their own research into their topic. The provided readings were collated into resource folders for the service, and were varied across services depending on the level of understanding they demonstrated in the interviews/ focus groups across Phases 1 and 2 as well as their specific area of interest for the practitioner inquiry project. Resources predominantly included current research and professional journal articles, as well as online resources such as government reports and other information. Gibbons (2010) suggests benefits in including a wider range of resources, such as media/ newspaper articles and government policies/ current framework.

The sharing of educators' ideas and knowledge gained from their reading and research into technology was to form the basis of team meetings and served to facilitate reflective dialogue. Meetings involved all team members participating in the study and took place at the individual services. The underpinning framework of the meetings was the key stages outlined in the practitioner inquiry information sessions (and associated handout). The content and questions within the meetings varied between services due to their different levels of understanding in relation to technology, practitioner inquiry and their own ideas and interests. The researcher shared findings from the observation visits and discussed these in relation to research, theory and practice. Educators responded to these observations and shared information, allowing the educators to gather more insights into educator beliefs and practices and also educator perspectives that assisted with more accurate analysis. After collaborative reflection, the teaching team were encouraged to develop their practitioner inquiry project topic for investigation.

This process involved the educators as a team identifying where they currently were in relation to integrating technology, and how they would like to see their practices evolve. Educators were encouraged to critically reflect on their reasons for these decisions, and to ensure that they were drawing on current research, the *EYLF* as well as the interests and experiences of children within their setting. This research approach drew on sociocultural theory, which promotes the benefits of discussing and deconstructing a problem collaboratively, and then transferring this knowledge for action in both individual and cooperative pursuits (Rogoff, 1990).

Phase 2 observation visits were similar to those in Phase 1. Observation sessions were unstructured; however, the researcher was aware of identifying alignments with themes from the Phase 1 summary of findings for each service as well the topics educators had identified for their practitioner inquiry projects. The role of the researcher changed during the Phase 2 observations. In Phase 1 the researcher was observer-as-participant, but in Phase 2 became more involved as participant-as-observer. With this approach, the educators knew they were being observed but the researcher did not interact with them (Jones & Somekh, 2011). They could, however get feedback from the observations, as discussed above (Johnson & Christensen, 2008). Observation visits lasted for approximately two hours. Collection of artefacts, such as records of planning and assessment and documentation of children's experiences, took place at the end of the observational visits. This additional form of data provided additional insights into how experiences relevant to the practitioner inquiry projects featured in the curriculum (as well as when practitioner inquiry focus experiences were not included) beyond what was observed by the researcher. The researcher was then able to discuss these experiences with educators during observation visits and within meetings.

In addition, monthly meetings were planned where the researcher met with educators to evaluate, offer guidance and support, and to fulfil the role of critical and reflective colleague (Fien, 2001; Groundwater-Smith & Mockler, 2006). Meetings were semi-structured with the researcher developing questions to encourage reflection and evaluation of the practitioner inquiry content and processes. Educators were also able to contact the researcher via email at any time during the practitioner inquiry period.

Journaling

The introduction of journaling also took place during the practitioner inquiry professional learning meeting. Educators were provided with a professional diary and asked to keep a reflective journal throughout their projects. Journaling is used to support critical reflection, thereby making it an effective resource to supporting educators in their professional learning (Lowe, Prout & Murcia, 2013). The service directors/ manager were asked to provide educators with the opportunity to regularly record ideas in their journals, preferably recording at least one entry per week addressing three basic reflective questions adapted from the Ritchart, Church and Morrison's (2011) 'see-think-wonder' model (p.55): "What is working? What is not working? What is surprising?" Richart et al. suggest that using questions such as these provide a framework for reflection and increase the capacity for critical analysis. The *EYLF* (DEEWR, 2009) notes that providing broader overarching questions, as well as more targeted questions which align with the area of investigation, often supports the reflective practice process.

Educators were provided with four additional reflection questions across the course of the practitioner inquiry projects. These questions aimed to gain educator perspectives on issues that specifically relate to the research questions. Table 3.10 outlines the links between the research journaling and research questions.

Table 3.10

Additional Journaling Questions with Links to the Research Questions

	Additional reflective journaling questions	Link to research questions
1	What factors support or hinder you in integrating technology into your curriculum?	1, 2
2	What links are apparent between children's interests and previous experiences, and the technological resources and experiences available to them in your setting?	1, 2
3	What links are apparent between the EYLF guidance and the technological resources and experiences available within your service?	1, 2
4	What are the successes and challenges that you are experiencing in being involved in practitioner inquiry?	3

The final practitioner inquiry meeting for each service involved educators and also the director or manager at each service. The service director for S1 and service manager for S2 were not able to attend the final meeting, so the researcher met with them individually and asked the same questions as asked of the other participants. The purpose of the final meeting was to gain deeper insights into individual and interpersonal beliefs and ideas (Johnson & Christensen, 2008; Rossman & Rallis, 2012) as well as being another avenue through which to support critical reflection. There were nine key questions designed to align with all three of the research questions while also serving as an evaluation of the practitioner inquiry process. There included:

1. What influences your decisions in including technology in your setting?
2. What factors prevent you from integrating technology into your early learning setting?
3. What factors support your integration of technology in your early learning setting?
4. What are your thoughts on how technology relates to the Early Years Learning Framework?
5. What were the benefits of being involved in practitioner inquiry?
6. What were the drawbacks of being involved in practitioner inquiry?
7. Did you feel that it was a helpful form of professional learning? Why/ why not?
8. What is your preferred method of professional learning? Why?
9. Any other comments?

As this research was design-based research (Anderson & Shattuck, 2012) data analysis was ongoing through the project with the disassembling and reassembling of data (Yin, 2011).

This approach recognised that later findings can alter the initial analysis. A design-based approach also recognised that emerging findings informed the next stage of the research. The next section discusses the analysis processes.

3.5 Data Analysis

The steps of data analysis followed guidance from Yin (2011) specifically relating to qualitative data. Initially this involved a process of compiling all data from each phase and each service and sorting into data sets. All analysis was undertaken manually rather than using coding software. This approach is recognised by Saldaña (2009) as effective for researchers who are conducting small scale studies, and helps to create a sense of "ownership and control" over analysis (p. 22). Additionally, the research did not have the time or resources to develop an effective grasp of analysis software for this project. Saldaña further notes that in this instance a disparate amount of time can be spent on understanding the software rather than the data, and can negatively impacted analysis and also completion timelines. A process of disassembling occurred next, where identification of key themes occurred for each data set, and data was manually coded according to findings. Data set codes are outlined in Appendix G. The disassembling process saw recoding occur, and led into the next stage of reassembling with grouping of common themes that emerged across data sets. Analysis of data was an ongoing process where interpretation of data continued to be disassembled and reassembled as different findings emerged. Finally, conclusions were drawn for the complete project (Yin, 2011).

In an adaptation of Saldaña's (2009) coding to theory, data was disassembled and reassembled first into categories and then, as the project progressed, into codes and sub-codes. These are outlined in Figure 3.2. Coding and sub-coding between data sets looked for patterns which Saldaña (2009) notes can include:

- similarities and differences
- frequency
- sequence
- correspondence

Additionally, coding occurred through the coding filter or analytic lens (Saldaña, 2009) of Rogoff's planes and analysis (1995) to balance the researcher's subjectivity with the underpinning theoretical framework of the research project. The following section further explains these connections.

3.5.1 Coding and theory.

A sociocultural framework, as defined by Vygotsky (1978) and Rogoff (1990) which suggests that an individual's learning and development is influenced by their social, cultural and historical experiences, underpin this study. As such, analysis of this research adopts the position that the individual is inseparable from their context, and this intersubjectivity (Rogoff, 1995) has a significant impact on their beliefs and practices as an early childhood educator, as well as how they respond to professional learning opportunities. Within this framework, Rogoff (1995) identifies three planes of observing sociocultural activity (personal, interpersonal and community) which correspond with related developmental processes (participatory appropriation, guided participation and apprenticeship). It is acknowledged within this framework for analysis that while one plane may be at the forefront, the other planes are inter-related and feature as background influences and must be considered when analysing data (See Figure 1.1).

Data analysis initially followed a codes-to-theory model as outlined by Saldaña (2009), who notes that "[…] When the major categories are compared with each other and consolidated in various ways you begin to transcend the "reality" of your data and progress towards the thematic, conceptual and theoretical" (p. 11). Three categories were pre-determined, relating specifically to the research questions (See Figure 3.2). The codes and sub-code categories were determined based on patterns of frequency, as well as similarity and difference (as outlined by Saldaña (2009) and noted in the previous section). Five categories were apparent in the first disassembling stage across all data sets. These aligned with the research questions with a focus on beliefs, practices and the practitioner inquiry process as a professional learning strategy. From these five categories a series of codes were identified. Due to the inter-related nature of the three planes of sociocultural activity, as described earlier in this chapter, some of the codes were relevant across categories, some sub-codes related to multiple codes. The connections and overlaps between the categories, codes and sub-codes are outlined in Figure 3.2 below. This diagram outlines the categories, codes and sub-codes that supported systematic analysis of the data. Discussion on how these sub codes relate to Rogoff's planes of sociocultural activity and analysis are discussed later in Section 3.5.4 of this chapter (see Figures 3.3 and 3.4).

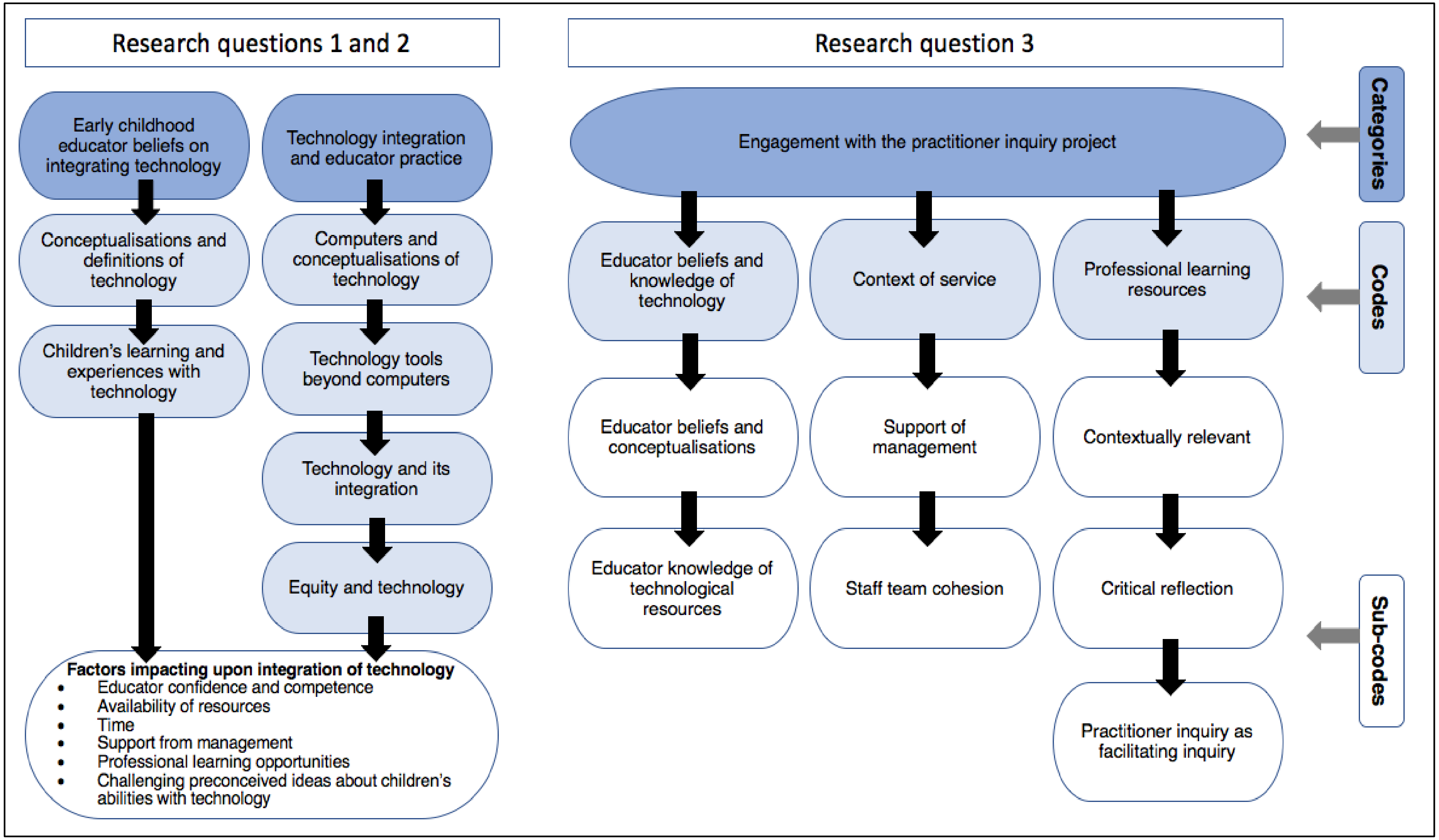

Figure 3. 2: Categories, Codes and Sub-Codes Based on Saldaña's (2009) Coding-to-Theory Approach.

3.5.2 Phase 1 analysis.

Data preparation differed between data sets. After transcription, digital recordings for the Phase 1 interviews were analysed and manually coded based on educator beliefs and their perceived practices. The researcher then coded the written notes from the observation visits and from artefacts, again looking for emerging themes. Data from these two sources were then compared to look for patterns in terms of similarity, difference and correspondence (Saldaña, 2009). After this re-assemblage, the themes were considered alongside the notes taken in the observation checklist (see Appendix F). The checklist served as another analytic lens (Saldaña's, 2009) for identifying codes and sub-codes, and helped to maintain a focus on the issues identified in the literature review to examine how the new data compared with previous findings, particularly in relation to the inter-related planes of personal, interpersonal and community (Rogoff, 1995).

At the end of Phase 1, emerging themes from all data sets were re-examined and reconstructed in terms of the key themes relating to educator beliefs and practices regarding integration of technology. From this, implications were also identified for the practitioner inquiry projects that were to take place in Phase 2. The iterative nature of this research allowed for earlier analysis to be revisited and reorganised (Bassett, 2013; Design-Based Research Collective, 2003; Yin, 2011). As an example, data collected in Phase 1 formed a summary of beliefs, ideas, practices and themes relating to technology that informed and guided the meeting discussions at the beginning of the practitioner inquiry projects in Phase 2. Similarly, data collected early in Phase 2 in relation to educator ideas in integrating technology, shaped the resources provided to support professional learning. The researcher transcribed notes from these meetings and reviewed them for patterns—again looking for similarities and differences (Saldaña, 2009) between espoused beliefs and perceived practices, and the practices and curriculum inclusions observed during Phase 1.

3.5.3 Phase 2 analysis.

Analysis involved viewing all data sets through the lens of the initial categories and developing new codes and sub-codes as they emerged, as outlined in Figure 3.2. This included reviewing for similarities and differences as well as frequency, with more common themes initially compared and contrasts. Less common, or more subtle themes were then sought and identified using the observation checklist as a guide for potential elements that may be of interest.

To understand practitioner inquiry as a professional learning strategy to support the integration of technology, two different aspects needed to be defined and understood. This included the steps required by an educator to integrate technology effectively into the curriculum, and key processes in a practitioner inquiry process reflected guidance from Perry (2004) (Table 3.8) and Parette et al. (2013) (Table 3.9). These two tables guided the researcher when supporting educators through their practitioner inquiry projects. The tables were utilised as a key point of reference in the analysis process to support concept-driven coding (Gibbs, 2007).

As design-based research (Anderson & Shattuck, 2012) the data was reviewed continually throughout the research process and emerging findings impacted upon how the researcher supported educators in their practitioner inquiry projects. After each observation session and each meeting throughout the practitioner inquiry projects, the researcher examined the data in terms of the guidance from Perry (2004) and Parette et al. (2013) (Tables 3.4 and 3.5), looking for similarities and differences and emerging themes based on the literature review. Additionally, the lens of personal, interpersonal or community were applied to enable for a stronger focus on seeking patterns of correspondence (Saldaña, 2009). In this way, the researcher examined the broader context of interrelated factors that were impacting upon the educators' experiences, achievements and involvement within the practitioner inquiry project. Identification of three main codes occurred during this analysis—educator beliefs and knowledge of technology, context of the service, and professional learning resources (see Figure 3.2) . These codes emerged from the data after several stages of constructing, deconstructing and reconstructing (Yin, 2011). Each of these factors did not exist independently and were seen to work together in a dynamic, interactive way that related to personal, interpersonal and community aspects. The influence of these factors varied in the analysis, and while one factor featured at the forefront through one lens other lenses were applied in the background to provide a more holistic picture of the influences.

Triangulation of data continued throughout Phase 2 in an iterative manner (Yin, 2011). Transcribed meeting notes and written records of observation undertaken, data collected from the educator's reflective journals as well as artefacts such as programming and planning recorded by the educators were all analysed and coded based on the categories defined at the beginning of Phase 1, with the opportunity to create new codes and sub-codes as themes emerged (Saldaña, 2009). This process allowed for consideration of both educator and researcher perspectives within the analysis and helped to ensure that data was valid (Yin, 2011).

Data collected in the final practitioner inquiry meeting served to provide reflection on the practitioner inquiry process as well as the study overall. Again, a patterns approach to coding (Saldaña, 2009) was adopted with data coded in terms of similarities and difference, frequency and correspondence with other data sets from the study. Rogoff's three planes served as coding filters with either the participatory appropriation, guided participation or apprenticeship plane at the forefront while the relevance, impact and influence of the two other planes were considered in the background. Examples of these are discussed in the following section.

3.5.4 Examples of Rogoff's planes as an analytical lens for coding.

The previous section provided a detailed account of how data was analysed across both phases of the study. Figures 3.3 and 3.4 demonstrate how Rogoff's lenses were applied at the forefront of data analysis, as well as in the background, and how they were presented to interpret and analyse data from a sociocultural perspective. Rogoff's planes served as a lens for analysis between established categories, codes and sub-codes (See Figure 3.2) and for the ongoing disassembling and reassembling of data throughout the analysis process. Rogoff (1995) posits that the three planes cannot be considered independently. Throughout the coding process the interplay of participatory appropriation, guided participation and apprenticeship were consistently identified and utilised as lenses for understanding the data.

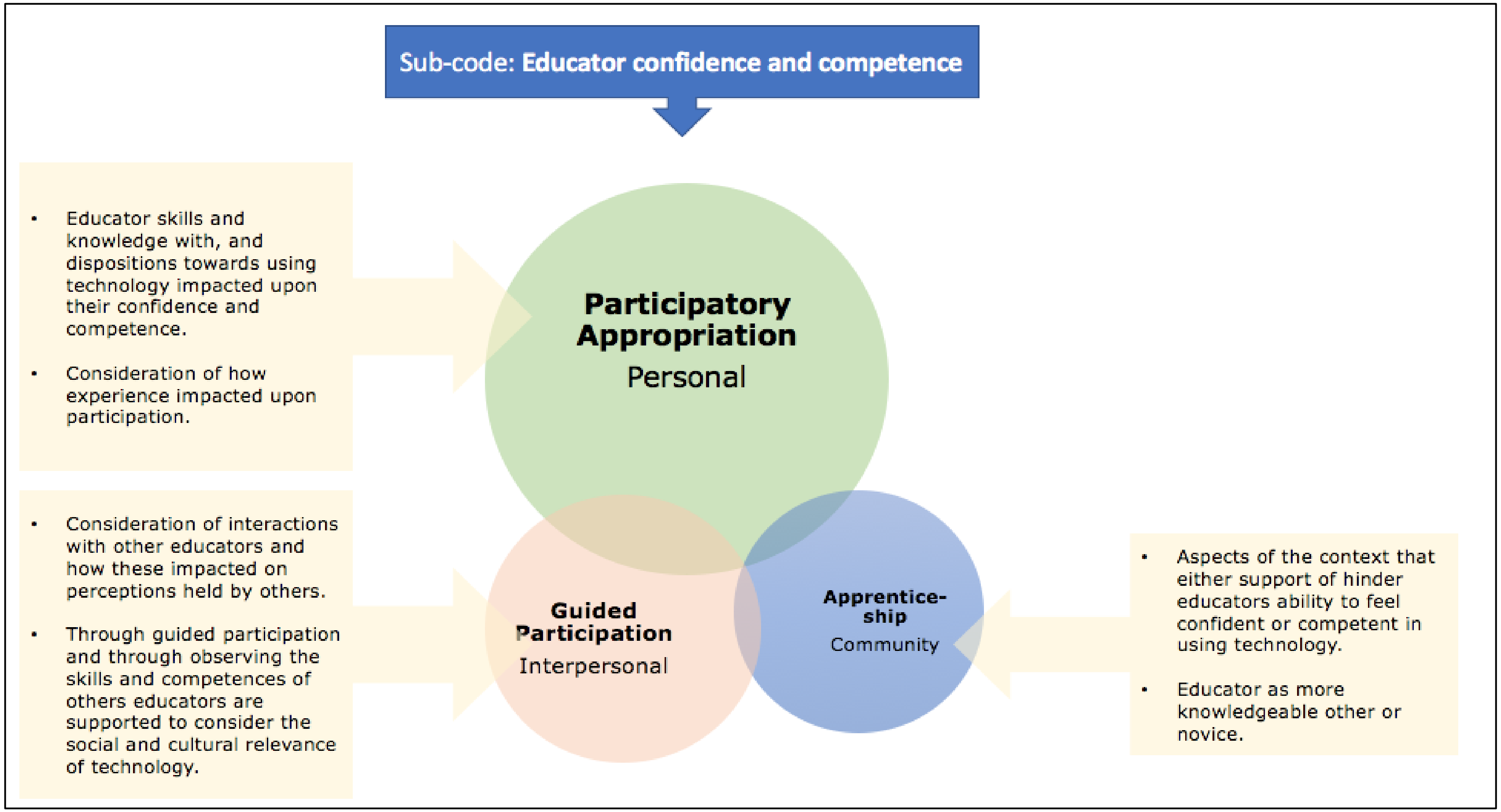

Figure 3.3: Example of connections between Phase 1 sub-code and Rogoff's planes of analysis (1995).

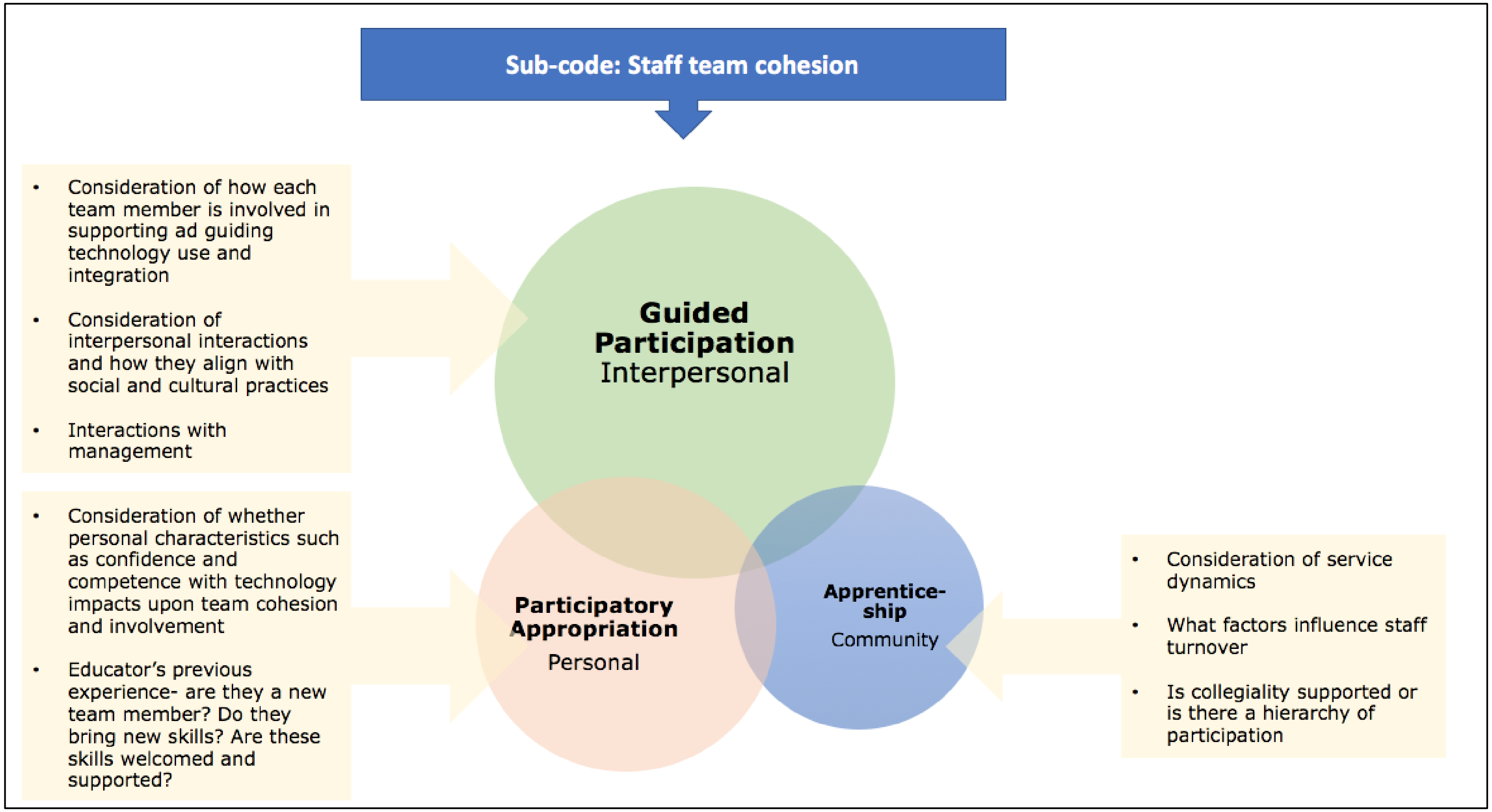

Figure 3.4: Example of connections between Phase 2 the sub-codes and Rogoff's planes of analysis (1995).

Throughout this research measures were taken to ensure that the analysis process remained objective; this included the observational checklist (based on a meta-analysis of research) as well as Rogoff's (1995) three planes of analysis. Additionally, educator voices, opinions and input were gathered through the meeting process to ensure that the researcher was not reaching false conclusions. The following section further describes the ethical steps taken to ensure processes were rigorous to ensure that findings were robust.

3.6 Rigour and Reliability

Rigour in qualitative research can be asserted through consideration of credibility, transferability, dependability and confirmability (Lincoln & Guba, 1985; Yin, 2011). Alghamdi and Li (2013) note that design-based research requires similar validity measure to other empirical research, and that this should include clear criteria from which validity can be measured. Credibility or 'truth-value' refers to whether the researcher is able to demonstrate the truthfulness of the findings (Silverman, 2015; Yin, 2011). This was achieved by using a wide range of research and professional literature to inform the research design, data collection tools and the analysis process as discussed throughout this chapter. Use of diverse data collection tools and literature ensured that multiple perspectives and constructs were considered to establish credibility (Lincoln & Guba, 1985). Additionally, the use of the observational checklist (Appendix F) prompted the researcher to consider an extensive set of factors relating to technology in early learning services that may not have been immediately noticed.

From the commencement of the research project, the researcher endeavoured to develop a rapport with the educators. Phase 1 commenced with face-to-face individual interviews with each educator. The researcher also took the time to assure educators in the initial interview that the research was to be conducted in the spirit of collegiality, with the purpose being to learn from each other. It was reinforced that they were not being assessed or judged. Building a rapport and sense of trust with educators at the commencement as well as throughout the research on an ongoing basis was not only beneficial in gaining rich data, but it also fostered a sense of trust in the researcher. Additionally, it enabled educators to feel more comfortable with the researcher during the observation stage. Johnson and Christensen (2008) note that feeling at ease with the researcher can assist participants to behave more naturally throughout data collection. However, even though the researcher's relationships were collaborative and professional, interactions did not become informal or overly familiar (Van Den Hoonaard & Van Den Hoonaard, 2012). Instead the researcher fulfilled the role of 'critical friend' (Groundwater-Smith et al., 2013). Here relationships between the facilitator and practitioners are collegiate and professional with the researcher encouraging critical reflection and analysis rather than more informal interpretations of the term 'friend'.

Typically, findings in qualitative research cannot be generalised beyond the services involved in the study (Johnson & Christensen, 2008; Yin, 2011). Instead, to achieve rigour it is expected that a sufficient amount of rich and descriptive information will be provided in a process referred to as transferability, which Lincoln and Guba (1985) describe as how easily findings can be applied to a different context or generalised. This research gathered an extensive amount of information over a nine-month period. It involved observation of practice as seen by the researcher, and also included a range of opportunities for educator voices to be incorporated appropriately based on data collected through interviews, the focus group, meetings, and individual journaling. A rigorous approach to coding was developed by identifying categories within research literature and extending these into codes and sub-codes as themes emerged in the analysis process following Saldaña's (2009) code to theory approach (see <u>Figure 3.2</u>). Additionally, background and demographic information was gathered on the services and educators. Provision of detailed and descriptive data also establishes rigour by ensuring that another researcher could investigate whether the findings are transferrable to another specific context (Lincoln & Guba, 1985).

A level of variation is anticipated when conducting qualitative research (Krefting, 1991; Yin, 2011). However, this should not impact on consistency and dependability (Lincoln & Guba, 1989). Dependability can be demonstrated in two ways, one being the provision of a comprehensive research methodology, and the second through triangulation (Lincoln & Guba, 1989; Yin, 2011). This chapter has provided an extensive description of the research design as well as data collection methods and tools that reinforce consistency and dependability. Services took part in the research contemporaneously which helped to control for external variances and influences that may impact upon the services such as national early childhood policy or other changes within the sector. In addition to the strong research design, the researcher engaged in ongoing consultation with other academics (such as the researcher's supervisors and colleagues), and constantly reflected throughout the research. Analysis of data included rigorous adherence to sampling criteria and stated methodology, and reflecting on all relevant research and articles including those that do not agree with the data gathered (Johnson & Christensen, 2008).

Design-based research and also practitioner inquiry have greater validity organically as they occur within a relevant content (Bakker & Eerde, 2015). However, Brown (1992) notes that validity can be compromised when participants feel they need to respond in a particular way to align with the expectations of the researcher. Using designed-based research and practitioner inquiry together mitigates this issue with validity. The Design-Based Research Collective (2003) states that objectivity can be supported and facilitated if the researcher vacillates between the roles of critic and advocate. This is a key feature of practitioner inquiry (Groundwater-Smith et al., 2012) and one of the researcher's consist aims throughout the study. Such an approach promotes subjectivity through use of ongoing critical reflection from different perspectives. Triangulation of data collection methods is noted as an effective strategy to support validity in design-based research as well as standardised measures or instruments. The checklist, based on research literature, was developed as a tool to support objectivity and diversity in data collection and analysis.

Triangulation of data within and between data sets strengthened the validity of findings (Yin, 2011). This process of examining results from different methods of data collection for signs of similarity or difference serves to corroborate similarities and note convergences (Johnson & Christensen, 2008). In this research, data methods included observations, interviews, physical artefacts, educator journaling as well as artefacts such as hard copy and digital documentation of children's learning and experiences as recorded by the educators (Yin, 2011). The use of multiple forms of data validates and strengthens findings by including multiple perspectives and enabling identification of commonality between sources (Flick 2007, Johnson & Christensen, 2008; Silverman, 2015; Yin, 2011).

Conducting observation visits on different days of the week and times of the day for each service allowed for diverse data collection. Variation in days allowed the researcher to consider whether a change in children attending the service on that day, or the dynamics of different times of the day impacted upon the phenomena observed. This approach further supported rigour by enabling collection of varied and comprehensive data, not only in terms of dependability but also in relation to applicability (Krefting, 1991). Additionally, triangulation provides insights into different aspects of each context (Richards, 2005). Triangulation can be a valuable way to identify inconsistencies, especially when there is a variance between what educators say they do and what happens in practice. The employment of a number of data methods and the triangulation of findings, as included in this research, is an effective way to ensure the confirmability of data collection (Guba & Lincoln, 1989).

Comparing and contrasting data from different methods of collection can provide a variety of different perspectives and therefore supports the researcher to maintain neutrality (Krefting, 1991). Every effort was made to maintain academic integrity. There was only one researcher involved in data collection and the same data collection process was followed for all three services. This approach further increased the consistency and therefore supported the reliability of the findings. However, it is acknowledged that single researcher projects can also impact rigour in terms of unchecked bias and this was addressed in a number of ways. The researcher engaged in ongoing critical reflection both individually and with research supervisors. An additional strategy was the inclusion of the voice of participants through recorded interviews and collection of artefacts, which helps to ensure data collection is objective (Bakker & van Eerde, 2015). The observation checklist (Appendix F) was an effective tool to counter the potential preferences or biases in data collection and analysis by the researcher as provided a wide scope of elements for consideration, drawn from professional research and literature.

3.7 Limitations of the Study

A number of limitations regarding the parameters of investigation were identified over the course of the study. These included the limited time frames, the impermanence of teaching teams and also the limitations of working with a case-study approach.

3.7.1 Time.

From the beginning this research was constrained by the time restrictions of a doctoral candidature that impacted on the study design and the time available to engage with each early learning service. The study had tight timeframes which required all three services to participate contemporaneously. Longer timeframes to work with each service on their practitioner inquiry project may have provided more comprehensive access to resources and supports. This in turn may have provided educators with greater opportunity to critically reflect on new information and their practices, and to trial and investigate new ideas in relation to integrating technology within their curriculum. Ongoing participation in practitioner inquiry supports depth of understanding and collaboration (Groundwater-Smith et al., 2013). Another consideration was that time constraints experienced by all three services involved with the research in terms of minimal release time from teaching. One result of this as that the practitioner inquiry workshop was condensed into a 30-minute information session with a further 30 minutes for context specific discussion. A longer initial workshop and discussion session introducing the concept of practitioner inquiry may have enabled educators to develop a more comprehensive understanding of the value of practitioner inquiry, and the processes involved. Developing this understanding and awareness was particularly important to the effectiveness of practitioner inquiry as it was a new professional learning approach for all educators, service managers and directors.

Another time related limitation was the restricted release time available to educators to engage with the professional learning content. Beyond the initial practitioner inquiry workshop, time limitations were also noted in terms of educators being able to engage with professional readings, time to be present in meetings and discussions without any other teaching duties. Educators also stated a lack of time to write up reflections and plans on the project and to engage in personal research. Practitioner inquiry engagement was distinctly different between the three services, with allocated time to engage with the project identified as a key facilitator. These findings highlight the need for recognition of the value of team collaboration in increasing professional knowledge and also in supporting educator agency (Aubrey et al., 2012). However, at the services participating in this study, either the director or manager made decisions about time allocations. Links were evident between these decision relating to provision of time and elements such as management beliefs in relation to technology integration and service policies.

Future research could include more comprehensive workshops on practitioner inquiry and require participation from service directors and management to instil a knowledge of practitioner inquiry as a professional learning strategy and a commitment to supporting educators to participate in their projects. At the commencement of the project the researcher should outline firm guidelines on the time required to participate in the project to ensure time allocation is not compromised throughout the project.

The issue of technology integration in early childhood settings highlights a need to develop new understandings for all educators involved—whether it was in terms of foundational understandings or in terms of new resources that would build on previous experiences with technology. As noted by Edwards (2015) in the epigraph this needs to be embedded within play-based curriculums that have the scope to be response to the interests, experiences and abilities of children. To support engagement in the practitioner inquiry projects, educators needed time to research new ideas, discuss, implement and discuss outcomes, and to adjust practice. These processes and time requirements should be emphasised as key components of practitioner inquiry as a professional learning strategy.

3.7.2 Impermanence of teaching teams.

Staffing changes that occurred throughout the study created fragility in terms of team cohesion. These changes served as a challenge to the practitioner inquiry process as data gathered in Phase 1 was to inform professional learning in Phase 2. For example, the educator who left S2 (S2P2) at the end of Phase 1 showed a strong interest in integrating technology in storytelling. The other educator in the room (S2P1) worked with S2P2 on integrating digital technology in storytelling, and this shared interest shaped their practitioner inquiry focus.

However, the new educator in Phase 2 (S2P3, replacing S2P2) did not see technology as pedagogically relevant and acknowledged the other educator's limited interest and confidence in using technology with children. In this way, the data collected in Phase 1 did not represent the teaching team taking part in Phase 2. Involvement in practitioner inquiry mitigated this instability by enabling the researcher to adapt content and resources in acknowledgement of the new team dynamics, as well as the new educator abilities and interests. However, less familiarity and participatory appropriation was available to the teaching teams that experienced significant staff changes (S1 and S2) than at S3, where they achieved stability and permanence within the teaching team.

3.7.3 Parameters of a case-study approach.

The use of a collective case study approach allowed for consideration of the complex, diverse and interrelated factors impacting upon educator beliefs and practices in integrating technology in their early learning curriculums. The information collected in Phase 1 of the case study reflected educator practices in their "real-life context" (Johnson & Christensen, 2008, p. 49), which provided relevant and contextually specific resources and guidance throughout the practitioner inquiry projects. However, the time constraints already discussed meant that only a small number of services in a small geographical area could be included in this study. It would be valuable to include a more diverse range of early learning services over a broader geographical area to determine the generalisability of the findings from this study. Additionally, findings from this study emphasise the importance of continuing to research culturally relevant integration of technology in play-based pedagogies. Continuing use of qualitative approaches would also be valuable to capture insights into thinking that occurred when educators engaged in critical reflection and dialogue. As such future research could consider a mixed-methods approach to gain wider, generalisable findings as well as capturing the detailed narratives and subtle nuances that may occur in terms of beliefs and practices at each service.

3.7.4 Absence of first-hand accounts of children and families.

As a doctoral research, the breadth of data collection was limited due to associated timeframes and available resources in terms of researchers and research assistants. This study builds of previous research undertaken by the researcher (as explained in 1.3.2). The implication identified in that study were that educators would benefit from context specific professional learning opportunities that would help them to understand socially and culturally relevant technology integration that aligned with the EYLF (DEEWR, 2009). To support development of context specific professional learning strategies, more in-depth understandings of educator beliefs and practices within each context. Initial iterations of this doctoral research involved gaining perspectives of families as well as educators, however this section of the research plan needed to be removed to meet thesis completion timelines. Similarly, there was not time or scope to also gain first-hand information from children on their beliefs, experiences or preferences with technology. It was decided that data collection would focus on educators, with the aim of gaining the perspectives of children and families through educators comments in interviews and meetings. Another way to gain an insight into the perspectives of children was through artefacts. The researcher was able to view documentation recorded by the educators and draw on the educators interpretation of events. Including the active voices and perspectives of children and families his is an area acknowledged as an important consideration, and is highlighted as an priority for future research (see Section 6.2.3).

3.7.5 Researcher positioning on technology integration between dichotomous beliefs.

The researcher's own personal beliefs placed her closer to the 'for' argument on the spectrum of beliefs regarding technology integration in early childhood learning, with an acknowledged proclivity for moderate technology integration. However, this was acknowledged as a potential limitation in terms of bias and became the subject of much critique and reflection for the researcher throughout the data collection and analysis processes. The researcher's focus was not on encouraging educators to include more technology in their curriculums. The aim of the study was to understand educator beliefs and other factors that impacted upon their pedagogical decisions, and to develop their knowledge around the integration of technology in their curriculum in ways that were socially and culturally relevant for the children within their services. Triangulation of data provided an additional level of rigour and supported the inclusion of multiple perspectives and understandings of nuances with each theme that emerged.

3.8 Summary

This research was an iterative, designed-based study (Anderson & Shattuck, 2012; Van Den Hoonaard & Van Den Hoonaard, 2013). A collective case study approach was selected to enable rich data to be collected at each service involved (Johnson & Christensen, 2008). Phase 1 findings influenced the content in Phase 2, particularly in addressing educator notions around technology and supporting them in their understandings of technology in prior-to-school settings. Phase 1 findings were also integral to the commencement and progress of Phase 2, with these findings informing development of practitioner inquiry questions, provision of resources and ongoing action plans. Additionally, the collective case study approach and ongoing nature of the project supported the researcher to understand each service (through Phase 1 and Phase 2 observations and interviews), which enabled authentic and appropriate professional learning guidance and support throughout the practitioner inquiry process. The following chapter discusses findings from Phase 1 and Phase 2 in relation to educator beliefs and practices in integrating technology, and addresses the first two research questions. Chapter 6 addresses research question 3 and discusses the practitioner inquiry process.

Chapter 4 – Presentation of Findings and Discussion Part 1

Society continues to be transformed by the advent of new technologies such as the wheel, television, the computer, and atomic energy. They arise from the efforts of creative individuals, from the power of new ideas. How does creativity fit with guided participation in sociocultural activity? First it must be recognised that such creativity builds on technologies already available, within existing institutions. A creative idea is in some sense a reformulation of existing ideas; there is nothing completely new under the sun. (Rogoff, 1990, p. 198)

The previous chapter provided an outline of the methodological approaches employed throughout this research. This chapter presents findings from both phases of the study to address research questions one and two:

1. What are the beliefs of early childhood educators about integrating technologies in early childhood services?
2. How was technology integrated in early childhood educators' practices?

The sometimes-exaggerated response to the 'newness' of technology, as defined by Gibbons (2015), continued to emerge through this study. As noted by Rogoff (1990) in the epigraph for this chapter, new technologies merely build upon those already available. Throughout the data collection and analysis in both phases of the study educator understandings of new technologies and foundational knowledge materialised consistently.

Findings are presented in terms of the emerging themes across both phases of the research project under the main categories of educator beliefs and how these presented in practice. The focus in this research on educator beliefs was related not only to educator beliefs about technology, but also looked at their early childhood pedagogy and how these more overarching beliefs impacted upon curriculum inclusions and provisions. A number of additional factors were identified in this study as impacting upon technology integration either by influencing educator beliefs, or influencing other aspects of educators practice. These factors were complex, interrelated and unique between educators and across services and were identified as factors that facilitated or hindered the inclusion of technology in the curriculum.

4.1 Educators' Beliefs on Integrating Technology

As noted in the Literature Review, (2.2.1), educators draw on a wide range of interpretations and conceptualisations when defining technology within their curriculum. This section discusses the nuances found in educator beliefs about technology, as well as their beliefs about how children learn with technology. It also considers the potential impact of educator conceptions of children's experiences with technology on curriculum integration in early learning settings. A number of factors were identified as influencing educator beliefs and practices relating to technology integration. These were associated with the two key themes of conceptualisations and definitions of technology, and children's learning and experiences with technology (see Figure 4.1). These two themes are discussed in the next section of this chapter.

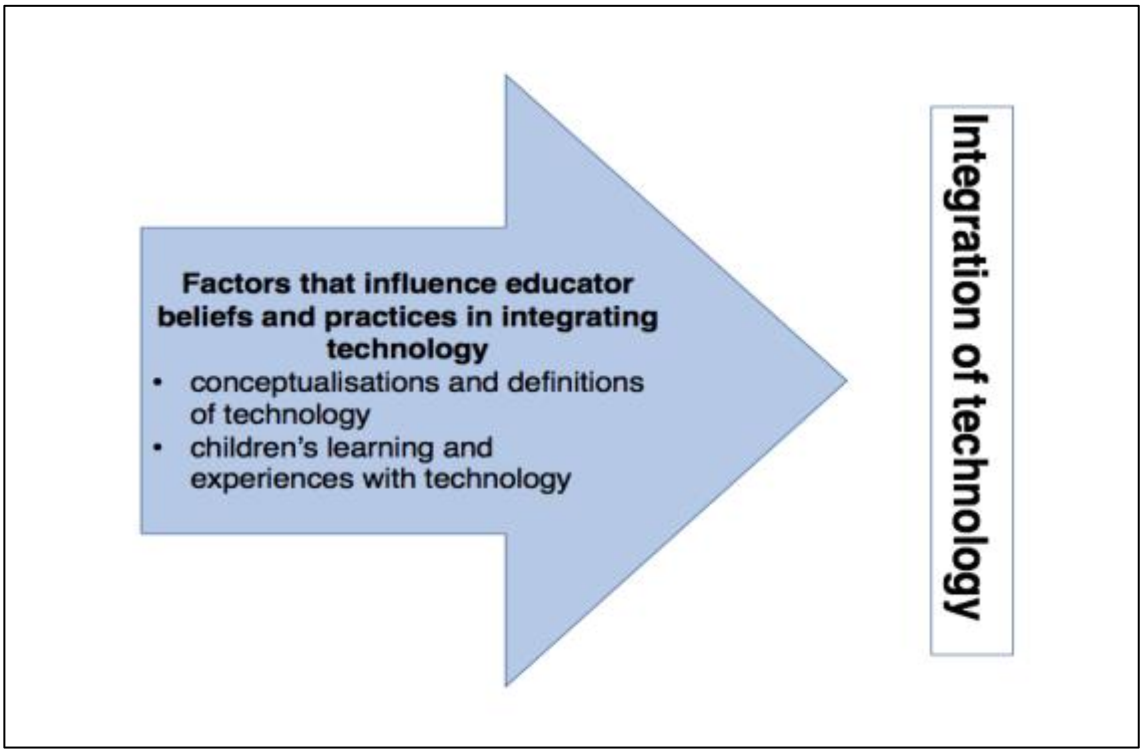

Figure 4. 1: Factors that influence educator beliefs and practices in terms of integrating technology.

4.1.1 Conceptualisations and definitions of technology.

Differences in beliefs were apparent between all educators in this study; not only in terms of the types of resources they considered to be valuable in their early learning settings, but also in relation to the ways in which they believed technology was relevant and contributory to pedagogy. For instance, both educators at S2 referred to technology primarily in terms of screen media (P1, S1P1 S2P2, Int.) such as iPads, computers, and smart phones. This contrasted with S3 where both educators agreed that technology should be conceptualised beyond physical resources, and on a more philosophical level to acknowledge related change and progress (P1, S3P1 S3P2, Int.). As an example, one educator at S1 discussed the integrated nature of technology in children's learning:

> You can't separate learning from technology, it has to be together otherwise it's hard these days […] I'm not talking about Internet or—there are other things [technological resources] that offer opportunities for children to learn. (P1, S1P2, Int.)

The service manager[12] for S2 discussed other forms of technology that were essential for the service such as telephones and cameras and also expressed a disinclination to use touchscreen devices. The service director from S3 indicated a broader conceptualisation of technology, stating:

> To me technology is anything that progressed things forward […] Like the progress of clocks through time, and telephone […] Typewriter to computer […] Technology is about constant change. It's about whatever is progressing life forward really (P1, S3SD, Int.)

Another example of diversity in conceptualisations of technology was observed in practice at S3 early in Phase 1. An educator noted that it was "not a very tech day" (P1, S3P2, Obs), however, the observed curriculum demonstrated a seamless and effective integration of a wide range of digital tools and resources such as the light table, an overhead projector, digital cameras and the use of a tablet during a whole group experience.

4.1.2 Children's learning and experiences with technology.

Integration of technology was apparent in the curriculum provisions and educational practices at all three services across both phases of the study. In the initial interviews one educator from each service (P1, S1P2, S2P1 S3P1, Int.) expressed the belief that technology had potential as a resource to support children's exploration and discovery. The room leader at S2 espoused the belief that technology was a valuable tool for providing children with additional information, and that it also provided children with access to answers and information immediately (P1, S2P1, Int.). Interview responses from an educator at S1 in

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[12] The term Service Manager is used for Service 2 rather than Service Director (as used for S1 and S3). The Service Manager at S2 was also the service owner. More details are included in the glossary and Individual Demographics (Table 3.2).

Phase 1 and information shared in a Phase 2 meeting by an educator at S3 reinforced this line of thinking:

> […] With things like iPads and the new apps there are different ways that children start knowing different things and it makes it easier for them […] they will become more close to technology and it will be easier for them to learn […] that helps them to research, to do something quickly. (P1, S1P4, Int.)

> [Using Google searches] is a discussion point that comes up all the time from here. So it's sort of fed in that there are other ways to find information fairly quickly. But they're really familiar with not even just the iPad. But the iPad is the tool to do it, but they know that it's almost immediate, to follow up on their interests. Straight away, they don't have to wait. (P2, S3SD, PIP Meet.).

Three educators across S1 and S3 acknowledged the importance of supporting children's inquiry, thinking and theorising when using technology (P1, S1P2, Int.; P2, S3P1, S3SD, PIP meet.). This acknowledgement was exemplified in a comment from S1P2:

> Because if we give them all the answers straightaway they—it's not like something that they've worked on to get the answer […] I see it's important to work on. So technology offers this opportunity for them to work on, to find answers, to explore things, to investigate things [...] It's not like we read a book, so okay, this is the answer in the book, so okay. (P1, S1P2, Int.)

Similarly, data collected at S3 also identified that they used technology as a complementary resource to support children's thinking and knowledge on a topic of interest (P1, S3, Obs, Art). The service director at S3 noted that they focused on "asking the questions, rather than giving the answers" in terms of using resources such as the Internet to facilitate inquiry and learning (P2, S3SD, PIP Meet.). At both S1 and S3 educators integrated technological resources alongside other tools such as books to support the development of critical thinking skills. Across these examples, it was apparent that the educators saw technology as a tool for integration into the curriculum much like any other resource. It was the way the educators used the technological resource, its positioning in the curriculum and the guidance provided by educators that made the difference.

The beliefs of all educators from all three services on how children learn in general also impacted upon their approaches to integrating technology into the curriculum. As an example, the S3 educators shared the belief that many children were visual learners (P2, S3P1 S3P2, PIP Meet.). As such, their process of planning and reflection identified that many concepts and ideas were easier for children to understand when resources included a visual element such as a YouTube clip or a DVD. Educators at S3 acknowledged and recognised the integrated use of visual media in the curriculum as intentional teaching. Visual media use was not a standalone or passive experience nor was it used to replace more traditional forms of seeking information, such as looking through reference books (P1, S3P1 S3P3, Obs). Additionally, the educators at S3 expressed an awareness that inclusion of visual media provided the children access to information that may not be otherwise accessible (such as time lapse in a YouTube clip). Similarly, educators from S1 and S2 held the view that technology was a way to further follow children's interests and to explore their questions, which had a direct impact on their practices and curriculum inclusions (P1, (S2P1 S1P2, Int.). However, technology integration was observed less in practice at S1 and S2 over the course of the study.

Discussion of educator beliefs on integrating technology

Findings from this study suggest that developing an understanding of educator beliefs about technology also requires an understanding about their views on how children learn with technology. Investigating educator beliefs about technology within early learning curriculums also provided insights into their understandings of children's experience with, and knowledge of, technology in their everyday lives. Educators acknowledged the need to consider a wider range of technological tools and resources and to think beyond the more traditional definitions of ICTs. This is an important consideration as the term 'information and communication technologies' has long been considered to almost exclusively include computers (Nikolopoulou & Gialamas, 2015b), and is therefore not reflective of the diverse experience children now have.

Research findings revealed limited conceptualisations and understandings from educators in terms of what constitutes technology as well as its relevance in the curriculum. Whilst diverse technologies were often present in the curriculum, they were not recognised by educators as technological resources (this was observed in interview responses, discussions in meetings or in secondary data such as documentation of planning and evaluation). This disconnect was evident in practice at S3 where the curriculum integrated a range of different technological resources which were not consistently recognised by the educators as technology. In one example, S3P2's perception of technology was very specific and narrow in terms of how they thought it should feature in the curriculum —or perhaps how they thought the researcher wanted to see it featured. This example demonstrated a disconnect between how educators conceptualised technology and how it presented in practice, where there were actually more examples of technology integration in the curriculum than acknowledged by educators. Educator conceptualisations of what constituted technology also created a disconnect between beliefs and practice at S1. As an example, S1P1 expressed strong support for the inclusion of technology in the curriculum, yet did not integrate resources beyond the computers that were permanently included in the curriculum. Argyris, Putman and McLain Smith (1978) note that a lack of connection between educators' espoused beliefs and practices does not occur by chance—rather, any action taken is the result of a design process, and that people have the power to influence that process. This was an important consideration for the Phase 2 practitioner inquiry projects as it highlighted that extending educator knowledge and confidence may empower them reconsider and potentially challenge their beliefs and practices. This in turn may be influential in promoting more critical and informed curriculum decisions making.

Findings from this study suggest that technology and learning are indeed inseparable in the context of play-based learning. For example, educators at two of the three early learning services (S1 and S3) held the view that technology was useful as a resource to follow up on children's interests in relevant and meaningful ways. Additionally, the educators at S1 and S3 were observed using technological resources contemporaneously with other resources, such as the Internet alongside books to access information. Yelland (2011) advocates the value of including new technologies alongside traditional ones to create integrated and holistic approaches to pedagogy. Integration of technology also links with the concept of convergence outlined by Edwards (2015) which acknowledges the difficulty in separating technology in children's play from more traditional resources due to interrelations and inter-reliance that exist between them, within the context of digital technologies and popular culture in children's play. Findings from this study extend on Edwards' arguments by providing examples of educators using technologies - both tangible (such as touch screen devices) and intangible (such as Internet searches) alongside traditional resources (such as reference books) - in an integrated and complementary way within a play-based curriculum.

Educators from all three services held the view that children now learn differently because of their interactions with technology. Parallels are evident with findings from Zevenbergen and Logan (2008) who note that children have different skills sets and approaches to learning to previous generations because of their experiences with technology. Growing up with the ability to access information so immediately presents the question of whether children are still afforded opportunities to reflect, theorise, hypothesise, and to develop critical thinking skills when using technology (Boe & Hognestad, 2010; Birbill, 2013: Murray, 2013). Educators at S1 conveyed a belief in the value of supporting critical thinking skills, a position reflected across data sets in Phase 1 for S1 (P1, S1 Art.; P1, S1P3, Obs; P1 S1P2, Int.). Rather than seeing technology as something that inhibits opportunity these educators interpreted technology as a resource. As identified by S1P2, instant access to information was not an issue unique to technology as a resource. They noted a belief that critical thinking was compromised whenever a child was provided with an answer without the opportunity to hypothesise or consider the problem. However, the Internet provides an additional element for consideration as information can be accessed instantaneously, with the options for sources of information being selected by the search engine. This presents additional challenges for early childhood educators seeking to develop children's critical thinking skills whilst simultaneously trying to impart an understanding of the technologies that they will continue to use throughout their lives.

Another challenge is the difficulty in knowing whether information on the Internet is factually robust and accurate. The findings from this study suggest that providing children with foundational understandings of the need to critically reflect on information and deconstruct its origins and purpose are a key component in developing digital citizenship. Edwards, Skouteris, Nolan and Henderson (2016) stress the importance of understanding the "Internet cognition" (p. 39) of young children. The technical concepts of Internet cognition involve the processes of both transmitting and receiving information (Edwards, Skouteris et al., 2016), and also involve developing an understanding of the integrity of these sources of information. Children will increasingly become involved in online worlds – either through direct use (for example, Skype calls with family members) or indirect use (such as seeing a family member order groceries online and observing subsequent delivery). To support children to understand and be agentic as digital citizens Edwards, Nolan et al. (2016) suggest that educators need to understand children's Internet cognition and build on their current understandings to create a foundation that be further developed as their experiences with the Internet and online resources continue to change and grow. This should include being critical and asking questioning when accessing information online.

The issues discussed above in relation to the immediacy and accuracy of information accessed through technology are important considerations for educators and potential areas for concern. However, as identified by S1P2, providing information to children through the Internet is not markedly different to when educators provide children with instant answers from a book or from the educator's own knowledge. Alper (2011) posits there is a certain 'moral panic' around technology use that draws it to the forefront of discussion relating to its suitability in early learning pedagogies, and this was observed as an influential factor in educator disinclination to integrate technology within this study. However, the key to supporting effective technology use it not in the resources themselves, but rather in the guidance and support children experience from educators in actively engaging with technological resources (Plowman & Stephen, 2007).

As presented by Malaguzzi (1994) an educator's view of the child influences how they respond to each child. Findings from this research corresponded with this statement, showing that the educator's image of the child at a philosophical and pedagogical level was also influential in shaping the educator's beliefs about integrating technology in the curriculum. Technology integration at S1 and S3 was influenced by educator propensity to ask children questions and thereby provide them with agency in the curriculum. This was also apparent in practice at S3 and S2 where pedagogical approaches supported children's agency and enabled them to have a voice and lead the curriculum. Such an approach results in a more accurate understanding of children's interests and experiences (Rogoff, 1995; 1990). The impact of children's agency extended to the integration of technology where more child-led approaches supported educators to comprehend children's prior experiences, interests and cultural understandings. Findings across both phases outlined a range of beliefs in terms of learning with technology and noted variations across the services as well as between educators in the services. The diversity in beliefs related directly to curriculum inclusion, with clear links between educator beliefs and practices across all three services. The following section provides examples and analysis of how this diversity in beliefs presented in practice.

4.2 Technology Integration and Educator Practices

As already discussed, findings from this research suggest educator beliefs about the value and relevance of technology in early learning pedagogies strongly influenced the positioning of technology within their curriculum. However, a number of other factors were identified as impacting upon, and working extraneously to, educator beliefs and the integration of technology in the early learning setting. These included consideration of computers and conceptualisations of technology, technological tools, technology and play, and equity and technology.

4.2.1 Computers and conceptualisations of technology.

In terms of conceptualising technology, early findings from this research indicated that many of the educators still primarily focused on computers when thinking about technology integration in early learning services. However, as the study progressed, discussions about other digital devices and outputs in relation to technology integration became more prevalent. Technological resources utilised by educators at each service, across both phases of the study are summarised in Table 4.1. Access and use of computers varied between services. Educators at S1 had computers for the children and educators to use, while educators at S2 had a laptop for educators to use that children were not permitted to touch. Conversely, educators at S3 rarely used computers at all, instead favouring tablet devices (See Table 4.1).

Table 4. 1

Technological Resources within the Services across Data Sets

	S1	S2	S3
Computers for educators	P1 Int. P1 Obs P2 PIP Obs P2 PIP Meet.	P1 Int. P1 Obs P2 PIP Obs P2 PIP Meet.	P1 Int. P1 Obs P2 PIP Obs P2 PIP Meet.
Computers for children	P1 Int. P1 Obs P2 PIP Obs P2 PIP Meet.		
Internet access in room	P1 Obs P1 Art P2 PIP Obs P2 PIP Meet.	P1 Obs P2 PIP Obs P2 PIP Meet.	
Internet access in office	P1 Obs P2 Obs P2 PIP Meet.		P1 Obs P2 PIP Obs P2 PIP Meet.
Tablet device for children			P1 Obs P2 PIP Obs P2 PIP Meet. P2 FG
Digital camera for educators	P1 Int. P1 Obs P2 PIP Obs P2 PIP Meet.	P1 Int. P1 Obs P2 PIP Obs P2 PIP Meet.	P1 Int. P1 Obs P2 PIP Obs P2 PIP Meet.
Digital camera for children		P1 Int. P1 Obs P2 PIP Obs P2 PIP Meet.	P1 Int. P1 Art P2 PIP Obs P2 PIP Meet.
Light table			P1 Obs P1 Art P2 PIP Obs P2 PIP Meet
Overhead projector			P1 Obs P1 Art P2 PIP Meet
Microscope	P1 Int. P1 Obs P1 Art		
Photocopier	P1 Art		
Imaginary play/ dramatic play props	P1 Int.	P1 Int. P1 Obs P2 PIP Obs	
DVD/ YouTube		P1 Int. P2 FG P2 PIP Meet	P1 Int. P1 Obs P2 PIP Obs P2 PIP Meet. P2 FG

In the initial Phase 1 interviews, comments from S1 and S2 educators largely focused on the use of computers when considering how technology featured in the curriculum, (P1, S1P1 S1P3 S1P4 S2P1 S2P2, Int.) as illustrated in comments including:

> We have computers in the room and the children use them for drawing and they know it's for writing. (P1, S1P1, Int.)
>
> Well we have two computers over there […] and you can play different colours and things like that. (P1, S1P4, Int.)
>
> We don't have computers where they can sit at and utilise it for any programs or anything like that. (P1, S2P1, Int.)
>
> […] It's very hard [to link technology with the EYLF] because we don't have computers […] See [Learning] Outcome 5 talks a lot about technology, but I haven't really used it here. (P1, S2P2, Int.)

However, in looking beyond computers as a primary focus, three educators across S1 and S2 provided slightly different perspectives (P1, S1P1 S1P3 S2P2, Int.). They noted that computer peripherals such as keyboards could feature in dramatic play to enable children to build familiarity with computers. For example, one educator commented:

> We have a lot of keyboards to get them used to the whole computer scene, but we also have computers in the room. (P1, S1P3, Int.)

This inclusion of technology was also observed in practice at S2 where non-functioning technological resources featured in the dramatic play areas across both phases of the study. Nonetheless educators did not identify these resources as a form of technology integration.

Computer use was conceptualised differently between services according to whether educators viewed it as an appropriate resource for children to interact with rather than just observe (Table 4.1). During an observation session, the room leader from S2 noted that they used the laptop to search for information with children, stating that it was conceptualised as an "educational tool" (P1, S2P1, Obs Int.). They also stated that it was just a "teaching one [laptop]" meaning that it was not for use by children (aged three and four years) (P1, S2P1, Int.). In this example, the experience with computers was solely teacher led but children were introduced to key terms and functions of computers and Internet usage such as "Google", "website" and directions such as "we just click here". The teacher-directed and controlled access to the laptop reflected the educator's stated belief that computers were for the sole use of educators.

> We kind of use [the laptop] as an educational tool. They don't get free reign of it or anything because obviously it's just a teaching one for us, so I think the role it plays here for us is just for education purposes really so they can learn how to utilise the Internet. (P1 S2P1 Int.)

This comment also elucidates the educator's theoretical and pedagogical beliefs. This finding demonstrates that factors influencing integration of technology extended beyond the educator's beliefs relating to technology to include personal philosophies relating to pedagogy. Here understanding what activities educators perceive as 'educational' and their corresponding beliefs around how technology should feature in a play-based curriculum directly influenced educator pedagogical practices.

Curriculum provisions at S1 were different to those at S2, in that the computers were freely available for children to use independently. During the six examples of children's computer use observed during Phase 1 at S1, educators provided consistent modelling and guidance (See Appendix I for an example P1, S1 Obs), with only one instance observed where a child was not able to attract educator attention before losing interest. Findings from these observations of computer use at S1 during Phase 1, indicated that the close proximity and consistent interaction of educators sustained children's engagement with the computer.

In contrast with the integration of computers in the curriculum at S1, S3 educators had an older computer that was used rarely by educators or children. The computer, permanently positioned on a high bench, was not visible to children. The only interactions that children at S3 had with a computer was when they accompanied an educator to the office to look for information on the director's computer (P1, S3, Obs; P2, S3, PIP Obs). However, the educator expressed a view in support of the value of technology as well as proclaiming self-efficacy. The curriculum at S3 included a diverse range of other technological resources and tools for children to engage with in their play including a light table, overhead protector, digital camera, iPads for photography and video, and iPad applications (P1, S3, Obs Art.; P2, S3, PIP Obs, PIP Meet Art.). Whilst a similar connection between educator beliefs and practices were evident in educator practices at S1, at times there was a disconnect in their conceptualisations of technology which meant that while technological resources was included in the curriculum, they were not always recognised or acknowledged (as discussed in 4.1.1).

4.2.2 Technology tools beyond computers.

Educators across all three services identified a number of technological tools and resources that they used to support children's interests and investigations in play-based learning. Table 4.2 presents data gathered in the initial Phase 1 interviews and provides a summary of the technology educators reported using in their curriculum.

Table 4. 2

Technology Educators Reported Using in their Curriculum

Type of technology	**S1**	**S2**	**S3**
Computers	S1P1, S1P3, S1P4		
Computers for educators		S2P1	S3P1, S3P2
Software – Drawing	S1P1, S1P4		
Software – Writing	S1P1		
Light table (To explore different concepts and extend thinking)			S3P1
Non-digital resources as technology (e.g. Blocks)	S1P1		
DVD documentaries			S3P1
YouTube clips			S3P1, S3P2
Music Keyboard			S3P1
CD Player		S2P1, S2P2	
iPod for music		S2P1, S2P2	
Microscopes	S1P2		
iPad/ Tablet	S1P4		S3P1
Overhead projector			S3P1, S3P2
Role play – non-functioning technology (making sense of their worlds)	S1P1 S1P3	S2P2	

Findings presented in Table 4.2 suggested that while some educators initially thought of computers when asked about technology, in fact their use of technology was more varied. Observations were made of diverse use of technology resources within the curriculum during Phase 1 (P1, S1 S2 S3, Obs; P1, S1 S2 S3 PIP Obs) and the related findings add to current professional understandings of how such forms of technology can support play-based learning. The section below includes examples in practice from each service.

Internet

Interestingly, no educators mentioned Internet use in their initial Phase 1 interview responses about technology use with young children (See Table 4.2). However, across both phases of the study educators at all three services used the Internet to varying degrees and in different ways. One example from S2 involved the room leader (S2P1) using a laptop and Internet search during a large group experience to extend children's interest in gardening (See Appendix J). Similarly, S1 and S3 educators included Internet searches in small group explorations with four or five children (See Appendices K and L) (P1, S1P1, Obs; P1 S3P1, Obs, Art.; P1, S1p3, Art.). In all three examples the experiences were teacher-led, with the children observing computer use but also offering ideas for Internet searches.

Cameras

Educators at S1 and S2 noted that cameras were available for use by both children and adults (P1, S1P3, S2P1, Int.). Children were able to extend their own areas of interest and exploration by using the cameras. Additionally, educators at S2 and S3 noted that allowing children to use the digital camera was helpful in gaining insights into their perspective (P1, S2P1 S3P1, Obs) and they encouraged children to use digital cameras to contribute to the documentation process (P1, S1P2 S2P3, Art.; P1, S2P2, Obs.).

Microscopes

Children's use of microscopes as a tool or resource featured at S1 (P1 S1P2 Int., P1, Art.). An educator (S1P2) spoke about microscopes complementing more traditional resources such as reference books and information posters. Documentation recorded by S1P3 showed that educators encouraged children to hypothesise about the roots of the plant they were looking at, to share ideas and discuss possibilities before then using books and Internet searches to test some of their theories (P1, S1P3, Art.). Here technology integration was as a meaningful tool rather than a novelty or stand-alone experience. Children gained support in using this tool as well. Additionally, the educator (S1P2) explained what a microscope was and how it worked before children had the opportunity to use it (P1 S1P2 Int., P1 Art.).

Light table

A light table was consistently observed in use within the S3 curriculum (P1, S3, Obs; P2, S3, PIP Obs). The room leader expressed a belief that this form of technology could extend children's current knowledge and give them an alternate way to explore items and concepts (P2, S3P1, PIP Meet.). Additionally, curriculum provisions for use of the light table included other traditional resources such as name cards for tracing and writing.

DVDs and YouTube

Educators at S3 held the view that DVDs and YouTube clips were a valuable way to support learning (P1, S3P1 S3P2, Obs.; P2, S3P1, PIP Meet.). As an example, they described a scenario where several boys in the room were adamant that males could not do ballet (P1, S3P1 S3P2, Meet.). Educators stated that showing the children a DVD that had male ballet dancers performing provided an additional level of information as the DVD was more detailed than a static picture, or simply having information provided by an educator.

iPads

While an educator at S1 reported using iPads with children, this was not observed in practice or in any of the artefacts observed in Phase 1, indicating that it was not a common inclusion. A tablet device was observed in use during every Phase 1 observation session at S3, and use was frequently evident in artefacts viewed. Tablets or iPads were not observed in any data collection for S2.

4.2.3 Technology and its integration.

Findings from this research highlighted that the technology was present within the curriculum despite educators not realising it, or thinking of it as technology in their planning. While this corresponds with the EYLF definition of curriculum to include both planned and unplanned experiences (DEEWR, 2009) it could also reflect diverse conceptualisations of technology that perhaps did not always reflect the range of resources available or experiences taking place with technology. This section discusses how both planned and unplanned uses of technology as well as how educator beliefs about technology, impacted upon pedagogical practices.

Technology as an integrated tool or resource

Educators at the three services approached technology integration differently during the Phase 2 practitioner inquiry projects, however they all considered multimodal approaches. At S1 and S3, children used the computer and traditional resources contemporaneously. In engaging with their investigations into space and the Solar System children at S1 viewed images and accessed information through space related websites on their Symbaloo Webmix (See Table 3.7). A Symbaloo Webmix is an online resource that allows for a number of bookmarks to websites to be collated into a central site. Further details are included in

Appendix M. Documentation of children's learning recorded by S1 educators early in Phase 2 (P2, S1, Art) indicated that educators offered children opportunities to use the drawing program on the computer as well as traditional art resources such as paint and pencils to express their ideas. Similar examples were apparent at S3 where the curriculum included opportunities for children to explore their interests and extend investigations through multiple resources (P1, S3, Art, Obs; P2, S3 Art Obs).

Another example of technology as a complementary and integrated resource was evident at S3 in Phase 2. An educator discussed using a digital video recorder to film silkworms emerging from cocoons as it took place before the children arrived at the service. Children were then able to view the footage later that morning and use it as a provocation to discuss the theories and hypotheses they had prior to the hatching as well as to discuss emerging ideas. Throughout the morning, resources such as information books and drawing and painting materials were available to the children. They were also able to view the live moths and revisit the recorded footage to assist them to explore their ideas (P2, S3P2, PIP Meet.). These examples demonstrated digital technologies integrated as an additional tool or resource to help children express their ideas and make meaning.

A different approach was apparent at S2 where educators used technology as a standalone, rather than integrated resource. As an example, in Phase 2 they trialled voice recordings during a collaborative story telling experience. This was conducted as a whole group experience in which children took turns to speak into a voice recorder (P2, S2P1, PIP Meet.). The educators indicated that the experience had not gone as planned. They noted the following in their evaluation notes:

> We have implemented voice recording and video footage of group times hoping to encourage new ways of telling stories, however it was not reciprocated as positively as expected by the children. Our next step is to use a child-friendly computer to

generate visuals as well as language through story telling programs. (P2, S2P1, PIP Journ.)

This example is indicative of the educator's proclivity to position technology as the main focus of an experience rather than as a supportive resource. This approach was apparent throughout their practitioner inquiry project (P2, S2, PIP Obs PIP Meet.). Such a pedagogical approach impacted upon experiences with digital resources as children were not given time to gain familiarity with the resources or use them in a hands-on, interactive way.

Active or passive use of technology

There was a clear contrast between the beliefs and practices of educators at S2 and S3 in relation to active and passive use of technology. Educators at S2, expressed concern about passive use of technology across both phases of the study (P1, S2P1 S2P2, Int., P2, S2P1 S2P3, PIP Meet), stating a belief that the frequent use of technology distracted children and encouraged passivity at the expense of interaction and conversation. Their concern was that children were missing opportunities in interacting with their families and failing to process information in the world around them as they may have done if not provided with technological resources such as smartphones or iPads.

> It's almost like [the parents] use it as a behaviour management tool to keep [the children] quiet. (P2, S2P1, PIP Meet.)

> Driving somewhere, children just don't have the time to sit and think. (P2, S2P3, PIP Meet.)

In addition to these comments, the manager of S2 expressed concern that passive entertainment impeded children's opportunity to engage in the wonder of investigation and discovery (P2, S2SM, PIP Meet.).This underpinning ideology of technology as passive entertainment limited the service manager's interest in or willingness to support inclusion of technological resources at S2. The service manager's beliefs subsequently impacted the educators' practices and curriculum inclusions.

Educators at S3 provided an alternative view of how the introduction and use of technology could be effectively child-led and interactive, rather than passive and isolated (P2, S3, PIP Obs). For example, S3P1 empowered children by adopting a co-learner approach, inviting children to explain what they knew about a new resource (iPad application) or in using digital story books. They also let children lead the process by asking open-ended questions, such as "how do we ..?" and enabled the child to demonstrate the features of the application to peers, while still providing a level of guidance and scaffolding (P2, S3P1 S3P2, PIP Obs). The educators at S3 also intentionally paired more capable children with those who were inexperienced to promote scaffolding (Vygotsky, 1978).

Support for autonomy with technology use at S1 involved children independently using computers in the classroom. However, during observations in Phase 1 at S1, children appeared reluctant to ask for help with computer use. During this observation session, educator absence resulted in the child seeking assistance from a peer (as a more knowledgeable other) (Rogoff, 2008). However, this endeavour was unsuccessful (See Appendix N for an example). By contrast, direct guidance and interaction with an educator was observed to result in more sustained engagement with the computer for children (P1, S1, Obs) (as demonstrated in Appendix I). In the observed computer use at S1 during Phase 1 it was apparent that guidance from educators resulted in children being more active and sustained in their engagement with the computer.

Technology and play

Conceptualisations of technology within a play-based curriculum varied between the educators at all three services. Differences were apparent in the underpinning pedagogical philosophies at S2 and S3. The S2 service manager explained that advice received during a National Quality Standard assessment influenced their position of avoiding technology integration in the curriculum.

> The real push I got in this last visit [from the assessor] was to let them play […] [but that] playing is not on computers, playing is not technology […] playing is about getting dirty, climbing trees, planting things. (P2, S2SM, PIP Meet.)

Conversely, examples of practice from S3 demonstrated seamless integration of technology in a play-based curriculum to extend and support children's understanding and engagement (P2, S3, PIP Obs). As an example, during a whole group experience educators encouraged children to discuss what they had seen during their school transition experience, and what they knew about school in general. Images on the iPad were used as a provocation for discussions on the similarities and differences (P2, S3P1 S3P2, PIP Obs) and enabled children to share their ideas, and compare their experiences. Here technology supported the investigations rather than being the main focus of the experience.

4.2.4 Equity and technology.

Educators at S2 and S3 provided a range of interpretations and conceptualisations of equity issues with technology in the curriculum. These views related to gender, general access, and children with additional needs when integrating technology. Equity related issues were not observed or discussed at S1. Educators at S2 expressed the belief that children of different genders engaged differently in play-based experiences (P2, S2P1, S2P3, S2SM, PIP Meet). The service manager at S2 felt this was particularly strong in relation to technology use noting:

> I'm not sure what it is but there's something there where boys have that continued focus [when using technology] whereas girls are more aware of their environment. (P2, S2SM, PIP Meet)

This contrasted with observations of practice in Phase 1 at this service (S2) where the primary form of engagement with technology involved females using non-functioning keyboards in dramatic play scenarios (P1, S2, Obs). This may indicate that the educators did not consider imaginary play as a significant form of engagement with technology. Educators at S3 noted a difference in gender groupings in play more generally:

> [We] do have days where they do seem to stick to their little gender groups […] It is an older group this year […] Well towards five and over now […] So they are very socially grouped based on interests. They've chosen specific friends now and it's a bit like watching a kindergarten class when they move towards more gender descript friends. (P2, S3SD, PIP Meeting)

The educators at S3 stated a belief that any gender divide reflected friendship groups (P2, S3P1 S3P2, PIP Meet.). However, observations during the practitioner inquiry project showed that a group of males dominated use of the overhead projector, while use of the light table and iPads was by small mixed gender groups (P2, S3 PIP Obs). Examination of artefacts such as documentation of children's experiences and entries in the daily reflective diary, showed children of both genders using iPads when educators were involved in the experience.

The Service Manager at S2 identified access to technological resources as an equity issue. They felt that it would not be fair to include digital resources such as iPads at the service because children who did not have them at home "won't feel included" (P2, S2SM, PIP Meet). The service director at S3 approached equity of technology use differently, stating:

> There'll be children who may never have seen it [different forms of technology] but they're all sharing their knowledge [...] and we just take it on board and they all get the same opportunity of exploring it in their own way. (P2, S3SD, PIP Meet)

Additionally, educators at both S2 and S3 acknowledged that digital technologies could support children with additional needs. The service director at S3 noted that some iPad/ iPhone applications were helpful in working with children with additional needs—particularly an Auslan application which was being used in another room at the service to assist children with autism and speech dyspraxia (P2, S3SD, PIP Meet.). While this was a different age group to those in the study, the S3 director noted that they felt it was an important point to raise as educators at the service considered the Auslan application as valuable as it supported children with their learning and promoted equity. This example of practice from S3 was in accord with other examples communicated by S2P1 who described accessing information via YouTube to learn simple phrases in Mandarin to help a child who could not speak English transition into the service with more ease (P1, S2P1, Obs; P2, S2P1 PIP Obs.).

Discussion on technology integration and educator practices

Educator responses in Phase 1 indicated that computers were still the predominant or initial thought that came to mind when asked about technology use. However, as the research progressed educators began to express more diverse ideas about technology integration in their curriculums. This tendency to initially identify technology as computers aligns with findings from other early childhood-based research which indicates that educator discussions and research foci around ICTs predominantly refers to computers (Nikolopoulou & Gialamas, 2015b; Plowman et al., 2010). However, as identified in 2.2.1, there is a need for educator conceptualisations of technology to move beyond computers to reflect more accurately the experiences that children have in their everyday lives (Plowman et al., 2012). Educators at S2 described computers as a teacher-led tool and this ideology was also evident in their pedagogical practices. This conceptualisation reflected the educators' stated beliefs that computers are not being pedagogically appropriate for young children to use. It also complements Nikolopoulou and Gialamas' (2015a) quantitative findings which highlighted that educator integration of technology is impacted by their beliefs about technology and also their beliefs about teaching.

Computers were the dominant form of technology integration at S1 with computers available for children to access independently. Observations of practice across both phases of the study identified children's computer use as most effective when an educator was in close proximity to provide consistent interaction, guidance and support. This proximal guidance was largely in terms of navigating operational aspects of the computer hardware and software, rather than the content of the software. This explicit teaching is a necessary part of building children's competency (Plowman & Stephen, 2007; Stephen, 2013). It was observed that children were reluctant to ask educators for assistance and seldom sought help from their peers. These findings are supported by Plowman and Stephen (2007), who are seminal researchers in relation to children and computer use. They found that children are unlikely to ask for assistance with computer related issues, but cannot navigate competently without explicit guidance and help. The consistency between findings in this current study and those of Plowman and Stephen almost a decade earlier indicates that despite changes in technology, some issues affecting effective computer integration in early learning services have remained constant.

Guidance and explicit teaching from educators was observed as a facilitator in including technology beyond computers as well, such as with the introduction and use of digital microscopes at S1. Introducing resources is an important step in the process of helping children to develop competency with technological resources (Blagojevic & Thomes, 2008), and relates to Vygotsky's notion of explicit mediation (Edwards, 2015). Additionally, this example demonstrated the respect educators had for children as being capable and competent in using technological tools. A clear link was apparent between the educator's image of the child, the types of technological tools provided and the positioning of technological resources within the curriculum. Here the findings present an example to answer Rogoff's (1990) question included in the epigraph for this chapter: creativity, agency and critical thinking skills were fostered when educators supported guided participation and built on children's existing knowledge and prior experiences. Conclusions from this study add to findings from Nikolopoulou and Gialamas' (2015b) quantitative study which suggested educator pedagogical beliefs and positioning impacted upon the types of technological resources and experiences they include in their curriculum. This is an important idea to further delineate given that relevant, integrated technology experiences help create a curriculum that reflect children's social and cultural contexts (Edwards, Henderson et al., 2016).

Educator beliefs about the appropriateness of different forms of technology in early learning pedagogies (iPads, tablets and computers as examples) were also found to influence how technology featured within the curriculum. This conclusion is consistent with findings from previous research (such as Edwards, 2015; Edwards, Henderson et al., 2016; Nikolopoulou & Gialamas, 2015a). However, findings from this study also highlighted that educator decisions regarding the integration of technology were part of a much larger, complex and interrelated network of factors at a personal, interpersonal and community level. Lindahl and Folkesson (2012a) note that developing an awareness of factors that support technology integration is important because educator practice in integrating technology has the capacity to build foundational knowledge and understandings in children.

Educators at S3 took a child-led approach and encouraged children to share their ideas and expertise regarding technology. This approach meant that the introduction of relatively new forms of technology for the group was an enjoyable and interactive process, and enabled the child to become the more knowledgeable other (Vygotsky, 1978) rather than the educator taking on this role. Additionally, such an approach promoted a sense of agency, with children acknowledged as capable and competent. It also fostered social skills, sustained shared thinking and collaboration among the children involved (Siraj-Blatchford, 2009). Educator support of child-led approaches at S3 demonstrated that effective integration of technology within a play-based curriculum can support children's learning and development.

Additionally, technology integration within the curriculum at S3 reflected educator conceptualisations of technology as a complementary resource rather than a standalone tool. These conceptualisations often linked to the espoused beliefs of educators and management in terms of technology as a pedagogically appropriate resource. Such integration of technology occurred sporadically at S1 and rarely at S2. This study found that combining technological and non-technological resources provided curriculum provisions that were more closely related to the ubiquitous way technology features in everyday life. Research acknowledges the value of integration between technology and traditional resources as an effective way to support children's experiences within early learning curriculum (Edwards, 2013; Yelland, 2011). Additionally, integration of technological resources can support children's engagement and depth of exploration within their broader play and investigations (Nikolopoulou & Gialamas, 2015a).

Educators at S3 integrated technology in a way that corresponded with children's previous experiences, which was important in making sociocultural connections (Rogoff, 1990). Educator understandings of children's experiences emerged from observations of children's capabilities and interests with technology within the curriculum, as well as from educator perceptions of children's experiences with technology in their home and social contexts. These understandings were acquired by educators through conversations with children and their families. This provides new knowledge of educator beliefs and practices in relation to technology integration and helps to counter the lack of research by providing additional insights into integrating technology within early learning curriculums (Palaiologou, 2016).

Data from S1 and S2 highlighted an important element in educators' conceptualisation of technology: its inclusion in imaginary play. One educator from S1 acknowledged the importance of technology in dramatic play to support development of foundational awareness of technological resources. In line with Rogoff's (1990) quote in the epigraph for this chapter, foundational awareness could build on what children already knew, and to also help foster the creativity needed to prepare children for later experiences with technology. However, educators at S2 did not recognise non-functioning keyboards as technological resources or technological play. Recognition of technology in imaginary play is important because gaining familiarity with resources and cultural tools through play, including imaginary play, can assist children to make sense of their social worlds (Vygotsky, 1986). Educator engagement in collaborative critical reflection may help to create further understandings of diverse technology inclusions in the curriculum, such as through imaginary play. Whilst some educators in this study had broad conceptions of technology (as outlined in Table 4.2), the findings suggested that more diverse conceptualisations of technology could further support integration of socially and culturally relevant experiences in a play-based curriculum. Stephens (2013) identifies this diversification as an important area of focus for early childhood education.

Opposition to technology integration within the curriculum was more prevalent when educators and service directors/ managers conceptualised it as a form of passive entertainment. These views relating to passive technology use are an important finding as contemporary research emphasises the value in educators helping children to conceptualise technology as a tool or resource within their everyday lives, rather than something predominantly used for passive viewing (NAEYC and Fred Rogers Center for Early Learning and Children's Media, 2012). The diverse, interactive possibilities with technology need to be discussed and redefined to present and facilitate more diverse views and conceptualisations of how technology can feature in the curriculum. Engaging in discussion and sharing knowledge with children aligns with the sociocultural perspective of learning through communication and collaboration (Rogoff, 2003) which highlights the possibilities of empowering children to understand and manage their use of technology. It is important that children develop an awareness of the technologies available in contemporary societies, if they are to be effective and safe digital citizens (Edwards, Nolan, et al., 2016; Fleer, 2011; Lindahl & Folkesson, 2012a). As such, discussions need to move beyond how children are afforded access to technology, to considering the types of technology children engage with and whether technology use exists in a context of active guidance and social learning.

Equity and access were also identified as factors that educators considered when integrating technology. No clear gender divide was observed across the three services in terms of children accessing and engaging with technology. This aligns with a meta-analysis presented by Plowman et al. (2012) which found that while factors such as socioeconomic status and race influenced children's engagement with various forms of technology, gender did not impact upon children's level of engagement with technology.

S3 educators demonstrated thoughtful contemplation of gender and technology play, and educators' stated beliefs about equity of access aligned with observations and artefacts gathered by the researcher. Educator perceptions of engagement at S2 showed a focus on physical digital resources with a preconceived notion that boys were more drawn to this kind of play. Physical digital technologies were not included as resources for children at S2 and the educators' presumptions about gender could not be substantiated in any data collected throughout the study. Educators at S2 in Phase 2 did not acknowledge imaginary technologies as engaging with technology. This was observed as an area where girls were more engaged in play using non-functioning technology in dramatic play scenarios. Plowman et al. (2012) note that technology featuring in dramatic play—such as office play—enables children to develop understandings of how technology features as a resource or tool within their world. However, Coyne, Linder, Rasmussen, Nelson and Collier (2014) argue that boys and girls engage in different forms of imaginary play based on a number of social and cultural factors, with the primary influence being media. Findings from this study highlight a need for further consideration of technology within imaginary play, with an investigation of whether gender divides are evident in children's engagement with more diverse technological resources, including imaginary play.

Coyne et al. (2014) note that gender stereotypes are pervasive and prevalent within the media, presenting a "hyper-masculinity" related to strength, power, aggression and leadership (p. 417). Findings from this study present an example of how media, in the form of YouTube clips and DVDs, could be used to counter stereotypical thinking and gender-biased understandings (See Section 4.2.2). While these findings are not generalisable, they do highlight the potential for technology to support equity and social justice and to challenge stereotypical thinking in children if educators are willing to seek out suitable resources and if service management support the use of such resources.

Opposing beliefs were evident between the service manager at S2 (S2SM) and the service director at S3 (S3SD) in terms of the importance of children accessing technology. S2SM believed that children who did not have access to technology at home would be disadvantaged by its inclusion in the curriculum, whereas S3SD believed that including technology in the curriculum would support children who had limited experience with technology in their home contexts. Findings in this thesis identify the value of recognising each child's experiences with technology. These understandings can then inform development of a curriculum that will foster foundational skills and understandings of technology that will support children's digital citizenship. Contemporary research suggests that integrating technology in play-based curriculums supports children as digital citizens and is a necessary inclusion given the ubiquity of technology in children's lives (Alper, 2011; Edwards 2014). Additionally, Edwards, Henderson et al. (2016) argue that discussions need to move beyond focusing on the disconnect between home and early learning service contexts in terms of technology provision to a focus on a "digital difference" (p. 13)—where contemplation on children's technology experience requires reflection on other influencing factors such as time, place, activity and function. Findings from this research indicated that considerations of equity of access to technology for children must expand upon the 'have versus have not' debate, as discussed in the Literature Review (2.3.2) (Alper, 2011) to instead consider the types of interactions that children have with technology and the diversity of resources available. In this way curriculum considerations could reflect the technological cultural tools (Rogoff, 1990) children experience in their home and social contexts, as well as at the early learning service they attend, while also addressing the digital difference outlined by Edwards, Henderson et al.

A polarisation of opinions was often evident between service directors, the service manager, and educators in being either for or against the inclusion of different technological resources. The role of the service manager or service director was pivotal in influencing how educators integrated diverse technologies in the curriculum. At S2, the service manager's position as being against technology created a situation where educators showed a disinclination to include it. Broader service policy further exacerbated this unwillingness.

Alternatively, the service director at S3 was an advocate for the integration of technology, which meant that they supported educators to include diverse resources. Lack of support within the service context is acknowledged as a key factor impacting upon educator proclivity to integrate technology, including resistance from other educators (Nikolopoulou and Gialamas, 2015a). This includes support at a policy level, with service based policy acknowledged as a significant influence in guiding everyday practice within early learning services (Gibbs, 2008).

Findings from all three services suggest that technology integration in practice required additional support for educators. For educators at S1 and S2 this related to conceptualisation of technology as an integrated resource within early learning curriculums. Dichotomous beliefs about the pedagogical appropriateness of technology were apparent between educators and service manager of S2 and service director of S3 as both against and for technology integration respectively. The beliefs of the service manager or director and subsequent provision of resources at a context level influenced how educators positioned themselves in the 'for' and 'against' technology integration debate. Research indicates that support from service directors and service managers has a pronounced influence on practice as there is an expectation that those in leadership roles have a sound professional understanding of early childhood and pedagogy that informs their decision making and guidance (Stampoulos, 2012; Waniganayake, Cheeseman, Fenech, Hadley & Shepherd, 2012). However, in this study, educator proclivity or disinclination to integrate technology was not static or solitary, and other factors such as personal confidence and competence also influenced educator positioning.

Increased discourse, reflection and professional learning opportunities for educators were found to enhance their understandings around possibilities for positioning technology within a play-based curriculum. The iterative nature of design-based research (Design-Based

Research Collective, 2003) supported this as findings from Phase 1 were shared with educators and discussed which helped to create professional learning content in Phase 2 contextually relevant. Resulting shifts in thinking could also potentially challenge some of the long-held beliefs or ideologies that are serving as barriers to technology integration, as suggested by Palaiologou (2016). The experience of S2—where the National Quality Framework Assessor was reported as discouraging technology use—further highlights the subjectivity that exists not only in defining technology but also in the idea that technology is somehow counterproductive to other forms of play-based learning experiences for children. This formal advice from a regulatory body representative had a significant impact on the attitude of the service manager towards technology integration within the service. Lack of support for educators is a prohibitive factor in the integration of technology and can also overlap with other barriers such as lack of resources or access to professional learning (Nikolopoulou & Gialamas, 2015a). These findings therefore highlight the need for a discourse amongst educators not only on how technology can feature in play, but also in challenging basic assumptions of what technology is, and the value it can add to play-based learning (Edwards, 2015; Marsh et al., 2016; Palaiologou, 2016). The next section further explores these factors that impact on technology integration.

4.3 Factors Impacting the Integration of Technology

Pivotal factors such as educator confidence and competence with technology as well as their beliefs about technology influenced educator choice in relation to integrating technology in their curriculum. A number of other factors were also identified as either a support or barrier to technology use and inclusion. These factors were complex, multifaceted, and often inter-related. They included educator confidence and competence with technology, availability of resources, support from management, and preconceptions about children's abilities with technology. An interrelationship occurred between the factors impacting upon how educators integrated technology and factors identified in Section 4.1 as influencing educators' beliefs and practices (Figure 4.1). Factors that supported or served as a barrier to the educators' integration of technology were influenced by educator beliefs and practices in relation to the integration of technology and vice versa (Figure 4.2). These factors worked together in different ways for each educator and impacted on educator beliefs and practices, as well as influencing educators' choices in integrating technology in the curriculum. These are further discussed in this section.

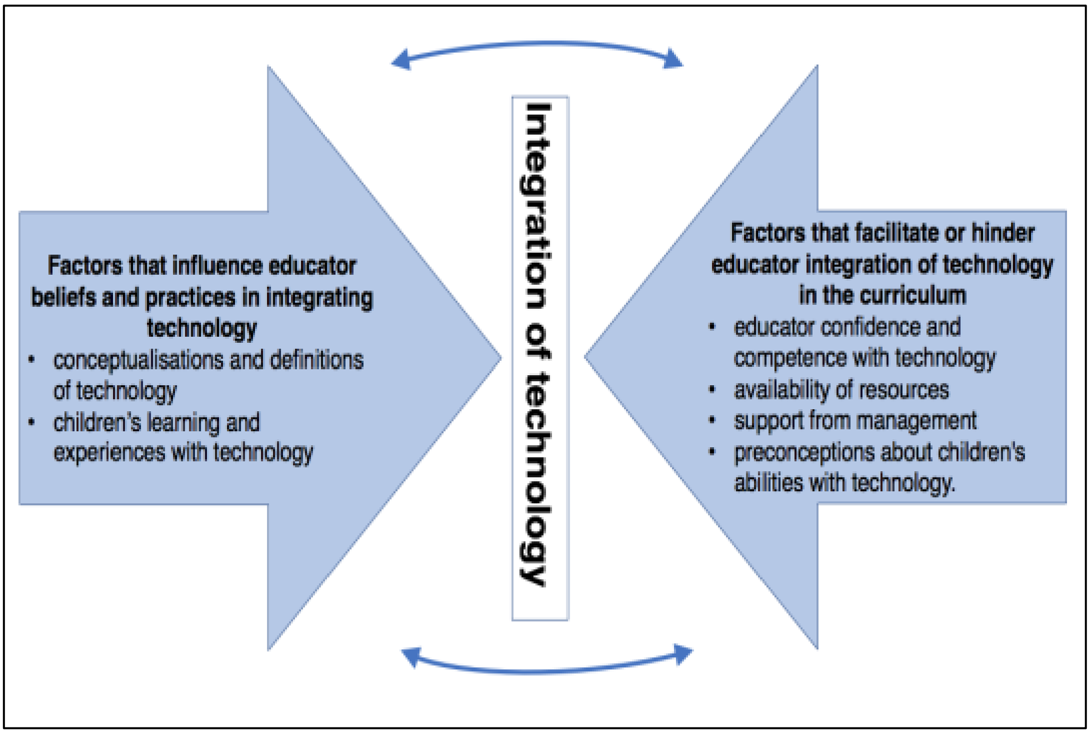

Figure 4. 2: Interrelation of educator beliefs and practices with factors that facilitate or hinder technology integration.

4.3.1 Educator confidence and competence with technology.

In the initial interviews, all but one of the educators rated themselves as confident with technology (S2P1) (See Table 4.3). Another educator (S1P1) acknowledged that having a competent technology user at the service supported other educators to include technology in the curriculum (P1, S1P1, Int.). The question these findings raised was whether purported confidence in using technology translated to the reality of integrating technology in the curriculum. Observations of practice during Phase 1 indicated that educator confidence in using technology did not always translate into including technology in the curriculum. However, the lack of expressed confidence did not always result in complete avoidance, as outlined in Table 4.3.

Table 4. 3

Educator Self-Perceived Confidence with Technology (Phase 1 Interviews) and Inclusion in the Curriculum (Phase 1 Observations)

Educator	Perceived confidence	Technology observed in curriculum in Phase 1
S1P1	Confident	No interaction with technology based experiences observed
S1P2	Confident	Integration of technology with other resources to extend learning observed in artefacts
S2P1	Not confident	One planned whole group experience demonstrating use of laptop observed
S2P2	Confident	Integration of technology with other resources to extend learning observed in artefacts
S3P1	Confident	Technology consistently integrated into the curriculum as a tool or resource to support children's learning, investigations and thinking.
S3P2	Confident	Technology consistently integrated into the curriculum as a tool or resource to support children's learning, investigations and thinking.

The educator (S2P1) who expressed a lack of confidence and competence also noted that a lack of knowledge and understanding in terms of pedagogy presented a challenge when introducing new technologies:

> I don't really know how to introduce [technology] […] like a transitional introduction kind of thing, rather than be 'just have this'. They don't have [technological

> resources] that they themselves can access independently, so if it's things that we do introduce obviously it's very teacher monitored. (P1, S2P1, Int.)

Phase 2 findings suggested that a self-acknowledged lack of confidence and competence in using technology linked to technology not being featuring in the curriculum. This extended on Phase 1 findings, which showed educator espoused confidence and competence did not result in technology inclusion in the curriculum. As an example, educators at S2 were provided with a laptop computer and a software program to extend on their practitioner inquiry focus of storytelling (P2, S2, PIP Meet) (See Table 3.7). These choices aligned with children's familiarities and interests in photography, as well as their experience with laptops modelled as a resource, as observed in Phase 1 (P1, S2, Obs).

The researcher also provided an interactive training session with the laptops and programs with both educators (S2P1 and S2P3). As the project progressed it became apparent that educators were not including the laptop or software in their planned story telling experiences as per their practitioner inquiry action plan (P2, S2, Art.). When educator at S2 (S2P3) attempted to use the laptop and software during an experience with children in the researcher's presence, the children showed no familiarity with the laptop which suggests that it had not featured significantly in the curriculum during the practitioner inquiry experiences (P2, S2P1, PIP Obs). The educators' reluctance to use these resources corresponded with their acknowledged lack of understanding and confidence with such technologies (P1, S2P1, Int.; P2, S2P1 S2P3, PIP Meet.).

4.3.2 Availability of resources.

Access to resources played a significant role in what educators included in the curriculum during both phases of the study. Table 4.4 outlines the technological resources available to the services across both phases of the study. Extending on the resources noted in

Phase 1 data collection, additional resources were introduced in Phase 2 as part of the practitioner inquiry project.

Table 4. 4

Technological Resources Available at Each Service across Both Phases of the Study

	S1	S2	S3
Phase 1 All services	• Digital camera for educators • Computer for educators		
Phase 1	• Computers for children • Microscopes • Internet access in room • Internet access in office • Microscope • Photocopier	• Internet access in room • Digital camera for children • Non-functioning technology (imaginary play) • DVDs/ YouTube	• Internet access in office • Tablet device • Digital camera for children • Light table • Overhead projector • DVD/ YouTube
Phase 2 All services	• Laptop • MP3 voice recorder • Drawing software • Slideshow program		
Phase 2	• iTunes card • Symbaloo Webmix		• iPad and case • iTunes card • Online tutorials • Application identification and testing

Another example of the impact of the availability of resources on integration of technology in the curriculum was apparent at S3. Educators at S3 rarely used computers with the children, but embraced a wide range of other technological tools and resources (See Tables 4.4 and 4.2) (P1, S3, Obs; P2, S3, PIP Obs PIP Meet.). Previously, educators at S3 were unable to use computers in the curriculum primarily due to a lack of access rather than a lack of interest (P1, S3P1, Meet.). However, they still opted for a touch-screen device over the laptop when provided with one. Educators at S2 had a laptop but it was not accessible to the children, as educators stated they were not able to "monitor their use" (P1, S2P1, Meet.)

This indicated a particular pedagogical belief and position in relation to children's level of ability and was potentially also linked with S2P1's comment that they were not sure how to introduce technology within the curriculum. Educator practices at S2 and S3 stood in contrast to those observed at S1 where children of the same age independently accessed computers.

Another example of interrelated factors affecting technology integration was apparent at S3. Both educators expressed confidence in using technology, and an interest in integrating it into the curriculum (P1, S3P1 S3P2, Int., Meet.). While they were confident with the iPad, finding suitable applications to use had been difficult. S3P1 and the researcher spent many hours trialling iPad applications throughout the practitioner inquiry project trying to find one that would allow the electronic sharing of digital story books with families. This frustration was reflected in a quote from the room leader at S3:

> You think you've found a good one and then it keeps crashing or there is a one feature off that you need, making it not useful (P2, S3P1, PIP Meet).

The process of trialling applications, according to the S3P1, was time intensive and costly (P2, S3P1, PIP Meet.). Educators expressed a number of frustrations with applications not working or being inappropriate for their aims. However, educators argued that that the use of various storybook applications was still a success as children developed digital stories documenting the transition to school process (P2, S3P1 S3P2, PIP Meet). Similarly, educators at S1 experienced technical issues with the computers that halted use of the drawing software that children were familiar with (P2, S1P1, PIP Meet.). The room leader at S3 (S3P1) used operational issues with technology as a learning experience, modelling how to find a solution to the problem and explaining the associated terminology and processes. This approach provided children with additional foundational understandings as to how technology works.

Educators at S3 (S3P1 S3P2) acknowledged the impact of insufficient digital resources. The lack of Internet access proved to be a significant challenge for S3 educators across both phases (P1, S3P1 Obs, Meet.; P2, S3P1 S3P2, PIP Obs, PIP Meet.) and they noted that this hindered their efforts to enable children to use visual resources to support their investigations such as online images and information, and video clips. The educators frequently used YouTube clips to provide specific information for children and without Wi-Fi access in the room they needed to access the clips externally and transfer them to a device in the room. This process was time intensive and often ineffective. S3P1 often used their personal smartphone as a hotspot to provide Wi-Fi access (P2, S3P1, PIP Meet.). Conversely S1 and S2 had consistent Wi-Fi access (P1 S2P1, Meet.; P1, S1P1, Meet.) however they rarely used it as part of the curriculum in Phase 2 (P2, S2P1, PIP Meet.; P2, S1P1, PIP Meet.).

4.3.3 Support from management.

Educators from both S2 and S3 noted that the support of service management, directors and owners was a significant consideration in the integration of technology (P1, S2P1 S3P1, Int.). Where members of management viewed technology as a valuable tool to support children’s learning, they were more willing to buy technological resources when requested by educators.

> I’d always wanted a light table and I’d always wanted a projector and I’ve got very supportive [service] owners. So when I have an idea for a resource for our service and I’ll go to them and give them the pros and how it can be used in children’s learning and they’re usually pretty good with accepting my views and understanding that I’m not just going to be frivolous with resources and things like that. So, they’re really

> understanding so that helps a lot, because I can usually resource where to get it from and they're pretty accepting of technology. (P1, S3P1, Int.)

> If we wanted something [the service manager/ owner] is more likely to just go out and get it anyway. So I guess money does take a part in it, depending what it is, but [service manager/ owner] is pretty generous when it comes to resources and things like that. (P1, S2P1, Int.)

Comments from educators at S2 and S3 indicated that funds were available for the purchase of resources if the educators could justify the relevance and value. However, S2P1 did not specify whether this would extend to technological resources. The service manager at S2 had strongly indicated a belief that technology was not pedagogically appropriate (P2, S2SM, PIP Meet., FG) which may have impacted willingness to fund the purchase of technological resources. The Phase 2 meetings at S2 showed examples of how management beliefs overpowered educator interest in integrating diverse forms of technology. Early in Phase 2, both educators at S2 acknowledged that excerpts from documentaries would be of interest to children and relevant to their explorations, yet they were reluctant to include them in the curriculum (P2, S2P1 S2 P3, PIP Meet.). One educator noted:

> I would like to bring in documentaries. I used to love watching them, but parents … you know what I mean. (P2, S2P3, PIP Meet.)

The S2 service manager shared this view, suggesting that they were not suitable for use in the curriculum. However, the two S2 educators presented beliefs to the contrary.

> I have tried to put them on at home, we have the David Attenborough series of all that. They get over it quickly don't they? (P2, S2SM, PIP Meet.)

> I think the reality that a documentary gives and seeing something real [is valuable] […] and they can learn. (P2, S2P3, PIP Meet.)

[Documentaries] are engaging, so engaging. (P2, S2P1, PIP Meet.)

This dialogue also drew attention to the perceived beliefs of families with S2P3 assuming families would not approve of documentaries featuring as part of the curriculum.

4.3.4 Preconceptions about children's abilities with technology.

As noted in Section 4.1 of this chapter, educators' perceptions about children's abilities with technology as well as educators' preferences in relation to pedagogical approaches impacted upon how technology was integrated into the curriculum. Findings from this study indicated that preconceived ideas relating to children, technology and pedagogy were both a barrier and a facilitator to the integration of technology. The S1 educators stated that children had greater knowledge and understanding of technology than they imagined (P2, S1P1 S1P5, PIP Meet). Similarly, S3P1 discussed how children's breadth of experience with technology exceeded their expectations, and that children were very comfortable and familiar with technologies, to the extent that they were guiding educators on how to use iPads (P2, S3P1 S3P2 PIP Meet.) (see Appendix O). The room leader at S3 noted that understanding children's diverse experiences with technology impacted upon educator planning, provision and support of diverse technology use within the curriculum (P2, S3P1, PIP Meet.).

Educators from S2 and S3 demonstrated preconceived ideas about the knowledge and experience children had with using various forms of technology (P1, Int.). In Phase 2, S2P3 expressed surprise at how unfamiliar children were with the laptop when she provided if for them to use in a storytelling experience. The educator reflected that children did not know how to use the mouse and found it hard to manoeuvre. S2P3 suggested that they probably had more familiarity in seeing their families use touch screen devices at home, and that children consistently sought guidance from her during these experiences (P2, PIP Meet.). These observations from the educator corresponded with data collected across Phase 1 and 2 at S2 (Obs), showing that children mainly observed the educators using a laptop with touch pad instead of a mouse during whole group experiences.

Educators from S3 provided reflections from a different perspective. They expressed their surprise at the range of experiences children had with technology in their home contexts (P2, S3P1 S3SD, PIP Meet.). Additionally, the S3 educators reported that when they shared their findings with children's families, the family members also expressed surprise at how much children seemed to understand and how easily they navigated technology (See Appendix P for an example from P2, S3, PIP Meet.). The room leader for S3 (S3P1) concluded that children had assimilated much of this understanding through observation of their parents or older siblings. Later in Phase 2, S3P1 reflected that this foundation knowledge might have been the reason why children quickly picked up the new skills and abilities with the iPads and applications; that is, the experiences provided were building on skills that were already emerging for many children (P2, S3P1, PIP Meet.). Dialogue recorded by the educators during their morning meetings with children (a whole group experience) showed that while some children were familiar with aspects such as the Internet or Wi-Fi, other children had no experience at all with these resources (P2, S3P2, Obs.). Therefore both educators and parents had diverse views of childrens' capabilities with technology. The children also had diverse experiences with the use of technology.

Discussion on Factors Impacting on the Integration of Technology

A number of complex and multifaceted factors were identified as influencing educator decision making in terms of integrating technology in the curriculum. However, there was diversity in the complex relationships between these factors at a personal, interpersonal and community level (Rogoff, 1990). The interplay of these factors also influenced educator conceptualisations of technology, their confidence and competence in using technology themselves as well as their understandings of technological as a pedagogical resource. Another factor was that educators needed to feel confident in introducing technological resources to children, and this related to their own familiarity and confidence with resources, as well as their belief in the appropriateness of the resource. The availability of resources also influenced integration of technology within the curriculum, reflecting findings identified in Nikolopoulou and Gialamas (2015a). However, findings from this study also demonstrated that access to technological resources was not sufficient to support inclusion. Contradictions were often evident between educator espoused beliefs and what was observed in practice. Influencing these paradoxes were individual educator beliefs and conceptualisations about technology and pedagogy, the beliefs and practices of fellow educators and management personnel and also their perception of family beliefs in terms of the suitability of integrating technology. Additionally, these enablers and inhibitors largely existed independent of the availability of resources.

Educator confidence and competence in using technology along with their beliefs about technology in general were key factors impacting on technology integration across the three services. Alongside this were educator beliefs about technology and pedagogy such as whether they believed technology was appropriate in early learning curriculums. These findings are supported by Nikolopoulou and Gialamas (2015a) and Palaiologou (2016), in terms of key facilitators and barriers to integrating technology. However, a new finding from this study was that educator espoused beliefs often contradicted practices, and paradoxical situations were evident where educators claimed not to include technology in the curriculum, though examples of diverse integration within the curriculum were evident during observations or in artefacts. Findings suggested that though it was important to identify educator beliefs and practices, it was more important to develop an understanding of why they held these beliefs and engaged in certain practices. The development of these understandings continued throughout the research process, with findings at each stage informing the next stage of data collection and analysis and also informing the professional learning resources and support provided throughout the practitioner inquiry projects. The practitioner inquiry process involved a focus on creating and consolidating connections between educator conceptualisations of technology and pedagogy and the ubiquity of technology in children's lives. The purpose of this was to create awareness and understanding of cultural practices with technology (Plowman et al., 2012).

Opportunities to engage in professional discourse and professional learning broadened conceptualisations, definitions, understandings and imaginings of technology for educators, service directors and the service manager involved in this study, to varying degrees. Professional learning is acknowledged as an important resource to increase educator confidence and understanding of the place of technology in play-based pedagogies (Palaiologou, 2016). However, the interrelated factors impacting upon technology integration identified in this research shifted the focus of knowledge building beyond educator understandings to include also increasing the knowledge of other stakeholders such as families and service directors and management, as these people influenced educator curriculum decisions. Different connections and disconnections were evident in terms of beliefs and understandings between stakeholders including dichotomous beliefs in terms of whether technology should be integrated in early learning curriculums. Stakeholders across the three services were positioned in varying degrees on a spectrum of 'for' or 'against' and it the beliefs of these groups at each service correlated with and were influenced by each other. This stands to reason given the strong focus on relationships and partnerships between families, educators and service providers in early learning services (Gibbs, 2008; Waniganayake, et al., 2012).

Examples of the interrelated nature of the beliefs of stakeholders was evident at each service though different in manifestation. These examples of the interrelated nature of beliefs about technology, relationships between stakeholders and the subsequent impact on curriculum inclusion builds on findings from research identified in Table 2.1, demonstrating the interplay between stakeholders and how this is influenced by educator characteristics. The S3 service director supported the integration of technology in the curriculum and also believed that families were in favour of its inclusion. This served as a facilitator for S3 educators, though it worked in tandem with their already established confidence and competence in integrating technology. The S2 service director opposed inclusion of technology based on personal beliefs and also on a misaligned interpretation of the National Quality Framework (ACECQA, 2012). The S2 service director also believed that families were not in favour of technology in the curriculum. The reluctance and resistance the S2 educators expressed to including technology in the curriculum appeared to be influenced strongly by the service manager's position, and further exacerbated by their self-acknowledged lack of confidence and competence. The S1 service director was generally indifferent to technology integration and neither the director nor educators at S1 commented on families' beliefs or values in terms of technology inclusion in the curriculum. The service director's general disinterest was further impacted when the educators with an interest in technology left the service after Phase 1 (S1P2, S1P3). This is an important point to note as pedagogical leadership is not always the sole responsibility of the service director or manager (Aubrey et al., 2012; Waniganayake, et al, 2012).

While findings suggest that educator integration of technology was responsive to the beliefs of and support provided by other stakeholders, their responses to these beliefs in terms of technology integration was also dependent on a diverse interplay of the factors identified in Figure 4.2. Connections between stakeholders helped to shape knowledge and provide more diverse understandings of the relevance of technology in early learning curriculums. This understanding is particularly important given the polarising thinking that often exists in relation to integrating technology (Palaiologou, 2016).

Broader conceptualisations of technology also extends to educator thinking in terms of technology integration. As noted in the epigraph quote by Rogoff (1990), technologies are always changing, but there need not be apprehension to advancements—they merely build on what one already knows. Educator conceptualisations of technology needed to extend beyond narrow definitions of technology to also include an understanding of the diverse technologies children experienced in their everyday lives, as well as the depth of children's interactions with, and understandings of these resources.

Educators at both S1 and S3 expressed surprise at the level of knowledge children had about different technological resources, and also about children's understanding of the place of technology in their lives. Educators at S2 were also surprised at the lack of familiarity that children had with a laptop—which they saw as a commonplace resource. Examples from all three services highlighted a reductive acknowledgement of assimilation of cultural practices through observation of use as well the antithetical need to bolster children's observation with explicit guidance. Edwards (2015) argues that many educators need support to understand the place of technology in play-based pedagogies, and findings from this research suggest that such support helped to combat the potentially unexplored and unconscious antipathy or reluctance educators may feel. In this way, findings from this project meets a research gap identified by Marsh et al. (2016) who identifies the need for research focusing on developing a firm foundation of what play-based learning in technology encompasses rather than research that focuses on specific technological resources.

Lack of technological resources impacted upon integration of technology for educators in this study. However, the availability of resources did lead to curriculum inclusion. Educators also needed to perceive the technological tools as important, relevant or valuable, as well as feel confident in introducing them to children. Lack of Internet access was an ongoing issue for educators at S3 who strongly believed in the value of visual media to support learning, whereas educators at S1 and S2 had Internet access but rarely used it. Findings from this study elaborate on research suggesting that lack of access to resources hinders technology integration in early learning services (Nikolopoulou & Gialamas, 2015a; Simon, Nemeth & McManis, 2013). Access to resources is one of a number of complex and interrelated factors that impact upon technology integration in early learning services. Educator decisions to integrate technology across all three services showed connection with their own levels of familiarity and confidence. Educators at S3 extended this to include resources that they knew children specifically had experience with. In this way educators acknowledged the relevance of tablets as an established cultural tool for the children, building on their current knowledge (Rogoff, 1990).

The beliefs and decisions of management consistently impacted on integration of technology. This was in terms of supporting educator interest in integrating technology as well as in the provision of resources. Educators at S3 acknowledged that they could justify the need to purchase technological resources to management for their service. However, the service director expressed a hope that involvement in the study would provide further evidence for the service owners in terms of increasing their access to technological resources. This hierarchy of decision making is acknowledged as a common structural feature in early learning services (Waniganayake, et al., 2012). Findings from this study suggest that there are benefits in supporting early learning educators and directors to effectively share their professional knowledge in a way that can impact decision making at a management level. Additionally, Zevenbergen and Logan (2008) argue that traditional early learning resources are often more valued to a greater degree than digital ones. This discrepancy further delineates that educator advocacy for technological resources could include demonstrating that they are socially and culturally relevant to their curriculum. However, educator access to resources highlights how personal, interpersonal and community planes overlap in influencing technology integration in early learning services.

Educators may not advocate for resources if they are not confident or competent with technology, or they may advocate for resources but not find support from fellow educators or management due to differing beliefs. Nikolopoulou and Gialamas (2015a) suggest that educators need to have a certain level of knowledge and confidence with technological resources so that they can guide the understandings of others. However, this study further develops their argument by identifying a disconnect experienced by educators where access to technological resource and professional learning resources are often controlled by management. However to affect change, educators need to be able to influence the resources that are available to them. This disconnect creates a situation where educators may need to shift the perspectives of those in management but do not have the resources and/ or the confidence to do so.

Critical reflection and discussions, such as those undertaken in the practitioner inquiry meetings and focus groups, were effective in providing a forum to challenge assumptions and beliefs, and to help create broader understandings of technology in early learning curriculums. Knight and Hunter (2013) note that providing opportunities for discussion, and empowering educators with further knowledge and confidence to advocate can also help. In this way, involvement in the practitioner inquiry projects as a form of professional learning strategy highlighted the diverse factors impacting on the integration of technology, and also provided the opportunity to increase educator knowledge and agency. The following chapter discusses the results and discussion of the practitioner inquiry projects.

4.4 Summary

This chapter presented data collected across both phases of the study, relating to educator beliefs around technology and its integration in the curriculum. Findings from this research highlighted that educator beliefs regarding technology impacted on technology integration within their curriculum. However, educator beliefs were complex and interwoven with a number of other factors that served as facilitators or barriers to technology integration. A significant key factor in integrating technology was educator confidence and self-efficacy, but this alone was not enough to support integration. Conceptualisations of what constitutes technology as well as pedagogical beliefs about education had a significant impact on curriculum decision making.

Other factors that impacted on technology integration were the availability of resources, lack of time to gain familiarity with resources or to research the most suitable resources, support from management, educator preconceptions about technology and pedagogy, and access to professional learning. The study presented a paradox between educator beliefs and action which included contradictions between espoused beliefs and what occurred in practice, as well as situations where educators claimed they had not included technology, though examples were evident. The following chapter discusses findings from the practitioner inquiry as a professional learning strategy and identifies factors serving as facilitators or barriers to technology integration within the practitioner inquiry projects.

Chapter 5 –

Presentation of Findings and Discussion Part 2

The words people use belong partially to others. (Rogoff, 1995, p. 66)

The previous chapter presented findings from Phases 1 and 2 on educator beliefs and practice in relation to technology in play-based pedagogy. A number of interrelated and interdependent factors were identified which delineated the complexities experienced by the educators when considering technology integration with their curriculums. This chapter presents findings from the Phase 2 practitioner inquiry projects to address research question three:

3. What supports and inhibits practitioner inquiry as a strategy to integrate technology in early childhood services?

This chapter first outlines a summary of the practitioner inquiry projects. It then discusses findings in terms of key themes that emerged as supports or inhibitors to the integration of technology within each service's practitioner inquiry project. Influential factors included educator characteristics, staff team cohesion, professional learning resources and support of management. The interrelated nature of these factors was identified, which in turn highlighted the need for professional learning strategies that were flexible and responsive enough to adapt to the unique attributes of the educators and service.

5.1 Summary of the Practitioner Inquiry Projects

Findings in Chapter 4 (4.1.1) identified the diversity in terms of definitions, conceptualisations and beliefs about technology by educators across all three services (P1, S1, S2, S3, Int.). As such, a professional learning strategy needed to be adaptable and responsive to individual and contextual differences. Findings from this research indicated that the flexibility afforded by engagement in practitioner inquiry projects enabled the professional learning content and resources to be adaptable to the specific information and guidance required by each educator. Table 3.7 provides a summary of the practitioner inquiry process for each service and provides a context for the findings reported in this chapter.

Educators at each of the three services engaged differently with the practitioner inquiry process. A number of factors were identified as influencing engagement including educator interest in and experience with technology, range of physical resources available for educators and children and also other resources for educators such as available time, and support from other educators and management. Part of the professional learning process was to increase understanding of how technology could feature in a play-based early learning curriculum. As discussed in Chapter 4 there was a recognised disconnect between educator's self-efficacy with technology and integration in their play-based curriculum (as noted in 4.3.1), as well as diverse and sometimes limited conceptualisations of technology (4.1.1). This disconnect created a paradox where espoused beliefs contradicted practices, or where curriculum inclusions exceeded educators' stated intention of technological content.

As such Phase 2 provided an opportunity for educators to access new information as part of the professional learning process. The researcher provided a context specific professional resource folder for educators at each service which included research articles relating to integrating technology in early learning curriculums as well as research articles relating to their specific practitioner inquiry topic and other relevant resources such as a guide on using Edublogs. This was supported by the design-based approach, which focuses on sharing knowledge, co-designing and co-building to support learning and theory-building (Majgaard et al., 2011).

Data gathered in Phase 1 as well as the engagement in the project in Phase 2 strongly influenced the focus of the practitioner inquiry projects, including the professional learning materials made available to educators. This strategy reflects a design-based approach where the process of reflection can support understandings pf usability and suitability of technology (Majgaard et al., 2011). The selection and provision of professional learning resources included a process where the research drew on data, researched possibilities and developed ideas for resources and supports. These ideas were then discussed with educators and adapted to ensure resources and supports were contextually relevant. Table 5.1 outlines the progression of ideas between the two study phases.

Table 5.1

Technology Integration across Phase 1 and 2

Resource	**Observed experience with resource in Phase 1 (P1, Obs)**	**Introduction of technological resources in Phase 2 (P2, PIP Obs; P2, PIP Meet; P2, Art.)**	**Effectiveness of technology integration in Phase 2 (P2, PIP Obs; P2, PIP Meet; P2, Art.)**
S1			
iPads	Educator noted that there were iPads in the parent library. No other use of iPads with the children.	iPad placed on a table in the room with no introduction.	Difficult for children to access the device and use in a sustained and meaningful ways.
Computers – child led	Used consistently throughout Phase 1 – word processing and art program.	Children encouraged to explore ideas on space through drawing at the computer or at the art table.	Educators reported examples of children further investigating and representing their ideas about space in drawings on the computer.
Computers – educator guided	Used consistently throughout Phase 1 – Internet searches with educator	Children encouraged to explore their ideas on nebulae and space concepts using the Symbaloo Webmix.	Educators assisted children to use this resource and they also accessed it with their peers. Children developed ideas on space related themes (as evident in their drawings on the computer and on paper). Educators discussed other technology related information such as how to skip past advertising materials on webpages.
Resource	**Observed experience with resource in Phase 1 (P1, Obs)**	**Introduction of technological resources in Phase 2 (P2, PIP Obs; P2, PIP Meet; P2, Art.)**	**Effectiveness of technology integration in Phase 2 (P2, PIP Obs; P2, PIP Meet; P2, Art.)**
S2			
iPad/ smart phone	Educators reported that some children used their parent's smart phone. No experience with touch screens at the service.	Not included	Not applicable
Computers –	Children observed the	Children shown laptop in	Computer and storytelling

adult led	educators using the computer to show them information in whole group experiences. Children familiar with using non-functioning keyboards in dramatic play.	a small group (3 children). Neither educator nor children were able to use the resource. Photographs were not available to be uploaded into the storytelling program.	program not used in the practitioner inquiry project.
Voice recorder	Educators noted that children were familiar with smart phones and with being photographed/ videoed (smart phones and cameras).	Voice recorder used on a whole group experience where each child was asked to add a line to the story.	Educators reported that children were not willing to talk into the device. Smart phone voice recording or video not used due to service policy.
Resource	**Observed experience with resource in Phase 1 (P1, Obs)**	**Introduction of technological resources in Phase 2 (P2, PIP Obs; P2, PIP Meet; P2, Art.)**	**Effectiveness of technology integration in Phase 2 (P2, PIP Obs; P2, PIP Meet; P2, Art.)**
S3			
iPad	Children had observed Android tablet daily in Phase 1. Educators noted that children's use of touch screen technology at home.	Educators provided time for children to familiarise themselves with the iPad and application. Educators spent four sessions guiding and supporting children as they learnt to use the application.	Children independently used the iPad application to document their transition to school experience.

Table 5.1 provides an overview of connections between technology observed in use in Phase 1 and how this aligned with technology introduction and integration in the practitioner inquiry projects in Phase 2. As a design-based study, findings from Phase 1 informed Phase 2. Phase 1 findings provided important understandings of educators' beliefs, practices and conceptualisations of technology.

A number of interrelated factors were identified as impacting upon the integration of technology in Phase 1 (See Figure 4.2). Findings across all three services showed that there were complex, interwoven and interconnected factors that influenced how each educator responded to the professional learning content, technology integration and changes to pedagogical practices. While one factor may have been paramount, the other factors were still influential in the background. For instance, when focusing on educator beliefs in integrating technology this factor could not be viewed discretely. The influence of each educator's previous engagement with professional learning or the support they received from management impacted upon shaping beliefs, conceptualisations and knowledge of technology in early learning curriculums. Figures 3.3 and 3.4 are examples of foregrounding through use of Rogoff's (1995) planes of analysis. Similarly, the effectiveness of educator engagement with professional learning opportunities could not be viewed separately from whether the content aligned with their preconceived beliefs, or if management supported the implementation of new ideas gained through professional learning. These factors included sub-elements which were also identified as supports and inhibitors to practitioner inquiry as a strategy to integrate technology in early learning services. Table 5.2 provides details of the main factor and sub-elements.

Table 5. 2

Factors that Impacted Upon Technology Integration

Factor that impacted upon technology integration	**Influential sub-elements of the main factor**
Educator personal characteristics	• Beliefs regarding technology • Beliefs regarding pedagogy
Technological resources available	• Access to resources • Familiarity with resources • Proclivity to include resources
Non-technological resources available	• Professional readings • Workshops • Staffing/ team cohesion • Researcher as facilitator • Critical reflection
Management beliefs relating to technology	• Support at a policy level • Support at a practice level

Developing an awareness and understanding of the factors that impacted upon technology integration for each educator was important in being able to provide professional learning materials and guidance that aligned with their specific knowledge and beliefs. Nikolopoulou and Gialamas (2015b) identified barriers to integration of technology for early learning educators including lack of support; lack of confidence; lack of equipment; and class conditions. Findings from the current study extended on Nikolopoulou and Gialamas' work by identifying the additional factors of educator beliefs and knowledge of technology, the context of service, and professional learning resources as well as providing more detailed insights into the relationships between each of these factors.

5.2 Educators Beliefs and Knowledge of Technology

Findings from the practitioner inquiry projects highlighted a number of personal educator characteristics that impacted on the integration of technology (P2, S1, S2, S3, PIP Obs PIP Meet.) (see Table 5.2). This included educators' beliefs and conceptualisations of technology and their knowledge of technological resources. The following sections include discussion of these factors in relation to practitioner inquiry as a professional learning strategy.

5.2.1 Educators' beliefs and conceptualisations of technology

As discussed in Chapter 4, educator definitions and understandings of technology were diverse and varied across all three services (4.1.1). Through involvement in the practitioner inquiry project the researcher encouraged educators to consider broader conceptualisations of technology, including its value as an integrated tool or resource within a play-based curriculum. The design-based research approach supported facilitation of practitioner inquiry projects effectively as it enabled an overlap of design and learning, as outlined by Majgaard et al. (2011). This included sharing of knowledge between educators and the researcher, individual and joint reflection, and collaborative problem solving. This encouragement was of relevance to educators at S1 and S2, who faced a number of interrelated challenges in identifying a practitioner inquiry topic and question. Educators at S1 and S2 initially viewed technological resources as the main focus of their practitioner inquiry project, rather than as an integrated resource to support children's interests and explorations on a topic of interest (P2, S1P1 S1P5, PIP Meet; P2, S2P1 S2P3, PIP Meet). Educators at S2 and S3 chose technology as a tool to support already established areas of interest, being storytelling and transition to school respectively. However, despite S2 educators discussing technology as an integrated resource in their practitioner inquiry action plan, their intentional teaching plans predominantly drew on non-digital resources. This disconnect resulted in a deviation from the practitioner inquiry focus on integrating technology to exploring the story telling focus with non-technological based resources. The disinclination to include technology appeared to emerge from the educators' lack of confidence and enthusiasm with technology as a pedagogical resource (P2, S2P1, PIP Obs; P2, S2P1 S2P3, PIP Meet). Conversely, educators at S3 had consistently demonstrated an understanding of technology as a tool within their curriculum throughout Phase 1 (P1, S3, Obs Int.) and therefore, continued to integrate technology throughout course of Phase 2. It became evident that other factors influenced educators' confidence and enthusiasm for integrating technology within the curriculum, and these factors needed identification and exploration.

Observations in Phase 2 continued to demonstrate that both S3 educators and children were familiar and confident with a range of technological resources (P2, S3P1 S3P2, PIP Obs Art). In this way their beliefs transferred into practice and supported the smoother implementation of their practitioner inquiry action plans. Beliefs and conceptualisations regarding technology were noted as influential in progress throughout the practitioner inquiry projects (P2, S1, PIP Obs PIP Meet.; P2, S2, PIP Obs PIP Meet.; P2, S3, PIP Obs PIP Meet). Engagement in the practitioner inquiry process allowed the researcher to identify educators' conceptualisations and definitions of technology in each service and help to extend on them.

5.2.2 Educators knowledge of technological resources

Findings from Chapter 4 indicated that each educator's knowledge of technological tools, resources and peripherals also impacted upon how technology was integrated into the curriculum (demonstrated in Figure 4.2) (P1, S1 S2 S3 Obs). These findings continued to emerge throughout Phase 2, and were a key consideration in the practitioner inquiry process. Educators at S1 and S2 expressed a lack of confidence and awareness in integrating technology (P2, S1P1 S1P5, PIP Meet.; P2 S2P1 S2P3, PIP. Meet.; P2, S1, PIP Obs; P2, S2, PIP Obs) (see Table 4.3) and required more scaffolding opportunities to build on their basic understanding of different forms of technology available to them and how these could be beneficial (as per Parette et al., 2013 - See Table 3.9). Alternatively, the educators at S3 already had a degree of proficiency (P1, S3P1 S3P2, Obs Int.) and were honing these skills and working on ways to integrate experiences effectively into the curriculum. This resulted in educators at S3 having a clearer research focus and more detailed action plan at the commencement of the practitioner inquiry project than educators at the other two services.

The case studies in Phase 2 exemplified how practitioner inquiry can support educators in integrating technology in socially and culturally relevant ways. Involvement in practitioner inquiry enabled differentiation of professional learning content to create a starting point that was appropriate for each educator. Additionally, the discussion in Section 4.3 of Chapter 4 posits that lack of access to a laptop, and a personal preference for touch screen tablets influenced S3 educators to opt to explore iPad use with children throughout their practitioner inquiry project (P1, S3P1 S3P2, Obs). Both educators expressed familiarity with iPhones and felt the range of applications available and ease of use were preferable with Apple devices as opposed to the Android tablet they had used previously (P2, S3P1 S3P2, PIP Meet.). Professional learning resources provided for S3 included guidance, support and suggestions on applications that would help them to achieved their practitioner inquiry focus of creating digital story books with children, with the aim of being able to export these digital files for children and families to be able to revisit at home.

Alternatively, S1 and S2 highlighted that professional learning content experienced through practitioner inquiry supported educators to develop foundational understandings of how technology could be integrated into a play-based curriculum (P2, S1 S2, PIP Meet PIP Obs). Examples of this in practice included shifts in thinking where educators began to conceptualise technology as a resource to support intentional teaching aims rather than as the main focus of the planned experience. As an example, an interactive workshop on space was conducted with educators and children at S1 with the researcher also taking part as an observer. After this workshop, the children further explored ideas about nebula through drawing. The S1 educators noted that they used images and information from the Internet with children to revisit ideas about nebulae, seek inspiration and to also increase their own scientific knowledge of components of nebulae. S1P1 commented:

> […] our children are pushing our knowledge beyond [what we know]. We need to have the knowledge and resources ready […] we don’t want to give them the wrong answer. (S1P1, P2, PIP Meet).

The integration of technology that continued to emerge throughout the practitioner inquiry project at S1 demonstrated an awareness of technology as a complementary resource. This shows a diversification in conceptualising technology as their ideas for a technological focus at the beginning of the practitioner inquiry project were primarily on investigating a technological source, such as powering rockets (S1P1 S1P3, P2, PIP Meet.).

Similarly, practices observed at S2 during Phase 2 indicated that educators conceptualised technology as the primary focus of an experience—such as using laptops or camera—rather than an integrated, complementary resource (S2, P2, PIP Obs). However, shifts in thinking became apparent in discussion towards the end of their practitioner inquiry project:

> […] I feel with the technology in the room, the pretend technology, like the phone, that kind of thing [...] the pretend play [...] They actually role play scenarios that they see at home using the babies, using the computers, using the telephones and things like that too. (S2P1, P2, PIP Meet.)

The educator had begun to acknowledge and recognise technology within the curriculum beyond physical digital devices to also include its prevalence in imaginary play scenarios.

<u>Discussion of educator beliefs and knowledge</u>

Educator characteristics such as confidence and competence with technology, and their conceptualisations of the appropriateness of technology within play-based pedagogies influenced their beliefs and practices. Generally, these educator characteristics resulted in a reluctance to integrate technology for educators at S1 and S2, and a proclivity to integrate technology for educators at S3. In this way, educator knowledge and beliefs served as a facilitator or barrier to the integration of technology. However, they were not a barrier to the practitioner inquiry process; involvement in practitioner inquiry enabled the researcher, as a professional learning facilitator, to acknowledge the pre-existing characteristics of individual educators and extend thinking in a contextually relevant way. Gibbons (2010) argues this is a valuable strategy when supporting educators to challenge beliefs and understandings relating to the integration of technology in early learning. Engagement in the practitioner inquiry process provided opportunities for the development and provision of professional learning that was responsive to individual knowledge, interests and contexts of the educators. Examples from the three services included: S1 in terms of realising that educators needed to understand their chosen topic of space before they could conceptualise technology as a resource; S2 in terms of challenging beliefs about the appropriateness of technology in the curriculum; and at S3 in relation to testing and suggesting iPad applications that would meet their practitioner inquiry aim of developing and exporting digital story books (See Section 5.2.2). Groundwater-Smith and Mockler (2006) present that the provision of professional learning content that is responsive to the particular interest and abilities of participants as well as their specific contexts underpins practitioner inquiry, but is more difficult to achieve with other forms of professional learning.

The opportunity to challenge beliefs and conceptualisations provided through the practitioner inquiry process was valuable as it enabled the focus of professional learning to move beyond considerations of physical technological resources and how to use them. This opportunity enabled a focus on the importance of broader conceptualisations of technology, resources and approaches to technology as well as its relevance within play-based pedagogy. The S1 case study exemplified the capability of practitioner inquiry to accommodate broader professional learning content. The practitioner inquiry focus for educators at S1 required them to develop new understandings of the Solar System and space (see Table 3.7). Siegal, Nobes and Panagiotaki (2011) posit that many adults do not have a strong or accurate understanding of the Solar System. Therefore, to support S1 educators in investigating their practitioner inquiry question, professional learning content needed to extend beyond technology and play-based curriculums to include resources specifically related to the overarching topic of space and the Solar System. Consideration then moved to how the integration of technology could add to children's interests and investigations. During this process connections and collaborations between the educator and researcher created stronger foundations from which to build professional learning strategies due to the shared expertise and knowledge in terms of context and content. An example of this was involvement in the space workshop by both educators and the researcher that was organised as part of the practitioner inquiry process. This provided a shared foundational knowledge the space concepts that were to be explored, which made it easier for the researcher and educators to identify suitable professional learning strategies to support integration of technology within their practitioner inquiry project. Involvement in practitioner inquiry was valuable in supporting exchanges of information between academics (including the researcher and the facilitator of the professional learning workshop) and educators – an approach acknowledged as valuable professional learning strategy (Rönnerman, 2015).

Involvement in practitioner inquiry was effective in challenging and extending educator beliefs and conceptualisations of technology for educators at S2 and enabled a different professional learning focus. The professional learning content[13] for educators at S2 focused strongly on developing an awareness of the value and relevance of technology within a play-based curriculum. Involvement in the practitioner inquiry process encouraged and supported educators and the service manager to reflect critically on their beliefs and conceptualisations of technology and encouraged consideration of new perspectives on the social and cultural relevance of technology within their curriculum. Involvement in practitioner inquiry did not always increase the technology integration, but this was not the aim of the study. Rather, the focus was on looking at supports and inhibitors to the

[13] Professional learning content included: professional readings that focused on the ubiquity of technology; extending technology use beyond computers; the value of child-led experiences with technology; and critical reflections on these topics during meetings and focus groups with the researcher as listener and critical friend.

integration of technology. Educator beliefs and conceptualisations of technology were factors that served as a facilitator or barrier to the integration of technology. This shifting of beliefs is supported in findings by Edwards (2015) who argues the need for a focus on supporting educators to understand the position of technology within play-based pedagogies. Supporting educators to develop broader conceptual understandings of technology provided a foundational understanding, as discussed in Section 2.5.3. This study was able to implement Edwards' (2015) suggestions and found that explicit mediation helped to increase foundational awareness of how technology was relevant in early learning curriculums. For educators at S2, involvement in the practitioner inquiry project supported educators to critically reflect on their positioning in terms of being 'for' or 'against' technology integration and to understand what their thinking was based on. This involved a broadening of conceptualisation where technology was not seen as a specific standalone resource such as a laptop or computer, but rather as an integrated resource to support play – such as in the example of educators identifying non-functioning technological resources or toys as another form of technology integration in the curriculum. In this way educators began to demonstrate an awareness of technological resources that aligned with their pedagogical beliefs in terms of play, which shifted their stance in terms supporting technology in the curriculum.

An additional example of strategies available through practitioner inquiry to facilitate learning was the flexibility and adaptability of resources. For all three services the researcher identified technological and professional learning resources that were socially and culturally relevant for both educators and children at the service. Technology observed in use within the curriculum in Phase 1 was used to inform guidance and technology integration in Phase 2 (as demonstrated in Table 5.1). Understandings of technology use across both phases also informed the professional learning resources and supports that were made available to educators (as outlines in Table 3.7). This is demonstrated in Table 5.1, which identifies technology inclusions across Phases 1 and 2 and is also reinforced in Table 3.7. Provision of socially and culturally relevant professional learning resources was an important consideration as learning occurs through observations and interactions with cultural tools within each context (Rogoff, 1995) and is a characteristic of practitioner inquiry (Woodrow & Newman, 2015). The researcher, as the facilitator in practitioner inquiry, utilised participatory appropriation (Rogoff, 1995) by drawing on knowledge of the educators' experiences, preferences and knowledge (as discussed in meetings or observed during the observation sessions) and used this knowledge to suggest suitable resources and extend educators' knowledge, familiarity and understanding of the value of integrating relevant technological tools (see Table 5.2). This is an important consideration as the effectiveness of introducing and explaining new technology to children directly relates to the overall effectiveness of the resource in the curriculum (Blagojevic & Thomes, 2008; Plowman & Stephen, 2005). Correspondingly, the effectiveness of resources was a key factor in the progression of the practitioner inquiry projects. Findings from this research align with and extend on Plowman and Stephen's (2005) research by highlighting the need for educators to understand and have some familiarity with resources before introducing them into the curriculum. Educator personal experience often influenced this familiarity as well as what was available in terms of resources and support within their service.

5.3 Context of Service

A number of factors within the service were identified as facilitating or hindering practitioner inquiry as a professional learning strategy to support the integration of technology. These factors aligned with two overarching themes of support of management and staff team cohesion.

5.3.1 Support of management.

The support of the service director or the service manager was of pivotal importance in facilitating the practitioner inquiry process. Management beliefs about appropriate professional learning opportunities and providing time for staff to engage in these opportunities were key factors that impacted on the practitioner inquiry process. These factors were complex, and interrelated with other factors identified in Table 5.2.

Available time presented as a consistent challenge throughout the practitioner inquiry process at all three services. Most notably, time restrictions were a significant challenge with educators at S1 and S2 and to a lesser extent with educators at S3. Staffing requirements made it especially difficult for S1 and S2 educators to have time away from their teaching duties to attend professional learning meetings, or to completely engage with the meeting agenda when in attendance (P2, S1 S2 PIP Meet.). This was exemplified in a comment by S1P5:

> I feel like I should have known more, I should have researched it at home, but with working five days and doing a Diploma and the commute to work, when I get home, I need time, you know to exercise. (P2, S1P5, PIP Meet.)

Often practitioner inquiry meetings took place in the classroom with educators maintaining a level of responsibility in supervising children and other team members (P2, S1, PIP Meet.). Noise levels were high, compromising educator engagement in the meetings. As such, it was difficult to determine whether educators had a lot to do and felt that they needed to get back to working with the children, or whether they were disengaged with the project.

Educators at S1 and S2 also commented that they often lost their allocated release time for planning and assessment due to staff absences and other operational issues within the service (P2, S1P1 PIP Meet; P2 S2P1, PIP Meet). Lack of time meant that they found it challenging to maintain the required documentation for their usual roles, and had minimal opportunities to engage with the practitioner inquiry information and reflections. An educator at S1 commented that to be successful they needed a set time each day or week reserved solely for engagement with the project (P2, S1P5, FG). Conversely, S3 educators had designated time away from face-to-face teaching which enabled them to engage in meetings.

The S1 director and S2 manager were absent from the initial practitioner inquiry workshop and this may have had some impact upon the support and consistency experienced by educators throughout Phase 2 for these two services. The S1 director expressed an awareness of the value of practitioner inquiry as a form of professional learning, and in recognising educators as researchers; however, she also noted that providing them with additional time was not possible (P2, S1SD, PIP Meet.). A similar situation was evident at S2 where educators did not have enough time to engage with the project, and the manager expressed a preference for online learning for the service staff rather than workshops or practitioner inquiry (P2, S2SM, PIP Meet.). The S3 director was present at the practitioner inquiry workshop and expressed interest in the project throughout Phase 2 (P2, S3SD, PIP Meet).

Service policy relating to integration of technology served as both a support and inhibitor during the practitioner inquiry projects. Service policies and procedures at S2 stated that certain types of technology were not to be used (P2, S2SM, PIP Meet; P1, S2P1, Int.; P2, S2P1, PIP Meet, FG) and this impacted upon potential curriculum inclusions. S2P1 noted an incident where service policy was a barrier to them following the online blog of one of the children’s relatives as they travelled:

> [Child’s name] grandparents were going around Australia but we weren't allowed to access their […] blog […] They were going around Australia and they thought it might be neat […] to look and see where they were […] I actually didn't know about

> it until later on and then someone's like, we're not allowed to do this and I was like [shows look of exasperation]. (P2, S2P1, PIP Meet).

S2P3 also demonstrated enthusiasm for the potential that this online resource could have provided within the curriculum.

> [The children would have the opportunity to] see how [the grandparents] were going like the path that they were taking, what they were doing at each pin point. I thought that would have been a cool idea just to see where they were and then talk it in the curriculum. (P2, S2P3, PIP Meet.)

The service manager at S2 explained that due to extensive issues with staff misuse of social media platforms such as Facebook the service director developed and implemented a policy on media use at the service. They noted that they needed to be mindful of using online technologies because of parents' beliefs and views:

> Then what would parents think? You've got some parents that are really anti [some forms of technology] this and really for [some forms of technology]. (P2, S2SM, PIP Meet.)

This created a situation where educators felt restricted in the types of technologies and resources they could include for children due to policy decisions made at management level. During this discussion the S2 manager (S2SM) listened to the educators' perspectives and expressed an openness to reviewing this policy. S2SM noted that the social media ban and subsequent policy had perhaps been an impulsive reaction by the service director and should be reconsidered in terms of defining social media (P2, S2SM, PIP Meet). Alternatively, service policies at S3 encouraged technology use within the curriculum as well to facilitate communication with families. Provision of support was reflective of management beliefs in terms of the value of technology in early learning pedagogies and extended to the provision of technological resources to enable educators to meet these service aims.

5.3.2 Staff team cohesion.

Findings from this study indicated that where staff teams were consistent and cohesive, practitioner inquiry was more effective in supporting the integration of technology. This finding was dependent on a number of variations observed between the three services. Educators at both S1 and S2 experienced significant staffing changes (Table 3.7), which contributed to delays in developing a clear focus and subsequent question for their practitioner inquiry project. A key point of influence was that both educators who left the study (S1P2 and S2P2) were the main supporters and providers of technology integration at their services during Phase 1 (P1, S1, Obs; P1 S2, Obs). This meant that their teaching beliefs and practices influenced the experiences that children and staff had with technology at the service. Additionally, the beliefs and practices of S1P2 and S2P2 had featured strongly in the curriculum, and therefore in Phase 1 data collection and analysis. In many of the instances where technology featured in the curriculum the other educators had been scaffolded by S1P2 and S2P2 through guided participation (as noted in P2, S1P1, PIP Meet, PIP Obs; P2, S2P2, PIP Meet. PIP Obs; P2, S2, PIP Obs PIP Meet. Art. ; P2 S1 PIP Obs PIP Meet. Art.).

Data collected from S3 reinforced the value of consistency in staffing in supporting the practitioner inquiry process. A steadiness was evident between the educators at S3, not only in that their staffing did not change (See Table 3.7), but also in their shared beliefs in terms of integrating technology and their collaborative approach to teaching and learning. This cohesion was evident across both phases of the study and included both educators at S3 as well as the service director (P1, S3P1 S3P2, Int.; P2, S3P1 S3P2 S3SD, PIP Meet PIP Obs FG).

Discussion of context of service findings

Findings from this study suggested that educators required dedicated professional learning time to gain familiarity with technology. Allocation of time was particularly important with technology where many concepts were new. Educators needed opportunities to engage with new technologically related ideas and resources, to test them in practice and reflect on their effectiveness with colleagues. Additionally, time allocated to engage with the professional learning readings, resources and meetings was a facilitator to integration of technology through the practitioner inquiry process. These processes align with Parette et al. (2013) (Table 3.9) who state that effective integration of technology into the curriculum requires educators to develop a level of understanding and competence before technology can be effectively integrated into the curriculum. Such an approach extends beyond integration of technology to reflect a basic underpinning element in effective professional learning strategies. Carter and Fewster (2013) identify the provision of opportunity to engage with new content as of key importance in successful and effective professional learning. Opportunities for collaborative, ongoing, interactive professional learning are also factors strongly reflected within practitioner inquiry (Groundwater-Smith et al., 2013).

Within this study support from management was a key facilitator or barrier in supporting technology integration within this professional learning strategy. Findings from this research indicated there was a lack of understanding of the practitioner inquiry process, or of the value of this form of professional learning at both an educator and management level, which impacted upon its effectiveness. The role of the service director is of pivotal importance in supporting professional learning (Fleet & Paterson, 2009; Waniganyake et al.,2012). Where the educational leader supports and understands professional leaning, and promotes dialogue to create shared understandings, the greater the professional learning outcomes.

Service policies were also a facilitator and barrier to the integration of technology. Policies in early learning services are based on legislative requirements as well as recommendations in current research or advice from recognised authorities (Gibbs, 2008). Policy content details strategies and guidelines to inform educator practice within the service. Educators were aware of whether service policies supported the integration of technology or not, with policy clearly identified as a barrier for educators at S2. However, involvement in the practitioner inquiry process helped to mitigate these barriers by facilitating discussions where educators could consider and critique the reasoning behind policy documents and question whether they aligned with educator's beliefs and professional philosophies. An example of this was the discussion between S2 educators and the S2 Manager when discussing the service policy relating to social media during a group meeting with the researcher. Through this forum, the manager was able to explain to the educators why such a strict policy was in place and the educators were able to provide the manager with their perspectives on how it limited children's experiences within the curriculum. This resulted in shared understandings with potential for renegotiation and adjustment of the policy. This discussion provided a degree of knowledge and agency that had the potential to support advocacy for new technology inclusions in the curriculum, as well as at policy level (Gibbs, 2008).

Staffing changes at S1 and S2 presented challenges to the commencement of the practitioner inquiry process. However, involvement in practitioner inquiry mitigated the impact of staffing changes as a barrier to the professional learning process. As noted, staffing changes at S1 and S2 meant a loss of educators who led technology in Phase 1. Additionally, new educators at S1 and S2 had less opportunity for participatory appropriation (Rogoff,

1995) and thus, a shift in educator interests, abilities and available peer guidance occurred when the previous educators left the study. Knowledge and insights of educator beliefs and practices in relation to technology in play-based pedagogies supported commencement of the practitioner inquiry projects. However, the nature of practitioner inquiry allowed for the focus and content to be based on, and adapted to each educator/service as it evolved. Staffing changes are a common occurrence in early childhood settings in Australia (Buchanan, Prescott, Schuck, Aubusson, Burke & Louviere, 2013; Hadley et al., 2015), therefore professional learning approaches are needed that can accommodate and complement such changes.

Team cohesion was a facilitator to practitioner inquiry as a strategy to support integration of technology in early learning curriculums within this study. Findings from S3 data indicated that team cohesion extended beyond teaching teams to include service directors and management. At S3 a distributed leadership approach was evident where a collegial, mutually respectful relationship between the service director and the educators had been created. Trust and cohesion, as evident within the S3 team, are of pivotal importance in supporting change and development of ideas (Stampoulos, 2012) (as discussed in <u>2.6.2</u>). The degree to which service directors and managers understood the practitioner inquiry process and their level of belief in the value of technology as pedagogically appropriate were commensurate with the level of support they provided to educators.

An advantage of practitioner inquiry is that it supports change within the service context (Groundwater-Smith et al., 2013) which meant that management could observe the effectiveness of new technological resources in practice. This is an important inclusion as change is more effective when participants see it work effectively in practice, as acknowledged in the Introduction (<u>Section 1.5</u>) (Guskey, 2002). Findings from the practitioner inquiry projects within this study delineate the importance of team cohesion in supporting integration of technology in the curriculum. This elaborates on research findings from Nikolopoulou and Gialamas' (2015a, 2015b) by demonstrating that factors influencing technology integration are diverse and inter-related, and that engagement in practitioner inquiry can help to mitigates these factors.

5.4 Professional Learning Resources

Findings from this study indicated that professional learning resources for integrating technology needed to focus on both technology and non-technology related content. Educators were supported to increase their knowledge of technology integration through the provision of professional learning resources and content which were specific, flexible and adaptable throughout the practitioner inquiry process. Additionally, engaging in professional learning experiences, such as critical reflection with peers and the researcher, are key components of practitioner inquiry (Groundwater-Smith et al., 2014; Fleet et al., 2016). Discussed next are the strategies that supported the integration of technology within this study, including contextually relevant resources, critical reflection, and the process of practitioner inquiry as facilitating inquiry.

5.4.1 Contextually relevant resources.

Educators at each service received a diverse range of professional learning resources, with some commonalities (See Table 3.7). Resources included professional learning materials such as readings as well as technological tools and resources. Educators across all three services expressed a lack of time to engage with the professional resources provided, however educators from S1 and S2 found this the most challenging.

Professional readings

Factors such as educator interest in, and availability to engage with the material in the professional resource folder influenced the development of the practitioner inquiry focus and question. Including accessible readings as a professional learning resource fostered an understanding of the value of technological tools and resources to support learning, rather than being the primary focus of the experience. During the practitioner inquiry process the researcher identified that educators at S1 and S2 were not engaging with the professional reading provided in the resource folder. All four educators at these two services specifically stated they did not have the time to do the readings (P2, S1P1 S1P5, PIP Meet.; P2, S2P1 S2P3, PIP Meet.). During further discussion educators at S1 and S2 revealed that the research articles were inaccessible to them due to structure and language, and also that such a format was unfamiliar and overwhelming (P2, S1, PIP Meet; P2, S2, PIP Meet). The researcher provided summaries for each of the three services which included synthesised and simplified information from each of the relevant research articles tailored to align with their identified interests and action plans.

S3P1 was the only educator who consistently engaged with all research literature and readings and explored resources for the project, though they completed much of this work at home rather than as paid work hours (P2, S3P1, PIP Obs PIP Meet.). S1P1 engaged with some of the readings but noted they were difficult to follow and too time consuming (P2, S1P1, PIP Meet.). This issue relating to time aligned with comments from S1P5 noted in Section 5.3.1, who noted that a lack of time affected their ability to engage with the practitioner inquiry process. S1P5 expressed a sense of guilt, wondering if they should have read the professional articles at home during their own time. While findings from this research cannot be generalised, the educators who did engage with the readings (S1P1, S3P1) were the only two educators who held bachelor qualifications and were also room leaders

(Table 3.2). Available time was a consistent barrier to involvement with practitioner inquiry and in developing further knowledge of integrating technology within early learning curriculums.

Technological resources

Involvement in the practitioner inquiry projects supported the researcher and educators to identify technological resources that would be socially and culturally relevant for educators and children at the service. This was achieved through observation, discussion and joint critical reflection. Technological resources provided to each service corresponded with the experiences and preferences of children and educators observed throughout Phase 1 (P1, S2, Obs; P1, S3, Obs) (See Table 3.7, Table 5.1). However, findings demonstrated that provision of resources did not automatically result in educators choosing to integrate them (P2, S1, S2, S3, PIP Obs). Educators at S2 were reluctant to use any forms of technology, as discussed in Chapter 4 (4.3.1). This reluctance was due to a combination of their personal beliefs and confidence, the beliefs of the service managers and also time available to engage with new resources and professional learning materials (P1, S2, Obs Int.; P2, S2P1 S2P3 S2Sm, FG; PIP Meet PIP Obs).

Educators at S3 declined the use of the laptops and software, but continued to explore their interest in touch screen tablet devices. The S3 educators had consistently used a tablet with the children at the service, but felt an iPad was a more effective resource (P2, S3P1 S3P2, PIP Meet). The room leader noted:

> At this stage I am frustrated with the reliability of the Android tablet and the time wasted trying to work with it only to then have to abandon it and use the computer (P2, S3P1, PIP Journ).

While the iPad was reported as a valuable tool (P2, S3P1 S3P2, PIP Meet) a number of challenges arose with its use. Both the researcher and S3P1 investigated many different iPad applications collaboratively to try and find a suitable one for their purposes[14], however there were often issues with these, as outlined in Chapter 4 (4.3.2). Another example from S3 was in considering the use of Dropbox[15] as a resource. The room leader (S3P1) experienced difficulties with limited Internet access at the service, and slow access to photographs when accessing Dropbox from her home computer. This discovery had wider implications for the practitioner inquiry process as it became apparent that the majority of iPad applications required Internet access. The room leader from S3 noted "To maximise the use of the iPad with children it is clear that you need to have a Wi Fi connection" (P2, S3P1, PIP Meet.). This was a significant challenge for S3 educators in implementing their practitioner inquiry project.

Educators at each service required different forms of support and guidance. This variation related to their practitioner inquiry focus as well as their individual and interpersonal levels of knowledge and understanding of technology. As noted in the discussion section of 5.2, the S1 educators had a more complex focus as there was a lot of new information to acquire and this shaped much of the professional learning focus for S1. Additionally, involvement in the practitioner inquiry project allowed for contemplation on broader opportunities for exchanges of information between academics and educators. For instance, at S1 an expert on space education with young children provided a tailored workshop designed to suit the learning styles of the two educators in the room (P2, S1P1 S1P5, PIP Obs) based on their practitioner inquiry project (P1, S1, Obs; P2, S1, PIP Obs). This example from S1 highlights how a number of forms of professional learning were used

[14] These included apps such as: Explain Everything, Pic Collage, Little Bird Tales, Haiku Deck, Toontastic, My Story, Story Creator, Little Story Maker, Little Bird Tales, My Story, Story Buddy and other resources such as Edublogs.
[15] Dropbox is an online resource that allows sharing of files (https://www.dropbox.com/)

in a complementary way.

5.4.2 Critical reflection.

Findings from this research indicated that the critical reflection components of practitioner inquiry were beneficial to unpacking and expanding educator beliefs and conceptualisations of technology at all three services which enhanced its integration in the curriculum particularly for S1 and S3 (P2, S1 S2 S3, PIP Meet, FG). Findings from Phase 2 demonstrated that educators across all three services were more open to engaging in critical reflection within the group discussions. The preference for group discussion was evident when educator contributions to discussions were analysed in comparison to their contributions in their reflective journals (P2, S1 S2 S3, PIP Meet, FG, PIP Journ.). Table 5.3 includes a summary of the contributions each educator made to their reflective journals.

Table 5. 3

Educator Contribution to Reflective Journaling

Educator	**Type of contribution**
S1P1	Responded briefly to the three main reflective questions. Reflection recorded at the end of the project rather than throughout.
S1P3	Brief comments recorded at the end of the project.
S2P1	Responded briefly to the three main reflective questions. Reflection recorded at the end of the project rather than throughout.
S2P5	No response recorded.
S3P1	Responded to each of the main reflective questions weekly and addressed all additional reflective questions. Reflections recorded throughout the project.
S3P2	Brief responses recorded throughout the project.

To support the critical reflection process, educators were asked to see journaling as important and something they prioritised as part of their commitment to their professional learning. However, ensuring that this time was consistently available to educators was dependent on provisions from service management (P2, S2P1 S2P2, S1P2, PIP Meet.). As outlined in Table 5.3, the room leader from S3 (S3P1) was the only educator to consistently respond to the weekly reflection tasks and the three additional reflection questions included as part of the journaling process (as outlined in Table 3.10) (P2, S1 S2 S3, PIP Journ.). A lack of engagement is particularly evident for educators who were not in team leader roles (S1P5, S2P3). S3P2 was not in a team leader role but still recorded some reflections. S1P5 commented that there needed to be a set time each day, or as a second option a time each week to focus on reviewing, reflecting and planning the practitioner inquiry process (P2, S1P5, PIP FG). While the service director at S1 indicated that this was not possible daily and even difficult to provide for weekly reflection time, they did feel it was possible to incorporate it into the allocated time for programming on a weekly basis (P2, S1SD, PIP FG). This however would not benefit those educators not in a team leader role.

An additional suggestion from data in this study was that educator's personal characteristics may influence consistency in maintaining their reflective journaling (Table 5.2). As an example, S3P1 was not only consistent in journaling but was also the most confident of all educators in engaging in critical reflection verbally and via email communication with the researcher, and welcomed dialogue that challenged her thoughts, ideas and pedagogical approaches. Additional factors that served to facilitate S3P1's engagement in the journaling process was their confidence and familiarity with including technology in the curriculum in various and integrated ways (P1, S3P1, Obs; P2, S3P1, PIP Obs PIP Art.). Findings highlighted a number of other characteristics of this educator, including the proclivity to engage with professional resource materials and also to continue researching resources for the practitioner inquiry focus in unpaid, personal time. (P2, S3P1, PIP Meet PIP Obs).

Another consideration arose in terms of equity of contribution in reflection across all three services. Discussions during group meetings across both phases revealed disproportionate responses from the room leaders (P2, S1P5, PIP Meet.; P2, S2P3, PIP Meet.; P2, S3P2, PIP Meet.). The researcher was mindful of this and specifically directed questions to the educators who did not provide their unsolicited perspectives to ensure their ideas were heard and to reinforce their role in the project. When approached individually all educators were active in discussing the practitioner inquiry content and processes as well as sharing their ideas and reflections on experiences within the curriculum. Similarly, during meetings where the service director/ manager was present the room leaders tended to say less than when the director/ managers were not present (P2, S1 S2 S3, PIP Meet. FG).

5.4.3 Practitioner inquiry as facilitating inquiry.

Involvement in the practitioner inquiry process provided opportunities for educators across all three services to link theory with praxis and in doing so to consider how technology was socially and culturally relevant for children, rather than just including technology in a tokenistic way. Opportunities for dialogue between educators, directors and the researcher were key in facilitating professional learning to support the integration of technology. Discussions enabled the researcher to adopt the role of ‘listener’ (Bakhtin, 1981), and develop new understandings of how technology could be effectively integrated within the curriculum. In this way, the researcher supported educators to deconstruct their understandings, beliefs and conceptualisations of technology. This was an important process because, as noted in the epigraph, “people’s words belong partially to others” (Rogoff, 1995, p. 66). Through the critical reflection process educators could identify the experiences that had shaped their beliefs and practices and critically reflect on these. The role of listener is explained further in examples throughout this section.

Working with three services contemporaneously the researcher shared ideas and learnings between the services and used these to add to their critical reflections and action plans. As an example, educators from S2 expressed that they would like to include documentaries but had concerns that families or regulatory bodies would react negatively (P2, S2P1 S2SM, PIP Meet.). The researcher shared examples of practice from S3 where integration of screen media such as this was a successful and effective tool to support children's explorations (P1, S3, Obs) with educators and the service manager at S1. In this way the researcher was able to listen to the concerns or perceived challenges that educators expressed and provide resources that supported educators to challenge current practices or ways of thinking. Similarly, as a listener, the researcher was able to hear successes experienced by services and share the perspective of educators at S3 with educators at S2 to help them find possible solutions to the challenges they were experiencing. While this sharing of information did not result in a change in practice during the practitioner inquiry project it did contribute to an open course of dialogue at S2 that challenged the service director's resistance and preconceived ideas.

The critical reflections that took place during the meetings between the researcher, educators and service directors or manager provided a strong forum for exploring ideas and challenging thinking in terms of technology integration. The researcher listened to issues or problems and shared knowledge and insights that assisted educators to identify a solution or course of action. As an example, the educators at S1 had discussed issues with costs and the integration of technology, specifically purchasing applications (P2, S1P1 S1P5, PIP Meet.). During a subsequent meeting S1P3 commented that they could not use clay often because of the high cost associated with the resource. The researcher used this dialogue to draw parallels between technological resources and non-technological resources in terms of cost highlighting that clay was not excluded from the curriculum. Through this discussion, educators were encouraged to become aware of assumptions around values in terms of service budget allocations, and questioned conceptualisations of technology as an appropriate resource in their play-based curriculum.

Another example of the researcher's engagement facilitating dialogue and challenging ideas and beliefs was evident in their role as a 'critical friend'. The following example from S3 reinforces the value of a practitioner inquiry facilitator within the role of critical friend. During a meeting, the service director and S3P1 discussed how they used the Internet to find information for children and to answer their questions, and described how children were aware of Google. The room leader noted:

> Using the Internet on] the iPad is the most immediate tool that can be used to follow up on the [children's] interests. (P2, S3P1, PIP Meet.)

The researcher, as the practitioner inquiry facilitator, asked whether they saw this as an issue, and whether they thought the instant provision of information had an impact on children developing critical thinking skills. This led to a collaborative, critical discussion between the room leader (S3P1) and the service director:

> Do we need to think about finding information somewhere else? We don't want them to get too comfortable. We don't look for the best one, just the first one that comes up. What if they are researching and take the first [website listed in search response] all the time just because it's fast? Where is the challenge to think that there is a different option? (P2, S3SD, PIP Meet.)

The room leader (S3P1) responded to the service director's queries with an example of an occasion they referred to and compared a number of online resources before selecting the most appropriate one. They continued to discuss this point:

> I have always said it's about asking the questions, not giving the answer… but is that

what we are doing? I hadn’t thought about it. (P2, S3SD, PIP Meet.)

I hadn’t either, but it’s very true. (P2, S3P1, PIP Meet.)

This example demonstrates how the practitioner inquiry process facilitated inquiry. The dialogue process encouraged discussion and critical reflection on practices and beliefs. Again, this shows professional learning in terms of integrating technology does not need to specifically focus on including physical resources in the curriculum: it is questioning and thinking at a foundational level also.

Discussion of professional learning resources

Findings from this research suggest three main resources that facilitated practitioner inquiry as a professional learning strategy to support the integration of technology, including contextually relevant resources and support; facilitating educator engagement in critical reflection; and the facilitation of practitioner inquiry through dialogue. The integration of such resources in professional learning aligns with the underpinning characteristics of practitioner inquiry (Groundwater-Smith et al, 2013; Woodrow & Newman, 2015). A number of influential factors were identified within these resources as facilitators and barriers to the integration of technology and these are discussed further within this section.

One example of contextually relevant resources were professional readings. These were provided to each service in a professional resources folder and contained information that aligned with the identified individual characteristics of each educator, interpersonal dynamics and also broader contextual influences. One aim of the readings was to provide educators with foundational understandings of technology and benefits of integration in play-based curriculums. Parette et al. (2013) identify that creating this fundamental understanding is a key starting point for integrating technology in early learning services (See Table 3.9). Involvement in practitioner inquiry allowed for the identification of appropriate resources due to the facilitator's understanding of each educator and each service context. It was identified that research article formats were prohibitive for some educators. The development and provision of summarised peer reviewed articles was an effective strategy to support learning and drew on what the educators already knew, as well as their feedback on preferred types of written information. Provision of relevant and accessible professional learning resources was a facilitator in integrating technology as educators accessed context specific information (Groundwater-Smith et al., 2013) where there was an otherwise paucity. Lawrence (2003) argues the need for research articles that are more accessible to those outside of academia. He suggests that engagement with research articles would be more widespread if they used simpler language and removed more complex sections such as the methodology away from the forefront. Similarly, a decade ago Groundwater-Smith and Mockler (2006) noted that higher education facilities such as universities require academics to produce research articles and professional book chapters, but place little value on writing articles that are suitably pitched and have impacted on the people working in the field. This phenomenon can create a situation where practitioners are disconnected from contemporary research and thinking that relates to their practice.

Findings from this research indicated that while engagement with professional readings was low with most educators, those with Bachelor degree qualifications (S1P1 and S3P1) were the ones who were most involved with the professional readings. This observation presented two potential conclusions: that educators who do not have tertiary qualifications may not be familiar with research articles and therefore they are not an accessible form of information, and/or that the room leaders (who generally hold higher level qualifications) receive release time from teaching and therefore may have more time to do readings. Factors that enabled engagement with professional readings were therefore multifaceted, linking with time, management beliefs in terms of professional learning and individual characteristics of the educator (See Table 5.2). Findings from this research relating to professional readings and engagement align with Hadley et al. (2015) who reported that engaging with professional readings was an under-valued part of professional learning, with the lowest levels of engagement being from those who held certificate level qualifications. An awareness of these issues are important as provision of suitable professional readings is recognised as an effective provocation in reflective practice (Fisher & Wood, 2012) as well as in helping to inform and facilitate all steps in supporting educators to integrate technology, as outlined by Parette et al. (2013, Table 3.9).

Educators across all three services expressed a lack of time to engage in professional readings. Across the spectrum of engagement there was one educator who completed the readings at home, another who expressed guilt at not completing the readings in their own time, and others who just did not engage. These examples raised the question of where responsibility for supporting educators' access to professional learning lies. Contemplations here extend beyond professional learning related to technology in early childhood and involve much more complex issues. Nuttall (2013) argues the need to reconsider professional learning opportunities in early childhood education in terms of overarching organisation and provision. More specifically this involves issues such as funding, release time for educators undertaking professional learning and also providing staff to release educators from face-to-face teaching when they are engaged in professional learning (Hadley et al., 2015). These factors served as barriers and enablers to the practitioner inquiry projects and are potentially relevant to other professional learning strategies.

The ongoing nature of practitioner inquiry was a facilitator for exploring integration of technology as it enabled trialling and testing technological resources that were relevant and suited the educators and children at the service. It also allowed for reflection on the successes and challenges and the opportunity to adjust practice based on new learnings. Having opportunities to develop familiarity with technological resources was identified in the methodology as an important step in effective integration of technology (Parette et al., 2013 - Table 3.9). Engagement in practitioner inquiry met with varying levels integration of technology in the curriculum. However, engagement with the practitioner inquiry projects added to the educators' foundational knowledge of technology and its relevance to play-based pedagogy as evident in the meetings and discussions that took place in Phase 2. The practitioner inquiry process afforded the opportunity think about new ideas, learning and approaches. For educators at S2 this meant further ruminating on ideas at a conceptual level and also at a service policy level, which is an important process for instigating change to policy and practice (Gibbs, 2008). For educators at S1 and S3 practitioner inquiry facilitated testing ideas and resources, and adjusting practice over time, which is recognised as an effective professional learning strategy (Carter & Fewster, 2013) and a key process in integrating technology into the curriculum (Parette et al., 2013 - Table 3.9). Here new knowledge created within the project involved educators as active agents, rather than passive receivers of information (Woodrow & Newman, 2015).

This study clearly identified that the provision of socially and culturally relevant professional learning resources was a facilitator in supporting educators to reconceptualise and reimagine technology within their curriculums. This is an important process as learning occurs through observation and interaction with cultural tools within each context (Rogoff, 1995). A strong connection was evident between the provision of resources and the critical reflection discussion that took place between educators and the researcher. Critical reflection is a key feature of practitioner inquiry (Woodrow & Newman, 2015) and a facilitator of learning within this study. However, journaling was received with mixed enthusiasm by educators and achieved varied effectiveness as a critical reflection process. An issue with lack of prioritising journaling was that educators did not have enough time to plan, reflect or evaluate the practitioner inquiry projects. These limitations restricted the educators' ability to engage in critical reflection on technology integration, something that Gibbons (2010) notes should not be considered a superfluity. Additionally, without opportunities to collect data, such as observations and reflections, there was a decrease in educator capacity to further develop their understanding of technology and the potential benefits to the curriculum.

Limited individual reflection from the educators in this study could have been due to a lack of professional confidence in their skills and knowledge, regardless of whether this is founded or not. Recorded thoughts take on a permanence that can serve as a record of a lesser-developed way of thinking or emergent knowledge. Some educators may be unwilling or uncomfortable to commit these ideas to paper. Often reluctance to record ideas in journaling derives from a history of negative feedback—criticism that is not constructive or strengths-based (Cameron, 2002). These findings further delineate Hadley et al.'s (2015) suggestion that solitary reflection is less popular with early childhood educators.

Within the three services it was found that while educators were more likely to contribute to critical reflection within verbal discussions, a hierarchy of contribution was apparent, where educators seemed less likely to contribute when a higher-ranking colleague was present. Across the three services involved in this project, educators who were not in the room leader role preferred to share their ideas with the researcher rather than recording them in a journal, but also needed prompting to contribute to discussions. Inclusion of all perspectives in dialogue and reflection is an important consideration in terms of integrating technology given the complex, interwoven factors that impact on educator belief and practices (Table 5.2). These findings identify the power of facilitated critical reflection and dialogue to overcome hierarchies that exist in terms of contribution to collective learning communities which adds to findings presented by Aubrey et al. (2012) and Colmer et al. (2014) (See Literature Review 2.6.2).

Similarly, Rogoff (1995) notes that roles within the plane of community activity are not symmetrical. As such, it is important to create learning communities that focus on collegiality, where all educators see their contributions and ideas as valuable, valid and respected. Rönnerman (2015) identifies “democratic dialogue” (p.73) as of pivotal importance when facilitating change and highlights its prevalence in practitioner inquiry. Democratic dialogue supports educator agency, focuses on equity of engagement and has collaboration at its heart (Rönnerman, 2015). The clear advantages of discourse in supporting critical reflection in relation to integrating technology into play-based curriculums require further investigation.

Engagement in critical reflection was identified as a key component of practitioner inquiry and as facilitating the integration of technology as it supported educators to challenge their beliefs and biases. Critical reflection was facilitated through the provision of professional learning content that supported the development of making connections between theory and practice, in alignment with other research findings (Anderson, 2014; Gibbons, 2010). Journaling and critical reflection are acknowledged as central to early childhood educators’ practice (Lowe, Prout & Murcia, 2013). While engagement with practitioner inquiry did not result in critical reflection through journaling, it did provide an environment where educators actively engaged in reflection through discussions with their colleagues, particularly when this was scaffolded by the researcher. Further research on the factors that foster journaling and critical reflection, such as guidance from a facilitator in practitioner inquiry, would help to unpack this complex topic.

Critical reflection pivoted on successful dialogue and discussion and this was most effective when the researcher combined the role of ‘listener’ (Bakhtin, 1981) and ‘critical friend’ (Groundwater-Smith et al., 2013). This enabled the researcher and educators to hear exactly what each educator was experiencing during the practitioner inquiry projects and to critically reflect on this based on previous developed understandings and familiarities about the educator's beliefs and practices. In the role of 'listener' the researcher supported development of connections between the inter-individual and the inter-subjective that emerged in dialogue with educators (Bakhtin, 1981). In this way, the researcher/ facilitator identified the contradictions and correspondences that exist between previously held technological beliefs and philosophies and new ideas presented through professional learning. This approach aligns with Gibbons (2010) who argues that educators need support to value their own beliefs, perspectives and goals in terms of integrating technology and that this process is facilitated most effectively in shared critical reflection with others.

5.6 Summary

This chapter provided an analysis and discussion of data collected in Phase 2, examining factors that supported or hindered practitioner inquiry as a professional learning strategy to support the integration of technology. Findings from the practitioner inquiry projects identified a number of complex and interrelated factors that influenced progress and experience within the practitioner inquiry projects. Educator beliefs and conceptualisations of technology, as well as their knowledge of technological resources served as both facilitators and barriers. However, these findings in relation to the integration of technology in early learning curriculums established the value of practitioner inquiry in working to extend understandings. The following chapter draws together findings from Chapters 4 and 5 and presents final conclusions in relation to technology integration and how these ideas and approaches are further supported through practitioner inquiry as a professional learning strategy. Implications for practice will be delineated, limitations of the study discussed and areas for further research identified.

Chapter 6 – Conclusion

> *The value of sensitivity of guidance, like so many other phenomena in psychology, may be curvilinear. In other words, it is possible to have so little sensitivity of support that children are left to their own devices to discover the regularities of their world, like feral children abandoned in the forest who do not develop skills in the use of human tools [...] conversely it is possible to have so much sensitivity on the part of eager parents that children are kept from having to learn to handle the rough spots of life (Rogoff, 1995, pp. 200-201).*

The previous chapter presented results and discussion of factors that supported and inhibited practitioner inquiry as a strategy to integrate technology into early learning curriculums. As suggested by Rogoff (1995) in the epigraph for this chapter, providing guidance in learning is pivotal but also delicate in terms of balance. Rogoff is referring to children's learning with cultural tools and the concept of striking a balance also resonates with the findings presented throughout this thesis. Children (or adults often do not intuitively know how to use digital devices, however they are strongly present as cultural tool as testified by their ubiquity in everyday life (Plowman & McPake, 2013). As intimated by Rogoff (1990), and as presented in this thesis, effective and independent use of cultural tools such as technology requires guidance from more knowledgeable others. This study identified a variety of complex and interwoven influencers that shaped educators' beliefs and impacted their pedagogical practice. Practitioner inquiry supported educators to investigate and unpack their beliefs and practice through engagement with a range of learning resources such as professional readings, critical reflection and collaboration. This final chapter presents a discussion of the main findings of the study and implications for policy and practice as well as future research.

6.1 Contribution of this Study

This study presents new knowledge and understandings about the interconnectivity of educator beliefs and conceptualisations of technology within early learning curriculums as contextualised within contemporary advances in technology integration in educational settings. Two prominent new findings that emerged from this research comprise the understanding that:

1. Educator beliefs and practices on the integration of technology within early learning services were often paradoxical, and there was a continuing dichotomisation of beliefs about the pedagogical appropriateness of these practices. This dichotomisation was influenced by a number of interrelated factors that shifted educator's positioning on a spectrum of being 'for' or 'against' technology integration within an early learning curriculum.

2. Practitioner inquiry was an effective professional learning strategy to extend thinking and understanding on integrating technology in early learning services. However, diverse and complex elements were identified as facilitators and barriers to the integration of technology.

6.1.1 Technology as a paradox.

The beliefs of educators and service management impacted on how educators integrated technology within their curriculum. Additionally, the perceptions that educators and service directors/ manager had of family beliefs also impacted upon the technology featured in the curriculum. The beliefs and understandings of the different stakeholder groups (including educators, families and service management) associated with the three services participating in this study were often dichotomous. That is, the participants' opinions were often polarised in terms of whether technology was viewed as pedagogically appropriate for incorporation into the early learning curriculum. However, a paradox was evident where educators' espoused beliefs were sometimes contradictory to their actual practices regarding technology integration. Within this study, there were examples of educators at all three services indicating that they had not included technology in the curriculum despite many examples of technology integration observed in practice and within the documentation of teaching and learning at the service. A disconnect was also evident with some educators expressing a belief in the value of technology, but not providing children with resources and opportunities to engage with technology-based learning experiences within the curriculum.

Argyris et al. (1985) in their seminal work on espoused theory argue that stated beliefs relate to what people claim they know and the course of action they believe they follow. However, there is often a disconnect between what people claim to believe and what they actually do in practice. Argyris et al. assert that this disconnect is not inadvertent and that people have agency to direct their actions. The identification of a paradox between educator beliefs about integrating technology and their actions as observed during this study highlighted the importance and value of providing educators with opportunities to extend and challenge their conceptualisations of both technology and the appropriateness of integrating technology within play-based pedagogies. In this way, educators were more empowered to critique their understandings and conceptualisations, and to be agentic in their curriculum decision making and pedagogical practices.

Analysis of the data collected demonstrated educator practices and beliefs reflected their stance in relation to technology, and positioned them on a spectrum of being either more 'for' or 'against' the integration of technology in early learning services and that their position was not static, rather they shifted in positioning between the dichotomous beliefs in relation to internal and external influences. This is demonstrated in Figure 6.1 which outlines the span across which educators were positioned in relation to beliefs about integrating technology in their curriculums. When educators appeared to be positioned as ‘against’ they expressed strong beliefs about not wanting to integrate technology in their everyday teaching and learning experiences. Their rationale encapsulated personal beliefs such as technology not being pedagogically appropriate as well as external influences such as families at the service being resistant to technology featuring in the curriculum. Educators were positioned at the ‘for’ end of the spectrum when their beliefs and comments reflected support for technology integration in their early learning curriculums (See Figure 6.1). Their explanations for wanting to integrate technology included that children showed an interest in various forms of technology and they could also see how it was able to extend children’s thinking and learning in play-based experiences.

It was apparent that each educator’s positioning on this spectrum varied depending on a number of complex, interdependent and interrelated factors and the interplay of personal, interpersonal and community aspects (Rogoff, 1995). Interpersonal elements that influenced educator positioning were the beliefs and practices of other educators in their teaching teams. This included educators who had expressed antipathy in regards to including technology in the curriculum when its integration was spearheaded by a colleague. There were also examples of educators who were interested in technology integration but were not including it in the curriculum due to reluctance from other educators or persons in management positions. Additionally, the absence of a colleague as a more knowledgeable other impacted upon educator proclivity to integrate technology and also their positioning on the continuum. In locating educators on this spectrum of beliefs about technology integration, it was important to emphasise that the underpinning goal or measure was not to specifically alter their beliefs either in the direction of being 'for' or 'against' technology integration but to understand the factors that influenced this positioning. Through the analysis of the findings it was apparent that educators' beliefs about technology varied in terms of where they sat on the spectrum; what they said and what they actually did also varied. As noted by Rogoff (1995) in the epigraph for this chapter, there is value in deconstructing what it means to provide suitable and valuable guidance to children. Educator beliefs and practices are explained throughout this section, culminating in Figure 6.4.

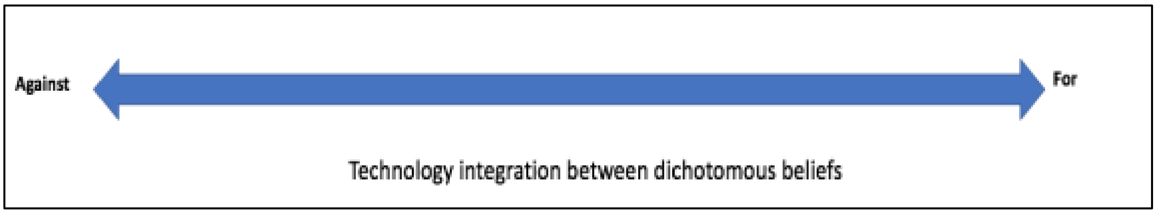

Figure 6. 1: Technology integration between dichotomous beliefs.

Overall, educators' understandings as to how children should interact with technology, children's capabilities with technology and the place of technology in play-based curriculums influenced educator pedagogical practice within their early learning service. The beliefs of family members, service managers and directors regarding technology and early childhood also influenced educator curriculum decision making. This is represented in Figure 6.2 which demonstrates the interrelated nature of family, educators and management beliefs relating to integrating technology in early learning services, and how this relates to their positioning on the spectrum between dichotomous beliefs. While families were not directly involved in this study, educator comments collected through interviews, focus group discussion and meetings provided their perceived understanding of family beliefs and perspectives.

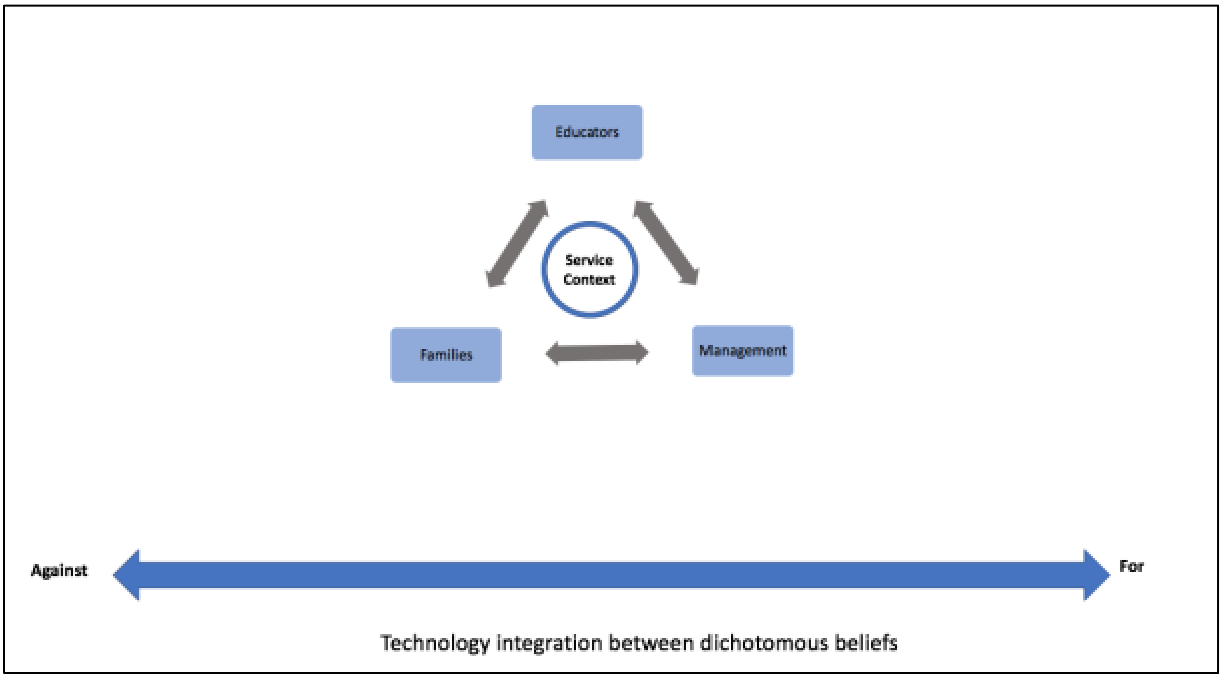

Figure 6. 2: Interplay of stakeholder beliefs in influencing technology integration

When taken together, it can be seen that a number of factors influenced how the families, educators and service management—the key stakeholders in this study—developed their beliefs about technology, which subsequently impacted upon whether or not technology was integrated by educators in the curriculum at the service. These factors included conceptualisations and definitions of technology, preconceptions about children's abilities with technology, and ideas on how children learn with technology. Figure 6.3 illustrates the additional factors that influenced the educator, family and management beliefs about the appropriateness of technology integration in early learning curriculums. This demonstrates the interrelated nature of these elements in influencing stakeholder beliefs and educator practices.

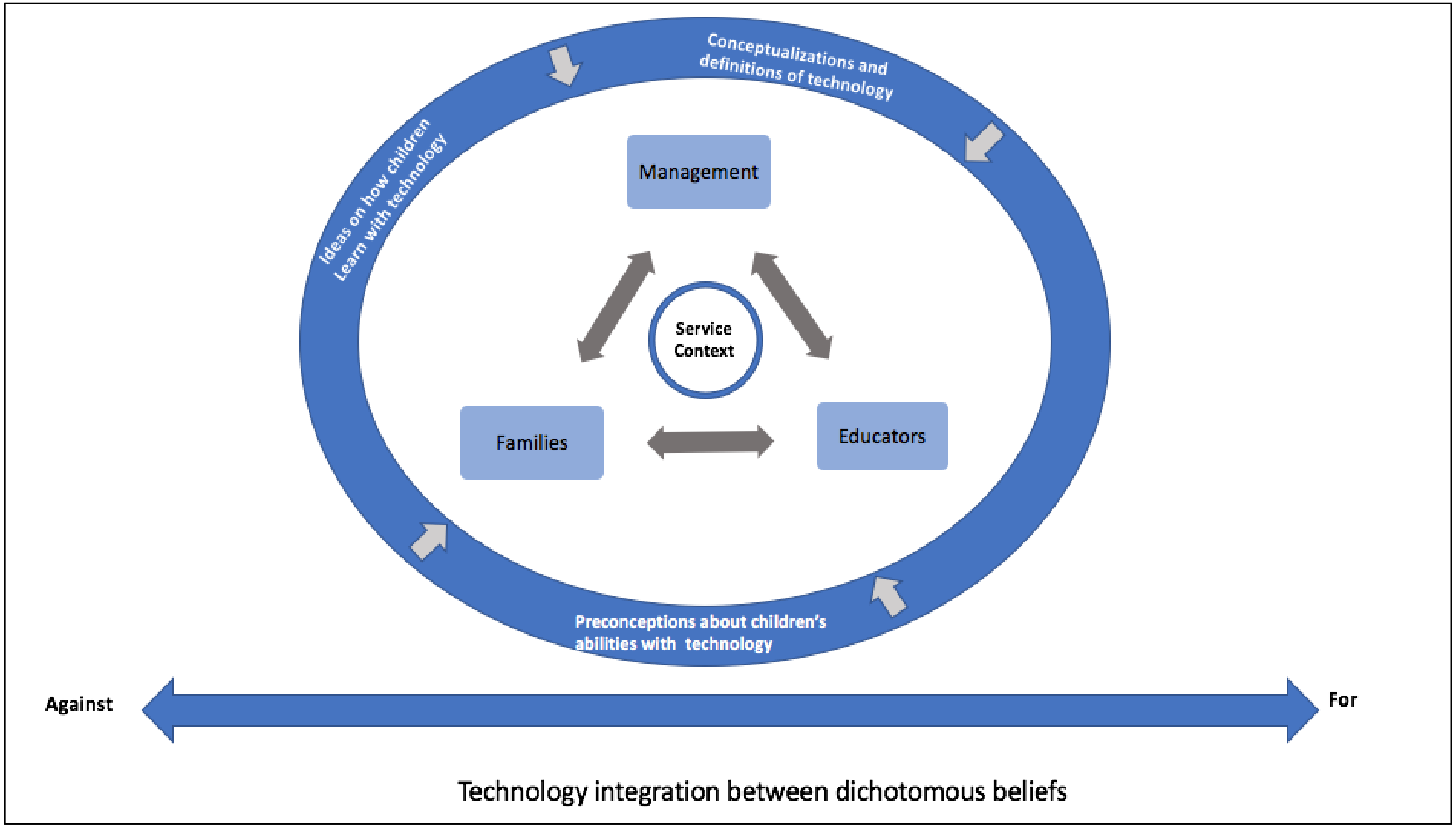

Figure 6. 3: Factors that influence stakeholder beliefs about technology integration in early learning curriculums.

Additional factors that influenced educator integration of technology in their early learning curriculums included educator confidence and competence with technology, availability of resources (technological resources as well as other resources such as professional learning and staffing), and support from management (resources available, beliefs/ attitudes to technology). Combining the three elements that influenced the educators, Figure 6.4 illustrates the additional factors that impacted upon educator beliefs and practices. These factors further influenced where educators were positioned in terms of being for or against technology integration, and this in turn influenced their advocacy to other stakeholders.

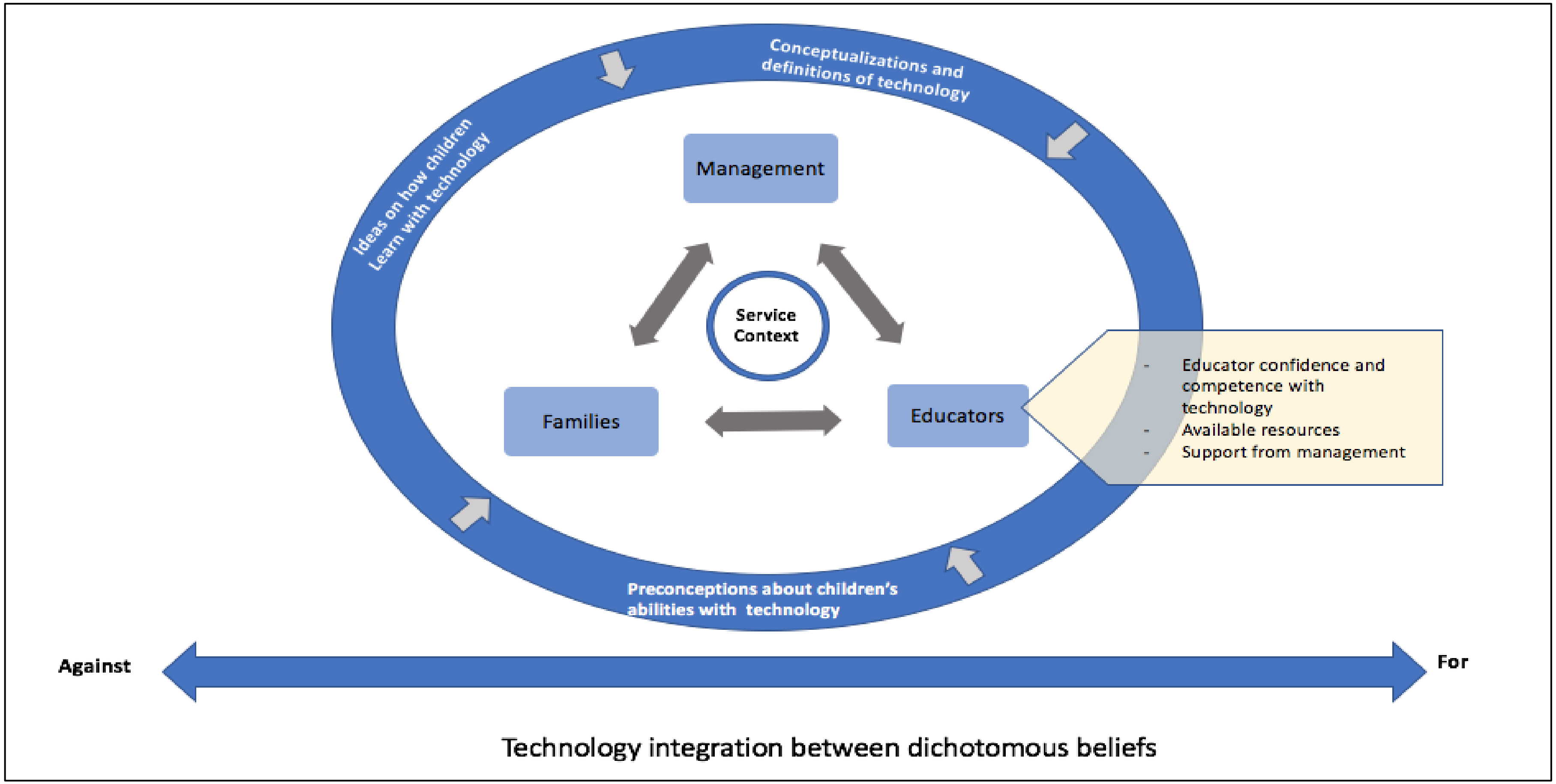

Figure 6. 4: Additional factors that impacted upon educator beliefs and practices in integrating technology in the curriculum.

Findings from various contemporary studies, by those such as Nikolopoulou and Gialamas (2015a) and Palaiologou (2016), suggest that scholarly thinking about technology has moved beyond the dichotomous debate of whether technology is appropriate for inclusion within a play-based early learning curriculum or not. However, findings from this study provide examples of polarised thinking in terms of whether technology should or should not exist in early learning services was demonstrated by educators and also by a service director and service manager. As such, it was observed that educators were dynamic in their positioning on a spectrum of being for or again technology inclusion based on a number of elements that impacted their beliefs and practices. Educators discussed a range of sources that influenced how they viewed the appropriateness of technology, such as the opinions of management, opinions of parents, service policies and procedures, or guidance received from external government quality and assessment representatives. This research presents the conclusion that while the debate on the integration of technology in early learning services is progressing within scholarly research or within academia (as noted by Nikolopoulou & Gialamas, 2015a and Palaiologou, 2016), new understandings from research do not necessarily filter through to educators working in early learning services.

Findings also suggest that the interrelated factors identified in Figure 6.4 need to be considered as part of a network of elements, rather than as individual influencers of educator beliefs and practices. Sociocultural theory, and specifically the application of Rogoff's (1995) lenses to data collection and analysis, led to the development of more detailed understandings of factors that impacted upon each educator's beliefs, practices and the practitioner inquiry projects. Viewing through the lenses of sociocultural activity (personal, interpersonal and community) by Rogoff (1995) was relevant in terms of investigating technology due to the diverse definitions and conceptualisations expressed by educators in the study and in understanding how to acknowledge, consolidate and extend educator knowledge.

Additionally, gaining an understanding of how educator beliefs were influenced by interpersonal and institutional factors (Rogoff, 1995) assisted in challenging misconceptions held by educators around the ‘newness’ of technology, as discussed by Gibbons (2015). This was significant as viewing technology as being new and unfamiliar reduced educator acknowledgement of their own prior experiences, understandings and foundational knowledge of diverse technologies. Educator critical reflection on definitions and conceptualisations of technology was a key component in supporting connections in their understandings of understanding technology integration in play-based curriculums.

Definitions and conceptualisations

Earlier research and the discourse about technology in early learning services was firmly associated with computer use (Nikolopoulou & Gialamas, 2015b; Plowman, Stephen & McPake, 2010). Conversely, contemporary research suggests that definitions and conceptualisations of technology are becoming more diverse, though predominantly still focused on screen-based devices (Plowman, 2016). Educators’ responses within this study suggested that for some, definitions of ICTs had moved beyond computers to also include tablet and touch screen devices. However, within this study computers were also a commonly used form of technology by educators, rendering them a cultural tool for teaching and learning. The increased prevalence of touch screen devices in everyday life creates the need to shift the debate in terms of the suitability of technology in early childhood pedagogy. Additionally, tablet devices are recognised as being easier for young children to use, as transportable and multipurpose tools (Manches et al., 2015; Zrim, 2015) which increase their suitability in early learning curriculums. However, within this study, educators at only one service used tablets in an integrated and effective way despite educators at all services acknowledging that some children were familiar with such devices. It is important to note, however, that the field work for this study was conducted in 2013. At this time, iPads had only been available for three years (Apple Newsroom, 2010) and therefore were not as commonplace in children's lives as they are in 2017. I tis likely that while some children were familiar with iPads, many children and educators involved in the study would not have been.

Non-screen based technology inclusions observed within the curriculum during this study were not often acknowledged as 'technology' by the educators (for example light tables, cameras and dramatic play). This reductionism suggests that conceptualisations of technology need to move beyond screen-based definitions to consider a diverse range of teaching and learning resources including non-physical resources (such as the Internet) and technology related play (such as the presence of technology in imaginary play). Further professional learning, guidance and critical conversations are needed to enable educators to move away from the 'for' or 'against' debate and towards integrating technology as a part of everyday life, both within the early learning service.

Preconceptions about children's ability with technology

Educators' beliefs and practices throughout this study highlighted the importance of re-examining discourses relating technology integration within early learning curriculums. Conversations that facilitated critical reflection by educators throughout Phase 2 of this study included questions on whether technology integration within the curriculum reflects the broader experiences children have with technology in their everyday lives. More specifically, findings across both phases of this study in the three services suggested a need to further develop educator understandings of how technology integration in the curriculum aligns with the play-based learning focus of the *EYLF* (DEEWR, 2009). This further develops the argument presented by Palaiologou (2016) who emphasises the need for educators to think of technology as an integrated resource within a play-based pedagogy. The need to think about technology at a more foundational level was an important starting point to support educators, management and other stakeholders such as families, to recognise the potential of technology to support play-based learning. Edwards (2015) suggests that current conceptualisations of technology do not adequately reflect an awareness of the contemporary understandings of play that now exists. A connection between two elements shifted educator cognisance and acknowledgement of children's capabilities with diverse technologies. These included an understanding of technology as a resource to support foundational knowledge of cultural tools, and also how such tools featured in a play-based curriculum. This connection in understanding has the potential to influence educator beliefs in terms of the relevance and appropriateness of technology in early learning curriculums, and subsequently influence educator decision-making in terms of technology integration at their services.

How children learn with technology

Educator beliefs about pedagogy and their image of children in terms of agency and competency in the general curriculum—as well as their preconceived ideas about children's abilities with technology—underpinned their beliefs about how children learn with technology. This finding was important in developing an understanding of why educators showed a proclivity or disinclination to integrate technology. Conceptualising technology as a resource to use contemporaneously with traditional resources was a new consideration for many educators in this study, and highlighted that technology was being conceptualised by these educators as the main focus of a learning experience rather than as an integrated teaching and learning resource. While these ideas have emerged as arguments in other research findings (see for example, Yelland, 2011), the current project brings these ideas regarding educator beliefs and practices together and provides a snapshot of an interrelated, bigger web of interactions and cross-effects in the integration of technology in the early years curriculum. Edwards (2013) notes that ongoing discussions need to focus less on understanding educator beliefs and factors that impact upon integration of technology, and more on how educators perceive technology within play-based curriculums. However, findings presented within this thesis indicate that both elements are important. That is, an understanding of educator beliefs as well as experience in integrating technology was imperative in supporting them to consider new ideas and information.

This thesis also identifies a need for further discussion and in-depth discourse to support the reconceptualisation and re-imagining of technology from beyond passive to active. Identifying the difference between active and passive technology use is an important part of progressive thinking in terms of increasing understandings of technology within play-based pedagogies and in challenging dichotomous thinking (NAEYC & the Fred Rogers Center, 2012). Similarly, challenging the assumption that technology limits social interaction and engagement (Plowman & McPake, 2013) enabled educators to consider why they made decisions for or against technology integration.

Connections and disconnections

The theme of connections and disconnections emerged consistently when considering how educators integrated technology in their play-based curriculums. Firstly, connections in knowledge and understandings between educators, families and service managers supported socially and culturally relevant technology integration for children. This connection included understanding of early learning curriculums and play-based pedagogies, as well as the three factors identifies in Figure 6.4 (being conceptualisations and definitions of technology; ideas on how children learn with technology; and understandings of children's experience with technology). Educators tended to position themselves further along the spectrum of being 'for' technology integration when there was a connection in understanding between stakeholders in terms of the social and cultural relevance of diverse technologies in children's lives. Where there was a disconnect in understanding, educators were not willing to advocate or challenge the views of others in relation to integrating technology.

Additionally, a disconnect was observed between what is known through research or academically, and what is known within the practitioner field of engagement. This disconnect was exacerbated by the inaccessibility of research articles by many practitioners, and the paucity of information on integrating technology in play-based curriculums that was specifically relevant to each educator and also to each service. The lack of accessible resources identified in this study impacted upon the ability to create connections in terms of knowledge, understanding and possibilities for educators, families and service managers and directors. It was apparent that understanding between and across stakeholders was a dynamic system of networking, collaboration and influence.

This research affirmed that factors influencing educator practices were complex and nuanced, and varied greatly between individuals and between services. However, findings in this thesis present new contributions to this topic by highlighting the need for detailed understandings of these complex and influential factors to gain comprehensive insights into why educators made certain pedagogical decisions. This thesis also proposes that it is important to understand contextual factors that impact upon choices to integrate technology in the curriculum, to support educators, and to also ensure that professional learning provisions are relevant and beneficial.

6.1.2 Making connections through professional learning.

Findings from this study demonstrated that practitioner inquiry offered many benefits as a professional learning strategy to support integration of technology. One key advantage of practitioner inquiry was that it supported the provision of context specific resources that were adaptable to the diverse and complex factors influencing educator proclivity to integrate technology. Creating awareness of these factors through the practitioner inquiry process enabled educators to identify what influenced their curriculum decisions and practice in relation to integration of technology. The factors that served as facilitators and barriers to the integration of technology within each early learning service, and for each educator, were influenced by the dynamic interplay of beliefs including those identified in Figure 6.4.

Three key factors were identified as supports or inhibitors, and aligned with each of Rogoff's (1995) three planes of analysis. Each factor brought a different plane of analysis to the forefront, with the other two planes present and influential in the background. Figure 6.5 outlines how the three factors that served as facilitators and barriers to practitioner inquiry as a professional learning strategy to support the integration of technology corresponded with Rogoff's three planes of analysis (1995) and demonstrates how the three elements were interrelated in terms of influence. These factors are as follows:

- Educator beliefs and knowledge of technology (including confidence and competence with technology, beliefs and conceptualisations of technology, educator knowledge of technological resources) – *plane of participatory appropriation*

- Context of service (support of management, staff team cohesion, availability of resources) – *plane of apprenticeship*

- Professional learning resources (access to courses and training, readings, time to engage with professional learning, engaging in critical reflection) – *plane of guided participation*

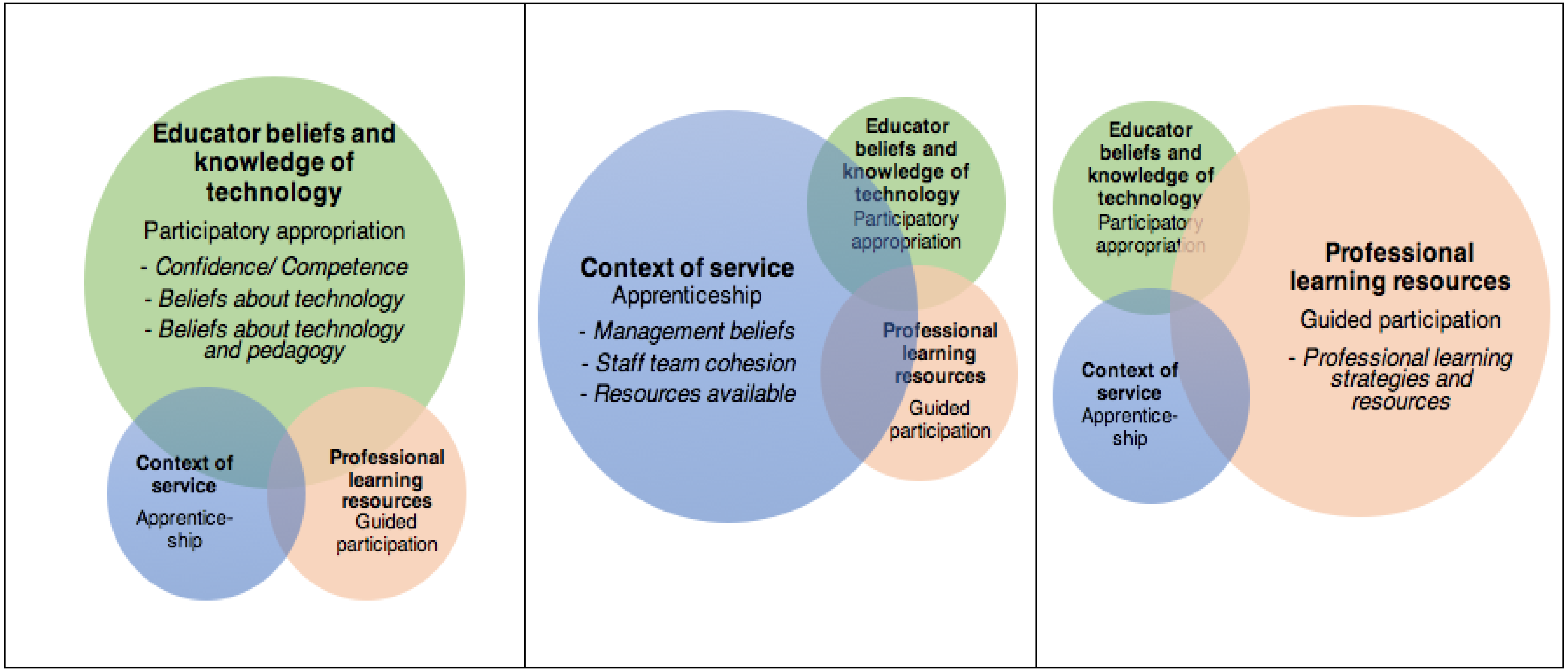

Figure 6.5: Alignment between Rogoff's planes with the three key characteristics identified in this study as facilitators and barriers within the practitioner inquiry process.

Given the established diverse and interrelated factors that impacted upon educator beliefs and practice in integrating technology, it was unsurprising that what served as an enabler for one service was perceived as a barrier by another service and vice versa. As an example, educators at S3 did not have access to Wi Fi (barrier) yet engaged in lengthy endeavours to find alternative solutions to provide children with digital information clips to support and extend their thinking. The solutions-based approach was due to personal characteristics of the educators (confident and competent with technology), a shared interest in technology between team members and also support from management and families to use technology as a resource to support teaching and learning (interpersonal). Alternatively, educators at S2 did have access to Wi Fi (facilitator) but rarely used any form of technology due to lack of support from management (not supported by service policy or philosophy) as well as a lack of interest or reported confidence in using technology by either team member (participatory appropriation not supported or developed through guided participation). These examples highlight that educator positioning as ‘for’ or ‘against’ technology integration was contingent on a number of diverse personal and contextual factors. A new finding from this study was that understanding the complex contextual factors that influence the integration of technology can support educators to deconstruct the elements that enable or prohibit technology integration. This critical reflection then supports educators to make curriculum choices regarding technology that are socially and culturally relevant for the children in their early learning service.

Research undertaken by Blackwell et al. (2013), Edwards (2005), Gialamas and Nikolopoulou (2010), Lindahl and Folkesson (2012a), Nikolopoulou and Gialamas (2015a), Nuttall et al. (2015) and Palaiologou (2016) all acknowledges the fluidity of various factors that serve as facilitators and barriers to the integration of technology. However, elements identified within these studies (such as beliefs, confidence, competence and access to professional learning) were often viewed individually or did not include guidance on how the factors could be addressed. This thesis contributes to research in the field by providing details of the complexity of influence between factors that serve as facilitators or barriers to the integration of technology. The application of Rogoff's planes of analysis (1995) (Figure 1.1) demonstrated that influences often simultaneously impacted at a community, interpersonal and individual level, and the impact of these elements was not static, equal or consistent between educators and contexts.

Findings from this study highlighted that the conceptualisations of technology within early learning services need to be re-examined and reimagined by educators, service directors and management, and also by families involved with the service. This re-imagining needs to reflect children's experiences, interests and knowledge of technology as a holistic and integrated resource that underpins many aspects of their everyday lives. The focus on technology in terms of screen media may come from the prevalence of these resources in school contexts. However, early learning curriculums should not include a 'push-down' approach (Alliance for High Quality Education in the Early Years of Schooling, 2014) from school when making decisions about technology integration. Instead there should be a focus on what research and literature indicates is most effective for young children: holistic, culturally relevant, play-based learning (Barblett, 2010; Ebbeck & Waniganayake, 2016). Reconceptualising technology through a deliberate and intentional early childhood lens may help educators to be more self- aware in terms of their beliefs and practices when integrating technology in the curriculum. Such a lens, if employing the *EYLF* (DEEWR, 2009) focus of becoming, being and belonging would focus on integrating technology to reflect how children experience it in their everyday lives (being and belonging), and the foundational skills needed to support children in their journey as citizens (becoming) in an increasingly digital and connected world. This would involve critique and reflection of individual, interpersonal and community sociocultural activities. The following section considers Rogoff's (1995) three planes of analysis and their connection to the three factors that served as facilitators or barriers to practitioner inquiry as a strategy to support integration of technology.

Personal characteristics

Findings indicated that educator personal characteristics impacted upon practitioner inquiry as a professional learning strategy to support the integration of technology. Educators' beliefs regarding technology and their beliefs regarding pedagogy were also influential. While personal beliefs served either as a facilitator or hindrance to the integration of technology, engagement in the practitioner inquiry process helped mitigate negative personal beliefs about technology. Strategies utilised throughout the practitioner inquiry projects allowed for the provision of professional learning resources that were socially and culturally relevant for each educator and also for the broader service context. This approach helped to expand educators' thinking, both in terms of technological resources as well as in terms of how technology was relevant and beneficial within a play-based curriculum. Underpinning this expansion in thinking was an awareness of foundational technology skills. As noted by Rogoff (1990), creative thinking builds on technologies that are already present in everyday life. The practitioner inquiry process supported educators to rethink and reconceptualise technology integration as a process of building on what they already knew rather than the introducing of a new, potentially intimidating resource.

Context of service

Team cohesion, management beliefs and available resources (such as, access to professional learning and time to engage with learning materials), were identified as key factors that either supported or hindered the practitioner inquiry processes as outlined in Section 5.3. However, while staff changes impacted apprenticeship and slowed the practitioner inquiry progress, it also demonstrated the effectiveness of practitioner inquiry as a professional learning model. Professional learning content and resources were adapted to meet the interests and requirements of the new team members, and also accommodate the impact of the new team on the broader service context. The flexibility with professional learning resources and approaches was an important benefit given the established variation in beliefs and practices regarding technology integration and the way in which these factors affected and were affected by aspects of the service context (as identified in Figure 4.1).

Other aspects of service context that served as a support or a barrier to the practitioner inquiry processes were the service policies and practices as well as the resources made available by management. In terms of educator apprenticeship, the personal and interpersonal interactions that took place within professional learning were influenced by overarching aspects of the service community and context (Rogoff, 1995). Beliefs of management in terms of the suitability of technology use by children in early learning directly impacted on integration within the service and curriculum as well as services policy content. The beliefs of the service directors and service manager also influenced the support they provided throughout the practitioner inquiry projects in terms of access to resources. This highlights the need to explore and investigate the knowledge and beliefs of those in management positions to further understand how their influence impacts on technology integration in the early learning curriculum of their service.

A key resource identified within this study was the provision of time. Findings demonstrated the need for dedicated time for educators to engage with professional learning materials and to also implement and try new approaches with technology, as identified in their practitioner inquiry plans. This finding corresponds with the research by Parette et al.

(2013) who stated that educators needed time to become familiar with new technological resources if they are to integrate them successfully into the curriculums for young children. One of the established benefits of practitioner inquiry is that it supports collaboration and mentoring in ongoing professional learning projects (Fleet et al., 2016). Findings from this study raised the question of whether the management of each of the three services recognised practices such as reading professional publications or engaging in discussions or collaborative reflections as valid professional learning strategies. This is important knowledge to reflect on and further investigate in terms of supporting educators with professional learning that enables socially and culturally relevant technology integration in early learning curriculums.

Other contextual factors of importance were the technological as well as non-technological resources available at each service. Non-technological resources included: professional readings, workshops, staffing, team cohesion, the researcher as a facilitator, and engagement in critical reflection as explained in Section 5.4 . While other researchers note these factors and their interrelation (such as Nikolopoulou & Gialamas, 2015a; 2015b, Palaiologou, 2016), involvement in practitioner inquiry enabled more in-depth understanding of the nuances for each educator and for professional learning content to be adapted accordingly.

Professional learning resources

Three main elements facilitated technology integration during the practitioner inquiry projects: i) the provision of contextually relevant resources (both technological and non-technological); ii) educator engagement in critical reflection; and iii) the researcher as a professional learning facilitator. These three elements are recognised as characteristic of practitioner inquiry (Groundwater-Smith et al., 2013; Woodrow & Newman, 2015).

However, these elements did not exist in silos or in isolation. The interplay between these elements and other factors influenced whether they were experienced as facilitators or hindrances in promoting technology integration. From a guided participation (Rogoff, 1995) perspective, engagement included where educators chose to engage with the professional learning materials, or where they specifically opted to resist and avoid the experiences offered.

Professional readings, which are acknowledged as an effective professional learning resource (Hadley et al., 2015), were used to address the aim of expanding educator foundational awareness of the relevance of technology in early learning curriculums (Parette et al., 2013). However, educators found it difficult to engage with the research articles both in terms of accessibility of format and also in terms of provision of time (see Section 5.4.1).

Findings presented in this thesis also demonstrated that the practitioner inquiry process itself was a facilitator to professional learning. By establishing rapport with individual educators, as well as developing an understanding of their interactions and characteristics of their early learning service, it was possible to adapt professional learning content to suit their needs and interests. However, findings from this research also reinforced the lack of context specific information relating to technology as identified by Gibbons (2010) and also confirmed the paucity of research-based professional publications that are easily accessible by a practitioner audience, as discussed by Groundwater-Smith and Mocker (2006). These are important factors to be aware of in considering future professional learning strategies to support educators to include socially and culturally relevant play-based experiences with technology.

The iterative nature of practitioner inquiry (Woodrow & Newman, 2015) supported educator understanding of the relevance of integrating technology, as well as the opportunity to investigate ideas in practice. The practitioner inquiry process enabled the provision of multiple professional learning resources such as the readings noted above, online tutorials, meetings, opportunities for individual and group critical reflection, and for one service, a workshop for educators and children. In many instances educators drew knowledge and understandings from the professional learning experiences they engaged with, and then applied these learnings in their everyday practice. This execution was variable between the educators in this study as described in Section 5.1. However, as discussed in Chapter 5, new thinking emerged for educators at all three services based on their participation in the practitioner inquiry projects. This process built on the beliefs and conceptualisations that educators brought with them at the commencement of the study.

Critical reflection within practitioner inquiry was also an enabler that supported the integration of technology, in connection with the researcher as a facilitator of professional learning. The researcher served in the role of both listener (Bakhtin, 1981) and critical friend (Groundwater-Smith et al., 2013), in addition to drawing on the knowledge of the educators and their contexts gained through Phase 1 of the case study. The researcher was able to encourage educators to question their beliefs and conceptualisations of technology and its relevance in play-based pedagogies drawing on the contents of the readings, findings that were emerging from the study, and also on the educator reflections and knowledge. Gibbons (2010; 2015) highlights the importance of creating a culture of question-asking amongst educators who work with young children, to support the journeys of both cohorts as digital citizens. Engagement in critical reflection provided a forum in which to address misconceptions. Additionally, critical reflection provided opportunities for exploration of potential solutions to problems as well as celebration of achievements. This process enabled educators to understand why they held beliefs for or against technology integration and to consider new thinking in terms of socially and culturally relevant technology integration for children.

Practitioner inquiry and technology integration

At the core of practitioner inquiry is a question or a problem for investigation that relates to specific features, traits and requirements of each setting (Groundwater-Smith et al., 2013). As such, educators could gather data, explore possibilities for change, and reflect on and analyse the processes to consider possibilities for technology integration within their contexts. This was an important process in supporting educators to deconstruct their beliefs and practices and to consider what influenced their decision making in terms of integrating technology in their early learning curriculum.

The practitioner inquiry research question and action plans gave the integration of technology purpose and relevance. This was a key focus of the study—supporting educators to understand their beliefs and practices in relation to technology integration and to identify what informed their thinking and pedagogical practices. Facilitating critical reflection and self-awareness was important given the divided conceptualisations of technology and beliefs about its pedagogical appropriateness across the three services. Practitioner inquiry afforded educators a 'safe space' (Fleet et al., 2016) to test ideas and practices (as discussed in 2.6.4) in terms of integrating technology, regardless of differences in beliefs, practices, confidences and context (see Sections 4.2, 4.3 and 5.2 for examples). This 'safety' also provided a space for educators to reflect on and then challenge their own beliefs and understandings (see Section 5.4.3), as well as broader organisational beliefs about the suitability of various technological resources in play-based pedagogy. In this way, practitioner inquiry promoted critical reflection and agency.

In this study, practitioner inquiry was a strategy that increased knowledge and understanding on the relevance of technology in play-based curriculums for educators at the three services. While it did not always result in increased use of technology, for many of the educators' engagement with foundational information and experiences relating to the social and cultural relevance or technology in play-based pedagogies were important learnings. The ongoing nature of practitioner inquiry and the ability to be flexible and context specific meant that the researcher (as facilitator) adapted information, guidance and resources to the specific needs of each educator and service. Turja et al. (2009) also note the important role professional learning has in supporting the integration of technology. They note "a need for continuous professional development in order to learn to identify local conditions, negotiate with all stakeholders, and keep their own pedagogical and subject-related knowledge updated" (p. 364). The practitioner inquiry process allowed for many of the elements identified by Turja et al. to be accommodated within the professional learning strategies offered throughout the study (see Section 5.4).

The researcher's reflections on practitioner inquiry

As a professional learning facilitator, the researcher was in a privileged position throughout the practitioner inquiry projects. They were able to gain in-depth insights in to educator beliefs and practices in a way that supported objectivity and authenticity. The researcher was able to observe, draw conclusions and consider professional learning strategies based on their own experience and expertise. However, the experience and expertise of the educators was also respected and acknowledged. Through the process the researcher was able to discuss, reflect and critique findings with the educators, which ensured relevance, increased possibilities and ideas and also reduced the likelihood of misinterpretation (Groundwater-Smith et al., 2006).

In the practitioner inquiry workshop in Phase 2, the role of the researcher was explained as someone to provide guidance based on current literature, research and also the National Quality Framework (ACECQA, 2013). However, it was also made clear that the research did not have all of the answers, and was not an unquestionable authority throughout the professional learning projects. It was reinforced to the educators that they were the experts on their contexts – the children, the families, the centre philosophy. It was also noted that there was no one right way to integrate technology and that the researcher and educators would be on a learning journey together. The researcher's role was explained as a facilitator and instigator of questioning, critical thinking and analysis during discussion, and to support educators to unpack and analyse their own data.

Through these dynamic roles of critical friend and listener, and expert and apprentice greater information was shared between all involved in the practitioner inquiry project (Bahktin, 1981; Groundwater-Smith et al., 2013). In this way, the practitioner inquiry projects facilitated creative and innovative ways to share information that was accessible to all involved. Additionally, the process supported and encouraged a willingness to engage where there may have otherwise been reluctance or resistance. The challenging of power balances was one of the key learnings as a practitioner inquiry facilitator- the need to challenge hierarchies of contribution and consider how all voices could be heard, and all critiques could be brought forth from educators who were not use to being heard or having their voice regarding with equal standing. From the researcher's perspective, this was one of the most valuable aspects of practitioner inquiry as a professional learning strategy.

Another rewarding and thought provoking aspects of the practitioner inquiry process for the researcher as facilitator was finding how to align with educator interests, and to demonstrate sociocultural relevance of certain technologies in children's lives. However, this process needed to acknowledge and be responsive to educator confidence, competence and belief. Hence provision of professional learning resources and content in professional learning dialogue needed to be constantly reviewed, reflected upon and adjusted. This, as noted in the initial paragraph of this discussion, was seen as a privilege. The educators shared their expertise, knowledge and ideas with the research which created a shift in power and overall created a more collegial and contextually relevant approach to professional learning.

6.2 Implications

This study presents new knowledge for those interested in technology integration in early learning services and as such has implications for future research and practice. Suggestions for future research include investigation of professional learning relating to technology in early learning services, as well as the need for longitudinal studies and larger scale studies that investigate perspectives of families, educators and early learning service management about technology in early learning. Practice implications identified include creating discourse around reconceptualising, redefining and reimagining technology to encourage curriculum inclusions that are socially and culturally relevant and that support children as citizens in an increasingly digital world.

6.2.1 Future research.

A number of areas for further research were identified within this study in terms of supporting socially and culturally relevant integration of technology in early learning services, particularly in terms of professional learning and development. Findings from this research suggest that providing professional learning and facilitating professional dialogue and critical reflection with educators can support the creation of broader understandings about the relevance and value of technology in play-based pedagogies. Nuttall et al. (2015) indicate that professional learning opportunities currently available for educators do not necessarily enable them to extend their interests in integrating technology in early learning curriculums. Future research on integration of technology in play-based curriculums could help to expand understandings of educators and other stakeholders and also the provision of resources. Additionally, studies that include more participants and longer timeframes may help to gain broader insights into the interrelated nature of personal, interpersonal and community lenses (Rogoff, 1995) in understanding conceptualisations of technology within early learning services. Additionally, this information may support developing an understanding of factors that impact the beliefs and experiences of educators, families, management and also of children's understandings in terms of their experience with technology. Areas for future research that emerged from this study include professional learning opportunities relating to technology in play-based curriculums, longitudinal research and a large-scale review of service policy documents.

Professional learning opportunities

Findings from this research suggest a need for additional professional learning opportunities that support educators to feel more confident, and to be able to articulate what integration of technology in an early learning curriculum means, what it looks like, and why it is important. Involvement in the practitioner inquiry projects within this study enabled educators to develop important foundational knowledge as to *why* technology was relevant in children's lives and implications for curriculum integration rather than just demonstrating *how* to integrate it. Another benefit of practitioner inquiry was that the professional learning content could be adapted based on individual, interpersonal and community needs, making it responsive to different educator beliefs, preferences and capabilities. While benefits were evident within the study, further research is needed. Further studies could specifically address factors identified in the limitations section, such as lack of time and the need for service directors and managers to be more involved. Facilitators and barriers to the practitioner inquiry process identified within this study (see Table 5.2) could also inform future research, with these factors utilised as a resource in planning and implementing more effective practitioner inquiry projects.

Within this study, the practitioner inquiry projects utilised a number of professional learning resources such as readings, discussion, critical reflection as well as an interactive workshop for S1. Further investigation of professional learning resources for technology integration within practitioner inquiry may also add to the practical knowledge that exists in relation to implementing practitioner inquiry projects. Additionally, there is a need for research that considers other forms of professional learning to support educators' understanding and integration of technology in play-based curriculums. The research could include a focus on online professional learning modules as well as other options such as workshops or in-services. A research project that investigated professional learning models that support technology integration, and also research that investigates different professional learning models within practitioner inquiry, would add to understandings on supporting technology integration in early learning services.

Critical reflection was of key importance in supporting educators' reconceptualisation of technology in early learning services. Future research could investigate educator preferences for and the benefit of dialogue with colleagues and the practitioner inquiry facilitator as a way to empower educators and create agency through distributed leadership (Colmer et al., 2014). As identified in the Introduction, dialogue and language are under-researched areas in terms of sociocultural theory (Lewis & Birr-Moje, 2003). Further exploration of journaling as a forum for critiquing knowledge and practice relating to technology integration could also add to contemporary understandings of professional learning strategies, particularly in relation to the integration of technology. Additionally, in this project the researcher only facilitated meetings, sharing of knowledge and critical reflection with each service. Future research focusing on practitioner inquiry as a strategy to support the integration of technology could investigate the value of facilitating discussion and dialogue between educators at different services.

The diagram provided in Figure 6.5 provides a model of the links between factors that facilitated or hindered technology integration throughout the practitioner inquiry process and how they corresponded with Rogoff's (1995) three panes of analysis. Rogoff's planes of analysis (1995) would serve as a valuable lens to adapt for future studies investigating the interplay of factors that impact upon how technology features in early learning curriculums. This could include focusing on how individual, interpersonal and community elements overlap and influence each other in terms of development of knowledge and of policy development. Future research could apply and test the model suggested in this study (Figure 6.5) for alignment or variation between educators and early learning services. Further investigation of the interplay and overlap of participatory appropriation, apprenticeship and guided participation would allow for a greater range of experience, knowledge, perception and understanding to be shared through professional and collegial dialogue.

Longitudinal study

No contemporary longitudinal studies on technology use in early learning services were evident in the extensive review of research and literature conducted throughout the research process (See Table 2.1). Instead, the longitudinal studies focused on school aged children in school or home contexts (such as Espinosa, Laffey, Whittaker and Sheng, 2010; Judge et al, 2004). This thesis has discussed the rapid changes in technology and noted that this has an impact on professional learning for educators, and on how technology is integrated into the curriculum. However, there is limited discussion within contemporary research about what these changes actually look like and mean over time. For example, technology focus in early learning based research is moving from computers to include other forms of screen media (Plowman, 2016). Additionally, ideas about age appropriateness for access to technology are changing as diverse technologies become more commonplaces. As an example, the American Academy of Pediatrics recently recanted their advice that children under the age of two should not access any screen media, instead proposing that “screen time has simply become time” (Brown, Shifrin & Hill, 2015, p. 54). This statement acknowledges that screens have become part of everyday life, and conceptualisations of screen time should recognise that screen media often replace other technologies, such as FaceTime or video Skype calls being used by young children to stay in touch with family members.

A longitudinal study can enable the investigation of difference in engagement and use over time, as well as any changes or instability within certain groups (Hayes, 2004). Utilising a longitudinal approach in examining changes in technology use by children in their homes as well as in their early learning services may provide insights into the changes that take place in technological resources as well as in technology use and access by children over time. These findings could help to provide an outline of the trajectory of technological resources and technology use by young children, and may help to quell the ‘moral panic’ (Alper, 2011) and anxiety over ‘newness’ (Gibbons, 2015) that often exists in discourses, policy and practices involving technology and young children.

Large scale research investigating service technology policies

Service policies were an influential and underpinning factor that impacted upon technology integration in the services involved in the study. Understanding service policies is thus an important part of exploring the interrelated elements that impact upon educator decision making in terms of technology. Identified within this thesis is a strong interplay between families, educator, management and children in terms of influencing pedagogy and curriculum. However, findings were not generalisable due to the small sample size (Harrison, 2004). A large-scale study across geographical areas, including various early learning service types would help to provide generalisability in findings by examining a large, but diverse cross section of early learning services. Gaining insights into service policy content regarding integration of technology, as well as the stakeholders that are active in contributing to service policies, would provide additional information in understanding how elements are interrelated in influencing technology integration in early learning services. Utilising a mixed method approach, with quantitative data gathered from a large sample, would help to identify key issues and themes, while utilising qualitative approaches with a smaller cohort would help to unpack and further investigate these issues (Blackmore & lauder, 2011).

6.2.2 Practice implications.

Discussion in this thesis establishes that technology features obviously as well as subtly in children's everyday lives. This positions technology as a cultural tool that should therefore feature in children's early learning curriculums. This thesis reports on a number of factors that need to be further developed and reimagined if children's experiences within their early learning services are to foster their journey of digital citizenship (see Sections 1.5, as well as the discussion sections for 4.1 and 4.2). These include critique and dialogue that extends educator understanding of play-based curriculums, and an understanding of technology as one of the many tools and resources available to children. This study provides exemplars of practice where technology is utilised concomitantly with other more traditional tools and resources within play-based learning. Additionally, examples of times where educators conceptualised technology as the sole focus of an experience are evident within this study—an approach largely at odds with how technology exists in everyday situations. The implication for practice here is that first viewing technology through the lens of play-based learning increases the likelihood of its conception as an integrated, complementary resource.

This thesis discussed professional learning for educators but findings are also applicable to teaching and learning within pre-service teacher training courses. Findings from Phase 2 demonstrated that educators needed to see technology effectively in practice in the curriculum to understand its value. However, Gibbons (2010) suggests that even experiences with technology at a conceptual level as a pre-service teacher may influence their development as a practitioner. This could include pre-service teachers engaging with online learning platforms to access course information and engage in discussion and reflection, or using technology as a resource for assessment tasks such as presentations. Dietze and Kashin (2013) reinforce this viewpoint, stating that pre-service student teachers who see technology as relevant to their own lives approach their teaching with a foundational understanding of technology as a tool or resource. As such, it can be interpreted that pre-service teacher training that includes diverse technologies as part of the learning processes may enable educators to build confidence, competence and understandings in using technology. This knowledge then influences their underlying beliefs and conceptualisations of technology. Findings from this study suggest that educator confidence and competence with technology impacted upon their beliefs and practices relating to integrating technology. Additionally, Gialamas and Nikolopoulou (2015a) argue that educator confidence and competence with technology reduced the impact of other barriers in pursuing the integration of technology. Dietze and Kashin and Gibbons also refer to early childhood teacher qualifications when discussing benefits for pre-service teachers, however there are advantages in including experience with technology in all types of formal studies that lead to a qualification as an early childhood educator.

A corollary to this is the need for educators to conceptualise and define technology in ways that reflected the broad ways that children experienced it in their everyday lives. Additionally, more effective support for the development and provision of socially and culturally relevant curriculum occurs when influenced by contemporary research and knowledge of play-based pedagogies. As identified in Figure 6.4, educators, family members and people in management positions within the early learning service influenced each other's beliefs about the place of technology in early learning curriculums. Management and educators may respond to family wishes, but the knowledge that family members have may be based on biased sources such as the media, as discussed in Section 1.1. Educators can fulfil the role of advocate, sharing their knowledge and ideas as experts on early childhood pedagogy as well as their understandings of play-based learning. Advocacy could be with families and other stakeholders at the educator's own service, and could also extend to government policy. Additionally, advocacy could extend to a public awareness campaign that focused on the need to support children as digital citizens and to be agents in their technology use rather than be passive consumers.

Overall, educators need to have a clear understanding of their own beliefs about technology, and to be able to reflect critically on how and why technology can feature in early learning services. A strong foundational understanding of play and pedagogy can underpin discussion and collaboration with families and support connections between home and service in terms of technology use, interest, preference and guidance. A key element here is the need for connection, communication and collaboration between families, educators and management to develop a strong understanding of children's interest and experiences with technology, as well as ensuring the social and cultural relevance of integrating technology in terms of supporting children's digital citizenship.

6.2.3 Research design.

Design-based research proved an effective approach for investigating practitioner inquiry. This aligns with findings from Marjgaard et al., (2011) who discuss design-based research and action research as an effective research design to explore technology. Future research considering this approach in similar situations should include an increased focus on developing an awareness and understanding to the practitioner inquiry processes. As discussed throughout this chapter, and also in the limitation section of Chapter 3 (Section 3.7) a number of variables such as time or inability to completely engage in the projects impacted upon professional learning. Future research could consider developing clearer guidelines of what practitioner inquiry involved on a personal, as well as professional level. Of particular importance is reinforcing that practitioner inquiry is a safe space (Fleet et al., 2016) to test new ideas, and trial new approaches. The hierarchy of contribution acknowledge in this study highlights the need to incorporate a distributed leadership approach (Aubrey et al., 2012) in the early stages of practitioner inquiry. Requiring participation of the service directors and managers in the development stages of practitioner inquiry projects should also be included in future projects, as this helps to reinforce and develop a joint understanding of the value of practitioner inquiry as a professional learning model, and also of the processes involved. However, it is also important to note that meetings should take between educators and the researcher without service director and mangers involved to help ensure that educator voices are authentically included.

6.3 Conclusion

Educator personal beliefs about technology as well as aligning technology with pedagogy influenced their curriculum decision-making. The beliefs of families, the directors and managers also impacted on educator beliefs as to the value of technology integration. Emphasising the value of connections between stakeholders in understanding technology in the early learning curriculum was identified as a key feature in supporting socially and culturally relevant technology integration. At the core of this were shared understandings of children's interests and experiences with technology as well as how children can receive the best support in their journey of becoming competent, confident digital citizens. However, disconnects between stakeholders were evident in terms of beliefs about technology and understandings of its relevance in a play-based curriculum. These disconnects impacted upon how technology integration occurred within the curriculum. Educators can have the agency and influence to inform the understanding of various stakeholders including service management and families, and to challenge practice at a policy or regulatory level. The impact of personal factors (such as preference, confidence and competence in using technology), as well as aspects of the community (such as resources and interpersonal support) impacted on educator beliefs as to the integration of technology as well as their positioning as being either 'for' and 'against' technology in early learning pedagogies.

In concluding this discussion of findings and implications of this study it is valuable to reflect on the fictional novel that inspired the researcher's thinking about technology and education over 20 years ago (1.3.1). In response to being asked whether the interactive, digital books (The Primers) that served as a useful learning tool for many young girls, the designer of the Primer responds:

> My opinion is that we made a mistake […] It was mistaken to believe that they could be raised properly. We lacked the resources to raise them individually, and so we raised them with [The Primer]. But the only proper way to raise a child is within a family (Stephenson, 1995, p. 455).

While this book is fictional, and when speaking of The Primer was, at the time, speaking of a resource that was decades away from design or development, parallels are apparent with the research presented in this thesis. Findings that emerged from this research reinforce that connections between people as well as face-to-face discussion, guidance and support are key in assisting both children and educators to develop foundational understandings of technology that enables them to navigate technological worlds with agency and to develop as competent, confident digital citizens. The presence, influence and importance of technology in everyday life is obvious. For example, Gibbons (2007) notes that while the initial focus was on creating technology, it has now expanded into the social and educational realm which means that children's play is directly influenced and driven by the ubiquity of technology in everyday life.

While the quote from Stephenson (1995) speaks of the role of families, this thesis presented the important role educators play in supporting children to develop their critical thinking skills and foundational understandings of technology. This thesis also identified the need to create connections between families and educators to foster deeper knowledge of the relevance of technology in children's lives and the intricacies of strong digital citizenship. This is outlined in Figure 6.2 where the interrelated nature of educator, family and management beliefs relating to technology are identified as factors that impact upon educator proclivity to integrate technology in the curriculum. Figure 6.3 demonstrates the conceptual understandings and beliefs that impacted upon each of the stakeholders in terms of appropriateness of technology integration in early learning curriculums.

Additional factors that impact upon educator beliefs and practices were identified in Figure 6.4, which, in turn, can impact upon the beliefs that are held by management and families. The iteration of findings culminating in Figure 6.4 demonstrate the complexity of factors that impact upon educator beliefs and practices in terms of integrating technology as well as on their understanding of the social and cultural relevance of technology within play-based pedagogies. Understanding technology is not intuitive and a great many factors influence beliefs, conceptualisations and dispositions towards technology (Nikolopoulou & Gialamas, 2015a; Palaiologou, 2016; Plowman & McPake, 2013). This study has presented new information to support understandings of educators' beliefs and practices in relation to integrating technology; it has also identified a disconnect between what is known within research or academic spheres, and what is common practitioner knowledge in the field. These are significant understandings necessary for developing and providing suitable professional learning opportunities for educators.

This thesis also identifies three key characteristics as facilitators and barriers to technology integration within the practitioner inquiry process. These characteristics were in alignment with Rogoff's planes of analysis as detailed in Figure 6.5. These characteristics provide a framework for planning and facilitating professional learning strategies that can support educators to increase their own understandings and formulate beliefs as to the relevance of technology in children's lives. These shifts in educator understanding can subsequently influence their decision making in terms of curriculum provisions and implementation to include socially and culturally relevant technology integration that will support children in their digital citizenship journeys.

Glossary

Apprenticeship: The process where understandings and development is fostered through engagement in a socially and culturally relevant activity, with part of the reason for the activity being to support less mature people to develop more advanced skills (Rogoff, 1995).

Early childhood service: An approved service that is compliant under the NQF, that provides education and care to children aged six weeks to five years of age, prior to starting at primary school.

Early Years Learning Framework (EYLF) – Australia's national, mandatory framework which aims to guide educators in their provision of high quality teaching and learning for children in prior-to-school, early learning services.

Curriculum: The term curriculum is used in alignment with the *EYLF*, which defines it as all events and experiences that children have throughout the day including resources, features of the environment, planned and unplanned experiences, the educator's pedagogical practices, and the child's interactions with others (DEEWR, 2009).

Digital citizenship: The need for adults and children to be responsible digital citizens by "understanding the use, abuse and misuse of technology as well as the norms of appropriate, responsible and ethical behaviours related to online rights, roles, identity, safety, security and communication" (NAEYC & Fred Rogers Center, 2012, p. 10).

Distal: Distal guided interactions are those that occur at a distance from a learning experience rather than being a direct interaction. The impact of distal guided interactions is therefore not as direct as face-to-face (Plowman & Stephen, 2007).

Documentation: Information gathered by educators about children's learning and experiences that informs curriculum planning, implementation and evaluation. It also records children's learning and experiences and can be used to share information with children and families.

Early childhood educators/ educators: As described in the *EYLF* (DEEWR, 2009), these words refer to all "early childhood practitioners who work directly with children in early childhood settings" (p. 5).

Guided participation: Collaboration and interaction between people engaged in social activity to support learning (Rogoff, 1995).

Intentional teaching: As described in the *EYLF* (2009), educators must be "deliberate, purposeful and thoughtful in their decisions and action." (p.15). Intentional teaching demonstrates how educators acknowledge that learning relies on conversations, interactions and social contexts. When being intentional, educators encourage children to question, speculate, hypothesise and work with their peers and engage in shared thinking and problem solving.

Interactive media: Digital resources and tools that are designed to promote creativity and social interaction (NAEYC & Fred Roger's Center, 2012).

iPad applications: Software that is developed specifically for use on Apple iPad devices.

Non-interactive media: Media or technology that promotes passive viewing (NAEYC & Fred Roger's Center, 2012).

Participatory appropriation: Changes to people's knowledge, skills and understandings through engagement in social activity (Rogoff, 1995).

Play-based learning: The term play-based learning is defined in the *EYLF* as "a context for learning through which children organise and make sense of their social worlds, as they engage actively with people, objects and representations" (DEEWR, 2009, p. 6).

Professional learning: The term professional learning is used throughout this thesis to refer to professional development and training that is undertaken by early childhood educators.

Proximal: These are face-to-face interactions that directly influence learning (Plowman & Stephen, 2007).

Technology: Technology is conceptualised to include digital toys or other devices such as personal computers, cameras and tablets (Palaiologou, 2016) as well as less tangible forms of technology, such as the Internet (Knight & Hunter, 2013); imaginary technologies such as those that are used in dramatic play (Edwards, 2015; Howard, Miles & Rees-Davies, 2012); and non-digital technologies that require an external power source such as light tables and overhead projectors. These descriptions and delineations underpin all uses of the term ‘technology’ throughout this thesis.

Service director: This is the individual responsible for providing pedagogical leadership and other daily operations of the early learning service. The director reported to the higher level of service management (S1) and the service owner (S3).

Service manager: This is the individual responsible for the daily operations of the service and may also be a part owner of the service. They may share responsibility for pedagogical leadership with the service director, though have no formal qualifications in early childhood education or other child related fields.

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Appendix A- Ethics approval

MACQUARIE University

Ethics Secretariat <ethics.secretariat@mq.edu.au>

Approved- Ethics application- Papic (Ref No: 5201200902)

Ethics Secretariat <ethics.secretariat@mq.edu.au> 20 December 2012 at 09:56
To: A/Prof Marina Papic <marina.papic@mq.edu.au>
Cc: Ms Fay Hadley <fay.hadley@mq.edu.au>, Ms Kate Highfield <kate.highfield@mq.edu.au>, Ms Kelly Lee-Anne Bittner <kelly.bittner@students.mq.edu.au>

Dear A/Prof Papic

Re: "Reconceptualising technology in Australian early learning environments" (Ethics Ref: 5201200902)

Thank you for your recent correspondence. Your response has addressed the issues raised by the Human Research Ethics Committee and you may now commence your research.

This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:
http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.

The following personnel are authorised to conduct this research:

A/Prof Marina Papic
Ms Fay Hadley
Ms Kate Highfield
Ms Kelly Lee-Anne Bittner

NB. STUDENTS: IT IS YOUR RESPONSIBILITY TO KEEP A COPY OF THIS APPROVAL
EMAIL TO SUBMIT WITH YOUR THESIS.

Please note the following standard requirements of approval:

1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).

2. Approval will be for a period of five (5) years subject to the provision of annual reports.

Progress Report 1 Due: 20 December 2013
Progress Report 2 Due: 20 December 2014
Progress Report 3 Due: 20 December 2015
Progress Report 4 Due: 20 December 2016
Final Report Due: 20 December 2017

NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4. All amendments to the project must be reviewed and approved by the Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

5. Please notify the Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University.

This information is available at the following websites:

http://www.mq.edu.au/policy/

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have final approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

Please retain a copy of this email as this is your official notification of final ethics approval.

Yours sincerely
Dr Karolyn White
Director of Research Ethics
Chair, Human Research Ethics Committee

Appendix B – Abstract, Johnston & Highfield (2017)

Johnston, K., & Highfield, K. (2017). Technology in outdoor play. In L. Arnott (Ed.), *Digital technologies and learning in the early years* (pp 58-68). London: SAGE.

CHAPTER OVERVIEW

For many children technology is an increasingly common, easily accessible part of their everyday lives (Nikolopoulou and Gialamas, 2015). Children have a dynamic relationship with the various contexts with which they interact, including family, early learning settings and the wider community (DEEWR, 2009; Rogoff, 1990) and as such it stands to reason that technology should be incorporated into early learning settings in a way that mirrors the experiences children have within their family environments, as well as their wider social contexts. This requires a broader conceptualisation of digital technologies and focussing on how these can be used to support authentic play-based learning across contexts. This chapter argues that technology needs to be reconceptualised as a resource to facilitate and support play, and that outdoor play and technology should not be dichotomised. Children, practitioners and parents need to understand the various forms of technology that will continue to feature throughout children's lives. Similarly, children need to experience nature and engage in exploration and play outdoors. Adopting a broad definition of technology allows us to marry these two fundamental components of contemporary children's play. Within this chapter technology is defined and conceptualised as: anything that can create, store or process data — this could include digital toys or other devices such as computers or tablets (Palaiologou, 2016); less tangible forms of technology such as the internet (Knight and Hunter, 2013); and imaginary technologies — such as those that appear in dramatic play (Edwards, 2014; Howard et al., 2012).

The chapter explores three key issues in relation to technology and outdoor play in early childhood:

- Outdoor play with technologies should be viewed as a mechanism for children to have increased autonomy and agency in their learning experiences.

- There is a false dichotomy when we consider technology as a structured indoor experience, whereas outdoor play is often viewed as 'free play'.

- Conceptualisations of technology need to move beyond the passive screen media lens — in relation to outdoor experiences this could include digital resources such as a GPS, compass, microscope or camera/video.

Appendix C- Consent letter – Service director/ Manager

Reconceptualising technology in Australian early learning environments

(Date)

Dear (director/manager)

We would like to invite your service to participate in a study that will investigate technology within early learning settings in Australia. The purpose of the study is to explore ways in which technology is integrated in early childhood curriculums, particularly within the context of the Early Years Learning Framework. We are looking to work with all educators in one room at your service, which caters for children over three years of age.

The study is being conducted by Kelly Bittner, to meet the requirements for the degree of Doctor of Philosophy, under the supervision of Associate Professor Marina Papic, Head of the Institute of Early Childhood, Macquarie University as well as Dr Fay Hadley and Dr Kate Highfield who are both academic staff and researchers at Macquarie University.

Participation involves two phases; Phase 1, a case study, will take place during February and May, 2013 and involves educators in the selected room at the service taking part in an interview, observation of class room teaching and interactions, and also observation of previous programming and planning. Phase 2 will take place during July and December 2013. It is also a case study but includes a professional learning component for participants. This is in the form of practitioner inquiry where participants as a team develop a pedagogical goal to be investigated and implemented, with support from the researcher. The researcher will work alongside the educators during this process and will also observe classroom practices and interactions. Some classroom interactions will be recorded on an MP3 player to assist with later data analysis. MP3 files will be store on a password protected computer and will only be accessed by the researcher. Children will not be directly consulted by the researcher, but will be observed in their interactions with educators. A more detailed description of time requirements is included in the attached consent form.

Involvement in this study is purely voluntary for all participants. Participants are free to withdraw at any time throughout the study and should feel confident that there will be no adverse effects from their choice to withdraw. Any information or personal details gathered remain completely confidential. No individual will be identified in any publication of the results. The investigator and supervisor will be the only people who have access to the data. Any participant referred to in a publication would be identified for example as participant 1 or centre 1. A summary of results will be made available to all participants at the conclusion of the study.

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

Please discuss the research project with your team. Information and consent letters are included for each educator in the selected room. If you are interested in taking part could you, as well as each educator complete the included consent forms and return them in the supplied stamped, addressed envelopes? If you have any further questions, please contact one of the investigators listed below. We look forward to your centre's involvement in the study.

Kind regards

Ms Kelly Bittner
kelly.bittner@students.mq.edu.au
02 9850 9865

Assoc Prof Marina Papic
marina.papic@mq.edu.au
02 9850 9867

Dr Fay Hadley
fay.hadley@mq.edu.au
02 9850 9833

Dr Kate Highfield
kate.highfield@mq.edu.au
02 9850 9878

Reconceptualising technology in Australian early learning environments

I,__________________ (*participant's name)* have read and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

I understand that participation in this research project involves:

Phase 1

- An initial interview (approximately 20 minutes)
- A researcher observing teaching and interactions in my class room (two visits of two hours each, over a two to four week period).
- A research observing previous examples of programming and planning within the class room

Phase 2

- An initial focus group discussion with all educators in the selected room (one hour)
- Involvement in a professional learning component over 5 months which includes:
  - A practitioner inquiry information and skill building session
  - Professional reading and discussion on issues relating to technology in early learning settings
  - Development of practitioner inquiry goals and questions for the project (one session of two hours)
  - A one to two hour workshop to develop action plans and reflective journaling skills
  - Engagement in a practitioner inquiry project
  - Researcher observation of previous programming and planning
  - Monthly observational visits by the researcher (Between July and November 2013)
  - Monthly planned meetings with the researcher for feedback and discussion (approximately one hour)
  - Contact with the researcher via email for feedback and discussion at any time during the project
  - Completion of a reflective journal throughout the research period (July- November 2013)
  - Evaluation interview with the researcher at the completion of the project (approximately 20 minutes)

Participant's Name:
(block letters)
Participant's Signature: ______________________________Date:

Investigator's Name:
(block letters)
Investigator's Signature: ______________________________ Date:

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

(INVESTIGATOR'S COPY)
Reconceptualising technology in Australian early learning environments

I,__________________ *(participant's name)* have read and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.
I understand that participation in this research project involves:

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  - Monthly planned meetings with the researcher for feedback and discussion (approximately one hour)
  - Contact with the researcher via email for feedback and discussion at any time during the project
  - Completion of a reflective journal throughout the research period (July- November 2013)
  - Evaluation interview with the researcher at the completion of the project (approximately 20 minutes)

Participant's Name:
(block letters)
Participant's Signature: ______________________________Date:

Investigator's Name:
(block letters)
Investigator's Signature: ______________________________ Date:

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

(PARTICIPANT'S COPY)

Appendix D – Consent letter – Educator

Reconceptualising technology in Australian early learning environments

(date)

Dear (educator)

We would like to invite your service to participate in a study that will investigate technology within early learning settings in Australia. The purpose of the study is to explore ways in which technology is integrated in early childhood curriculums, particularly within the context of the Early Years Learning Framework. We are looking to work with all educators in one room at your service, which caters for children over three years of age.

The study is being conducted by Kelly Bittner, to meet the requirements for the degree of Doctor of Philosophy, under the supervision of Associate Professor Marina Papic, Head of the Institute of Early Childhood, Macquarie University as well as Dr Fay Hadley and Dr Kate Highfield who are both academic staff and researchers at Macquarie University.

Participation involves two phases; Phase 1, a case study, will take place during February and May, 2013 and involves and involves educators in the selected room at the service taking part in an interview, observation of class room teaching and interactions, and also observation of previous programming and planning. Phase 2 will take place during July and December 2013. It is also a case study but includes a professional learning component for participants. This is in the form of practitioner inquiry where participants as a team develop a pedagogical goal to be investigated and implemented, with support from the researcher. The researcher will work alongside the educators during this process and will also observe classroom practices and interactions. Some classroom interactions will be recorded on an MP3 player to assist with later data analysis. MP3 files will be store on a password protected computer and will only be accessed by the researcher. Children will not be directly consulted by the researcher, but will be observed in their interactions with educators. A more detailed description of time requirements is included in the attached consent form.

Involvement in this study is purely voluntary for all participants. Participants are free to withdraw at any time throughout the study and should feel confident that there will be no adverse effects from their choice to withdraw. Any information or personal details gathered remain completely confidential. No individual will be identified in any publication of the results. The investigator and supervisor will be the only people who have access to the data. Any participant referred to in a publication would be identified for example as participant 1 or centre 1. A summary of results will be made available to all participants at the conclusion of the study.

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

Please discuss the research project with your director and team members, and if you are interested in taking part, could you please complete the included consent forms and return them in the supplied stamped, addressed envelopes? If you have any further questions, please contact one of the Investigators listed below. We look forward to your centre's involvement in the study.

Kind regards

Ms Kelly Bittner
kelly.bittner@students.mq.edu.au
02 9850 9865

Assoc Prof Marina Papic
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02 9850 9867

Dr Fay Hadley
fay.hadley@mq.edu.au
02 9850 9833

Dr Kate Highfield
kate.highfield@mq.edu.au
02 9850 9878

Reconceptualising technology in Australian early learning environments

I,_________________ (*participant's name)* have read and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

I understand that participation in this research project involves:

Phase 1

- An initial interview (approximately 20 minutes)
- A researcher observing teaching and interactions in my class room (two visits of two hours each, over a two to four week period).
- A research observing previous examples of programming and planning within the class room

Phase 2

- An initial focus group discussion with all educators in the selected room (one hour)
- Involvement in a professional learning component over 5 months which includes:

- A practitioner inquiry information and skill building session
- Professional reading and discussion on issues relating to technology in early learning settings
- Development of practitioner inquiry goals and questions for the project (one session of two hours)
- A one to two hour workshop to develop action plans and reflective journaling skills
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- Monthly observational visits by the researcher (Between July and November 2013)
- Monthly planned meetings with the researcher for feedback and discussion (approximately one hour)
- Contact with the researcher via email for feedback and discussion at any time during the project
- Completion of a reflective journal throughout the research period (July- November 2013)
- Evaluation interview with the researcher at the completion of the project (approximately 20 minutes)

Participant's Name:
(block letters)
Participant's Signature: ______________________________Date:

Investigator's Name:
(block letters)
Investigator's Signature: ______________________________ Date:
The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

(INVESTIGATOR'S COPY)

Reconceptualising technology in Australian early learning environments

I,__________________ (*participant's name)* have read and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.
I understand that participation in this research project involves:
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- A research observing previous examples of programming and planning within the class room

Phase 2

- An initial focus group discussion with all educators in the selected room (one hour)
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  - Evaluation interview with the researcher at the completion of the project (approximately 20 minutes)

Participant's Name:
(block letters)
Participant's Signature: ______________________________Date:

Investigator's Name:
(block letters)
Investigator's Signature: ______________________________ Date:

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

(PARTICIPANT'S COPY)

Appendix E- Participant codes

Service 1	
S1P1	Service 1 Participant 1
S1P2	Service 1 Participant 2
S1P3	Service 1 Participant 3
S1P4	Service 1 Participant 4
S1P5	Service 1 Participant 5
S1SD	Service 1 Service Director
Service 2	
S2P1	Service 2 Participant 1
S2P2	Service 2 Participant 2
S2P3	Service 2 Participant 3
S2SM	Service 2 Service Manager
Service 3	
S3P1	Service 3 Participant 1
S3P2	Service 3 Participant 2
S3SD	Service 3 Service Director

Appendix F - Observation checklist

Explanation of checklist

The following is more of a "list of components for consideration" rather than a checklist – it is meant to be qualitative in nature and provide descriptive information rather than just ticking off what is occurring and what isn't.
It also serves as a reminder for the researcher of what potentially could be occurring, but perhaps isn't observed during the visits. This will highlight specific areas of focus, or topics to be aware of for subsequent observational visits, and will also be helpful when entering phase two of the research project.
Educators and the research can look at what was observed, and what the possibilities are, and this may inform thinking around the practitioner inquiry component.

The "Comments" section will be used to jot comments immediately after the observational visit. As a working document, I have included links to the research questions in this section to assist with analysis later. There is a separate table of related codes that further supports analysis.

All phase 1 observations will be analysed within the context of the EYLF.

Data collection checklist

Centre name:
Date:

Guided interactions: Indirect					
	Aspect	**Descriptor**	**Check**	**Comment**	**Link to literature**
1	**Availability of technology**	Tech available as a tool/ resource throughout the day, rather than just within specific tech related experiences			1
2		Integrated into play experience			1
3		Children are able to access tech related tools/ resources without assistance			1
4		Equity of access between children is monitored and supported			1, 4, 10, 38, 39
5	**Educator practices**	Educator is accessible for help with tech related experience/ play			2, 27
6		Educators monitor engagement with resources/ tools/ experience			2
7		Educators model how to use tech related tool/ resources			3
8		Educators scaffold how to use tech related tool/ resources			3, 8, 25
9		Educators share a sense of wonder in using technological tools and resources (real or imagined)			7
10	**Resources**	Are tech related tools and resources in working order?			4
11		Are there a range of tech related tools and resources available?			5, 6
12		Children actively engage			33

		with technology in their environment			
13	**Programming and planning**	Experiences extend on children's interests as documented in written observations, day books or as observed by the researcher			5, 21
14		Technology is included in planned as well as spontaneous experiences			5
15		Use of technological tools and resources is child – led, and/ or child driven (they choose the influence the direction of the experience and/ or the technological tools and resources that are included)			32
16		Technology tools, resources and/ or experiences extend on children's abilities			22
Guided interactions: Direct					
	Aspect	**Descriptor**	**Check**	**Comment**	**Link to literature**
17	**Educator practices**	Children are encouraged to engage with new tech related experiences and resources			12
18		New skills in handling/ using technological tools and resources are modelled and scaffolded: educators explain how to use tools and resources			8, 25, 46, 47, 16, 25
19		Scaffolding demonstrates a level of expert guidance in relation to the specific tool or resource being used			17, 25
20		Topics that will be explored using technology are explained by the educator			9

21		Technological concepts are introduced in a systematic way			31
22		New skills in navigation of software and/ or applications are modelled and scaffolded			8, 25, 46, 47
23		Children's experiences and understandings in relation to technology are acknowledged and reinforced - Reinforcement may be verbal or non-verbal			13, 27 13, 18
24		Modelling/ scaffolding is responsive to individual interests and abilities			8, 36
25		Educators adjust experiences to suit children's abilities - challenges are increased/ decreased as needed			11, 27, 41, 50
26		Educators sit with one or more children when technological tools or resources are being used			44
27		Educators actively assist children when technological tools or resources are being used			45
28		Educators suggest options or alternatives when children are using technological tools or resources			48
29		Educators offer assistance when children make mistakes in using tech related tools and resources			51
30		Younger children are allowed more time to develop skills with the			36

		resources/ Or less abled children			
31		Children are encouraged to revisit tech related resources and experiences that they find more challenging or have less experience with			12
32		Experiences/ interactions encourage critical thinking and challenge using technology as a tool/ resource - Children encouraged to reflect on their own thinking processes - Promotion of collaboration and sustained shared thinking			26, 30, 31
33		Tech related resources are used appropriately and safely, and educators intervene if they are not			10
34	**Curriculum**	Technological resources used to support the curriculum (as a tool/ resource- or to access information, such as through internet searches)			9
35		Children lead the direction of exploration in relation to using technology as a tool or resource			22
36		Children have opportunities to use technology to create new visual representations or to manipulate pre-existing ones			28
37	**Equity**	Is peer scaffolding effective? is the more capable peer taking over?			34, 36

38		Is one gender more dominant in using the resources? Is one gender more passive in relation to waiting for their turn?			35
Assessing technological tools and resources					
	Aspect	**Descriptor**	**Check**	**Comment**	**Link to literature**
39	**Contexts**	Technological resources and tools are authentic and relevant to children’s lives. Children have the opportunity to use technological tools resources to solve every day problems - Consideration is given to cultural in relation to technology in terms of appropriateness and anti-bias representation			14, 20 19 20
40	**Resources available**	• Consideration of the tech based tools and resources available • Consideration of whether tech related tools and resources have multiple purposes and values, such as: - Do they allow children to manipulate, investigate, identify and make mistakes? - Are there opportunities to hypothesis, predict, investigate, experiment and explore multiple solutions for problems? - Do resources and tools promote critical thinking?			23 24 29 26
41	**Collaboration**	Considerations such as: • Are children conflicting in relation to turn taking with resources? Are some children dominating other children’s turn with a resource?			**34**
Reactive supervision					

	Aspect	Descriptor	Check	Comment	Link to literature
42	Supervising rather than guiding	• Educators Watching engagement with tech related tools and resources from a distance • Children walk away from experience because they are having issues/ difficulties with it. • Children walk away from experience because they don't know what to do next • Children are oblivious to a problem that is occurring (e.g. pushing random buttons to try and get a response)			37, 40, 41, 42
43	**Equity**	• Keeping a check on turn taking • Keeping a check on time that each child is engaged with tech tools and resources (e.g. are some children preferring this resources, are others avoiding it)			**38, 39**
44	**Curriculum**	Technology not contributing to play or learning (beyond social and negotiating the social aspects)			**43**

Appendix G – Data Set Codes

Phase 1	
P1 Int.	Phase 1 Interviews with educators
P1 Obs	Phase 1 Observations of practice
P1 Art	Phase 1 Artefact (Documentation of children's experiences recorded by the educator)
Phase 2	
P2 PIP Meet.	Phase 2 Practitioner Inquiry Project related meeting with educators
P2 PIP Obs	Phase 2 Observations of practice during the Practitioner Inquiry Project
P2 PIP Art	Phase 2 Artefact (Documentation of children's experiences recorded by the educator)
P2 PIP Jour.	Phase 2 Reflections recorded by educators in their reflective journals during the practitioner inquiry project
P2 FG	Phase 2 Focus group discussion with educators

Appendix H - Practitioner inquiry project summary and role of the researcher

The researcher fulfilled the role of practitioner inquiry facilitator throughout Phase 2. This involved drawing on knowledge gained from Phase 1 data collection (interviews, observation and artefacts) to help determine an understanding of educator beliefs and practices relating to technology integration in their early learning services. The researcher shared findings with educators at each service during the initial focus group discussion at the commencement of Phase 2. Educators discussed these findings with the researcher and used them as an impetus to begin thinking about a focus for their practitioner inquiry research projects. A summary of the projects and the facilitators role is outlined below.

Service 1

Service 1 opted to investigate the topic of technology supporting children's investigation of space and the Solar System. Initially the researcher provided the service with a resource folder including information on technology in early learning services as this was identified as an area for professional learning focus in the Phase 1 findings. The researcher reflected on communication with the educators and ascertained that they positioned technology as the main focus of the experience rather than as an integrated resource to support investigation. As such the researcher met with the educators and discussed how technology could support children's investigation and learning, linking with example of practice that emerged (with different educators at the service) in Phase 2. The professional learning focus for educators at S1 was on exploring ways that technology could be integrated into the curriculum rather than as a standalone resource.

Once the topic of space was selected by the S1 educators, the researcher located and read a number of research articles on supporting children's investigation of this topic. Research indicated that this is a topic in which many adults often have limited knowledge (Seigal et al., 2011) – something that was reinforced by the educators during a Phase 2 meeting. This highlighted for the researcher that effective professional learning approaches could acknowledge the support educators as co-learners. The researcher contacted another academic who specialises in teaching very young children about space and the solar system and organised for an interactive workshop to take place at the service for both children and educators.

Additionally, in sourcing and suggesting technology that could support children's investigations it was considered that educators would also be learning about space related concepts. The Symbaloo Webmix was developed as a screen/ Internet based resource that provided a combination of images, video and written information for children and educators. The Webmix linked to reliable and robust online sources such as NASA and National Geographic. The researcher also provided the educators with guidance and advice on using technological resources, as well as access to physical resources. This included introducing items that may be of interest such as computer programs, and web resources. The focus was on how these resources could support children's investigations on the topic of space and the Solar System.

An educator at S1 was very interested in introducing iPads to the children, within the curriculum. The researcher shared ideas on how children could be creates with technology rather than consumers – such as in using digital story books. The educator worked with small groups of children to make digital cartoon stories. The researcher provided iTunes cards for the educators to buy apps that they thought would be useful. The researcher suggested a number of space related applications that were manipulable or constructive (Highfield & Goodwin, 2013) rather than instructive or close-ended.

Service 2

Educators at S2 were very interested in exploring storytelling with the children in their group. They had explored many different mediums for storytelling, and these were well documented in the Phase 1 data. However, the educator that led those experiences was no longer working in that room at the service. The researcher encouraged the educators to share their ideas on how technology could be used to support children's engagement in storytelling (as per the research focus). S2P1 noted that some children enjoyed watching themselves on video, which indicated that they had some degree of familiarity with the resource. Data from Phase 1 also indicated that children were familiar with the use of digital cameras – both in being photographed and in taking photographs themselves.

The educators were provided with information on technology integration with the curriculum as an everyday resource that reflected children's experiences (rather than as the sole focus of an experience), as this was identified as an area for professional learning in Phase 1 observations. The researcher provided educators at S1 with a number of resources that could support their storytelling. This included a laptop for the educators and children to use, software that could support digital story telling through slideshows, and art/ drawing software, and an MP3 voice recorder. Educators were also provided with guidance from the researchers on how to use the resources.

The educators initially used the voice recorder as part of a whole group experience but found that the children were reluctant to speak into it. Discussion between the educators and researchers determined that this was due their unfamiliarity with the device. The researcher suggested that the educators use video recordings they are an age appropriate resources (child can include their voice and story without being able to write) and also because Phase 1 interview data indicated that children were familiar with smart phones. This was not able to proceed as the service did not allow smart phones to be used within the rooms and the educators were reluctant to pursue this pathway. Educators opted to not use the laptops with children either.

Storytelling progressed using web-braining storming on paper and children contributing ideas that the educators transcribed. The researcher drew on examples from Phase 1 where children had been able to actively engage in story telling through a wide variety of means such as slide shows, photographing their ideas and also through dramatic play. The educators decided that the focus needed to be on getting quieter children to tell their stories in whole group experiences, and were happy to not use technology throughout this process. The educator continued to talk with the educators to gain insights and understandings of their ideas and beliefs that underpinned their decision to not use technology.

Service 3

From the beginning of the research project educators at S3 knew that they wanted to explore how children’s use of technology could support them to have agency, and for their voices to be authentically represented in the curriculum. Data collection from Phase 1 demonstrated that educators were confident and familiar with integrating technology into the curriculum as an everyday tool. It also showed that children were very familiar with technology such as iPads, tablet, photographs and video recordings, using the Internet as a resource, light tables, projectors and a viewing media to support investigation and play-based learning. With this in mind, the initial information provided to the educators at S3 focused less on foundational understandings of integrating technology, and more on specific issues around agency. This included research articles considering power and rights around photography and supporting communication through use of digital media.

During the first meeting in Phase 2, educators expressed that they would like to focus on including children's voices in their transition to school process. They also wanted to be able to share this information digitally with children and families. The researcher shared a number of resources with the educators. Initially this included a laptop and tutorial on how to use Edublogs. This is an online blog which allows children, educators and families to post and share content. The researcher suggested this resource as it met the project aims of including the children's voices and being easy to share. However, educators opted to not use this resource and expressed an interest in using an iPad. This aligned with Phase 1 data as well, as computers and software were not observed in use whereas tablets were.

The researcher sourced and iPad and iTunes cards for the educators to use throughout the project. Children and educators were familiar with the resource and very little introduction was needed for this resource to be integrated into the curriculum. Finding an application that met the requirements of being easy for children to use and also being able to export the digital story books proved problematic. Additionally, there was no Internet access in the room and many of the applications needed online access. The researcher and educators both trialled different applications and then discussed them in the meetings. S3P1 and the researcher also communicated via email to share ideas on apps that may be suitable. A number of issues impacted upon the use of apps such as poor design (application would freeze or not load), unable to explore story books, limited function (some did not include option to record voice or to input text as an example), and difficulty in understanding> as example of this last point was the app Explain Everything. Even though it was the most comprehensive in content, options and exportability, it was more complex than the other apps and therefore not as easy for the children to use independently.

To combat the issues with exporting from the apps the researcher offered to revisit the Edublog option with the educators. A number of the apps had the option to embed digital story book link within blogs or websites to share with families. The educators opted not to do this as they felt they did not have time to learn this system or to effectively promote it to families. Also, as it was a new system of technology they were not sure how it would be received by service management. The decision was made to focus on finding a suitable app rather than developing a blog. Children worked collectively on making a digital book for four weeks as an ongoing project. Engagement was based on their interest and was supported by educators. The project began to taper off towards the end of November the transitions to school visits finished. This time Christmas preparations and celebrations emerged and became a focus and area of interest in children’s play.

Appendix I - Observed examples of computer use at S1

S1 (P1 S1 Obs.)

Two children seated next to each other, each with a computer.

Child: Appears to be actively using the computer

Child: Pushing keys randomly and an error message comes up

Educator: Sitting nearby and notices that the error and models how to close the pop up box

Child: Types a few letter and touches the screen. Looks around and appears disinterested

Educator: Suggests that the child uses a painting program. Opens the program and explains to the child how the program works and what they can create. The educator remains sitting close by the child while they use the program.

Appendix J – Observed example of Internet use at S2

(P1, S2, Obs)

The educators planned to start a fruit-planting project with the children and used the Internet as a way for children and educators to work together to develop an understanding of what plants would be suitable for their garden. The educator provided key questions to scaffold the Internet search such as what time of the year to plant and what type of environment was needed. The experience was teacher-led with children observing technology as a tool for providing information. They were introduced to key terms related to this resource such as ‘Google’, ‘search’ and ‘website’. They were also able to see how laptops were used in terms of keyboards and track pads. This provided a foundational knowledge on computer use that could be extended over time to foster a deeper understanding of this particular form of technology (Lindahl & Folkesson, 2012a).

Appendix K – Example of small group computer use at S1

(P1, S1P3, Art)

Extending on children's interests in trains the educator (S1P3) made a book on trains with the children. The book created was shown to children to support their interest in steam trains, and to complement a story "Steam train, dream train" that they had read as a group.

The educator took a group of nine child to sit with her at a laptop computer. The educator suggested that they search for photos of steam trains using the Internet. One child suggests using Google search "images". The educator conducted the search and then asked each child to select the image of the train that they like best. The educator then printed out all of the images selected by the children and made them into a book. The book was shared with the children at group time, and was available in the room for children to revisit.

Appendix L- Example of small group Internet use at S3

(P1, S3, Obs Art)

During a whole group meeting with the children S3P1 reminded children of an experience where they were watching the lifecycle of a caterpillar on DVD. Several children continue to recall information on the lifecycles of caterpillars throughout morning meeting and when the group had moved on to the morning meetings.

A small group of four children continued showing interest. S3P1 called this group 'The Research Group' and they accompanied S3P1 to the director's office to use the office computer and Internet to further explore their ideas about caterpillars, as there was no Internet access in the room. S3P1 typed in "vey hairy caterpillar" and showed the children the images that came up. They printed out the pictures and discussed that they could not find an exact match to the caterpillar they were trying to identify.

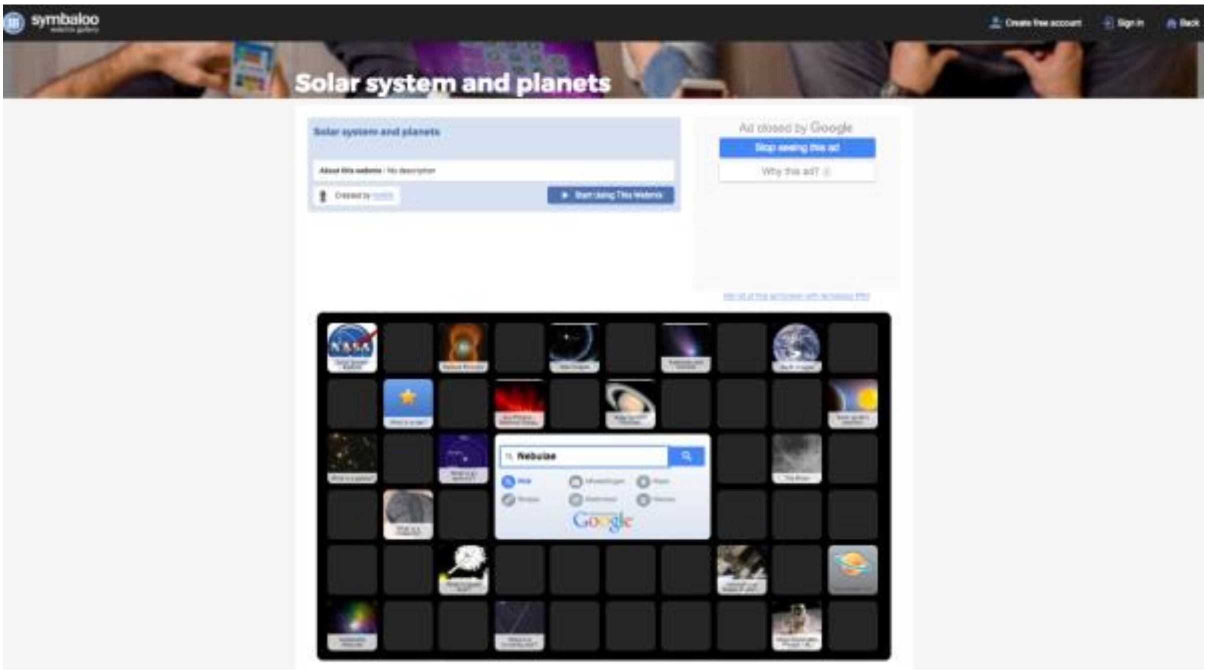
The children discussed the similarities and differences, identifying that it the caterpillar in the image had different legs. The children noticed the name and comment that now they know the name they need to "research it".

S3P1 commented that she put the name into the "search engine to find out more but nothing came up". She then noted that there was a YouTube clip that she could download and put onto a DVD for next week.

Appendix M – Symbaloo Webmix

Symbaloo Webmix resource for the S1practitioner inquiry project.

The researcher suggested Symbaloo Webmix as a resource that could build on the experience and understanding that the children already had in terms of computer use and in using the Internet to provide information. The Webmix included a wide number of resources that related to space and the Solar System, and particularly to nebulae, as this was a strong focus and emerging interest from the space and Solar System workshop. Sites were added to the Symbaloo Webmix based on the children's interests and also the areas educators had indicated that they needed additional information. This enabled educators to be co-learners with the children in accessing information on planets, the Solar System and the Sun. It also allowed the children a degree of autonomy and agency as they could select the sites that wished to go to and then navigate through them easily. For example, one icon took the children to a slide show of nebulae images. The children could then discuss the images together, linking with the information they had gained from the space and solar system workshop as well as previous or subsequent related experience. This also extended the opportunity for educators to sit with the children and hear their ideas on nebulae or ask questions that would encourage critical thinking. An image of the Symbaloo Webmix, as well as the hyperlink are included below.



http://mobileiphone.symbaloo.com/shared/AAAABi052wMAA42ACq4lKQ==

Appendix N – Observed example of computer use at S1

(P1 S1 Obs)

Child: Sitting at the computer, looking around the room and not engaged. There is a dialogue box open on the screen and the child is not able to use the computer because of this.

Child: Begins pressing keys, trying to make the program work again. Looks around the room.

Educators: One is helping with a painting experience, one is in the book corner with an upset child, and another is taking photographs of other children playing.

Child: Tries to encourage another child to come over and use the computer next to theirs.

Child slid off chair and looks towards the educators. Child turns off the screen and walks away.

Appendix O – S3 educator perceptions of children’s technology use

(P2, S3, PIP Obs)

Type of technology	**Number of children (16 children)**
Games on touchscreen devices or online	13
Online shopping	4
Photographs (using iPhones)	2
Researching/ exploring (such as using Google Earth)	2
Music	2
Social media	1
Watching videos	1
Voice recordings	1
Using the Internet and Wi-Fi	1

Appendix P – Example of conceptualisations of children's familiarity with technology

Example of Educator and Service Manager Conceptualisations of Children's Familiarity with Technology (P2, S3, PIP Meet.)

> Service director: That's been the biggest surprise for me. I didn't actually realise how much they knew about the Internet.
>
> S3P1: Have we asked how many have got [an iPad] in their house?
>
> Service director: Yeah […] nearly every single child had a tablet or an iPad or an iPhone.

Researcher: So to begin with the [iPad] is not unfamiliar

Service director: No, exactly. They've had experiences. Then that conversation about Internet shopping […] That blew me away.

S3P1: I think that was an eye-opener [The email they received from a parent]. I thought it was priceless […]

S3P2: Taking a selfie!

S3P1: To send to FaceBook and she's like- [child at the service's] mum was there, because his sister is in high school. She's like, 'told you'! 'This is it- the boys learn from you all the time. They watch'. So I think it was a real eye-opener to the families that think their children are not aware, not even just their general stuff. But not aware of what they're doing all the time or at home. They're aware!

Service director: Definitely. They know exactly what they're doing with shopping and [other online environments]. (P2, S3P1 S3P2 S3SD, PIP Meet.)