The rabbit ate the grass!
Exploring children's activities on digital technologies in an early childhood classroom.

Submitted by

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Statement of sources

This thesis contains no material published elsewhere or extracted in whole or part from a thesis by which I have qualified for or been awarded another degree or diploma.

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Jo Bird

Abstract

The aim of this project was to make children's activities on digital devices visible, in order to be understood, which could then assist educators to extend these activities, thus potentially increasing children's learning. The purpose of the study was to explore the children's activities as they used a range of digital technologies. The research was framed by two research questions: a) 'what activities do children engage in around digital devices within an early childhood classroom?' and b) 'how do these activities relate to elements of Vygotsky's theorisation about young children's play?' By examining these questions the study, which will inform early childhood education practices through four implications in learning with and through technologies in early childhood settings.

Historically, the research literature in early childhood technologies has focused on educators' use of technological devices with a focus on using desktop computers. Researchers exploring digital technology in early childhood education have called for further investigation into the role digital technology plays in the current context. This includes thinking beyond how educators use technologies in the classroom to the implications for children's play, learning and development; and what this might mean for pedagogy and curriculum.

This study used a single site, case study approach where the researcher, who was also the educator, along with the children, documented the use of two iPads™, two digital cameras, a Flip™ camera and a computer within the kindergarten classroom. Sociocultural theory framed the research, in particular Vygotsky's views on children's play, learning and development. Both qualitative and quantitative methods were used for analysing the data collected and the results were then discussed in detail.

The study resulted in four main findings which were: 1) digital devices are supportive cultural tools for fostering social interactions; 2) time is needed to explore the technology; 3) digital devices assist leading activity; and 4) children shift from recording artefacts to recording imaginative episodes. These findings formed the basis of four implications for educators which included: 1) educators need to provide children with the time and knowledge to appropriately use ICT and extend their learning; 2) educators need to plan, provide for and encourage social interactions between children using digital technologies; 3) educators need to develop children's skills as mentors for each other in their ICT use; and 4) educators need to consider and provide apps that encourage imaginative play. This investigation identified the necessity for further research around children's need for time to explore digital devices to assist them in moving from explorative to imaginative behaviours.

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Chapter One: Introduction

1.1 Introduction

The world has changed in the last three decades with the infiltration of digital technology into everything we see and do (Selwyn, 2003, p. 24). Many children are not immune to this influence. They are born into the digital age, surrounded by computers, smart phones and a range of other digital technologies and this influences their play, learning and development. The effect of digital technology on children, especially in education has only recently been investigated, with most research focusing on secondary and tertiary education (see Bennett, Maton, & Kervin, 2008, p. 1006; Coombes, 2009; Margaryan, Littlejohn, & Vojt, 2011). A particular problem with digital technologies in early childhood education is around understanding how to use them in settings that have traditionally focussed on children's active exploration and play such as block building, art and craft and dramatic play areas. Continued research into digital technology in regards to its implications on play and pedagogy is needed to inform the early childhood community and provide the best educational experience for children.

1.2 Research focus and rationale

Over the last few decades digital technologies have become more and more common, and in recent times digital devices have begun to penetrate early childhood centres. The focus of these devices within early childhood education centres has been around educator's use of technology (Perkins, 2009/2010) and how the devices can be used to capture children's learning (Boardman, 2007). Although research exists on educators using technologies in early childhood settings, there is not as much research around children's use of technology and how it can be used to enhance an educational program. Children are growing up in a world full of digital devices and an understanding is needed of the potential of these devices in children's play and learning.

As a teacher in a kindergarten, I was intrigued when a child in my group was using a free draw program on a computer to enact a dramatic play situation. He had used the program's stamps to draw a rabbit in grass with a sun and trees. He then changed to an eraser and started removing the grass. I asked him what he was doing, he replied, (with an 'isn't it obvious' look on his face), "The rabbit is eating the grass!" (Bird, 2011, p. 38). On the computer screen was a scenario that could have been created with plastic animals and play dough as grass. He ignited my curiosity, what else was possible for children and digital technologies in an early childhood classroom. As McLachlan (2010) notes, "we do educational research because we need more knowledge about something concerning education" (p. 89). I wanted to know more about children's use of digital technologies and research into this quandary was an appropriate way of

finding out more. Therefore the focus of this study was on the type of activities children engaged in when using digital technologies in the classroom and how these related to a particular perspective (sociocultural) of play.

1.3 Digital technology in early childhood

The use of digital technology within early childhood education continues to be an emerging area of research. Early research in this area focussed on the implications of using technologies on young children's development (Lepper & Gurtner, 1989). These concerns were largely unfounded with research suggesting technologies helped children participate in social interactions and collaborative problem solving (Yelland, 2005). A great deal of contemporary digital technology research focuses on primary, secondary or tertiary levels of education (for example Branch, 2003; Thrupp, 2005), and the insights from these studies do not necessarily transfer easily to early childhood. This is because early childhood education often has a pedagogical orientation towards learning that is based on understandings of children's play. When early childhood is the focus of digital technology research it often only studies how educators use devices to capture children's learning (see Boardman, 2007) or how to teach 'digital natives' (see Clarke, 2005). This study investigated children's use of digital technology within a kindergarten classroom and which activities they engage in around these devices.

1.4 Theoretical orientation

This thesis uses sociocultural theory as its theoretical underpinning. Sociocultural theory was founded on Vygotsky's (1978) theorisation around human behaviour and his notion that a person's social and environment influences their development. Vygotsky's perspective on play largely relies on a child's interactions with others in their social and cultural context to develop their play skills. This study investigated children's use of digital devices as they engaged in their early childhood classroom and as an early childhood classroom is a social context, the use of sociocultural theory was an appropriate choice. Vygotsky's ideas about play were also used to frame the study theoretically. This is because play is an important pedagogical vehicle in early childhood education (Edwards, 2011) and Vygotsky's theorisation about play is used in contemporary early childhood research (Verenikina, Harris, & Lysaght, 2003).

Five main theoretical constructs derived from Vygotsky's work were used within this thesis including: a) imagination (Vygotsky, 2004a); b) leading activity (Kravtsova, 2006); c) social interaction (Edwards, 2003); d) cultural tools(Vygotsky, 1978); and e) the Zone of Proximal Development (ZPD)(Vygotsky, 1978). These constructs are detailed in chapter three and are used in the data analysis of this study and also when discussing the findings and further implications for the field of early childhood education.

1.5 Research questions

Researching what activities children engage in around digital devices within an early childhood classroom requires exploring the children's world as they participate in the educational program. A second lens is then used to interpret the data collected to discover which elements of Vygotsky's theory are evident in the children's activities. Given this study was focussed on children's activities with digital devices and using a sociocultural perspective on play to understand these activities the two research questions were:

1. What activities do children engage in around digital devices in an early childhood classroom?
2. How do these activities relate to elements of Vygotsky's theorisation about young children's play?

Exploring children's activities on digital devices requires the researcher to be situated within the early childhood classroom, to observe and record the children's activities as they take place. This research project employed a qualitative approach, as "qualitative research consists of a set of interpretive, material practices that make the world visible" (Denzin & Lincoln, 2011, p. 3). In this research project, the 'world' was the early childhood classroom containing the various digital devices and the 'material practices' are the activities the children engaged in on these devices. The aim of this project was to make children's activities on digital devices visible, in order to be understood, which could then assist educators to extend these activities, thus potentially increasing children's learning.

1.6 The structure of the thesis

This thesis has seven chapters. The first being this introductory chapter which outlines the research topic and rationale, lists the research questions and gives a brief overview of digital technology in young children's lives and the theoretical orientation.

Chapter Two discusses the current literature in relation to young children, digital technology and early childhood education. It begins by defining digital technology, explores the concept of 'digital natives' and explains the notion of the 'digital divide'. The chapter then discusses digital technology in early childhood education, its specific uses and the current perspectives on its place in early childhood education.

The third chapter explores the theoretical framework for this thesis. Recently, early childhood education has moved from a developmental framework to what is commonly known as a 'postdevelopmental' perspective (Nolan & Kilderry, 2010). Postdevelopmental perspectives include a range of theoretical orientations including, poststructuralism, critical theory and sociocultural theory. Of these perspectives, sociocultural theory as has a strong presence in early childhood education (Edwards, 2003). This chapter establishes sociocultural theory as the theoretical framework used in the study. Five core constructs derived from Vygotsky's work about young children's learning, development and play are considered,

including: a) imagination; b) leading activity; c) social interaction; d) cultural tools and e) the Zone of Proximal Development.

Chapter Four describes the methodology employed for this study. Initially, the chapter discusses the qualitative and quantitative approaches and the differences between the two. The ontology and epistemology of the research is then explored with the methodology described in greater detail. The study is a qualitative case study. The chapter explores the data collection methods, the participants, ethical considerations, data analysis methods and concludes with a description of its limitations.

Chapter Five uses transcripts and photographs to describe the findings of the study. The chapter begins by discussing the insights gained when the project was introduced to the children. These findings are divided into two sections, with each outlining the findings related to each of the research questions.

Chapter Six discusses the findings in more detail. The most frequent activities children engaged in are discussed in more detail, as are the relationship between the children's activities and the five constructs from Vygotsky's theory that were outlined in Chapter Three. The findings resulted in four implications for educators considering introducing and using digital technologies in early childhood education and these are identified and discussed.

Chapter Seven is the conclusion chapter for this thesis and begins by reiterating the four implications for practice. The chapter then explores the dual role of teacher and researcher. The chapter concludes by discussing the challenges of data analysis and suggests possibilities for future research.

1.7 Conclusion

This chapter provide an introduction and overview of the thesis. The rationale for the research focus has been identified and a brief discussion of research into digital technologies in early childhood education provided. The chapter has indicated that sociocultural theory is used as the theoretical orientation for thinking about children's learning, development and play in early childhood education. The research questions have been identified and the structure of the thesis outlined.

Chapter Two: Literature Review

2.1 Introduction

This chapter discusses the current literature related to young children and digital technology. It begins by defining Information and Communication Technology (ICT), digital technology and outlines the term used throughout this thesis. The chapter describes digital technologies within children's lives and explains the term 'digital divide'. A discussion is then presented around the notion of 'digital natives' and its opposition. Finally, the chapter concludes with an overview of digital technologies within early childhood education, specifically how they are used within early childhood education and the current perspectives on their use within early childhood education.

2.2 Digital Technology

Information and Communication Technology (ICT) was defined by Siraj-Blatchford and Siraj-Blatchford (2003) as "anything which allows us to get information, to communicate with each other, or to have an effect on the environment using electronic or digital equipment" (p. 4). The understanding of ICT has expanded to include a wider range of devices as Bolstad (2004) shows in her list of possible ICT's within early childhood classrooms:

> computers (including desktop, laptop, and handheld computers); digital cameras and digital video cameras; creativity and communication software and tools; the Internet; telephones, fax machines, mobile telephones, tape recorders; interactive stories, simulated environments, and computer games; programmable toys and "control" technologies; videoconferencing technologies and closed-circuit television; data projectors, electronic whiteboards, and more. (p. 2)

In this thesis the term digital technologies is used over the term ICT to encompass all the potential activities and practices children engage in using these devices.

2.3 Digital technology in children's lives

In 2005, children's use of digital technology was investigated in the United States, although now an outdated study it is the only one available that provides data relevant to this research. Vandewater et al. (2007) surveyed over 1000 families and was "the first to provide comprehensive information regarding the extent of media use among young children" (p. 1006). The study found that on a typical day 75% of children watched television and 32% watched videos/DVDs for over an hour. Computers, which were described as 'new media' were used by 27% of 5 to 6 year olds for an average of 50 minutes. The authors were surprised that "a striking number have a television in their bedroom (one third of 3- to 6- year-olds)"

(p. 1006). Children have become consumers with "electronic media marketed directly at the very youngest children in our society", and companies have realised that children have a voice in the products their parents buy (p. 1007). Edwards (2010) also questions children as consumers and the role that digital technology has on consumerism and commercialisation. She reflected on her experiences as a parent and how children's exposure to digital technology might influence their other interests and in turn, their play. She writes:

> In the same day, we might have watched a Thomas the Tank Engine™ DVD, read a Thomas the Tank Engine™ book and refused to buy a Thomas the Tank™ t-shirt or tub of yoghurt. Did accessing a community of Thomas the Tank Engine™ fans on YouTube help them see how to engage with the toys in a creative way or was it just more entertainment? (Edwards, 2010, p. 266)

The question of the relationship between digital technology and children's play is becoming more frequent in the research literature. Marsh (2010) explored children's involvement in virtual worlds via online surveys and group interviews, its influence on their play and the relationship tension created between the two. Marsh, like many other authors calls for further research into children's use of digital technology stating "academics and educators need to examine their affordances more closely in order to identify what children gain from their playful engagements in these worlds and how their experiences can be built upon in early years settings" (Marsh, 2010, p. 36). This is echoed in the Vandewater et al. (2007) study, "at this point, there are more 'unknowns' than 'knowns' in terms of the impact of exposure to screen and electronic media on very young children's development" (p. 14).

Digital technology is not only affecting children's play but it is creating "significant changes in social and cultural practices in the 21st century" (Marsh, 2010, p. 23). The Vandewater et al. (2007) study was aware of this and explored the amount of time spent with media in conjunction with the time spent reading, being read to or outdoors. The authors found there was no real difference between the children who used media within the American Academy of Paediatrics (AAP) guidelines and those who used media excessively (p. 1012). The notion that media is taking children away from other activities especially outdoor play was not supported by this study.

2.4 Digital natives and the digital divide

One explanation of children's technological abilities presented was Prensky's (2001) 'Digital Natives, Digital Immigrants' concept. In 2001, Prensky proposed the idea of 'digital natives' and 'digital immigrants' which quickly become a popular way of explaining children's ability to use digital technology with apparent ease. Prensky described digital natives as students who "are all 'native speakers' of the digital language of computers, video games and the Internet" (p. 1) and " as digital

immigrants learn like all immigrants, some better than others – to adapt to their environment, they always retain, to some degree, their 'accent', that is, their foot in the past" (Marc Prensky, 2001, p. 3). Prensky argues that educators need to change their teaching methods to engage the children of the digital age and design new, technology embracing, ways to impart knowledge. Martinez (2011) agrees with Prensky, but only so far, suggesting instead that "catchy phrases should never be confused with guiding principles of education" (p. 6). She goes on to state the digital native/ digital immigrant metaphor only encourages teachers to give up trying to speak the language today's children understand, but if that was the case all teachers would still be writing with chalk on a blackboard, rather than embracing whiteboards and data show projectors. What is needed in addition to catchy phrases such as the idea of the digital native is an understanding of the type of educational principles that can be used by educators to guide their practice when using digital technologies with young children.

When presented with the digital natives argument, many people agree claiming children can just pick up a digital device and seem to instantly know how to use it without instruction. Does the research support this premise? Prensky's statements were not based on empirical research and just as he had followers to his beliefs he also had opposition. Coombes (2009) questioned Prensky's notion of every child being technologically savvy just because they were born in the digital age by asking:

> Does this mean that children born into an era where cars are the ubiquitous mode of transport will therefore not only drive, like driving, but also be good drivers simply because they have never known a landscape that is different? (p. 32)

Guo, Dobson and Petrina (2008) investigated the competency levels between digital natives (those born after 1980) and digital immigrants (those born before 1980) in a response to Prensky's theory. Through surveys and classroom observations, they found "that there was no statistically significant difference in ICT scores between digital natives and digital immigrants" again, refuting Prensky's claims (p. 251).

Originally the digital divide was referred to as the difference between the 'haves' and the 'have nots' but now a second level "describes the difference or 'divide', in *how* technology is used" (Hargittai, 2002; Reinhart, Thomas, & Toriskie, 2011, p. 181). These differences in technology use can be attributed to "age, educational level, and amount of experience with the technology" (Reinhart, et al., 2011, p. 182). These differences influence technology competency and create evidence that the digital native idea is unfounded. Selwyn and Facer (2010) state "ICT use is certainly not a pre-requisite to surviving in twenty-first century society, it is almost certainly an integral element of thriving in twenty-first century society" (p. 4). Some authors believe the digital divide is a thing of the 1990s but Selwyn and Facer contend that the digital divide does still exist and is "one of the most important social issues of our time" (p. 8). They caution that the divide is not as clear cut as once thought, as investigation into digital exclusion illustrates a whole collective of people who do not access ICT due to their cultural context rather than affordability

or lack of digital cognition. Their interpretation of various studies shows that *how* people engage with digital technology can explain the divide more appropriately than the data stating people's ability to access it. To bridge the digital divide, Selwyn and Facer (2010) call for governments to introduce a "set of policy responses which go far beyond simply increasing levels of hardware provision and then assuming the 'gap' to have been 'bridged'" (p. 11).

Selwyn, Boraschi and Ozkula (2009) used children's drawings to investigate ICT use within primary schools in England. They concluded "if the education technology community is convinced of the benefits of ICTs in school settings, then there is a pressing need to demonstrate to children that ICT-based learning can be engaging, and to explore ways of creating pupil demand" (p. 925). Before educators can be convinced of the benefits research into understanding these benefits needs to be undertaken and disseminated within the educational community.

2.5 Digital natives opposition

Selwyn (2003) discussed the increased prevalence of mobile phones, stating they now outnumber personal computers. He weighed in on the need for research into the educational value of digital technologies, "indeed, from Seymour Papert to Bill Gates, many esteemed commentators have made similar (and largely unsubstantiated) claims about earlier technologies based on little more than personal experience, political conviction and wistful utopianism" (p. 133). He explains that many schools have tried to fit mobile technology into current school structures and "it is hoped, normalise mobile technologies" (p. 139). Coombes also believes that technology has affected our lives but she calls for "closer analysis" into the generation being labelled "tech-savvy" before we can assume the uniform level of competence (Coombes, 2009, p. 31). Martinez (2011) agrees, "labels only solidify boundaries and imply that teachers and students are adversaries" and advocates "young people still need teachers and parents to guide them to use these tools wisely and purposefully" (p. 7). The call for pedagogical guidance is widespread however; more knowledge is needed about how children use technologies in early childhood classrooms so that work can continue on identifying pedagogical principles for the use of technologies with young children.

2.6 Digital technology use in early childhood education

Play has long been valued in early childhood settings as the means in which young children learn (see Bodrova, 2008; Brooker & Edwards, 2010). Educators make pedagogical choices and "equipment and materials are still designed to foster symbolic play in classrooms. For example, almost all classrooms of preschool and kindergarten levels have a dramatic play area" (Saracho & Spodek, 1995, p. 134). In contemporary classrooms digital technology can be used as an artefact in children's play, for example non-working mobile phones, computers, televisions or other digital devices can be used to enact the

pretend play scenario. As stated earlier, in his early childhood classroom, Mark a four year old boy, used the computer and the program TuxPaint™ to create an imaginative play situation. He drew on the screen grass, flowers, a sun and rabbits and then used the eraser to remove the grass as the rabbit ate it (Bird, 2011, p. 38).

The use of digital technologies to capture children's learning has increased in early childhood settings. Carr (2001) encourages the use of digital cameras in assessment of children's learning as they provide instant feedback and can involve children in creating a record of their learning in the classroom (p. 152). Learning stories are a form of assessment documentation used to capture children's experiences and learning in a way that parents can easily understand and value. Learning stories are written in a positive voice and avoid focusing on children's deficits. Social interactions are often represented in learning stories and are a flexible assessment tool that "can also sustain the learning by influencing the other parts of the cultural constellation – the social networks, the way that 'joint activity' is organised and the discourses that are used and valued" (Carr & Lee, 2012, p. 4). Boardman (2007) investigated the use of digital cameras and voice recorders in early childhood settings and found there were many advantages associated with their use. Boardman found the "immediacy with which the image is available for reflection by children and teacher, and how the viewing of the image can motivate children" was invaluable (p. 65). Although parental feedback was not initially included in her study, parents valued the authenticity of the documentation presented using the digital technologies. Dwyer (2008) also values placing the technology in the children's hands. At his early childhood setting children are given digital cameras and "by recording their day, children are more engaged in what they are doing and interested in capturing what is happening" (p. 33). He admits that in the beginning they were wary of handing over often valuable pieces of equipment to young children in case they were damaged or the images were not useable but he has found that their fears were unwarranted.

Parette, Queensberry and Blum (2010) believe early childhood educators are 'missing the boat' in terms of digital technology use in their classrooms. Drawing on ideas associated with the digital disconnect they describe the huge divide between children's digital technology use at home and at the early childhood setting. The authors state "a visitor in many early childhood settings might think that young children were asked "to leave their technology at the door" before entering the classroom" (p. 336). They value appropriate use of digital technology within early childhood settings and encourage both current educators and preservice teachers to develop their technology skills to adequately teach their students.

In Australia, the Victorian Government has a statement that informs educators in ICT use within government schools, but does not mention early childhood. The statement describes the government's "vision and strategies for digital learning…to unlock the full potential of digital technology in our schools" (Department of Education and Early Childhood Development, 2010, p. 10). The three strategies are: "anywhere, anytime access; advancing teaching practice; and quality resources, tools and data"

(Department of Education and Early Childhood Development, 2010). The statement doesn't go into pedagogical specifics that educators could use to inform their direct work with their students. Countries like the New Zealand, United Kingdom, and the United States of America appear to be ahead of Australia in principles to guide early childhood education in the implementation of digital technologies. These countries have statements published by various authors and government departments on the use of digital technologies in early childhood education. For example, in New Zealand, Bolstad (2004) prepared a report for the Ministry of Education; in the United Kingdom the Developmentally Appropriate Technology for Early Childhood (DATEC) (Siraj-Blatchford & Siraj-Blatchford, 2003); and in the United States of America the National Association for the Education of Young Children (NAEYC) (National Association for the Education of Young Children & Fred Rogers Centre for Early Learning and Children's Media at Saint Vincent College, 2012).

In New Zealand, Bolstad (2004) has been investigating the role and potential of ICT in early childhood education. Her report found:

> There are at least three reasons why ICT matters in early childhood education. First, ICT already has an effect on the people and environments that surround young children's learning. Second, these technologies offer new opportunities to strengthen many aspects of early childhood education practice. Third, there is support and interest across the whole education sector for the development and integration of ICT into education policy, curriculum and practice. (p. 2)

Bolstad believes the current literature supports two ideas around ICT use in early childhood education. The first that children's "ICT literacy" can be developed and extended and the second "practitioners need guidance, and opportunities to become capable, competent, and informed about the educational role and potential of ICT" (p. 7). In the UK, Brooker (2003) found that "the rapid growth in curriculum requirements, and in hardware, has not always been matched by a growth in practitioners' understanding of appropriate ways to use the new technologies" (p. 261). She discovered practitioners are often narrow in their understanding of what constitutes digital technology, believing that a desktop computer is the only digital technology in their classroom. Brooker goes on to list other forms of everyday technologies that children are aware of including "control and signal mechanisms, like those that operate traffic lights and washing machines dials, electric wheelchairs and microwave ovens", tape recorders, digital cameras, overhead projectors and programmable toys (p. 262). Brooker calls for understanding of the role and potential of ICT use in early childhood education and cites the DATEC project's criteria as a guideline for implementing ICT in early childhood education. The DATEC's seven principles have been designed to assist England's practitioners provide ICT in their classrooms. The principles are:

1. Ensure an educational purpose;

2. Encourage collaboration;
3. Integrate with other aspects of curriculum;
4. Ensure the child is in control;
5. Choose applications that are transparent;
6. Avoid applications containing violence or stereotyping; and
7. Be aware of health and safety issues. (Siraj-Blatchford & Siraj-Blatchford, 2003).

In the United States of America, the NAEYC published a report aiming to provide guidelines to early childhood educators "to improve program quality by intentionally leveraging the potential of technology and media for the benefit of every child" (National Association for the Education of Young Children & Fred Rogers Centre for Early Learning and Children's Media at Saint Vincent College, 2012, p. 1). The report and its implications cover children from birth to age 8 and concludes with a request for more research into the short and long term effects to "guide policy and inform practice" to ensure digital technologies are used effectively in early childhood programs (p. 11).

2.7 Specific technology use in early childhood education

Plowman and Stephen (2005) conducted a study to "inform the development of an information and communication strategy for the pre-school years of education" (p. 145). Their study was conducted in Scotland within pre-school settings catering for children aged 3-5 years before they enter formal schooling. Plowman and Stephen found that the Scottish government (as with the UK and others) had policies related to Information and Communication Technology (ICT) use within schools but these "are not necessarily transferable to pre-school settings" (Plowman & Stephen, 2005, p. 146). Again, this highlights the need for specific early childhood data around how children engage with digital technology in classrooms to develop principles that inform early childhood practice and helps educators use and implement digital technology in their classrooms.

In their study, Plowman and Stephen (2005) found that children's engagement with computers was often referred to as playing with the computer by adults which didn't surprise the authors as "the dominant ethos of pre-school environments is that children learn through play" (p. 149). While engaged in computer use, children interacted with both peers and adults, and the authors noted that interactions with peers fell into three categories:

1. Negotiating access and taking turns;
2. Managing operations, such as deciding where to click; and
3. Sharing enjoyment of the action depicted on the screen. (Plowman & Stephen, 2005, p. 150)

They found that sometimes children worked together but not in a way that would help the user succeed in future difficulties. The authors noted that typically the computer users sought help from more experienced others "at the risk of the expert child using the intervention as an opportunity to take over the game"

(Plowman & Stephen, 2005, p. 150). Many children were found to give up rather than persevere or seek help from others, even adults. Brooker (2003) discovered that for many children the gains "were the result of peer tutoring that the technology itself appears to stimulate" that free play with a computer encourages (p. 265). Adult interactions tended to be reactive, checking on turn taking and limiting damaging behaviours. Plowman and Stephen identified three categories of adult interactions:

1. Reactive supervision;
2. Guided interaction; and
3. A hybrid approach that combined elements of both. (Plowman & Stephen, 2005, p. 151)

When children did ask for help the authors found it was often when the screen froze or to enforce turn taking and teachers only offered help when they recognised the user was having problems usually through random clicking of the mouse. Plowman and Stephen described the interactions they observed as a guided interaction approach. Guided interaction includes not only adult interaction but also where the computer interface can offer support, for example the program giving children instructions on what to do next. The interactions observed between children and adults occurred around demonstrating how to use the software or mouse, providing feedback, sharing pleasure in features of the program; and intervening in turn-taking (Plowman & Stephen, 2005, p. 151). The authors found limited positive, lengthy child-adult interactions and this was mainly due to the time and resource restraints that these usually one-to-one interactions placed on them. Teachers noted that their attention was often required elsewhere and by the other children they were responsible for in the classroom. The hybrid approach was used by the teachers when they showed the children how to use the computer or software then it would move to a reactive approach once the teachers identified the child as competent in their computer skills (Plowman & Stephen, 2005, p. 151).

Plowman and Stephen found their "observations suggested that computer play does not always act as a support for learning" as often children did not learn the reason why a response was incorrect, whereas if an adult was involved the correct response would be provided and explained (Plowman & Stephen, 2005, p. 153). The use of scaffolding by adults did provide more learning opportunities and the authors noted "scaffolding, whilst common practice in other curriculum areas, was noticeable by its absence in relation to children's play with computers" (Plowman & Stephen, 2005, p. 155). This study further weakens Prensky's argument that digital natives automatically know how to use digital technology and naturally use these technologies to learn. Instead, this study validates the argument that adult interaction plays a large part in learning with or without technology use (Schetz & Stremmel, 1994). Yelland (2007) also acknowledges the valuable role educators have in extending the children's learning through social interactions, questioning and "stimulating them to make new inquiries" (p. 12). She does not see a computer as an isolated tool for children's learning but rather as a tool which when combined with social interactions can influence children's learning. This research suggests that important principles for practice in using ITCs in early childhood education are likely to include increasing educator knowledge in understanding the possibilities to extend children's learning by turning new technologies into "artefacts of

learning" (p. 1). Through social interactions, and importantly verbal communication, educators can question and stimulate children to make their own inquiries and enable them "to learn in multimodal contexts that were not possible in previous times" (p. 1). These principles of valuing social interactions and increased teacher education are also evident in the Victorian Government's ICT statement encouraging "advancing teaching practices"; DATEC project encourages collaboration and the NAEYC in the United States of America calls for research that can inform appropriate practice.

Guided interaction was further explored in a second study conducted by Plowman and Stephen (2007) investigating three and four year olds' play within an early childhood setting. Their focus was on "interventions selected and implemented by practitioners" particularly face-to-face interactions (p. 14). They identified two main dimensions for understanding guided interaction: distal and proximal. *Distal* refers to "interactions that takes place at a distance from the specific learning interaction and so has an indirect influence on learning" and *proximal* refers to "face-to-face interactions…that have a direct influence on learning" (p. 18, italics in the original). Plowman and Stephen found, contrary to Prensky's supposition, that children did need help to learn how to use the digital devices "after which they may move on alone to become independent users" (p. 22). After this basic knowledge was achieved the children could move on to more sophisticated learning and use of the technology. The authors found that the children's competence in using the technology was dependant on a number of factors including "developmental stage, their own interests and preferences, access to ICT, the quality of guided interaction and the particular interests and aptitudes of practitioners and family members" (p. 21).

Through the course of their study and analysis of the data Plowman and Stephen (2007) found that pedagogical choices in the distal dimension also guided children's participation, which included monitoring turn-taking and time spent on devices, "creating an environment to facilitate learning, planning the curriculum and identifying next steps" (p. 18). Plowman and Stephen (2006, 2007) believe this reflects a Piagetian approach to learning where "the usual pedagogical approach derives from a concern with children's progress thought developmental stages or sees child-initiated free play as the medium for learning" (Plowman & Stephen, 2007, p. 19). Under this approach, direct and intentional interactions can be seen as inappropriate and too structured for the early childhood setting, but the authors found them necessary when learning with digital technologies. Proximal interactions were seen to have more impact on children's learning than waiting for children to initiate help-seeking behaviours or to support from a distance. Play is viewed as the way children learn in early childhood classrooms but Plowman and Stephen's (2007) "observations challenge the widespread belief that free play is a sufficient condition for learning in the context of ICT" (p. 23). Early childhood educators already have pedagogical knowledge but lack the ability to transfer it to ICT use. Bodrova (2008) supports the thesis that scaffolding can be beneficial in teaching children academic skills they need for their educational futures. Her article is not specifically related to digital technology, but her research based on a Vygotskian perspective, validates Plowman and Stephen's findings regarding the role of the adult in supporting

young children's learning. Plowman and Stephen's (2007) findings would suggest that an additional aspect associated with pedagogical guidelines that assist educators to create and extend learning outcomes related to ICT in their classrooms include exploring what constitutes ICT; reflecting on the value of ICT in early childhood classrooms; and exploring ideas to transfer current pedagogical approaches to the use of ICT (p. 24).

Brooker (2003) values ICT use in early childhood education and believes it "can be compatible with traditional beliefs and principles for children's learning" as it allows "children to control, explore, and understand their environment and the vast fields of knowledge they will be encountering throughout their schooling" (p. 266). Plowman and Stephen relate their ideas of guided participation to other educational theories and question whether these traditional theories can be transferred to the use of digital technologies,

> The research described here can be situated within other theories of supported learning with a Vygotskian orientation including scaffolding (D. Wood, Bruner, & Ross, 1976), assisted performance (Tharp & Gallimore, 1989), dialogic inquiry (Wells, 1999) and guided participation (Rogoff, Mistry, Goncu, & Mosier, 1993). All of these approaches can be applied to the support of technology-mediated learning but they have not been developed specifically for this purpose. (Plowman & Stephen, 2007, p. 23)

The authors explain that current research tends to focus on the desktop computer rather than all digital devices that are used within early childhood classrooms. In all the research they refer to, interactions are seen as the vital part in understanding learning with digital technology, with educators playing an important role in extending children's learning on the devices. This suggests that social interactions between children and educators and children and their peers will be an important aspect of early childhood education ICT use guidelines (Plowman & Stephen, 2007).

2.8 Current perspectives on digital technologies in early childhood settings

Research and practice associated with ICT use within early childhood education is an emerging field of investigation. The majority of literature relates to secondary and tertiary levels of education (For examples see Branch, 2003; Bull, 2010; du Plessis & Naughton, 2008; Sheely, 2008). The early childhood specific literature often ends with the author calling for more investigation into the digital technology and its effect on young children's play, learning and development (See Marsh, 2010; Selwyn, 2011; Vandewater, et al., 2007). The limited studies reported in the literature reflect children and

classrooms usually located in Western-European contexts, including the United States of America or the United Kingdom. As an educator of young children, I have found it difficult to locate reliable evidence on what children actually do with digital technology in early childhood classrooms, and even less useful support on pedagogical ways to maximise the learning potential of such technologies in my classroom! Within this limited body of literature, many studies are not theorised in relation to an existing and well established perspective on play such as that offered by Vygotsky. The authors may refer to a theorist like Vygotsky but usually in one sentence, and without detailing core aspects of his theory that would be useful for understanding what it is children do with digital technologies in early childhood education in terms of play-based learning. This includes ideas such as play as a leading activity and the one Australian paper that has made a start in investigating children's digital technology use and draws on Vygotskian ideas is Verenikina, Harris and Lysaght (2003).

Verenikina et al. (2003) conducted their study to investigate "the ways in which classical and modern theories of play may be applied to an analysis of the developmental value of computer software in the early childhood years" (p. 1). The authors developed a list of criteria educators can use when assessing the appropriateness of computer software in the education of young children. They do admit that it is a starting point and "the next step is to further explore and elaborate the criteria while probing and testing them on a variety of software designed for young children" (p. 8). They found the criteria useful for preservice early childhood educators to evaluate their own beliefs about computer and software use in children's play and explore the benefits of computer use on children's development. This has been a useful contribution because preservice educators will be entering the field equipped to appropriately judge and implement computer use in early childhood classrooms that extends children's development and learning.

Selwyn (2011) also draws upon various theories to explain the use of digital technology within educational settings and admits the current research falls short: "the use of technology in education becomes ever more entwined with the wider social, economic, political and cultural aspects of society, the need for an advancement of a 'sociology of educational technology' has perhaps never been greater" (p. 93). The need continues for early childhood education research that contributes to guidelines that inform educators on how technologies can be integrated pedagogically in the early childhood classroom.

2.9 Conclusion

Digital technologies are evident in the everyday lives of children and researchers are beginning to promote their place in early childhood education. A problem surrounds the understanding of how they can be used so that current practice is based on informed educational principles and not slogans about digital natives. Informed educational practices are premised on the theoretical understandings about learning, development and play in early childhood education. A particularly important theory in early childhood

education related to play is Vygotsky's work located in sociocultural understanding of children's learning and development. This would be useful for adding to existing research (Plowman, 2010) about the use of technologies in early childhood education and existing guidelines (NAEYC, ECA) that help teachers navigate decision making about how to use digital technologies in ways that align with existing practices. This is because digital technology use with early childhood education is an emerging field of research and understanding what activities children can engage in around these technologies will inform practice. Sociocultural theory is explored in the following chapter as an appropriate theoretical underpinning for the use of ICT's in early childhood.

Chapter Three: Theoretical Overview

3.1 Introduction

This chapter provides the theoretical overview for this project. This includes understanding how ideas such as development and play are used in early childhood education. It is necessary to establish a theoretical perspective on these ideas to provide a context for understanding children's engagement with digital devices within an early childhood classroom. The chapter outlines the influence of developmentalism on early childhood education prior to examining the role of sociocultural theory in understanding children's development and play. The first section of the chapter defines what is meant by the term 'digital technologies' in the early childhood context.

3.2 Digital technology

Since the early 1980s, the global introduction of information and communication technologies (ICT) has "supported a reshaping of the planet's social, economic and political circumstances in which all forms of education operate" (Bigum & Rowan, 2008, p. 245). In education, ICT has often been seen as a desktop computer, but as Stephen and Plowman (2003) admit "desk-top computers with a visual screen are not the only form of computer available. There is a growing array of products aimed at younger children that do not rely on a visual display, keyboard or mouse" (pp. 226-227). More recently the term 'digital technologies' has been used. Digital technologies includes: cameras; recording devices; digital toys and digital music. In this thesis the term digital technologies is used because it encompasses all forms of digital technology and is not limited to computers and computer related devices. The definition of use is that provided by Stephen, McPake, Plowman and Berch-Heyman (2008) which states:

> We mean not only desktop computers, laptops and peripherals but also interactive television, digital cameras, video cameras, DVDs, mobile telephones, games consoles, electronic keyboards and toys that simulate 'real technology' such as toy laptops or barcode readers (Plowman and Stephen, 2006). This definition allows us to incorporate technologies that are both interactive and communicative and which are particularly appropriate for preschool age children because they do not rely on using text or a keyboard and are more ergonomically suited for three- to five-year-old children. These technologies are present in many preschool playrooms and represent the range of resources available at home. (p. 100)

Throughout this thesis, the term 'digital technologies' will be used to refer broadly to the experience of engagement with the digital world, including (but not limited to) the use of digital devices themselves, the

experience of teaching and learning through digital means, and exposure to digital media. The term 'digital devices' is therefore understood within this thesis as a sub-set of the broad field of digital technologies, and refers to the use of specific digital cultural tools such as smart phones, iPads™, and digital cameras.

3.3 The Developmentalism influence on early childhood education

Historically, theories of development have been used to explain children's growth and development. Piaget (1962) believed that children follow a series of developmental milestones achieved in succession, regardless of their cultural context or social situation. He believed that development influenced learning, and that "development is the essential process and each element of learning occurs as a function of total development" (Piaget, 1964, p. 176). For every early childhood educator, a fundamental understanding of child development was a requirement of successfully completing their training and became the basis for pedagogical decisions in the early childhood classroom. The publication in 1987 of the Developmentally Appropriate Practice (DAP) guidelines in the United States of America (Bredekamp & Copple, 1987), saw early childhood educators providing experiences and activities that were aimed at the children's current ability level. In Australia, the belief that the use of DAP determined the level of quality for early childhood settings resulted in Australian early childhood educators following the American concept of DAP rather than determining local guidelines relevant to the Australian context (Aldwinckle, 2001, p. 36). In recent years, the concept of DAP has been challenged by researchers suggesting that children's development is influenced by the social and cultural context they are situated in, something the original DAP guidelines did not take into account. Walsh (1991) believes the use of stages of development, "as described by Piaget, that is, as all-encompassing, invariant, and universal, is that they have not stood up well under empirical test" (p. 113). He identifies the contradictions with the DAP guidelines and questions the DAP notion that children can acquire knowledge on their own within a social context (p. 115). DAP follows a Piagetian belief that learning is dependent on development whereas, Vygotsky offers an alternative to this view that learning actually leads development (p. 116).

In 2009, the DAP guidelines were rewritten to be more inclusive of children's cultural and social experiences. In 2011 Australia produced its first national early childhood curriculum guidelines *Belonging, Being and Becoming The Early Years Learning Framework for Australia* (Department of Education Employment and Workplace Relations, 2009). This document suggests that educators can use multiple perspectives of understanding children's play and development.

Understandings of play have been of recent interest in the field of early childhood education since the beginnings of criticisms associated with DAP. For example, Stephen (2010) calls for the field to look at how play and the pedagogy of play is understood in early childhood education:-

> The time is ripe for a critical empirical and theoretical look at the contribution of play and an examination of what is perceived as play from the perspectives of all the stakeholders, including the children, involved in early years provision. It is important to recognise that looking critically at play does not imply a rejection of play as a crucial component in the learning environment. The purpose of reviewing the contribution of play is rather to strengthen its place as a medium for learning when that is most appropriate, to ensure that the play opportunities offered to children are playful and engaging to them and to develop a more nuanced and evidence-based rationale for play in the learning environment that is clear about the benefits and can go beyond an appeal to consensus and historic claims to distinctiveness. (p. 19)

Stephen's call for re-thinking play has formed an important part of research into the use of play in early childhood education. For example, Hatch (2010) disputes Piaget's theory that development leads learning stating that scholars "have demonstrated the inadequacies of expecting children to construct complex understandings based on independent exploration, free play, and discovery" (p. 260). Instead he encourages a Vygotskian view where learning leads development, and suggests learning be the centre of early childhood education and the driving force behind everything educators do (p. 259). In Australia and New Zealand, researchers (see Aldwinckle, 2001; Edwards, 2003; Fleer, 1995) have also drawn on sociocultural ideas about children's play to suggest an alternative framework for thinking about play to that initially suggested by DAP. For example Smith (1996) believes the DAP influence relies on children's development guiding early childhood practice, "while in reality early childhood centre practice should guide children's development" (p. 53). She acknowledges the large individual difference amongst children and the valuable influence early childhood educators can have on children's development and learning (p. 53).

Fleer (2005) called for educators to reconceptualise the term 'child development', drawing on sociocultural theory (amongst others) to "move the field forward" and define what occurs in early childhood education using alternative ideas to those traditionally valued in ideas based on developmentalism (p. 2). An important part of this call was the use of sociocultural theory in early childhood education, especially as "Vygotsky saw learning as driving development and the development of thinking as a shared process rather than an individual one" (Smith, 1993, p. 47).

3.4 Sociocultural theory

Sociocultural theory was founded on Vygotsky's theorisation and work around the difference between human and animal behaviour. Vygotsky recognised that humans have higher developed social organisation than that of animals, stating as "an individual has the capacity to externalize and share with

other members of her social group her understanding of their shared experience"(Vygotsky, 1978, p. 132). Not only does the social context or environment mediate the person's development, but the person in turn contributes to the development of the social context in which they are located. These beliefs about the mediating potential of the social context and the role it plays in how and what children learn are reflected in Vygotsky's ideas about children's development which "espouses the view that social interaction among two or more people is the greatest motivating force in human development" (Eun, 2012, p. 401).

Early childhood researchers interested in Vygotsky's ideas about the mediating value of social and cultural context on development were also interested in how he viewed the role of children's play on development. An important idea in sociocultural theory is that children's play is related to the social and cultural context in which they are located. Play enables children's participation in their social and cultural context, as van Oers (2010) states play "opens activities and practices for novices…, and creates opportunities for meaningful learning that can promote the quality and willingness for participation" within their social and cultural context (p. 201). Researchers using Vygotsky's ideas about play in early childhood education started to emphasise play as important for children's active participation in their social and cultural context, this included researchers in the United States of America who said that "supporting children's cultural identity and competencies is key to supporting their overall development" (Bredekamp, 2006, p. 26). In Australia, sociocultural understandings of play included "understanding how children construct knowledge in social settings and have emphasised the idea that development is a culturally determined rather than universal process" (Cutter-Mackenzie & Edwards, 2006, p. 13). New Zealand researchers were also interested in Vygotsky's ideas because, as Smith (1993) states, "Vygotsky's theory is a theory of education" (p. 54). New Zealand researchers value his ideas about play suggesting that "play liberated children from situational constraints and allowed them to experiment with meaning" (p. 60). Smith (1993) believes that early childhood education should work towards culturally valued goals for children rather than rely on developmental goals decided in a cultural context from across the globe (referring to DAP from the United States of America) (p. 61).

Vygotsky (2004a) valued children's social context and interactions with others and he believed these experiences shape a child's learning, play and in turn development. Play is a symbol of children's creativity and "not simply a reproduction of what he has experienced, but a creative reworking of the impressions he has acquired" (Vygotsky, 2004a, p. 11). Through play children use their experiences to form a new reality and understanding of their social context. Vygotsky (2004a) used the example of a child who, seeing a crippled man on the street, used his imagination to create a scenario to explain what had happened to the man, which involved the man coming off a horse, hitting a rock and requiring medicine to heal his damaged legs. The child already held knowledge about horses, injuries with rocks and medical interventions in healing people, but used his creativity and imagination to build on this knowledge and form the scenario (p. 12). Vygotsky (1967) stated "every advance from one stage to another is connected with an abrupt change in motives and incentives to act" (p. 538). What motivates an

infant will not necessarily motivate a toddler. In preschool play, children are motivated by pleasure but of a different kind than that of an infant or toddler. Children play to experience: for example, to experience driving a car or riding a horse rather than to travel somewhere, so "play is intrinsically rather than extrinsically motivated" (Duncan & Tarulli, 2003, p. 273). Some play is derived from a child's need to for fulfil unsatisfied desires. For example, a child who wants to ride in a cab but is denied by his mother may go home and play the scenario of being in a cab (Vygotsky, 1967, p. 539). In this way, children do not play with an awareness or understanding of their motives. For example, "the motivation in a play situation is, for instance, to drive a car or to ride the horse, not to travel somewhere" (Duncan & Tarulli, 2003, p. 273) Therefore they do not differentiate between play and work or other activities.

When investigating play Vygotsky (1998) looked to other authors such as Groos, Weiss and Blonsky for existing understandings about play. He considered what Groos and Weiss said about play, including the idea that a child's thinking is different in experimental as opposed to symbolic play and can both be classified as 'play' and Blonsky argued that play "should be eliminated from psychology" due to its lack of a clear definition (p. 267). He argued that these ideas were not entirely satisfactory because play is one of the most difficult phenomena to study and "least developed theoretically" (p. 266). He then stated "that play is a unique relation to reality that is characterized by creating imaginary situations or transferring the properties of some objects to others" (p. 267). He went on to publish three critical underlying criteria to define play: 1) children create an imaginary situation; 2) children take on roles and 3) children follow the rules defined by the specific roles (Vygotsky, 1967, pp. 540-543). These criteria are interconnected and all three are required before Vygotsky would define an activity as 'pretend' play. To truly comprehend Vygotsky's theorisation about play as "the leading source of development in pre-school years", an understanding of other key concepts is necessary including: imagination; leading activities; the zone of proximal development (ZPD), cultural tools and social interactions is required. This is because his theorisation about play considers the role of play in children's development and development from a sociocultural perspective is situated in the child's social and cultural context which includes interactions with people and the use and acquisition of cultural tools such as language. These are each described in the following section.

3.4.1 Imagination

Some researchers understand imagination as linked to fantasy and far removed from reality. Singer and Singer (2005) define children's imagination as "a form of human thought characterized by the ability of the individual to reproduce images or concepts originally derived from the basic senses" (p. 16). Vygotsky (2004a) described imagination as the way children connect with reality. To further explain imagination, Vygotsky describes a four part circle that links imagination to reality. The first association between imagination and reality is that everything a child imagines is based on elements taken from reality, that is, their experiences to this point in their life: "it would be a miracle indeed if imagination could create something out of nothing or if it had other sources than past experience for its creations"

(2004a, p. 13). The implications for education of this first association of imagination are to provide children with a broad range of experiences for them to draw on when creating imaginary situations. The second association is where imagination is used to create a situation that links together elements of reality to form a new reality. For example, to link the elements of dryness, sand, heat and enormous spaces, the imagination can create a concept of a desert, even though direct experience of a desert is not part of the reality (2004a, p. 16). This approach to association can use other people's experiences or social experience to link imagination and reality by creating a new reality based on another person's narration and description of their experiences. Vygotsky provides the example of reading in a newspaper events not directly witnessed but which can be formed in one's imagination through the journalist's narration. The third association relates imagination to reality through emotions. Reality is clouded by the emotions felt at the time of the experience. For example the act of blowing out birthday candles on a cake may create feelings of happiness whereas a smell may trigger feelings of fear or anger due to a linked experience. It is through this association that "works of art created by their authors' imaginations can have such a strong emotional effect on use" or why a piece of music can elicit an emotional response in the listener (2004a, p. 20). The final association brings imagination full circle by creating a new reality based on the previous three associations, and is where imagination becomes reality. Vygotsky uses the creativity of an inventor to illustrate his point:

> The elements out of which they are constructed were taken by the human inventor from reality. Within the mind of this inventor, in his thoughts, these elements underwent complex reworking and were transformed into products of the imagination. Finally, once they were given material form, they returned to reality, but returned as a new active force with the potential to alter reality. This is the complete cycle followed by the creative operation of the imagination (2004a, p. 20).

It is through this complete circle of association between imagination and reality that experiences are broadened and new realities are created. Understanding imagination as related to reality is therefore a very important part of understanding Vygotsky's ideas about play. This is because he did not see imagination as being about children doing fantasy play, but imagination as the process that connected children to reality so that their experiences of reality in the social and cultural context could inform their play.

3.4.2 Leading activity

The concept of leading activity was first initiated by Vygotsky and then expanded by Leontiev and Elkonin who created a 'periodisation of mental development', in which "in their opinion, leading activity is what defines the specific nature of a child's development at a given age" (Kravtsova, 2006, p. 8). In the preschool years play is the 'leading activity' meaning it is "the preschooler's most important type of activity from a developmental perspective" (Duncan & Tarulli, 2003, p. 272). The concept of leading

activity involves five central psychological functions that involve social and cultural participation. These are: sensory motor; perception; emotions; memory; and thinking (Kravstov, 2008a). From the social situation of development a new psychological function emerges, which acts like a bridge to the next leading activity, for example once the leading activity of experimenting is mastered the child moves to the leading activity of play. The leading activity then creates a new social situation of development which gives rise to a new psychological function (Kravstov, 2008b). The concept of leading activity is not the activity that a child performs most frequently; instead it is the activity that creates the greatest opportunity for cognitive and social-emotional development, and "these most important changes are the specific changes that prepare the child for the further challenges of the next developmental stage" (Duncan & Tarulli, 2003, p. 272).

To master a leading activity a child must be capable of recalling the activity voluntarily and verbalising the process and the "transition between different leading activities involves a *change in position within the social structure*" (Duncan & Tarulli, 2003, p. 272 italics in the original). Mastering a leading activity then changes the social situation and the child's relationship with adults, as Kravtsova states "a child's ability to construct and perform a leading activity independently leads to a change in the relationship between a child and the adult" (Kravtsova, 2006). For example, Edwards (2011) describes when a child is playing woolly mammoths with his mother in a park, the child verbalises their play and demonstrates that he has mastered play as a leading activity:

> amongst his final comments was the child's observation that 'it was very lucky that some other children made that cubby house, otherwise we could not have played woolly mammoths at the park today.' In this episode and discussion we can see that the older child is able to verbalise and voluntarily recall his play activity and the processes involved in his play. In doing so, he moves towards mastering play as a leading activity. This mastery changes the relationship he has with his mother and so creates a new social situation (p. 5).

The mother and child go on to collectively theorize about the play as woolly mammoths and work towards the child's mastering of the next leading activity – 'learning activity'. Leontiev and Elkonin linked each central psychological function to an age range; these were not universal and they recognised the historical and cultural influence on a child's development.

3.4.3 Social Interaction

Vygotsky placed a large emphasis on the impact of social interaction on a child's development. "Vygotsky's central tenet was that learning led the developmental process, with children acquiring (or learning) the knowledge practices of their host communities as they interacted with others" (Edwards, 2003, p. 255). This claim that children learn and develop as they interact with more experienced members

of society connects to Vygotsky's argument that the "social situation of development specific to each age determines strictly regularly the whole picture of the child's life and his social existence" (Vygotsky, 1987, p. 198). He believed children's development occurred through the participation in the social context in which they are situated and through interactions with community elders assisting them to appropriate the knowledge practices of their host communities (Edwards, 2003, p. 256). This participation in their host community first occurs on the social level and secondly inside the child. As Vygotsky (Vygotsky, 1978) stated "every function in the child's cultural development …first, *between* people (*interpsychological*), and then *inside* the child (*intrapsychological*)" (p. 57 italics in the original). Rogoff (1990) extended Vygotsky's ideas and developed the notion of guided participation. Rogoff, like Vygotsky, believed that the "processes of individual development as they constitute and are constituted by interpersonal and cultural-historical activities and practices", and thus, children's cognitive and cultural development are dependent on their enactment within their social environment (Rogoff & Chavajay, 1995, p. 871). Rogoff (1990) described guided participation as children and adults "in the collaborative processes of (1) building bridges from children's present understanding and skills to reach new understandings and skills, and (2) arranging and structuring children's participation in activities, with dynamic shifts over development in children's responsibilities" (p. 8). She values both the guidance of adults and children's participation in their social context to increase their understanding of their social context and to increase their learning.

3.4.4 Cultural tools

Tools "are created by societies over the course of human history and change with the form of society and the level of its cultural development"(Vygotsky, 1978). Tools are specific to the individual society and "important among these tools are representational forms that contain instrumental knowledge, that is knowledge about how to accomplish practical goals of everyday life" (Gauvain, 2001, p. 127). Vygotsky believed they transform behaviour and, in turn, affect development (Vygotsky, 1978). The mastering of cultural tools coincides with a child's development and acquisition of the skills to be a member of his or her society. "For example, eating with a spoon is an operation in which the hand (and the whole body) has to perform an established sequence of "unnatural" movements… in accord with the culturally developed design of the spoon", a skill younger children will master through instruction and observing others (Arievitch, 2005, p. 156).

3.4.5 Zone of Proximal Development

When discussing children's learning, Vygotsky (1978) recognised that learning occurs through the acquisition of speech and their many, varied experiences, long before children attend school. For example, a child does not begin to learn mathematics at school; instead they arrive at school with experience of mathematical concepts including quantity, addition, subtraction and size. He argues, however, that there is a difference between the two types of learning, everyday and scientific, and it is

through his explanation of this difference that he introduced the concept of the zone of proximal development (ZPD) (Vygotsky, 1978, p. 84).

In schools, teaching is often aimed at children's developmental level and many schools use standardised tests to determine a child's mental age. Vygotsky called this a child's "*actual developmental level*" and defined it "as a result of certain already *completed* developmental cycles" (Vygotsky, 1978, p. 85 italics in the original). This level reflects a child's ability and what they can perform independently. Whereas, the ZPD is defined as the distance between the tasks a child can perform independently and the tasks they can perform with the assistance of a more capable other, either another child or an adult (p. 86). The ZPD was seen by Vygotsky as the most useful means of assessing learning because it identified the child's next or 'nearest' area of development. For example, two 8 year old children assessed through tasks they can independently perform today, have the same *actual developmental level* of say an 8 year old, whereas with assistance may be capable of performing tasks of varying degree. One may be capable of tasks of a 9 year old, while the other can perform tasks of a 12 year old. Both children have the same *actual developmental level*, but their ZPD reflects the tasks they can perform with assistance and will perform independently in the future(Vygotsky, 1978, pp. 85-86). Vygotsky stated "what is in the zone of proximal development today will be the actual developmental level tomorrow – that is, what a child can do with assistance today she will be able to do by herself tomorrow" (p. 87).

3.5 Conclusion

This study will use sociocultural theory to frame the investigation of children's activity on digital devices in an early childhood classroom. The use of digital technology within early childhood education suits this theoretical underpinning as the study aims to make children's activities on digital devices visible, in order to be understood, which could then assist educators to extend these activities, thus potentially increasing children's learning. To investigate Vygotsky's theorisation and how it fits with digital technology in early childhood education requires a sociocultural framework that explores his theorisation around play; his notions of imagination; his beliefs about the ZPD; and the role of leading activity in children's learning and development. This is also important because historically play has had an important role in early childhood education where it has been seen as a basis for curriculum. It is therefore necessary to consider how children's activities on digital devices can be understood in relation to an established theory of play in early childhood education such as that provided by Vygotsky's theorisation into children's play, learning and development.

Chapter Four: Methodology

4.1 Chapter Overview

This chapter begins by stating the research topic, reasons for the chosen research topic and the research questions that emerged from the chosen topic. Just to reiterate, the two research questions I investigated were 'what activities do children engage in around digital devices in an early childhood classroom?' and 'how do these activities relate to elements of Vygotsky's theorisation about young children's play?' This chapter briefly describes qualitative and quantitative approaches to research and the reasons why qualitative research was chosen for this study. The ontological perspective of this research is outlined, followed by the epistemological influences on the researcher and the research. The chosen data collection methods are then described, along with reasons for each. The details of the participants and how consent was gained from both parents and children are also described. The ethical considerations outlined include: the teacher as researcher; researching *with* children rather than *on* children; and using photographs and videos as data. The chapter concludes with a description of the limitations of the study and a summary of the main themes to be discussed in the findings chapter.

4.2 Qualitative and quantitative approaches to research

Researchers need to decide not only the topic of their research but also the way in which they will conduct their research, the methods they will use, the ontological implications of the research questions and the epistemological relationship between the researcher and what is being researched. The topic and research question will guide the researcher's path but a clear understanding of the different research approaches available is needed to make an informed decision. One primary question is whether to use a qualitative or quantitative method.

Qualitative research is subjective, "aimed at explaining complex phenomena through verbal descriptions" (Suter, 2006, p. 41), with participants sharing their expertise on their world, the one being studied. Qualitative research investigates the perspective of the subject, and "the socially constructed nature of reality" (Denzin & Lincoln, 2011, p. 8), with the relationship between the researcher, participants and the topic creating the data to be collected.

Qualitative research is characterised by the type of question being asked and the way the researcher wants to answer it. Yin (2011) suggests that there are five main features of qualitative research:

1. Studying the meaning of people's lives, under real-world conditions;
2. Representing the views and perspectives of the people in a study;
3. Covering the contextual conditions within which people live;

4. Contributing insights into existing or emerging concepts that may help to explain human social behaviour; and
5. Striving to use multiple sources of evidence rather than relying on a single source alone. (p. 7)

On the other hand, "quantitative studies emphasize the measurement and analysis of casual relationships between variables, not processes" (Denzin & Lincoln, 2011, p. 8). Quantitative research involves numbers, and measurable data that can be used to make assumptions and generalisations about the subject and reality being investigated. Within education, quantitative methods can be used to study different subjects and "it often serves as a check on qualitative data" (Kincheloe, 2003, p. 187). Quantitative research records numbers and occurrences of the topic being investigated and Kincheloe (2003) emphasises the need for quantitative researchers to be "aware of the qualitative dimensions to all quantitative research" (p. 187). An understanding of the context and social influences on the topic is needed for the research to be an accurate representation of reality, presented by the researcher, when viewed through either a quantitative or qualitative lens.

Kincheloe (2003) also describes 'context stripping' as an unfortunate part of quantitative research that "distorts the reality they are trying to portray" (p. 187). Quantitative data does not necessarily take into account the context from which it was gathered, whereas qualitative data relies on the context to inform and create the basis of the research. A qualitative approach was judged best for the present study because the study was focussed on how the children engage with digital technology. This means that it was necessary to understand what and how the children were using the digital devices in the context of the kindergarten setting. Qualitative research fitted this research focus because it more readily supported investigation of the children's activities than an entirely quantitative approach.

4.3 Qualitative research

As stated in Chapter One, exploring children's activities on digital devices requires the researcher to be situated within the early childhood classroom, to observe and record the children's activities as they take place. The aim of this project was to make children's activities on digital devices visible, in order to be understood, which could then assist educators to extend these activities, thus potentially increasing children's learning.

As stated earlier, Vygotsky focused on social and cultural influences on children's learning. To investigate children's activities on digital devices from a Vygotskian perspective requires an approach that values the social context to be used. Qualitative researchers "seek answers to questions that stress *how* social experience is created and given meaning" (Denzin & Lincoln, 2011, p. 8). To seek answers to the second research question therefore requires a qualitative approach and data collection methods which elicit socially constructed responses and data that respect Vygotsky's ideas about social and cultural influences on children's learning.

4.4 Ontology and epistemology

The concept of ontology refers to human beliefs about the social world, "the very nature and essence of things in the social world" (Mason, 2002, p. 14). In other words: What is 'real'? This research uses sociocultural theory, which subscribes to a materialist ontology. Vygotsky (1986) believed that learning led development and that children's social interactions influenced their learning process,

> 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. (p. 163)

'Reality' therefore exists intra-mentally, but is not ontologically 'real' until it is observable in its material effects, for example as cultural practices such as play. These cultural 'realities' the child experiences as he or she grows up affect their learning and development. As stated by Edwards (2003) "Vygotsky's central tenet was that learning led the developmental process, with children acquiring (or learning) the knowledge practices of their host communities as they interacted with others" (p. 255). Sociocultural theory fits well with this research as this project is investigating children's observable use of digital technologies within a kindergarten program. The children are understood as interacting with each other and with the teacher and assistants within the cultural environment of the kindergarten, in which digital devices are understood as cultural tools (see Chapter Two).

The concept of epistemology refers to the 'theory of knowledge' underpinning a set of claims and also, how knowledge can be gained (Mason, 2002, p. 16). This thesis is grounded in a sociocultural perspective, and following Vygotsky (1978), who argued that learning is socially and culturally constituted. In this study, the researcher entered the social context of the kindergarten to observe the social experiences of the kindergarten children as they engaged with the digital devices, where this engagement is understood as a process of knowledge generation and/or exchange.

Ontological and epistemological bases need to be taken into account when designing a research project. The data collection methods, data analysis tools and interpretation methods all stem from the ontological perspective of the research and the researcher. Therefore for this research, the social context of the kindergarten is understood as a material reality in which a process of knowledge creation can be observed and recorded.

4.5 Methodology

Dockett, Einarsdotti and Perry (2011) state “the terms *method* and *methodology* are often used synonymously” (p. 68 italics in the original). For new researchers these two concepts can be difficult to understand and differentiate. This is because method is about the ways we capture the data that represents the study and methodology is the philosophical assumptions underpinning the choice of methods. When new to conducting research it is easy to think that these two terms are talking about the same thing.

The methodology for this project is a qualitative, case study that focused on investigating children’s practices on digital devices, to inform educators to design the kindergarten program to encourage the most learning for the children they are trying to educate. The use of Vygotsky’s views on learning and development aligns with the research questions and the investigation of children’s engagement with digital technologies within an early childhood classroom.

4.5.1 Case study

Case studies are a popular research method and have been used for a range of research projects (Flyvbjerg, 2011). Many authors provide definitions of case studies, what they are, what they entail and how to conduct case study research. Most have a common thread or familiar aspects they present. Yin (2003) states quite clearly that a case study is

> An empirical inquiry that:
>
> 1. Investigates a contemporary phenomenon within its real-life context, especially when,
> 2. The boundaries between phenomenon and context are not clearly evident. (p. 13)

This project follows Yin’s definition by investigating children’s use of digital technologies within a specific kindergarten context. The data gathered relates to the particular children and setting studied. Flyvbjerg (2011) believes that “case studies comprise more detail, richness, completeness, and variance” than other types of studies (p. 301), but in this “study of human affairs, there appears to exist only context-dependant knowledge” (p. 2). The data gathered will be rich but will only relate to the children and kindergarten under investigation. Although often considered, a limitation of this kind of research, case studies nevertheless contribute to wider understandings of specific educational problems.

As Merriam (1998) describes "a case study design is employed to gain in-depth understanding of the situation and meaning for those involved" through a range of data collection methods (p. 19). The outcome of this project was an understanding of how digital devices were used by children in a kindergarten and a list of activities in which the children engaged. Through the analysis phase, links were

made between the activities observed and Vygotsky's ideas, leading to implications for educators, as described in the discussion chapter.

As stated earlier, case study research needs to collect "multiple sources of evidence" and study participants "under real-world conditions" (Yin, 2011, p. 7). The data collection methods used for this project included photographs, videos, observations, discussions and children's drawings. Researching with children requires a range of data collection methods that accurately capture a child's involvement with digital technologies. In this research project, the participants - children and assistants, as well as the researcher - collected the data. Children were involved in taking photographs and recording video that was understood as data. Employing a variety of data collection methods increased "children's opportunity to choose and have at least partial control about how to contribute" and to also demonstrate "that we recognized them as active agents in the creation of their worlds" (Darbyshire, MacDougall, & Schiller, 2005, p. 424). In the following section, I describe the specific data collection methods used in this study, before turning to ethical issues and approaches to analysis.

4.5.2 Data collection

This study used five different data collection techniques. These included: video recordings; direct observations; children's drawings; digital photographs; and documentation of discussions. These data collection methods are appropriate to the case study methodology because they focussed on helping understand the participant's experiences and activities. Each of these techniques are now discussed in more detail.

4.5.3 Video recording as a method of data collection

Children's experiences with digital devices were recorded and analysed from video data. Robson (2011) endorses the use of video data when researching with children by stating that "a particular advantage of using video data is its potential for capturing rich data" (p. 187). Video data captures children's facial expressions, body language and accurately records their words and expressions. The data can then be replayed to help children recall what happened and what they were thinking. As Hatch (2002) described a second layer of video data can then be created by recording the participants watching themselves in a previously recorded video. In this project this occurred when children were recorded watching the movie they made.

Children may act differently when they know they are being filmed or they "may be disturbed in their play spaces when adults interrupt them with cameras" (Berkhout, Hoekman, & Goorhuis-Brouwer, 2011, p. 1326). As the research question is asking what activities children engage in with digital technologies, there were examples in the data collected that showed children 'performing' for the camera, especially when another child was the one holding the camera.

The devices chosen to record children's activities were a Flip™ camera and an iPhone™. Both are small and unobtrusive, which were used by the researcher. Children often appeared oblivious to the camera; this could also be due to children's contemporary context and how often children are being photographed and filmed.

4.5.4 Photographs and 'photovoice' methods

During the data collection the researcher, assistants and children all took photographs. The photographs created two types of data. The first type were examples or snapshots of the children using the devices. The second type of data were used as- evidence of children using the digital devices. The researcher and assistants created the first type of data – snapshots of children using the devices, whereas the children created both types of data.

'Photovoice' as a research method, was developed by Wang and Burris (1997) for a "participatory health promotion strategy in which people use cameras to document their health and work realities" (Wang & Redwood-Jones, 2001, p. 560). Participants were given cameras to record what they saw as important in their own environment and lives. As a research method, "it entrusts cameras to the hands of people to enable them to act as recorders", allowing the participants to also become the data collectors (Wang & Burris, 1997, p. 369). Photovoice "as a visual data production strategy, it had the potential to enable children to depict people and places that were important to them within their home, school and wider community" (Darbyshire, et al., 2005, p. 423). The photographs taken can be thought provoking and act as a prompt for further discussion and analysis. Darbyshire et al. (2005) believe that "if a respectful and sensitive inquiry approach was taken, children could and would describe and discuss their perceptions, experiences and understandings" (p. 423). The researcher can gain an understanding of what the children were thinking when they took the photograph and the photographs are evidence of the children's ability to use the camera to capture their experience.

4.5.5 Direct observations

During the data collection period, sometimes it was not possible to record situations through photographs or videos, so written observations were made by the researcher instead. Also, to avoid recording children who had not consented to be part of the research, observations were used to record vital evidence, without compromising ethical parameters. If the digital device was the focus of the situation, and being used by the children, for example the children were filming each other with the Flip camera, observation were taken by the researcher to record the play episode.

4.5.6 Documentation of discussions

Discussions were held with children individually and in small groups about their experiences with digital devices. In small groups, "children discuss the questions, help each other with the answers, remind each other about details, and keep the answers truthful" (Einarsdottir, 2007, p. 200). The first discussion was

held at the beginning of the project with the whole group of children to explain what was going to happen and the basic rules about looking after the devices. Also during this discussion, children explained their experiences with the different devices and answered the question 'What do you want to do on the devices while they are at kindergarten?' During the project, discussions were also had with individual children using their photographs as a prompt. The aim of these discussions "was to explore the act of photography from the child's perspective, through stimulated recall" (Sharples, Davison, Thomas, & Rudman, 2003, p. 306).

4.5.7 Collection of children's drawings

The children were asked to complete two drawings specifically related to the project during the data collection period. Spontaneous drawings related to the project were also collected. Drawings are a way young children can voice their opinion on a subject and "can lead to rich individual and collective narratives that enhance differing approaches to research" (Leitch, 2008, p. 37). The first specific drawing was on the first day of the project, when the children were asked to draw which digital devices they wanted at kindergarten and what they wanted to do with these devices. At the end of the project children were asked to draw what they liked doing with the digital devices at kindergarten. These drawings became "children's intentional representations of thought and activity, in which they interpret roles, identities and feelings" (E. Wood & Hall, 2011, p. 270). The final drawings were quite detailed and when asked about them the children were very animated in their descriptions.

4.6 The participants

As I was conducting my research with the children with whom I worked, I invited all 27 children to be involved. The children were all aged four and five years old. Parents were given a Letter of Participation and Consent Form [Appendices 1, 2 & 3]. Once the parents gave their consent, children were invited to complete their own Assent Form [Appendix 4]. From the possible 27 participants, 21 parents gave permission for their child to be involved. Within the consenting parents only one child did not agree to be part of my research. The research went ahead with 20 child participants (n=20).

Prior to data collection, I was working with a kindergarten assistant and an additional assistant, both of whom gave their consent to be involved [Appendices 5 & 6]. Just before data collection began, my assistant discovered she would need to take two weeks of sick leave. During data collection, a relieving assistant agreed to participate in my research. A preservice teacher was doing her placement at the kindergarten and also agreed to become part of the data collection. Within this thesis, all assistants are referred to as assistants without distinction between relieving or additional. Throughout the project, the assistants' participation involved interacting with the children, recording observations and taking photographs and video data.

4.7 Ethical considerations

4.7.1 Research with children

Within recent early childhood research, researchers have been exploring ways to conduct research *with* rather than *on* children (Darbyshire, et al., 2005; Lahman, 2008; Mayall, 2000; O'Kane, 2000). Authentically involving children "as active co-producers of data" (Thomson, 2008, p. 8), through the design of the research, encouraging their voice in terms of how to conduct the research and valuing their input into the actual data collected, can be a challenge for researchers. Oakley (1994) argues that just because people are knowledgeable about children, doesn't mean they will conduct research that fits the criteria of research *with* children,

> It would seem that experts on children are precisely that – in other words, advocates of research on children, rather than defenders of children's interests in taking part in research which is for them. The best way to defend the development of children's studies for children is to enrol them fully in the research process. (Oakley, 1994, p. 26)

Darbyshire et al. (2005) state "if a respectful and sensitive inquiry approach was taken, children could and would describe and discuss their perceptions, experiences and understandings", hence children would be a valuable partner in the data generation and collection (p. 423). Researchers also have their own values and beliefs about the research and how it will be conducted, and this can sometimes clash with what the children value and want to have included in the research.

4.7.2 Children's assent

The child participants in the research were asked to complete an Assent Form [Appendix 4]. The aims of the project and the requirements for their involvement were explained in basic terms and pictures were used on the form to reinforce these ideas. Thomson (2008) believes "it is common practice to ask parental permission to conduct research with children" but "getting their [i.e. children's] permission for involvement is often bypassed" (p. 3). If research is conducted *with* children, then their permission should be sought just like any other participant.

In this project, when completing the assent form, one child agreed to be part of the research but when it came to being part of the thesis and publications he refused. On the other hand, two children whose parents had not completed consent forms wanted to be part of the research and offered their consent freely. Due to university ethics and Department of Education and Early Childhood Development (DEECD) requirements, these children could not participate in the research. This raises questions about whether the process is truly respectful of children and their ability to give their consent to be part of research if parental permission is always required first. For example, Thomson (2008) "Practices such as the right to informed consent, and the right to withdraw from participation in research, can also be seen as

expressions of the voices of research participants" (p. 3). In this research project the voices of children were sought and respected, although children wishing to participate without parental consent were able to use the digital devices and record their views, this data could not be reported in the thesis itself.

"In seeking to empower children, the researcher must respect the child's decision to participate and acknowledge the child's right to withdraw from the observation process at any time" (Harcourt & Conroy, 2005, p. 576). Throughout the research project, children asked to see photographs and videos taken by their peers and the researcher. If a child wanted a photograph deleted this was respected and the photograph was removed by the researcher. Children had strong opinions about the data collected and whether they wanted their image used for the project. If they wanted to withdraw their assent for use of a particular image, this was always granted.

Parents and children were also given the option of using their first name or pseudonym. One parent requested a pseudonym and the child chose 'Butterfly'.

4.7.3 The teacher as the researcher

In this project I wore two 'hats' simultaneously – the *educator* and the *researcher*. Studying children can introduce challenges for any researcher, but to add also being the educator to the role can increase these challenges. The role of the educator is to supervise and educate the children in attendance as well as maintain the day to day running of the centre. The role of the researcher is to enter the kindergarten, "understand what is going on", "research the activities" and the whole time keeping "the aim of the research in mind" (Hedegaard & Fleer, 2008, p. 202). This provides a challenge but also creates a feeling of familiarity within the kindergarten, with the children, families and other educators. While most researchers need time to build a rapport with children, families, and educators, researching in a workplace avoids this necessity. The limitations of being the teacher and researcher include the need for duty of care responsibilities to take precedence over data collection.

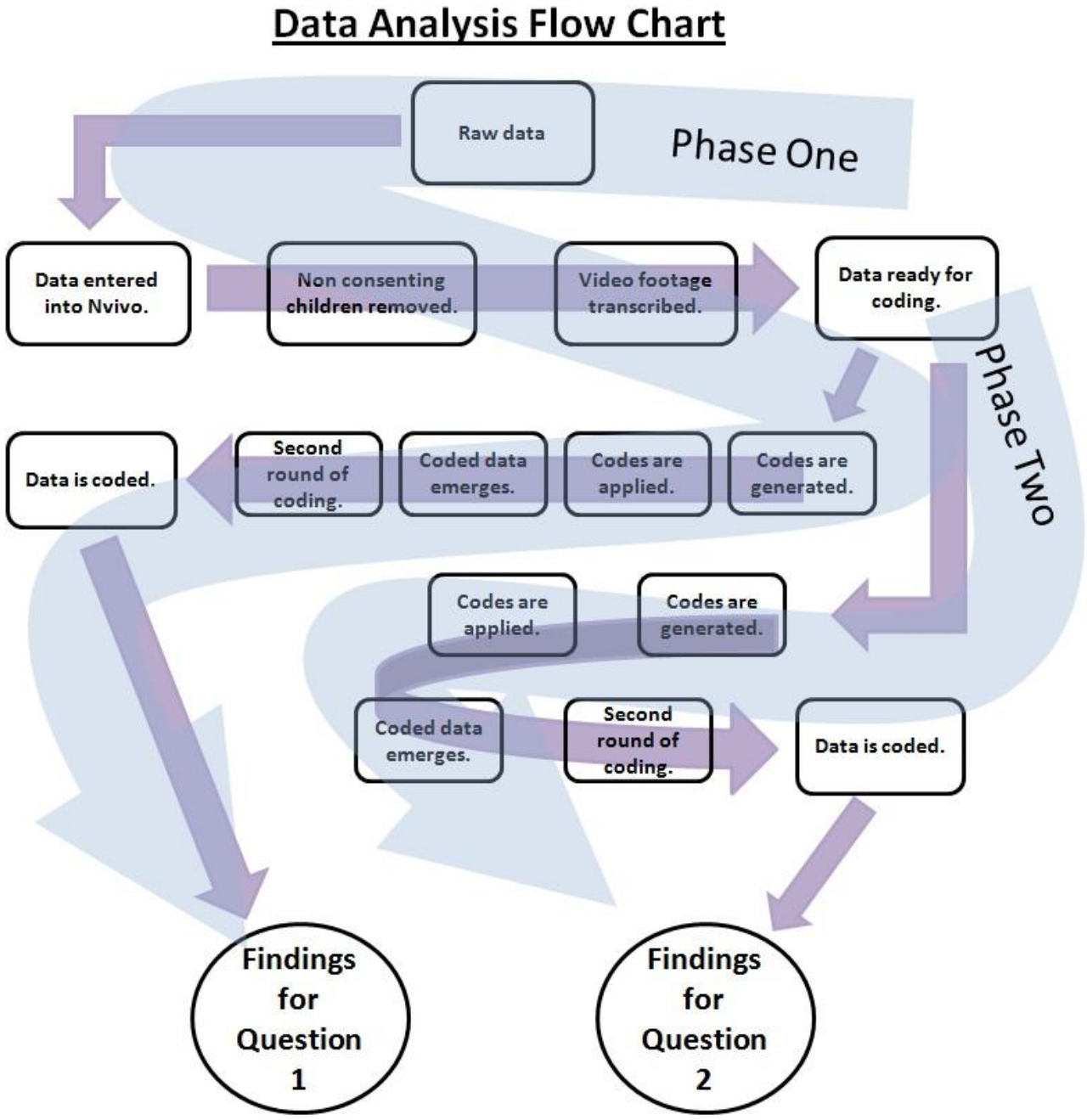
The project was accessible to all children in the kindergarten group, whether they had permission to be involved in the data collection or not. Every child was given the same opportunity to use the digital technologies within the program and was photographed and recorded for program and curriculum documentation purposes as would usually occur. The data recorded was checked and only the data that involved consenting children was kept for use and reporting within this research project.

4.8 Data analysis

Data collection is only one step in the research process. Hatch (2002) states that "data analysis is a systematic search for meaning" (p. 148). Researchers need to write the story the data is trying to tell the audience. In the qualitative research tradition, "researchers are translators of other persons' words and

actions" (Corbin & Strauss, 2008, p. 49), who transform the data into a rich story, full of reflections and insights for the future.

The data gathered during this project included observations, discussions, drawings, photographs, and video data. Miles and Huberman (1994) state "such data are not usually immediately accessible for analysis, but require some *processing*" (p. 9 italics in the original). There are many ways to prepare qualitative data ready for analysis including but not limited to: affixing codes to field notes, noting reflections in the margins, sorting notes into common phrases or themes and isolating patterns within the data collected (Miles & Huberman, 1994, p. 9). In the present study, once the data was collected, the video footage was checked to ensure that children who had not consented to participate were not recorded. As the children used the Flip and digital cameras to capture their peers, some children were captured without consent for the research. Photographs and video footage containing non consenting children was removed from the data set. The data was then entered into the computer software NVivo which assists with organising and analysing data (QSR International, 2012). The video footage was transcribed within the computer program NVivo, which has a feature that slows the footage allowing the researcher to transcribe what is being said. The data was uploaded to NVivo into folders titled according to the data source: 'Adult using technology'; 'Flip camera Videos'; 'iPhone Videos'; 'Observations' and 'Photographs'.



4:1 Data analysis flow chart.

Once the data was transcribed and entered into NVivo, detailed analysis began. Miles and Huberman (1994) describe their general view of qualitative analysis as "consisting of three concurrent flows of activity: data reduction, data display, and conclusion drawing / verification" (p. 10). For this project, data reduction involved isolating common activities, phrases, and themes, and applying a code using NVivo to recognise these common activities, then repeating this activity with the same data but linked to Vygotsky's concepts. Coding was a challenge in this research project. The codes used for phase one were based on common areas of a kindergarten context, for example, literacy, numeracy, and imaginative play [Appendix 9]. Vygotsky's typology was present in the researcher's thinking and such, was also reflected in the codes that emerged from the data [Appendix 10]. The codes reflected areas of the kindergarten

context and were often ambitious and difficult to define, resulting in data being assigned to more than one code. For example, in Table 4:1 Neha filming lips coding table, the episode was coded to ‘social interactions’, ‘exploring the technology’, and ‘capturing an event’ from the kindergarten activity nodes and ‘social context’ from the Vygotsky nodes. In another example shown in Table 4:2 Destiny taking Indiana's photo coding table, the episode was coded to ‘social interactions’, ‘exploring the technology’, and ‘capturing an event’ from the activity nodes and ‘social context’ and ‘cultural tools’ from the Vygotsky nodes. This resulted in more coding examples for each node than there were data episodes.

Once the data was displayed using codes generated during data analysis, conclusions were drawn that are detailed in the findings and discussion chapters. Descriptive statistics were also used to “describe or summarize the research data” and to “make the key characteristics easily understandable to others” (Christensen, Johnson, & Turner, 2011, p. 391). In analysing the data for this project a frequency distribution table was used to summarise the extent to which each code was represented in the final raw data grid.

Vygotsky nodes		Activity nodes								
		Social interactions	Exploring the technology	Capturing an event	Imaginative play	Literacy	Motor skills	Numeracy	Creative expression	Puzzles
	Cultural Tools									
	Social Context	✓	✓	✓						
	ZPD									
	Speech									
	Imagination									

Table 4:1 Neha filming lips coding table

Vygotsky nodes		Activity nodes								
		Social interactions	Exploring the technology	Capturing an event	Imaginative play	Literacy	Motor skills	Numeracy	Creative expression	Puzzles
	Cultural Tools	✓	✓	✓						
	Social Context	✓	✓	✓						
	ZPD									
	Speech									
	Imagination									

Table 4:2 Destiny taking Indiana's photo coding table

4.8.1 First phase of data analysis

Phase one of the data analysis involved coding the data to identify the typical kindergarten activities children engaged in, thus answering research question one 'What activities do children engage in on digital devices within an early childhood classroom?' The resulting 'kindergarten activity' nodes in Nvivo were: capturing an event; creative expression; exploring the technology; imaginative play; literacy; motor skills; numeracy; puzzles and social interactions. To achieve these nodes, an open coding technique was used where codes are generated as the data was worked through. NVivo classifies these first level codes as 'parent nodes'. Nodes can then be broken down into sub nodes known as 'child nodes'. During phase one, parent nodes were the kindergarten activities identified and the child node' were these activities broken down into more detail. For example, the parent node 'exploring the technology', was broken into two child nodes – 'general use' and 'exploring the functions'. As new nodes were identified during the first round, a second round of coding was conducted to ensure all relevant data was coded to the same list of nodes. A frequency count was used to determine which nodes were most prevalent and to determine the focus of the discussion chapter. [4:1 Data analysis flow chart.]

4.8.2 Second phase of data analysis

Phase two involved coding the data according to Vygotsky's concepts drawn from Vygotsky's work and identified prior to fieldwork. Again, an open coding technique was used. The parent nodes were: cultural tools; imagination; social context; speech; and the zone of proximal development (ZPD). These nodes were broken into child nodes, for example, ZPD was broken into child-child and adult-child. [4:1 Data analysis flow chart.]

Frequency tables were also developed to display the nodes according to the type of data: for example, photographs, videos or documents. Nodes with frequency counts higher than 30 were then selected for further analysis. A number higher than 30 was selected because this was considered a repetition of the node within the children's 'world' (the kindergarten setting) that suggested it was important for understanding their activity on the digital devices and how these related to Vygotsky's ideas about play. Conclusions were then drawn from the data and described in detail within the findings and discussion chapters. Christensen et al (2011) says that when using descriptive statistics derived from qualitative data, it is useful to establish a baseline number for the type of examples that are considered most typically of the phenomena under investigation. In the second phase of coding, three codes had frequencies of 96, 95 and 34 respectively, while the remaining two had frequencies of 4. The most frequent three were then discussed in more detail.

A comparison between the two sets of data derived from the two main research questions was also undertaken. This enabled intersections between the two sets of findings to be identified. These intersections were identified in the data by running a query in Nvivo that finds all examples of the same

data occurring across two or more sets of nodes. For example, both 'ZPD' (codes based on Vygotsky's theory of play) and 'Exploring the technology' (codes describing typical kindergarten activities) could be matched with Nvivo. This was an important part of the analysis because it allowed the findings for research question two to be developed from the mainly descriptive analysis in response to research question one; thereby elements of Vygotsky's theorisation could be identified within typical kindergarten activities where digital technologies were is use by children.

4.9 Limitations of the study

4.9.1 The problem of generalisations

A limitation of case study research is the inability to make generalisations from the data collected. As Stake (2005) believes "the purpose of a case report is not to represent the world, but to represent the case" (p. 460). The data collected only relates to the specific case, for example the activities described in this thesis relate to the particular children observed in the particular kindergarten studied. However, Flyvbjerg (2011) values the ability of case study narratives to paint a picture for the reader that can be then translated for use in their own case, as "it is easier to remember and make decisions on the basis of 'meaningful' stories than to remember strings of 'meaningless' data" (p. 311). One aim of this thesis is for educators who read it to be able to transfer the insights gained into practical ideas that can inform their teaching.

4.9.2 Time limitations

The data collection phase of this research was limited to twelve kindergarten sessions over a five week period. The time limit imposed on the project restricted the data collected to a manageable level, but consequently may have affected the children's ability to use the devices at a more mature level. I return to this point in the concluding chapter and its implications for further research on this topic.

4.9.3 Ethical considerations

The ethical considerations described above also had an impact on the project and the data collected. The project occurred within a kindergarten where not all children had given their assent or whose parents had not consented to their participation. Data collected involving non-consenting children was removed affecting the study, by reducing the amount of usable data and through affecting the data that was collected on children with consent because of the presence of children without permission to participate.

4.10 Conclusion

This chapter has described the framework for which the study will be conducted. This study is a qualitative, case study that uses sociocultural theory as its ontological perspective and the epistemological

influence on both the research and researcher were outlined. The methods of data collection and ethical considerations were discussed, as well as the methods chosen for analysing the data. The next chapters present the findings, and then discuss them in relation to possible implications for educators.

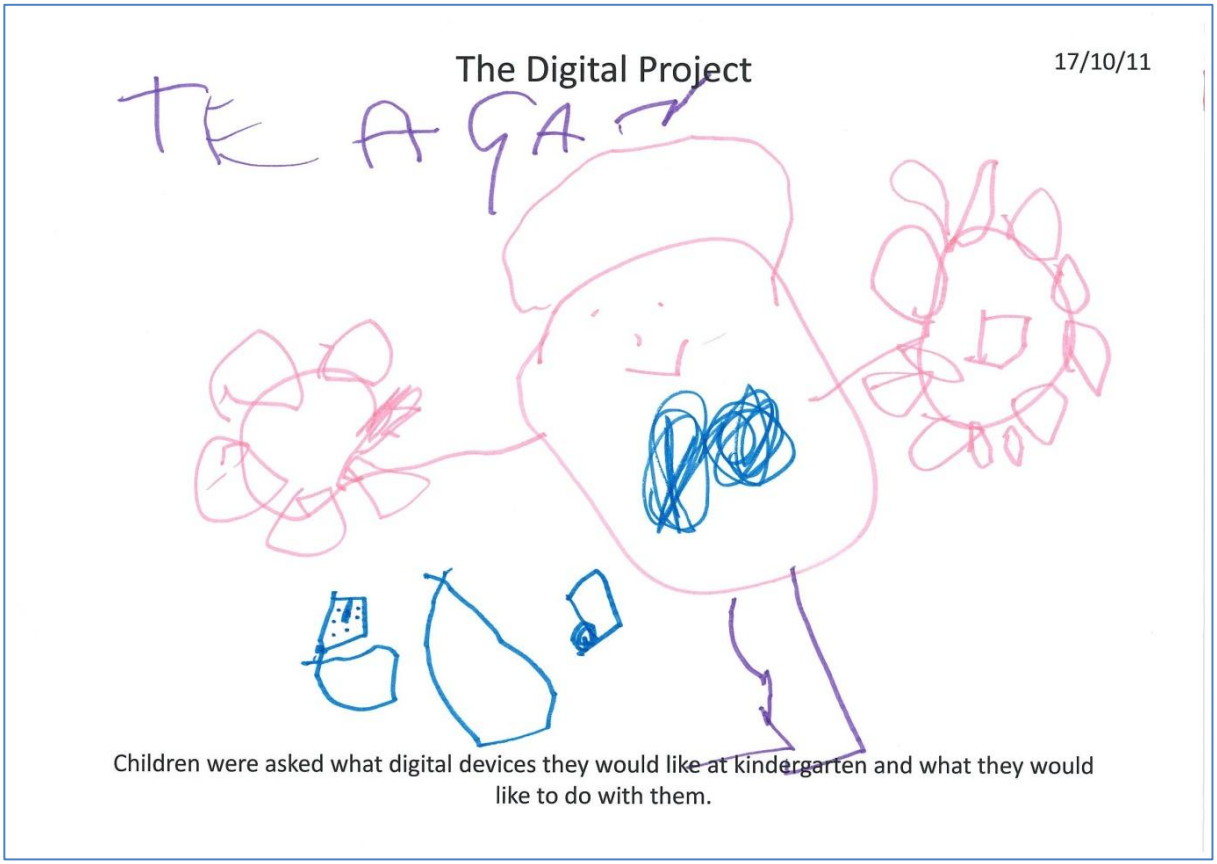
Chapter Five: Findings

5.1 Chapter Overview

This thesis is an attempt to understand the types of activities children engage in with digital devices in early childhood education. The first section of this chapter engages with this research question. The second part of the chapter presents the findings in relation to research question two: 'How do these activities relate to elements of Vygotsky's theorisation about young children's play?' Based on the research findings it will be argued that children need time to explore digital devices with an emphasis on social interactions within their kindergarten classroom.

5.2 Insights from introducing the project to the children

This first day of data collection began with a large group discussion, where I introduced the children to the project and to the devices available to them. The discussion about their knowledge and experience of digital devices surprised me. When asked if their parents had an iPhone half the group put up their hand and all of them indicated that they are allowed to use it (17/10/11). The children were then asked to draw a picture of which device they would like to use, what they wanted to do with it and what they would like to learn. The children had clear ideas about what they wanted to achieve throughout the project. The most common answers were that they wanted to "play games" (17/10/11), "learn ABCs and numbers"



Children were asked what digital devices they would like at kindergarten and what they would like to do with them.

Figure 5:1 Teagan's initial drawing.

(17/10/11) and take photos and videos of their friends. Teagan wanted to use "the big square one", (the iPad) and "the one that you put around here and record", (the Flip camera) and learn "how to write" (17/10/11) [Figure 5:1 Teagan's initial drawing.]

During the first week only one iPad was available and it was very popular. Another iPad was introduced during the second week and the children learnt very quickly which one they wanted a turn on because each had different software applications (apps) on them [Table 5:1 List of apps on each iPad].

Apps	iPad 1	iPad 2	Apps	iPad 1	iPad 2
3D Coaster	✓	✓	Mad Math	✓	✓
Ace Multiply		✓	Mrs Owl's Learning Tree	✓	✓
Air Hockey	✓		My Play Home	✓	✓
Air Penguin	✓	✓	Paint		✓
Angry Birds		✓	Photo Booth		✓
Ant Smasher	✓	✓	Piano Cats	✓	✓
Beanstalk		✓	Pig Shoot		✓
Bird Crazy		✓	Puppet Pals		✓
Cindy MM	✓	✓	RF Alphabet		✓
Cute Puzzles	✓		Shapes	✓	✓
Face Goo		✓	Sheep Launcher	✓	✓
Falldown	✓		Talking Ben	✓	✓
Fruit Ninja	✓	✓	Talking Gina	✓	✓
FS5 Hockey		✓	Talking Larry	✓	✓
I Hear Ewe		✓	Talking Roby	✓	✓
Jack Beanstalk		✓	Talking Tom	✓	✓
Jigsaw	✓		Talking Tom 2		✓
Kids Math		✓	Tic Tac Toe	✓	✓
Labyrinth LE	✓		Train Conductor	✓	
Let's Create Pottery	✓	✓	Waterslide	✓	

Table 5:1 List of apps on each iPad

The first iPad came with *My Play Home, Cindy MM, Photo Booth* and *Jigsaw* already installed. The remaining apps were selected based on their price (all apps added were free) and were recommended on the Victorian Government's iPads for Education website. In 2011, the Victorian Government distributed over 700 iPads to schools, the Royal Children's Hospital and one kindergarten as part of a trial to build

"on evidence that engaging and innovative learning environments are needed to connect with today's students and equip them for tomorrow's world" (Department of Education and Early Childhood Development, 2011). Home Road Kindergarten was part of the trial and they allowed free play on the iPads for a limited time each day as part of their daily program. Each iPad was restricted to the same selected 13 apps. The second iPad came with many apps installed and the same ones were added from the iPads for Education website.

Figure 5:2 Reza and Joyen showing Joshua how to play *Labyrinth LE*.

The most popular iPad for the girls was iPad One because it had more rooms available to explore on the *My Play Home* app. The most popular iPad for the boys was iPad Two because it had the *Penguin Lite* and the *Angry Birds* apps. During the four weeks of the project the children became competent in using the iPads. They shared their knowledge and taught their peers how to use the devices or how to use a particular app. For example, Joshua was playing *Labyrinth LE* on the iPad and Reza and Joyen told him what to do and how to play (25/10/11) [Figure 5:2 Reza and Joyen showing Joshua how to play *Labyrinth LE*.] The app involves tilting the iPad so the ball rolls into the holes. In the footage Reza points and explains to Joshua what he needs to do to get the ball to roll into the hole. [Table 5:2 Transcript of Joshua playing *Labyrinth LE*]

	Time span	Content
1	0:00.0 - 0:01.0	Joshua playing *Labyrinth LE* on the iPad. Joyen and Reza are watching.
2	0:00.3 - 0:14.2	Reza: "No don't go that way. Joshua! Come on" Joshua: "What?" Joyen: "Going, go that way" Joshua: "Yay!" Reza: "No don't go that way. Go that way." Joshua: "Ok"
3	0:14.3 - 0:32.0	Reza: "Go in the hole, go in the hole." Joyen: "Joshua" Joshua: "I will". Reza: "Joshua don't want to go in the hole" Jo: "He's trying. It's a bit tricky"
4	0:32.0 - 0:33.2	Joshua gets the ball in the hole. Joyen: "Yes" Jo: "There you go he got it in the hole"

Table 5:2 Transcript of Joshua playing *Labyrinth LE*

The children were all familiar with the digital camera. When asked if they had used a Flip camera, all the children hadn't. It was explained that the Flip camera takes video and some children stated that their parents took videos. The Flip camera and iPads were borrowed from the researcher's colleagues and family members so the rules were discussed with the children about how to use them. This included things like using the hand strap on the Flip camera (just like the Wii™ at home); cleaning hands before using the iPads; and sitting down at the table to use the iPad. Several drawings produced by the children of the Flip camera clearly showed the hand strap [Figure 5:1 Teagan's initial drawing.]

5.3 What activities do children engage in on digital devices in a kindergarten setting?

The first research question was 'what activities do children engage in around digital technologies in the early childhood classroom?' This section presents the findings relevant to the question. During coding, nine categories became apparent with respect to the type of activities children engage in when using digital technologies. These include: capturing an event; creative expression; exploring the technology; imaginative play; literacy; motor skills; numeracy; puzzles and social interactions. For each coded category a frequency distribution table was created, which is "a systematic arrangement of individual measures from highest to lowest" (Ary, Cheser Jacobs, & Sorensen, 2010, p. 105). The frequency with which each activity was noted across all of the data types was recorded. Table 5:3 Activity results illustrates the frequencies for each category of activity. Some of the data was coded to two or more categories, for example an exploring the technology involved a child and adult interaction so it was coded to the social category as well. Many data examples could not be assigned a single code and were assigned to multiple codes.

	Data type			
Activity Category	Document	Picture	Video	Frequency
Social interactions	3	11	65	79
Exploring the Technology	5	4	68	77
Capturing an Event	2	15	42	59
Imaginative Play	1	10	20	31
Literacy	2		26	28
Motor Skills		1	14	15
Numeracy			6	6
Creative Expression		3	3	6
Puzzles	1		1	2

Table 5:3 Activity results

Categories that had frequencies of 30 or higher were then selected for further consideration. This was because these categories appeared to be more persistent amongst the children than those with lower frequencies, such as literacy, motor skills and numeracy. Social interactions, exploring the technology, capturing an event and imaginative play all recorded frequencies higher than 30 and so were considered

the dominant activities children engaged in when using digital technologies in the early childhood classroom. In developing the categories the following definitions were used to indicate how data was assigned to each category:

1. Social: a use of the device involving children in peer to peer or adult to child social interactions that included sharing information, showing how to use an application or device or communicating about video and/or digital data.
2. Exploring the technology: a use of the device involving children engaging in behaviours such as being shown the functions and how to operate them by either a peer or an adult, experimenting with the features of the device and reviewing the results on a device.
3. Capturing an event: a use of the device involving children using the digital device to take photos, record video files and to record an experience in the early childhood classroom.
4. Imaginative play: where children used the device to create an imaginative play situation including using the device as a prop in their play or creating a play situation on a digital device.
5. Literacy: a use of the device to create a literacy experience including songs, stories, plays and rhymes.
6. Motor skills: a use of the technologies that encouraged the use of fine or gross motor skills.
7. Numeracy: a use of the device that requires the children to use their numeracy skills such as counting, pattern making and matching.
8. Creative expression: a use of the device involving children creating artworks through drawing, painting or photo manipulation.
9. Puzzles: a use of the device involving children completing manipulation puzzles on a digital device.

5.3.1 Category One: Social Interactions

Category one was the social category. The social interactions category was defined as ‘a use of the device involving children in peer to peer or adult to child social interactions that included sharing information, showing how to use an application or device or communicating about video and/or digital data.’ Examples of social interaction were evident across each of the devices and were often coded to other categories. For example:

1. Digital camera: children would use the camera to capture their peers, educators or the kindergarten environment. The social interactions occurring around this device were between the user and those photographed, and between those being photographed. An example from the data was when Destiny used the digital camera to take photos of her twin sister Indiana. Both girls were smiling and laughing. (8/11/11) [Figure 5:3 Destiny taking Indiana's photo.]

Figure 5:3 Destiny taking Indiana's photo.

2. iPad: children would gather around an iPad and discuss the app, comment on the player's success, or lack of, debate the rules and how to play it. Some apps allowed two players for example *Tic Tac Toe*, whereas in others like *Air Penguin* children competed for the highest score. Examples from the data are when Jo and Teagan played Tic Tac Toe together (27/10/11) [Table 5:4 Transcript of Teagan and Jo playing *Tic Tac Toe*.] and when Ricky played *Air Penguin* and the other children watched (17/10/11) [Figure 5:4 Ricky surrounded by his friends as he plays on the iPad.]

Figure 5:4 Ricky surrounded by his friends as he plays on the iPad.

	Time span	Content
1	0:00.0 - 0:29.0	Teagan playing *Tic Tac Toe* on the iPad. She is typing in her name. Teagan: "Is this e?" Jo: "Yep" Teagan: "T...E...A...T...E...A...G...A..." Jo: "Can you find N?" Teagan: "N"
2	0:28.9 - 0:37.3	Jo: "Beautiful. Go done. The blue one. Yep. And then I will type my name in. Can you type my name in for me?"
3	0:37.3 - 0:46.1	Teagan: "No" Jo: "J do you know which one J is?" Teagan: "No" Jo: "This one J. And O. Done."
4	0:46.0 - 0:52.9	Jo: "Press start game down the bottom" Teagan presses start.
5	0:52.9 - 1:03.1	Teagan: "I'll be that that one, you be that one" Teagan points to the X and O at the bottom of the screen. Jo: "Ok so it's. See the arrow there pointing to the cross? Yeah you're the cross. Whoap"
6	1:03.1 - 1:07.0	Teagan: "And" Jo: "See the cross. So you press on a square that you want."
7	1:06.9 - 1:16.2	Jo: "Have you played *Tic Tac Toe* before?" Teagan: "I have on Mum's phone"
8	1:16.2 - 1:20.9	Jo: "Yep, ok. You press the square that you want". Teagan presses a square. Jo: "Ok now it's my turn" Jo presses a square.
9	1:20.9 - 1:31.2	Teagan presses another square. Jo presses a square and blocks Teagan's three in a row. Jo: "Uummmmm" Teagan: "Aayyyyy" Jo: "I stopped you! You've got to watch. You've got to stop me." Teagan: "Uummm ok"
10	1:31.1 - 1:46.0	Teagn: "Mmm" Teagan waits and then presses a square. She smiles at Jo. Jo: "Oh look. Look." Jo points out the line of three she can make. The iPad plays an "Ooohhh" sound. Teagan: "Sssss ohhh" Jo: "Ohhhh. Ok new game. The arrow is next to you so you are first again" Teagan presses a square.

Table 5:4 Transcript of Teagan and Jo playing *Tic Tac Toe*.

3. Flip camera: children would use to the Flip camera to capture their peers, the kindergarten environment or an event. Children would perform for the friends, knowing they were being filmed (see 20/10/11 or 15/11/11). An example from the data was Rithik, a 5 year old child who often sang to himself as he participated in different activities. Rithik was the first child to use the Flip camera. He asked many questions about its operation and then experimented with the various settings, recording other children and the kindergarten environment. On one of the project days, my thesis supervisor from the Australian Catholic University came to visit. Rithik spent time with her as she modelled how to ask questions in an interview style, how to make a movie and how to record someone else's movie (8/11/11). Rithik took these newly learned skills and taught others how to use the Flip camera. He spent one session interviewing and recording his classmates, asking them what they liked and disliked about kindergarten (Rithik 14/11/11) [Figure 5:5 Rithik asking Tiffany questions.]

Figure 5:5 Rithik asking Tiffany questions.

4. Computer: children often gathered around the computer to assist the person having their turn or to observe what was happening on the computer. For example Joshua was playing Reader Rabbit Kindergarten on the computer and Butterfly showed him which curtains to open to match the letters and move on in the game (20/10/11) [Figure 5:6 Butterfly showing Joshua how to match the letters on the computer.]

Figure 5:6 Butterfly showing Joshua how to match the letters on the computer.

5.3.2 Category Two: Exploring the Technology

Category two was defined as 'a use of the device involving children exploring behaviours such as being shown the functions and how to operate them by either a peer or an adult, experimenting with the features of the device and reviewing the results on a device'. When examples for this category involved the child and a peer or adult, they were also coded to category one: social. Other examples for this category involved the child exploring the device alone and as a result did not also appear in the social category. Findings in this category were divided into two sub categories:

1. Learning functions: exploratory behaviour related to when the children were shown how to perform a function by either an educator or peer or when they discovered the function

independently. These behaviours often involved the child repeating the function or commenting on how it worked. Some data examples of these around each device include:

a. Flip camera: Jo showed Sebastian how to use the Flip camera explaining how to press the red button to start recording, the numbers changing to show it is recording, to view what is being recorded on the screen and to press the red button again to stop it recording (3/11/11), Rithik learned how to zoom when Jo showed him how to zoom in using the '+' button to zoom in and the '-' button to zoom out (17/10/11) and during one session, Neha used the Flip camera to compare different children's lips (25/10/11) [Figure 5:7 Neha recording lips.] She gave a running commentary as she zoomed in on various lips around the room. While watching the video she discussed the similarities and differences between the lips. Her video sparked a long discussion between the children about looks, skin colours and the uses of our lips.

Figure 5:7 Neha recording lips.

b. iPad: Jo showed Indiana how to swipe the pictures to make them scroll across the iPad (27/10/11) [Table 5:5 Indiana playing *I Hear Ewe*] and Kiara telling Butterfly how to play *Puppet Pals* on the iPad (20/10/11) [Figure 5:8 Kiara showing Butterfly how to play *Puppet Pals* on the iPad.]

	Time span	Content
1	0:00.0 - 0:06.9	Indiana playing *I hear Ewe* on the iPad.
2	0:06.9 - 0:14.8	Jo: "If I put it down like that, does it make it easier?"
3	0:14.8 - 0:21.2	Jo: "You can move it across, there is different animals"
4	0:21.2 - 0:27.9	Jo: "You going to push one?" Indiana nods and moves her hand to a picture. Jo: "Lift your hand up now"
5	0:27.8 - 0:41.6	Indiana presses the lion. Jo: "Push. Op. Watching?" Indiana looks at that screen. iPad: "This is the sound a lion makes, roar"
6	0:41.6 - 0:59.7	Jo "What other one do you want to push?" Indiana looks at the screen and reaches for the elephant. Jo "This one, what about the snake?"
7	0:59.7 - 1:11.2	iPad: "This is the sound a parrot makes, squawk" Jo: "A parrot" Indiana looks at Jo at smiles, and then looks back at the screen and smiles.
8	1:11.2 - 1:36.6	Jo: "What's on the next page, move it across like this, watching, like this, ooooh. What are you going to push on that page?" iPad: "This is the sound a police car makes, siren" Indiana looks away then back at the screen and smiles. Jo: "A police car" iPad: "This is the sound a car makes, engine starting" Indiana smiles.

Table 5:5 Indiana playing *I Hear Ewe.*

Figure 5:8 Kiara showing Butterfly how to play *Puppet Pals* on the iPad.

c. Digital camera: Sebastian asking Jo how to view the photos he has taken and Jo showed him how to press the ▶ button to play the photos (27/10/11) [Table 5:6 Transcript of Sebastian asking Jo how to see the photos he has taken.]

	Time span	Content
1	0:00.0 - 0:07.4	Sebastian using the digital camera.
2	0:07.4 - 0:33.1	Jo: "What are you doing Sebastian?" Sebastian: "Taking a photo of these" Jo: "Are you?" Sebastian: "And how do you get the photo up so you can have a look at it?" Jo: "You have to turn this circle thing round" Sebastian: "Oh" Jo: "To the play, see how it's got play? Then it comes up?" Sebastian: "Oh" Jo: "And then you use these to move 'em across, and put it, you got to turn it back to the green one for when you are taking photos." Sebastian: Oh"
3	0:33.1 - 0:57.9	Sebastian is scrolling through the photos, smiling at some. Jo: "They're other people's photos"

Table 5:6 Transcript of Sebastian asking Jo how to see the photos he has taken.

d. Computer: Butterfly showing Joshua how to play *Reader Rabbit Kindergarten* on the computer (20/10/11) [Figure 5:6 Butterfly showing Joshua how to match the letters on the computer.] and Destiny learning how to type her name on the keyboard (20/10/11) [Figure 5:9 Destiny learning to type her name.]

Figure 5:9 Destiny learning to type her name.

2. General use: exploratory behaviours that related to the functions of the device that weren't categorised as learning the functions. These were often where children practised the functions they had learnt. Some examples for the data coded to this category were Reza filming Joyen with the Flip camera where he said "I want to video you" (8/11/11) and Joshua on the computer when he had just learnt how to type his name on the keyboard, and then asked Jo. "Do I need to type it again?" (20/10/11). This category was evident across all of the devices including the iPad, Flip camera, computer and digital camera.

5.3.3 Category Three: Capturing An Event

Category three was defined as 'a use of the device involving children using the digital device to take photos, record video files and to record experiences in the early childhood classroom'. The children

captured everyday activities, special events and unique experiences. This category was divided into five sub categories:

1. Adult capturing a child's activity with device: involved data where an adult had recorded a child's use of a digital device. Examples occurred across all digital devices and some examples from the data are: Geehan recorded Rithik using the Flip camera (17/10/11) [Figure 5:10 Rithik using the Flip camera.]; Jo recorded Destiny taking Indiana's photo (8/11/11) [Figure 5:3 Destiny taking Indiana's photo.]; Jo recorded Anshika using the iPad (20/11/11) [Figure 5:11 Anshika using the iPad.]; Jo recorded Joshua typing his name on the computer (20/10/11) and Jo recorded Sebastian using the digital camera for the first time (27/10/11).

Figure 5:10 Rithik using the Flip camera.

Figure 5:11 Anshika using the iPad.

2. Involved in: the child is involved in the event and directly involved in using the digital device. Examples from the data include: Lara taking photos of the block construction she made with friends (8/11/11) [Figure 5:12 Lara's photograph of her friends' block construction.]; Rithik recording Geehan recording him (17/10/11); Reza recording Joyen dancing (8/11/11) [Figure 5:13 Reza recording Joyen dancing.]; Shamone telling Reza he wants to see him in the video (15/11/11); Jo and Teagan playing *Tic Tac Toe* (27/10/11) [Table 5:4 Transcript of Teagan and Jo playing *Tic Tac Toe*.] and Joshua taking photos of the sun (15/11/11) [Figure 5:14 Joshua taking photographs of the sun.]

Figure 5:12 Lara's photograph of her friends' block construction.

Figure 5:13 Reza recording Joyen dancing.

Figure 5:14 Joshua taking photographs of the sun.

3. Non technology related: the device used to capture the event was the only device involved in the specific data. Examples of non technology related capturing an event include: Rithik recording the alien movie my thesis supervisor made as an example with Rithik (8/11/11) [Table 5:7 Transcript of Rithik recording my supervisor's movie]; Joshua and Shamone discussing snails (20/10/11) [Figure 5:17 Joshua and Shamone talking about snails.]; Neha recording lips (25/10/11) [Figure 5:7 Neha recording lips.]; Sebastian taking a video of the bird (24/10/11) [Figure 5:18 Sebastian taking video of the bird.]; Teagan filming the kindergarten (20/10/11) [Table 5:4 Transcript of Teagan and Jo playing *Tic Tac Toe*.]; Butterfly filming Shaheen smiling (20/10/11) [Figure 5:16 Butterfly filming Shaheen smiling.]; Joshua filming Shamone singing 'Happy Birthday' (20/10/11) [Figure 5:15 Joshua

filming Shamone singing Happy Birthday.]; Kiara filming Anshika's jungle (14/11/11); Rithik asking Tiffany questions (14/11/11) [Figure 5:5 Rithik asking Tiffany questions.] and Teagan filming Sebastian playing with a bird (25/10/11) [Table 5:8 Transcript of Teagan videoing Sebastian playing with the bird].

	Time span	Content
1	0:00.0 - 0:10.8	Suzy holding a spaceman. Rithik: "Yep" Suzy: "Have you got him?" Rithik: "Wait...aargg. Haven't got him" Suzy: "Is he in? Tell me when to start" Rithik: "Start"
2	0:10.7 - 0:16.7	Suzy: "Start. Well my name is spaceman." Rithik: "Yep"
3	0:16.6 - 0:44.2	Suzy: "Where should I go today? Should I go to the zoo?" The camera wobbles as Rithik shakes his head. Suzy: "No. Should I go to the park?" The camera wobbles as Rithik shakes his head. Suzy: "No. Oh dear where does a spaceman go? Ahhhh ha. There's a rocket! That's what I need. Go in my rocket. Open the door, in I go. Arrrg close the door. Now."
4	0:44.1 - 1:08.6	Suzy: "Now what do I have to say to make my rocket go? 10..9..8..7..6..5..4..3..2..1..0 blast off. (rocket noise) and boom landing."
5	1:08.6 - 1:52.7	Suzy: "Open the door, Oh my goodness where am I? Everything's all shiny and hard. I must be in space. And who are these funny people? (standing up the aliens) They've got three eyes. Gobble, gobble, gobble, gobble, gobble. Hello I'm spaceman. Gobble gerbel (alien speak) Oh dear says spaceman; I can't understand what they're saying. Gobble gerbel (alien speak) and they're going this way and I have to follow them."
6	1:52.6 - 2:24.8	Suzy: "So spaceman followed them. Everybody sat down. They had some rocks. They must eat rocks. They offered spaceman some but they were too hard for his teeth. Ouch. Couldn't eat them. Gobble gerbel (alien speak) so the aliens they like them. Then spaceman said well I better go. Thanks for the afternoon tea."
7	2:24.8 - 2:57.7	Suzy: "Back in his rocket. In you go spaceman, close the door. 10..9..8..7..6..5..4..3..2..1..0 blast off. Rocket noise. And spaceman landed back home again. Open the door, left his rocket, laid down, said good night. That's the end of the movie. Press stop" Rithik: "I did press stop" Suzy: "Press the red button

Table 5:7 Transcript of Rithik recording my supervisor's movie

Figure 5:15 Joshua filming Shamone singing Happy Birthday.

Figure 5:16 Butterfly filming Shaheen smiling.

Figure 5:17 Joshua and Shamone talking about snails.

Figure 5:18 Sebastian taking video of the bird.

	Time span	Content
1	0:00.0 - 0:01.0	Sebastian's face.
2	0:00.7 - 0:02.9	Teagan: "Hi Sebastian. What are you doing?"
3	0:02.8 - 0:06.4	Sebastian: "Playing with a bird"

Table 5:8 Transcript of Teagan videoing Sebastian playing with the bird.

4. Not directly involved in: a child captures another child's play that doesn't involve the use of digital technologies. Examples from the data include: Sebastian and Madisyn playing investigator kids (20/10/11) [Figure 5:19 Madisyn and Sebastian playing investigator kids.]; Kiara explaining taking turns to Lara (17/10/11) [Table 5:9 Transcript of Kiara explaining its Lara's turn next.]; and Lara filming Neha and Anshika playing at the light box (24/10/11).

Figure 5:19 Madisyn and Sebastian playing investigator kids.

	Time span	Content
1	0:00.0 - 0:10.2	Kiara walking. Kiara "It's Lara's turn after me. Okay? Lara wants a turn after me".
2	0:10.1 - 0:19.3	Kiara walks. Then see Lara on the swing.

Table 5:9 Transcript of Kiara explaining its Lara's turn next.

5. Technology involved event: a digital device was used to capture an event that focused around a digital device. Examples from the data included: Geehan recording Rithik using the Flip camera (17/10/11) [Figure 5:10 Rithik using the Flip camera.]; Jo recording Joshua taking photos of the sun (15/11/11) [Figure 5:14 Joshua taking photographs of the sun.]; Joyen dancing for Reza (8/11/11) [Figure 5:13 Reza recording Joyen dancing.] Linda's birthday video (7/11/11) [Figure 5:20 Recording *Happy Birthday*.]; Rithik recording *Mr Potato Head* going to pieces (8/11/11) and Jo recording Teagan and herself playing *Tic Tac Toe* (27/10/11) [Table 5:4 Transcript of Teagan and Jo playing *Tic Tac Toe*.]

During the project one assistant was absent and her time off also coincided with her birthday. The Flip camera was used to record the children singing her *Happy Birthday* and it was emailed to her as a birthday surprise (7/11/11) [Figure 5:20 Recording *Happy Birthday*.] [Table 5:10 Transcript of the discussion about how old Linda is.].

Figure 5:20 Recording *Happy Birthday*.

	Time span	Content
1	0:00.0 - 0:03.9	Children: "89" Jo: "89?" Sebastian: "7" Jo: "7"
2	0:03.8 - 0:07.0	Children: "6, 49" (yelling out answers) Jo: "How many, how many claps are we going to give her?"
3	0:06.9 - 0:10.6	Children: "5, 1" Jo: "One clap? She's a bit odler than one"
4	0:10.5 - 0:18.6	Children: "89, what about 100" Jo: "Is Linda that old?" Shamone: "Arrr 14" Jo: "14. How about 14 that's a good number"
5	0:18.5 - 0:27.7	Jo: "We give her 14 claps, are we ready? Ready and I will video you"

Table 5:10 Transcript of the discussion about how old Linda is.

The children used the Flip camera to capture their friends in regular play experiences and in events that were staged for the camera. On separate days, different children staged and recorded each other singing

Five Grey Elephants Balancing (see 17/10/11, 25/10/11 and 3/11/11). This song was a common occurrence at the kindergarten and its dramatic depiction became a regular videoed event during data collection. Lara used the Flip to record Kiara and Tiffany acting out the *Five Grey Elephants Balancing*. Lara directed the acting of the song, telling Tiffany where to go and when, all the while capturing the event on the Flip camera [Table 5:11 Transcript of Lara directing Elephants Balancing.].

	Time span	Content
1	0:00.0 - 0:01.8	Kiara on the balancing beam.
2	0:01.8 - 0:08.4	Lara: "Now me, go on. Now Tiffany go on".
3	0:08.3 - 0:14.4	Lara: "Two grey elephants"
4	0:14.3 - 0:32.6	Lara: "Tiffany! Understand, go here. Uh behind. Come to here. Walk all the way to here. Walk all the way to here. Nope walk all the way to here Tiffany!"
5	0:32.6 - 0:42.7	Lara: "Please! I won't be upset of you when you do that. Go... go.... come"

Table 5:11 Transcript of Lara directing Elephants Balancing.

During another episode, a child recorded Lara, Anshika and Neha acting out the song. As there were only three of them their version was changed to *Three Grey Elephants Balancing* (25/10/11) [Figure 5:21 The acting of *Three Grey Elephants Balancing*.] In these events the device was not only used to capture the event but it became a medium for developing other skills including negotiating roles, taking on lead roles in play and practicing numeracy and communication skills.

Figure 5:21 The acting of Three Grey Elephants Balancing.

5.3.4 Category Four: Imaginative Play

Category four was defined as 'where children used the device to create an imaginative play situation including using the device as a prop in their play or creating a play situation on a digital device'. This category was broken into two sub categories:

1. Device as a prop: where the digital device was used as prop within the children's dramatic play situation. Data coded to this category included functioning devices as well as devices that were broken and didn't operate. Children have access to many tools and equipment in the kindergarten including non-working digital technologies. These include a laptop, mobile phones and old, film cameras. An example from the data is when Joyen set himself up on the woodwork bench under the veranda. He had a hammer, wood, nails and the laptop. When asked what he was doing, he explained that he was making a camera and needed to look in the computer to find out how to do it. His play episode lasted over 15 minutes and included making the camera and a trip to Bunnings™ to buy a new hammer (25/10/11) [Figure 5:22 Joyen using the laptop to find out how to make a camera.]

Figure 5:22 Joyen using the laptop to find out how to make a camera.

	Time span	Content
1	0:00.0 - 0:01.0	Joyen is standing at the woodwork table. He has a piece of wood with a nail in it on his right and the laptop on his left.
2	0:00.5 - 0:17.6	Jo: “What are you doing Joyen with the computer?" Joyen: "I'm doing hammering" Jo: "Yeah what are you doing with the computer?" Joyen: "To see how to make a camera" Jo: "A camera. How to make a camera" Joyen: "Yeah, you look into the computer" Jo: "Ahhhhh, so you look on the computer to find out how to do it?"

Table 5:12 Transcript of Joyen using a non-working laptop to find out how to make a camera.

2. iPad app: children could create imaginative play scenarios within the iPad apps. The apps on the iPads that allowed for imaginative play scenarios were *My Play Home*, where children can move the family members around various rooms of a house and allow them to complete everyday tasks for example: eating; sleeping; showering and listening to music, and *Puppet Pals* where the children can create a puppet show by moving the puppets and recording their own voice as they narrate the story. Examples from the data include: while Neha and Ricky played *My Play Home*, Neha says, as she moves the baby “the baby’s sleeping” (24/10/11) [Figure 5:23 Screenshot of *My Play Home* with the children sleeping and Table 5:13 Transcript of Neha and Ricky playing *My Play Home*.]; Teagan playing *My Play Home* feeding the people and discovering how to lie the people down (24/10/11) [Table 5:14 Transcript of Teagan playing *My Play Home*]; Joyen playing *Puppet Pals* and, as he moves the characters he says “the dragon, and the squirrel, and then… the Fairy Godmother I’m going to turn you into a dragon” (24/10/11) [Table 5:15 Transcript of Joyen playing *Puppet Pals*.].

	Time span	Content
1	0:00.0 - 0:01.0	Ricky and Neha playing *My Play Home* on the iPad. Kiara is watching.
2	0:00.2 - 0:03.7	Neha: "The baby's sleeping" She moves the baby with her finger.
3	0:03.6 - 0:09.2	Ricky touches a person but it doesn't move. He touches it again, nothing happens. He touches it and holds his finger on it and moves it towards the door. The person moves. He smiles.
4	0:09.1 - 0:11.7	He presses on the arrow and the room changes.
5	0:11.7 - 0:16.4	He presses the home button and chooses another game.

Table 5:13 Transcript of Neha and Ricky playing My Play Home.

Figure 5:23 Screenshot of My Play Home with the children sleeping

	Time span	Content
1	0:00.0 - 0:01.0	Teagan playing *My Play Home* on the iPad.
2	0:00.5 - 0:14.0	She is moving the people around in the bedroom. Teagan looks quickly up at Jo. Teagan: “They do lay down" Jo: "They do? How did you make him lie down?" Teagan: "You raise above and they lie down" Jo: "Ah"
1	0:00.0 - 0:01.2 Second film	Teagan playing *My Play Home* on the iPad.
2	0:01.1 - 2:15.0	Jo: "You can feed them. You can give them the food" Teagan: "Where's the plates? Oh, yeah" Jo: "Up on the shelf" Teagan moves the food to the people. Teagan puts the food to the people's mouths and they crunch it and eat it.
3	2:15.0 - 2:29.2	Teagan: "How do you get the plate out?" Jo: "The what out?" Teagan: "The plate back out of here?" Jo: "I'm not sure" Teagan moves the plate.
4	2:29.1 - 2:40.1	Jo: "And you can press on the arrows to go to different rooms" Teagan: "I know"

Table 5:14 Transcript of Teagan playing My Play Home.

	Time span	Content
1	0:00.0 - 0:16.9	Joyen is watching the play he made in *Puppet Pals* on the ipad. Reza and Shaheen are watching. He looks up to Jo and smiles.
2	0:16.8 - 0:27.8	Joyen: "Let's do another one" Jo: "So you've got to press record again. No the red one, the red circle"
3	0:27.8 - 0:41.9	Joyen watches his play, smiling. Joyen: "That's Shaheen's voice"
4	0:41.9 - 0:44.9	Jo: "That is. If you want to record another one you need to press the red dot."
5	0:44.8 - 1:08.7	Joyen presses the red dot. Joyen moves the characters telling a story. Joyen: "The dragon, and the squirrel, and then... the fairy Godmother I'm going to turn you into a dragon"
6	1:08.7 - 1:32.9	Joyen watches his latest play. He looks at the camera and smiles.

Table 5:15 Transcript of Joyen playing Puppet Pals.

5.4 Section two: how do children's digital activities relate to elements of Vygotsky's theorisation about children's play?

This section focuses on the findings for the second research question. This research question was 'How do children's digital activities relate to elements of Vygotsky's theorisation about children's play?' All the data sets were coded to determine which elements of Vygotsky's theory could be used in the current context to help define children's activities on digital devices or whether new definitions might be required to conceptualise children's contemporary activities. Five main categories were evidenced including: 1) Cultural tools; 2) Imagination; 3) Social context; 4) Speech and 5) the Zone of Proximal Development (ZPD). The categories were defined as follows:

1. Cultural tools: instances where children used the devices as cultural tools that supported social interaction and communication.
2. Imagination: instances where children used the devices to connect to reality through imagination.
3. Social context: where the devices were used to broker social interactions or situations amongst children.
4. Speech: instances where the devices encouraged children to develop their oral language skills.
5. Zone of Proximal Development: where children were assisted to complete a task by a peer and/or adult that they could not complete on their own.

As for section one, a frequency distribution table was created, which is "a systematic arrangement of individual measures from highest to lowest" (Ary, et al., 2010, p. 105). Frequencies were used to indicate the trends of the elements of Vygotsky's theory within the defined activities. The table showed that Cultural Tools, Social Context and the ZPD were coded the most frequently across the data sets [Table 5:16 Frequencies per category for conceptual ideas from Vygotsky's theory evidenced in the children's interactions with the device.] These are now discussed in more detail.

	Data set			
Conceptual idea from Vygotsky's Theory	**Document**	**Picture**	**Video**	**Frequency**
Cultural Tools	6	16	74	96
Social Context	6	13	76	95
ZPD	1		33	34
Speech	1		3	4
Imagination	1		3	4

Table 5:16 Frequencies per category for conceptual ideas from Vygotsky's theory evidenced in the children's interactions with the device.

5.4.1 Category One: Cultural Tools

The kindergarten contains many cultural tools that are considered typical of early childhood classrooms such as blocks, puzzles, climbing equipment, home corner furniture, construction sets, dolls and imitation people and animals. The children interact with these tools continuously on a daily basis. Cultural tools within this study were also evident when the children used the digital devices to support social interaction and communication. This definition was based on Vygotsky's (1978) explanation that "the tool's function is to serve as conductor of human influence on the object of activity; it is externally orientated; it must lead to changes in objects" (p. 55). Signs, which are "internally orientated and aimed at mastering oneself", when combined with tools create mediated activity or a higher psychological function (Vygotsky, 1978, p. 55). Vygotsky believed that these tools and signs are culturally constructed and "socially rooted and historically developed activities" (Havnes, 2010, p. 493). Cultural tools were used by the children in this project in two ways. First, when the children used the digital devices to record themselves and/or peers playing with typical kindergarten tools. For example, Lara taking photos of the block building she and her friends created (8/11/11) [Figure 5:12 Lara's photograph of her friends' block construction.]; or Joyen using the Flip camera to record the CD player while *The Wonkey Donkey* was playing. He recorded the speaker too close so the video is blurred but the words of the song are clearly heard. He then turned the Flip camera on himself where the video stops (8/11/11). Teagan using the Flip camera to film the kindergarten yard (20/11/11). Teagan gave a running commentary of what she saw as she moved the camera around the kindergarten yard. [Table 5:17 Transcript of Teagan filming the

kindergarten yard.]. Secondly, the children used the device as a cultural tool. For example, Ricky played *Air Penguin* on the iPad (17/10/11) [Figure 5:4 Ricky surrounded by his friends as he plays on the iPad.]; Joshua played *Reader Rabbit Kindergarten* on the computer and Butterfly showed him which curtains to open to match the letters and move on in the game (20/10/11) [Figure 5:6 Butterfly showing Joshua how to match the letters on the computer.] and Destiny used the digital camera to take photos of Indiana (8/11/11) [Figure 5:3 Destiny taking Indiana's photo.].

	Time span	Content
1	0:00.0 - 0:07.6	Shows the roof of the kindergarten. Teagan: “This is the roof of the kindergarten and there's the sandpit.
2	0:07.7 - 0:12.9	Teagan: "And that's the slide. That's where you make the music."
3	0:12.8 - 0:29.9	Teagan: "I can go closer so you can see. Up the steps you go, over here is the talking about."
4	0:29.9 - 0:50.1	Teagan: "Over there is the cacoon puncher (punching bag). And over here is the swing. I can go closer, down the steps. This is how you sit on it"
5	0:50.0 - 1:08.6	She turns the camera onto her own face and starts to swing. Teagan: "Wheee. Now that's enough of swimming... swinging"

Table 5:17 Transcript of Teagan filming the kindergarten yard.

5.4.2 Category Two: Social Context

Social context was defined as ‘where the technologies were used to broker social interactions or situations amongst children’. This definition was based on Edward’s (2003) interpretation of Vygotsky’s theory about the role of social interactions within the social context of kindergarten. She stated “Vygotsky’s central tenet was that learning led the developmental process, with children acquiring (or learning) the knowledge practices of their host communities as they interacted with others” (p. 255). This idea suggests that children learn and develop as they interact with their peers and is connected to Vygotsky’s argument that “that consciousness is constructed through a subject’s interactions with the world. Development cannot be separated from its social and cultural context” (Verenikina, 2003, p. 4). Children used the digital device as a medium for social interactions; for example, Destiny taking Indiana’s photo and the two of them laughing (8/11/11) [Figure 5:3 Destiny taking Indiana's photo.] Often the digital device brought children together as they watched another child on the iPad or computer; for example, Ricky playing *Air Penguin* on the iPad (17/10/11). In this example the children were discussing how to complete the game, issuing words of encouragement and congratulating Ricky on completing each level. [Figure 5:4 Ricky surrounded by his friends as he plays on the iPad.] This example illustrates how the device created a social context because the children were interested and all wanted to see what was happening on the iPad which required negotiation of the viewing space, resulting in both physical and

verbal interactions. The children also displayed an understanding of social rules through giving Ricky praise and encouragement as he participated in the game. Another example is where Joyen, Destiny, Indiana and Neha watched *The Bear Hunt* on the computer (27/10/11). The children sang the words of the song, did the actions and smiled at each other [Figure 5:24 Joyen, Destiny, Indiana and Neha watching *The Bear Hunt* on the computer.]

Figure 5:24 Joyen, Destiny, Indiana and Neha watching *The Bear Hunt* on the computer.

5.4.3 Category Three: Zone of Proximal Development

This category was defined as 'where children were assisted to complete a task by a peer or adult that they could not complete on their own'. This definition was based on Vygotsky's ideas about ZPD which initially described the space between what a child could do with support as the most useful means of assessing learning because it identified the child's next or 'nearest' area of development. Vygotsky (Vygotsky, 1978) stated "what is in the zone of proximal development today will be the actual developmental level tomorrow – that is, what a child can do with assistance today she will be able to do by herself tomorrow" (p. 87). The ZPD category in the digital project comprised two sub-categories, including adult-child interactions and child-child interactions. Adult-child interactions were characterised by an adult assisting a child to complete a task on a digital device that the child could not perform on his or her own. An example of this was when Jo taught Rithik how to zoom on the Flip camera (17/10/11) [Table 5:18 Transcript of Rithik learning how to zoom on the Flip camera.]. As Plowman and Stephen (2007) found in their study "children usually need adults to help them acquire specific operational skills, after which they may move on alone to become independent users" (p. 21). The data indicates that

children usually need one or two interactions with a more knowledgeable peer to explain the functions before they can comfortably use devices independently.

	Time span	Content
1	0:00.0 - 0:05.8	Rithik: "How do you make it go to the other side?"
2	0:05.8 - 0:09.9	Jo: "What do you mean to the other side?" Rithik: "The other side to go... after?" Jo: "Well it won't."
3	0:09.9 - 0:17.9	Jo: "To go closer? Do you mean like, like" Jo takes the Flip camera and shows Rithik how to zoom in and out. Jo: "Like that?" Rithik: "Yeah"
4	0:17.9 - 0:38.3	Rithik: "Aaaaahhhhhh. Ok" Rithik takes the camera back. Rithik: "I can't go closer" He zooms in and out.
5	0:38.2 - 0:49.0	Rithik: "Shaheen" Zooms out. Sebastian comes into view and Rithik follows him.
6	0:49.1 - 1:11.5	Sebastian, Teagan and Kiara in home corner. Rithik zooms in and out. Rithik sings to himself.

Table 5:18 Transcript of Rithik learning how to zoom on the Flip camera.

Child-child interactions were characterised by a child assisting another child to complete a task he or she could not perform independently. For example, Joyen and Reza showed Joshua how to play Labyrinth LE on the iPad (25/10/11). They both gave Joshua directions on how to move the balls and succeed in the game [Table 5:2 Transcript of Joshua playing *Labyrinth LE* and Figure 5:2 Reza and Joyen showing Joshua how to play *Labyrinth LE*.. Another example is shown in a photo of Reza showing Joyen how to record Shamone with the Flip camera (20/10/11) [Figure 5:25 Reza showing Joyen how to film Shamone with the Flip camera.] Interestingly, there were three times more occurrences of adult-child incidents than child-child. Analysis of the adult-child data shows that typically adults were helping children learn to use a device, achieve a goal (i.e. record something) or were there to capture an event with the children.

Figure 5:25 Reza showing Joyen how to film Shamone with the Flip camera.

The ZPD category intersects with Category two from Section one: 'exploring the technology'. This is because there were 24 examples of ZPD that related to exploring the technology. This was identified in the data by running a query that finds all source examples of both 'ZPD' and 'Exploring the technology' in *Nvivo*. This function allows nodes (main themes) from data sets to be compared. Some examples from the data that were coded to both ZPD and exploring the technology include: Rithik learning how to zoom (17/10/11); Kiara telling Butterfly how to play *Puppet Pals* on the iPad (20/10/11); Butterfly showing Joshua how to play *Reader Rabbit* on the computer (20/10/11) [Figure 5:6 Butterfly showing Joshua how to match the letters on the computer.]; Destiny learning how to type her name on the keyboard (20/10/11) [Figure 5:9 Destiny learning to type her name.]; Reza showing Joyen how to record Shamone with the Flip camera (20/10/11) [Figure 5:25 Reza showing Joyen how to film Shamone with the Flip camera.]; Jo showing Indiana how to swipe the pictures (27/10/11); and Sebastian asking Jo how to view the photos he has taken (27/10/11) [Table 5:6 Transcript of Sebastian asking Jo how to see the photos he has taken.] An example of one of these instances in more detail is Sebastian asking Jo how to use the Flip camera then describing what he wants to video (3/11/11) [Table 5:19 Transcript of Sebastian asking Jo how to use the Flip camera.]

	Time span	Content
1	0:00.0 - 0:16.7	Sebastian using the Flip camera. Jo: "No, no let go. See how the numbers are red?" Sebastian: "Yeah" Jo: "That means it's recording" Sebastian: "So you can video it?" Jo: "Now it's videoing now. Whatever you see you are videoing." Sebastian: "Argh. I'm going to video lots of things"
2	0:16.6 - 0:23.0	Sebastian: "I'm going to video dem" Jo: "You've got to make sure the numbers are going red and they are changing."
3	0:22.9 - 0:31.2	Sebastian videos Reza, Shaheen and Sajaad running.
4	0:31.3 - 0:38.6	Reza and Shaheen come into shot. Reza: "Arrgh. Mr Potato... run". Sebastian keeps videoing the boys running and laughing.

Table 5:19 Transcript of Sebastian asking Jo how to use the Flip camera.

5.5 Conclusion

The chapter has presented the findings for the project related to the two research questions. The two research questions were 'What activities do children engage in on digital technologies within an early childhood classroom?' and 'How do these activities relate to elements of Vygotsky's theorisation about young children's play?' Findings for research question one suggest there are nine activities that children engage in around digital technologies, with four clearly more common than the others. Findings for research question two suggest that elements of Vygotsky's theorisation are evident in these activities and his theorisation can be used to help define children's activities on digital technologies in the current context. The next chapter of this thesis discusses these findings in more detail.

Chapter Six: Discussion

6.1 Introduction

In this chapter I discuss my findings and reflect on what these findings mean. I start by drawing out the key findings, and then analyse and discuss them within the framing of Vygotsky's theorisation. I will show how many findings answer my research questions. I will discuss the questions my research project raised for me in my two roles, first as a researcher and secondly as an early childhood educator. I conclude by identifying questions raised by my findings and discuss the implications for early childhood education and future research.

In discussing my findings, I will make four main claims: 1. digital devices are supportive cultural tools for fostering social interactions, 2. children need time to explore the technology, 3. digital devices assist children's leading activity, and 4. children's shift from recording artefacts to recording imaginative episodes. These claims will influence the development of guidelines I have proposed for supporting early childhood educators to introduce and use digital technologies in their classroom.

6.2 Summary of findings

The findings indicate that children engage in a wide range of activities on digital devices in kindergarten classrooms. Some activities that were enacted on the iPad were traditional kindergarten activities like puzzles, drawing, puppet shows and doll house play. However, the four most prevalent categories I identified were social; exploring the technology; capturing an event and imaginative play.

Of these, the most frequent activity children engaged in was the social interaction category. Devices that are usually one person devices, for example the digital camera, became cultural tools that mediated social interactions. An example in the previous chapter was when Destiny used the digital camera to take photos of her twin sister Indiana (8/11/11). The two children smile and laugh at each other and the interaction lasts for approximately ten minutes. There is limited verbal communication and Indiana looks at Destiny holding the camera, then turns her head and looks away repeatedly. When she does look back at the camera both girls laugh.

The iPad had apps for both single player and multiply players. When a single player app was being played often other children would stand behind and watch. An example was when Ricky was playing *Air Penguin* and the other children were standing behind him watching him play (17/10/11). During this time the other children offered words of encouragement and cheered Ricky when he made the penguin jump onto icebergs and miss the sharks. *Tic Tac Toe*, by contrast, was an app on the iPad that needed two players. When Teagan and Jo played together they discussed typing their names, how to play and how

Teagan had played *Tic Tac Toe* before on her Mum's iPhone (27/10/11). Social interaction was the most frequent activity and emphasised the importance of interactions when children engaged with digital technologies. I return to this point later in my discussion, to reconsider the idea that devices for sole use and/or single-player apps can become a tool that fosters social interactions.

A second insight from the data was that children did need help to learn the functions of the devices. Children did not pick up the Flip camera and instantly know how to use it; instead they sought help from an adult or a more capable peer to show them how to use it and learn the functions. Educators showed children the functions of the Flip camera, for example how to zoom and how to press the red button to start and stop recording. The children then practiced these newly-learned skills and often then showed other children how to perform these functions. The digital camera was similar. Some children had experienced using digital cameras before and were confident using it without guidance, but others needed assistance to learn the basic functions of taking the photo and how to see the photos taken. Again, once learnt, children often passed these skills onto their peers if assistance was required.

Figure 6:1 Sajaad using the Flip camera.

The iPad on the other hand, needed less explaining due to the fact most children had experience using an iPad or their parent's iPhone and transferred these skills to the iPad and as a result most children could

use the device independently from the beginning of the project. Some children still required assistance and at other times children sought adult help to explain how to use a particular app, for example the rules of *Tic Tac Toe.* Children discovered things for themselves through trial and error on the iPad. For example Teagan discovered how to make the people lie down in the app *My Play Home* even though she had asked Jo how to do it and Jo didn't know (24/10/11). Teagan then showed other children how to make them sleep, passing on her learning to others.

Learning the functions of devices occurred more frequently at the beginning of the project and general use occurred throughout the project. The children's confidence on a device when using it for the first time depended on the device. Children used trial and error on the iPad and only asked for help when they had difficulty with a specific app, whereas, with the Flip camera, the children tended to ask to be shown how to use it by either a peer or educator before they felt confident. I maintain in my discussion later in this chapter that these forms of engagement with digital devices provide clear examples of the role of ZPD in children's learning.

The capturing an event category was broken into two subsections. The first was adults capturing children's use of digital technologies; the second was children capturing their own or other children's digital technology use. Adults captured the children's digital technology use and this was important as it allowed me see what activities the children engaged in and answer research question one. Digital technology is a valuable resource to capture children's learning, especially social interactions and activities that do not result in a final, tangible product to keep and show to parents and friends.

Children also used the digital technology to capture their own play and kindergarten experiences. Several children took photos or video footage of their kindergarten environment see Sebastian taking video of the bird (24/10/11); Teagan filming the kindergarten (20/10/11); and Joshua taking photos of the sun (15/11/11). These examples show the value the children place on their kindergarten environment and their understanding of the role digital technology can play in capturing their important things. Lara took photos of the block construction she made with her friends (8/11/11) and she saw it as a way of preserving what they had created to show their parents. The Flip camera was used to record different children enacting the song *Five Grey Elephants Balancing* (see 17/10/11, 25/10/11 and 3/11/11). This experience helped develop children's skills through practicing recording techniques, via directing the enactment, and also extended children's social skills through negotiating roles and responsibilities, interacting with other children and communication.

The children could later watch their videos and look at the photos they had captured and recall the event. This was a valuable prompt for discussing what learning took place and to reinforce the skills that were developed in the play episode. This was a valuable insight for me as the researcher as I could validate what the children were engaging in and learning in respect to the digital devices. It was also valuable for

me as the educator to recognise the children's learning and assist with planning a learning environment that meets the children's interests and developmental needs. I return to this point later in the chapter to consider what this might mean for early childhood educators.

The imaginative play category was more frequent towards the end of the project as the children became more familiar with the devices and their use moved from experimental to imaginative play. This category was broken into two subcategories: using the device itself as a prop, for example when Joyen made a camera (25/10/11) and iPad app, like *My Play Home*. The availability and use of digital technology within the kindergarten reflects the children's reality as these items are commonplace in their world. Mobile phones are another popular cultural tool within the kindergarten and children use them not only to speak to each other and to call their parents, but to also take photos and play games.

Some of the iPad apps were designed to encourage imaginative play, for example *My Play Home* and *Puppet Pals*. The children created imaginative play scenarios just as they would using tangible puppets, or dolls and furniture in a doll's house. Using *My Play Home* Ricky and Neha acted out a family scenario, feeding the people, bathing them and then putting them to bed (24/10/11). The scene could have been acted out in a typical kindergarten home corner or with a wooden doll's house and furniture. Joyen created a stage play with the *Puppet Pals* app (24/10/11). He changed his voice for the characters and made up the storyline. The app also records the enactment, so Joyen got to watch his creation over and over and show other children what he had created.

The possibilities this app creates can extend children's play and develop their imaginative skills. Through being able to watch their creation, children can learn from the experience and change what they do the next time they create something. Educators could use this app to extend the children's learning and also use the recording as documentation to share with parents what the children are learning.

6.3 How do these findings relate to Vygotsky's theorisation of play in early childhood?

Traditional theories of play are still being used in early childhood education to explain what children do and to influence pedagogy. Digital technology was unknown when Vygotsky developed his theories around young children and play. Looking at children's activities on digital devices in relation to Vygotsky's theorisation will help determine the application of his ideas in early childhood settings using digital technologies. The relevant categories relating to Vygotsky's theorisation as presented in Chapter Two include: cultural tools; social context; imagination; leading activity; speech and zone of proximal development.

Within the kindergarten, digital technologies were used to capture play with traditional cultural tools like blocks, puzzles, construction sets and dolls. However, the children also used the digital devices as cultural tools that became just like any other tool within the kindergarten program. The iPads were placed on the puzzle table at the start of each session. The children came to the table, used them and then moved on to other activities. There were times when the iPads remained on the table unused, while the children played outside and with other cultural tools. Vandewater et al. (2007) found in their study there was no real difference between the children who used media within the American Academy of Paediatrics (AAP) guidelines and those who used media excessively (p. 1012). The notion that media is taking children away from other activities especially outdoor play, was not supported by the Vandewater et al. study. While my study did not specifically investigate children's choices between digital devices and traditional kindergarten tools, the observational data from my study also supported the possibility that the availability of digital technologies within kindergarten programs does not appear to affect the choices children make about the activities in which they engage.

As stated earlier, children used both operating and non-operating devices in their play. Digital technologies have become cultural tools of the current age that impact children's play and social interactions. This fits with Stephen's (2008) definition of what constitutes digital technology and "represent the range of resources available at home", whether they are operating or non operational (p. 100). Children are exposed to these technologies in their daily lives and these experiences need to be mirrored in their kindergarten and learning environments. It is unrealistic for children to be "asked 'to leave their technology at the door' before entering the classroom" (Parette, et al., 2010, p. 336). The cultural tools of a classroom need to reflect the culture that the children experience every day. Within the project, the digital devices became cultural tools embedded in the kindergarten environment, they were not seen as unusual and after the first few days the novelty wore off and they were not seen as any different to any other tool within the kindergarten.

The third most frequently coded conceptual category was the zone of proximal development. A child's learning and activities can be extended through interactions with both adults and more knowledgeable peers (Vygotsky, 1978). The use of digital devices in the kindergarten provided many opportunities for extending children within the ZPD. Once children were confident in using the devices independently, they became the more knowledgeable peer who then taught other children. Early on in the project the ZPD interactions were more frequently adult to child, whereas later in the project there were more examples of child-to-child interactions in the ZPD. This was due to more children being confident with the devices and being able to teach their peers. The data shows that children can be trained as mentors for their peers while building on their own skills of teaching and sharing knowledge.

The ZPD automatically links to the social context category of this section and the social interactions category from section one, as children need to have the interactions with others for movements across the

ZPD to occur. These categories reinforce Vygotsky's notion that children develop in their social context and that positive interactions with others can extend their ZPD and in turn their learning. In the next part of this chapter, I bring these findings together under four main claims arising from this project. The first of these is the potential of digital devices to foster social interaction.

6.3.1 Digital devices are supportive cultural tools for fostering social interactions

Throughout the project examples of children using the digital devices by themselves was rare. Most examples were of children using the devices and interacting with other children in a variety of ways. The social context of the kindergarten was enhanced through the introduction and use of the digital devices. Vygotsky's (2004a) tenet of children learning through their social experience was reinforced by the data in this project. Through their experiences with the digital devices, children could form a new reality and understanding of their social context. With the new understanding of their social context came newly-mastered skills, and skills that were being extended and developed.

Many social skills were enhanced through the interactions during the project and with the digital devices. These skills included: negotiations around roles, space and time; interactions; role taking; sharing; and communication both verbal and non verbal. These skills can be developed in various areas of a traditional kindergarten program, but the use of digital technologies in a classroom encourages these interactions in an appealing way to the children. Through social interactions, children's ZPD can be extended and new skills mastered. The digital devices became cultural tools within the kindergarten program that specifically fostered social interactions and expanding of children's ZPD. Different children learn at different paces and, the role of the more knowledgeable other needs to be easily accessed for all children. Throughout the project there was often a flow-on effect: where one child was the more knowledgeable other teaching a second child, a flow on occurred where the second child mastered the skill and in turn became the knowledgeable other to the next child. Bodrova (2008) reflected on the play experiences of children in multi-aged groups in the past, arguing that "children had an opportunity to learn from older 'play experts', practice their skills with the peers of the same age and then pass their knowledge on to the 'play novices'" (p. 365). At the start of this project, the 'digital experts' were the educators who used guided interaction to teach the necessary skills to some of the children who started as 'digital novices' but who quickly took over the role of 'digital experts' to train the next lot of 'digital novices'. Plowman and Stephen (2010) describe guided interaction as "the ways in which children's interactions with digital technology can be actively supported in preschool settings" (p. 95). Their work focuses on the adult's interaction with children around digital technology engagement and the pedagogical changes needed to support children's learning. This study suggests, however, that the notion of digital natives is simplistic when applied to a whole generation of children. Instead, children take on expert or novice roles from

moment to moment, depending on the next development occurring in their ZPD. This study also showed that this process takes time, a point I turn to next.

6.3.2 Time to explore the technology

The data showed that children did need help to learn the functions of the devices. This goes against what Prensky (2001) argued about digital natives. Children did not pick up the Flip camera and instantly know how to use it, instead they sought help from an adult or a more capable peer to show them how to use it and learn the functions. In the project, the children started from similar knowledge points, having never seen or used a Flip camera before. Through their experiences and movement within their ZPD children, moved at their own pace and reached their own level of understanding of the camera and its workings. For example, Rithik's experience with the Flip camera, involving making a movie, interviewing peers and recording his kindergarten environment, moved him quite far in his ZPD than another child, Sebastian, who spent less time using the camera and did not develop the same skill level as Rithik. Both children experienced guided participation from educators but Rithik spent more time exploring the device and thus his learning reflected his greater expertise. In relation to Vygotsky's theorisation around ZPD, as described in Chapter Two, Rithik and Sebastian started at the same *actual developmental level,* but their ZPD reflects the tasks they can perform with assistance and will perform independently in the future(Vygotsky, 1978, p. 87 italics in the original).

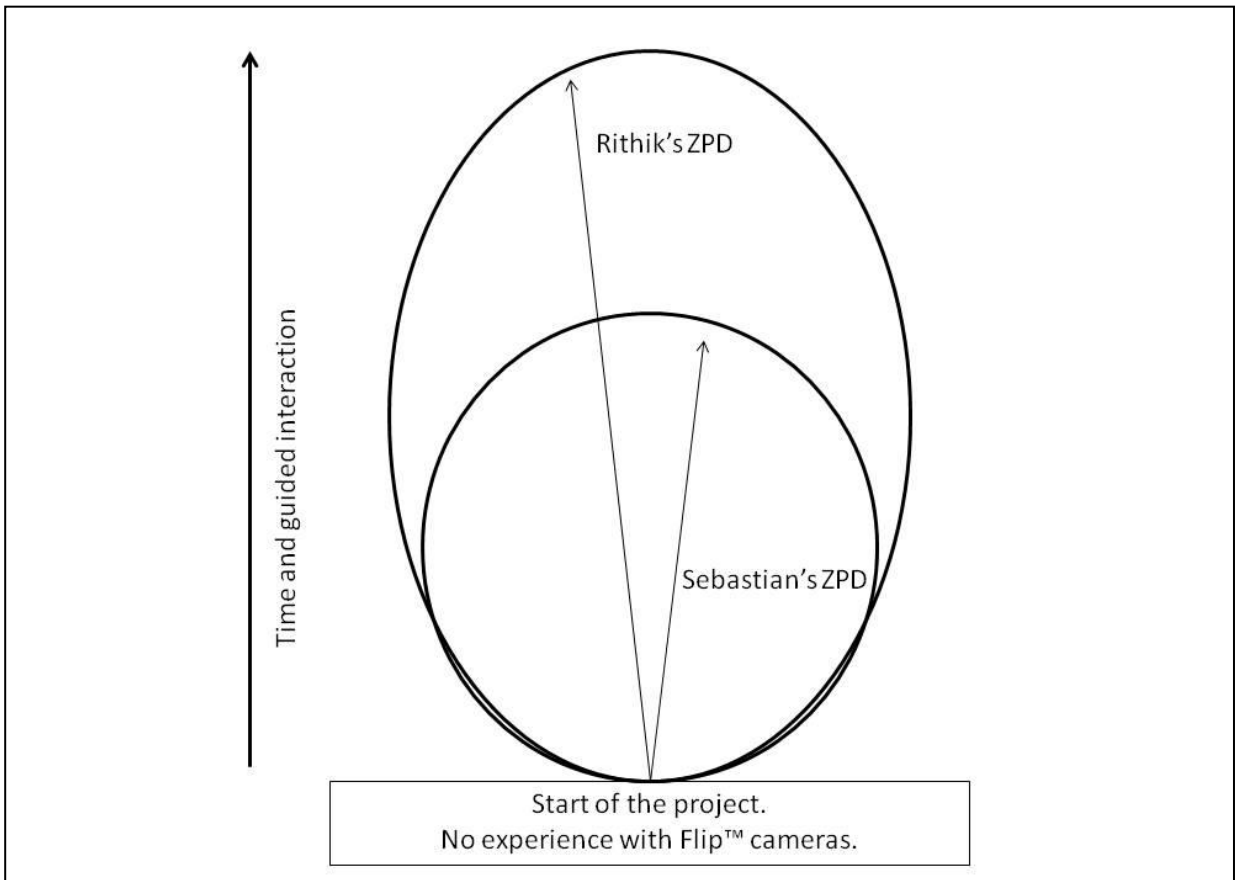


Figure 5:2 Rithik and Sebastian's ZPDs during engagement with digital devices during the project.

These findings, however, raise the question of whether different behaviours would be evident if the study had been conducted over a longer period of time. Based on the literature, Vygotsky's theorisation, and findings from this study, I believe, given longer time to explore the devices, children would move from exploratory behaviours to more complex behaviours, including more examples of imaginative play. I raise this possibility because of the next insight derived from this study, related to the notion of leading activity.

6.3.3 Digital devices assist leading activity

Within the project there was evidence that digital devices operated as cultural tools that assisted children in progressing from one leading activity to the next. As discussed in the previous section, children require time to advance from exploratory behaviours to more complex behaviours, but there were examples where children did move from the leading activity of experimenting to the leading activity of play. One example was when Neha was recording other children's lips (25/10/11). She started in the experimental stage (learning the possible functions of the camera) and moved into the play stage as she recorded the different lips. While she watched her video, she recalled what was occurring in her play and began to analyse her play episode. As Edwards (2011) states, "mastery of leading activity therefore involves a child thinking consciously about the activity and their actions within the activity" (p. 4). Neha confidently described her actions and displayed that she had mastered the leading activity of play. This then caused the social situation of development to change and a new social situation, known as 'collective theorising', to emerge. This was where Neha began to theorise about different lips, and to demonstrate her previously gained knowledge about lips and their functions and related it to her current play episode. The Flip camera was the digital device that assisted Neha to move through the cycle of leading activity and, in turn, extend her learning.

Most examples in this study related to the leading activity of 'experimenting', with children learning the functions of the devices. I observed, however, that children displayed their movement from 'experimenting' to the next leading activity of 'play' when they verbalised 'imagination in action' (Kravstov, 2008b). This was seen in examples of children explaining what they were going to do with the device, or describing their play episode and the role of the digital device. For example, Sebastian started practicing the functions of the Flip camera, then moved towards 'play' as the next leading activity as he described videoing his friends in the yard (27/10/11). At the same time as moving from exploration to play, a shift was observed in how children were 'positioned' in relation to the digital devices, which I will explore more in the next section.

6.3.4 Children's shift from recording artefacts to recording imaginative episodes

Prior to the project only the educators used a camera to record children's experiences, learning and special events. During the project, the children took control of the camera and, what was being captured and they began "to see their activities and creations as important things to record" (Dwyer, 2008, p. 33). After the project children would often go up to a peer or educator and ask to borrow the camera to take a photo of their work. The photos were then shown to their parents or put in their portfolio.

The children started using the devices to record *artefacts* within the kindergarten - their block buildings, the kindergarten yard - but, as the project continued there was a shift within the children's understanding and they started to record *narratives* within the kindergarten - for example, Lara directing other children in acting out *Five Grey Elephants Balancing (17/10/11)*; Teagan filming Sebastian playing with the bird (25/10/11); and Shamone telling Reza he wants to see him in the video (15/11/11). This shift coincided with the development of children's understanding and confidence in using the devices and their functions, so their use of the device became about expressing themselves imaginatively rather than just using the device to record 'things'. Towards the end of the project, the children had begun to articulate what they wanted to capture and they checked the footage or photo to confirm its accuracy. The children took control of the documentation of their learning, rather than the educators collecting the evidence of what they see as important and valuable, the children claimed this role and began to document what was important and valuable to them. In the Reggio Emilia approach to early childhood education, children are encouraged to explore and actively seek meaning in their world and their learning. Rinaldi (2006) states that documentation of children's learning is "a visible trace and a procedure that supports learning and teaching, making the reciprocal because they are visible and shareable" (p. 100). She believes this is an important contribution of the Reggio Emilia approach to early childhood pedagogy and she values children input into being part of documenting their own learning path. I believe that digital technology can assist children to be active in this process which in turn will encourage their learning and mastering of imaginative play skills.

Carr (2001) found digital cameras, like other digital technologies are useful to provide children with "instant feedback" and that they help value what children do in their kindergarten (p. 152). Documentation continues to be an important part of the kindergarten program and a valuable assessment tool and the use of digital technologies can greatly assist both children and educators to capture valuable events, activities and learning. The insight from this study is that these 'activities', given time, will potentially move towards increasing levels of imaginative complexity reflecting key elements of Vygotsky's theorisation about play including the shift from one leading activity to the next their ability to verbalise the process (Kravstov, 2008b).

6.4 Implications for research and practice in early childhood education

The findings of this thesis have implications for early childhood educators interested in introducing and using digital technologies in their classrooms. By researching the activities children engage in with digital devices and how these align with Vygotsky's theorisation about play, I have identified the following implications as important implications for early childhood education practice:

1. Educators need to provide children with the time and knowledge to appropriately use ICT and extend their learning.
2. Educators need to plan, provide for and encourage social interactions between children and children and educators around ICT use.
3. Educators need to develop children's skills as mentors for each other in their ICT use.
4. Educators need to consider and provide apps that encourage imaginative play.

6.4.1 Implication One

The first implication for practice is providing children with time to get to know the digital devices and move from learning the functions of a device to more imaginative play. As stated earlier in this chapter, children need time to learn and feel confident using digital technology and educators can assist with these skills through guided participation, extending their ZPD and in turn their learning. How educators see digital technologies will affect the way they provide and support learning around digital technologies in their classroom. In their study Verenikina, Harris and Lysaght (2003) encourage educators to explore their beliefs about play, computer use and the implications these have for the children they are teaching (p. 4). If educators underestimate the possibilities of digital technologies use then they will not provide the devices or encourage children to use them in the classroom. On the other hand, a classroom rich in digital technology with an educator that values and supports its use, will provide children with a positive experience of digital technologies and an environment that supports and extends children's learning through play. Through thinking about digital technologies and the various devices available, educators can fully comprehend the potential of digital technologies and how the devices can be used to enhance an early childhood program. It is interesting to note here the definition of digital technologies used for this thesis included non-working technologies in early childhood settings (Stephen, et al., 2008). This means that digital technologies in early childhood education connects with children's play and the use of cultural tools in play. This definition of digital technologies was supported by the findings in this thesis which also identified children using non-functioning as well as functional technologies in their play. Early childhood educators may need to think more broadly about what constitutes digital technologies for young children and as a basis for their play. For example, as well as non-functional digital technologies Brooker (2003) identified many forms of "everyday technologies" that children are aware of including "control and signal mechanisms, like those that operate traffic lights and washing machines dials, electric wheelchairs and microwave ovens", tape recorders, digital cameras, overhead projectors and

programmable toys and she believes that they all need to be present in an engaging early childhood classroom (p. 262). If an educator believes digital technologies involves just mobile phones and desk top computers then their classroom is going to reflect this narrow understanding. Through exploring the possibilities, educators can provide children with a range of digital resources, that can include functional and non-functional technologies to extend opportunities for the type of exploration that the results of this study suggested lead to later, more sophisticated imaginative play. A quality early childhood classroom reflects the cultural tools of the children they are trying to teach. Digital devices potentially become like any other cultural tool within the kindergarten, and from this perspective can be seen as appropriate to the provision of play-based learning in early childhood education.

The results from this project provide evidence to suggest that Prensky's notion of digital natives may be unfounded and does not necessarily fit with the reality of a kindergarten classroom. Within my class of supposed digital natives some children, for example Rithik, learnt the features of devices easily whereas, another child, Sebastian, took longer to gain the skills Rithik found basic. Prensky's (2005) argument does not acknowledge these differences and, according to his notion, these differences do not occur. Sociocultural theory better explains children's use of digital technologies in the kindergarten classroom, particularly Vygotsky's notion of the ZPD which can be used to show the starting point for each child and how children move towards particular types of technology use. The high value placed on social interactions and the time children are provide with reinforces the learning of skills and the mastering of the digital devices as a cultural tool in children's differing ZPDs. This is in contrast to suggesting all children are natural digital users of technology.

6.4.2 Implication two

The second implication is about the importance of social interactions in young children's use of digital technologies. Social interactions include those between children, and between children and educators. As an educator having conducted this research and seen how children participated in social interactions with peers and adults when using technologies, I now think about, plan, and provide for social interactions that encourage collaboration. I think about, plan and provide for these social interactions to assist in developing children's skills not only in their use of digital technologies, but in ways that can flow into other areas of their learning such as science based concept learning, literacy, numeracy and general enjoyment of the learning environment. When working with the children, often my aim is to develop children's skills as mentors for each other in their digital technologies use (implication three), because not only does it build their confidence but it helps them progress though the leading activity cycle, and therefore aids their learning.

6.4.3 Implication three

The third implication for practice is to develop children's skills as mentors for each other in their digital technology use. The findings of this study showed that children can become the more capable other and assist other children in developing their digital skills. Brooker (2003) discovered that for many children the gains "were the result of peer tutoring that the technology itself appears to stimulate" that free play with a computer encourages (p. 265). Since this study I have reflected on my practice as an educator and now often my aim and teaching style encourages the children to be mentors for each other. The use of digital devices within an early childhood classroom can even assist a quiet child to become a mentor to others. When given the responsibility of teaching another child how to use a device, quiet children can demonstrate their skill and build their confidence.

6.4.4 Implication four

I have also argued that digital devices can support imaginative play so educators need to think carefully about the apps they provide. The fourth implication encourages educators to provide apps that encourage imaginative play. The two apps provided in this study were *My Play Home* and *Puppet Pals.* Educators decide the apps that are on the iPads provided and time is needed to try the apps and decide if they are appropriate and their worth and "it is important to examine its developmental value from the same perspective that is taken when considering the significance of traditional forms of play in child development" (Verenikina & Kervin, 2011, p. 6). Verenikina et al (2003) developed a list of questions educators can consider when choosing computer games for young children, their findings can be transferred to iPad apps and early childhood education situations.

Vygotsky (2004b) valued imagination in play, and *My Play Home* and *Puppet Pals* both support role play and imaginative play because they are opened ended and the children have to control the characters and develop their own script for the play episode. Verenikina et al (2003) developed a list of questions that educators can ask themselves to assess the appropriateness of a computer game. They included:

> Does this computer game involve and develop use of symbolic meaning? If so, in what way? Does this computer game allow children to engage in their zone of proximal development and function above their everyday abilities in cognitive and socio-emotional areas? Does this computer game provide children with an opportunity to act out and explore the roles and rules of functioning in adult society? Does this computer game allow for group work and collaboration? (p. 7)

These same questions could be asked about iPad apps to judge their suitability for young children. The authors admit this is only "a starting point in developing an instrument that can be used to explore the developmental value of individual items of computer software for young children" (p. 8). The authors, along with the findings of this study, recognise the value of social interactions and the influence these interactions can have on a child's imaginative play and learning. Through assessing each computer game

or app on a digital device before children engage with it, educators can ensure the programs they provide are educationally appropriate and provide opportunities for developing imaginative play skills.

6.5 Conclusion

This chapter considered how the findings inform four main ideas that are important for thinking about digital technologies in early childhood settings. These include (a) digital devices are supportive cultural tools for fostering social interactions, (b) children need time to explore the technology, (c) digital devices assist children's leading activity, and (d) children's shift from recording artefacts to recording imaginative episodes. These four finding suggest a further set of implications for educators thinking about using digital technologies in their early childhood settings, including (a) educators need to provide children with the time and knowledge to appropriately use ICT and extend their learning; (b) educators need to plan, provide for and encourage social interactions between children and children and educators around ICT use; (c) educators need to develop children's skills as mentors for each other in their ICT use; and (d) educators need to consider and provide apps that encourage imaginative play.

Chapter Seven: Conclusion

7.1 Introduction

At the start of this thesis it was argued that digital technologies need to be further researched in early childhood education because the effect of digital technology on children has only recently been investigated and there is a limited understanding of the possibilities of these technologies. Part of the problem in understanding digital technologies in early childhood education is that research has looked mainly at how teachers use technologies in early childhood education and the notion of the 'digital native' has coloured perceptions of how children learn to use digital technologies. This thesis has challenged some of these ideas by considering two questions, 1. What activities do children engage in on digital devices within an early childhood classroom? and 2. How do these activities relate to elements of Vygotsky's theorisation about young children's play? This thesis has established four main arguments that may be important in relation to these questions: 1. Digital devices are supportive cultural tools for fostering social interactions; 2. Children need time to explore the technology; 3. Digital devices assist children's leading activity; and 4. Children shift across time from recording artefacts to recording imaginative episodes. These are then proposed as a basis for four implications for practice, including: 1. Educators need to provide children with the time and knowledge to appropriately use digital technologies and extend their learning; 2. Educators need to plan, provide for and encourage social interactions between children and children and educators around digital technology use; 3. Educators need to develop children's skills as mentors for each other in their digital technology use; and 4. Educators need to consider, and provide apps that encourage imaginative play. In this final chapter I discuss the implications of these implications for practice, and reflect on my role as a teacher and as a researcher in this project.

7.2 Implications for practice

What do these findings and implications mean for early childhood education? The findings and implications from this project have contributed to an understanding of what is possible for children to engage in and learn while using digital devices in a kindergarten classroom. The implications can be another tool, such as those provided by the Victorian Government's statement that informs educators in ICT use in government schools (Department of Education and Early Childhood Development, 2010), England's DATEC principles for ICT use (Siraj-Blatchford & Siraj-Blatchford, 2003), and the NAEYC guidelines in the United States of America (National Association for the Education of Young Children & Fred Rogers Centre for Early Learning and Children's Media at Saint Vincent College, 2012, p. 1), for educators to consider when making pedagogical and curriculum choices. However, one reason, the implications emerging from this study might be useful for educators is because they are focused on what children actually do with digital technologies in early childhood settings, and how these relate to an

established and known used theory of play in early childhood education. This is contrast to the DEECD guidelines, which focus only on primary education, or the Vandewater et al (2007) study, which tells educators about how often to use technologies, but does not make pedagogical implications that can help educators think about and support children's learning through play using technologies. As discussed in the literature review, there is a need for educators to know some pedagogical principles for using digital technologies in early childhood education and the implications that emerged from this study provide a way of thinking about these pedagogical principles by providing educators with a basis for practice.

In a digital technology-rich classroom, a supportive educator will make pedagogical choices that will enhance the learning program. Early childhood educators already have a wealth of pedagogical techniques that encourage children's learning, and these can be adapted and transferred to digital technology use (Plowman & Stephen, 2007). Guided interaction is one technique that early childhood educators are skilled in using with children and Plowman and Stephen believe can transfer it to digital technology use. In their study Plowman and Stephen found that leaving children to explore digital technologies independently did not support learning. In fact, their study found that "guided interaction provides support not only in terms of operational skills but also for less measurable positive dispositions towards learning such as persistence, engagement and pleasure" (p. 24). Through changes in pedagogical choices, such as those reflected in the four implications provided in this thesis, educators can maximise the benefits and learning around digital technology use in their classroom. This is because these implications are related to what children are likely to do with technologies in an early childhood setting and relate to a social and cultural understanding of play and how play related to children's use of culturally relevant tools.

Throughout this research project I also gained a deeper appreciation of digital technology as an assessment tool. Reflecting on my use of digital technologies when assessing children's learning prior to the project, I would say my photographs were a token gesture that were aesthetically pleasing to the children, parents and outsiders who came to visit the centre. They enhanced my program only to make it look good on the wall, but lacked any deep connection to my pedagogy and to the children's learning. I could interpret the photographs and write a descriptive story to go beside that detailed the learning taking place; the photograph was an addition, the decorative part. Now when I (or the children) take photographs I aim to capture the learning that is occurring, the photo is the focus and is of equal weight as the story that is added to the page. This is important pedagogically because the value of children's play and learning is documented in a genuine way. This connects with the first implication arising from this thesis, that - educators need to provide children with the time and knowledge to appropriately use digital technologies and extend their learning. Ultimately this can result in them capturing what they have learned and sharing this with their families.

Conducting the research raised many questions that sparked my interest but which I did not have time to investigate and analyse in detail, due to the scale of a Masters by Research thesis. These questions included but were not limited to: issues around power in researching children's engagement with digital devices; the impact of having children, rather than the researcher, behind the camera; how the children mentored each other in their learning about the devices; issues of gender in digital technology use; the educator's role in children's digital technology competence; how children make choices between digital and other activities; and the availability of suitable apps and their effects on learning. With respect to selection of apps for use on the iPad™, I became aware through observing children's responses to the two iPads with their different apps, of how this related to educator power and who has control over what children are able to do and learn when using technologies. This question of power also extends to external factors like parents, policies and regulations and how these are in a dynamic relationship with children's day to day experiences within a kindergarten setting. This project did not investigate the issue of power and how this intersects with digital technologies and their use in early childhood settings. However, this is an interesting and important concept that requires future detailed exploration and consideration.

7.3 The educator as researcher

As discussed in Chapter Three, I had simultaneous roles during this project – as an educator and as a researcher. These two roles had both advantages and disadvantages. The project opened my educator eyes - as I tried something new and saw the children and their learning in a different light. The research project gave me the confidence to explore a new possibility of providing the children with digital devices to use and to capture their own learning. The disadvantage with being the educator included having to stop recording potentially valuable data to deal with issues occurring in the classroom. The responsibility of being the educator came first – if a situation needed my response then my research was put on hold. At times this caused internal conflict – but, as the educator responsible for children, their needs and safety came first.

The advantage with undertaking research with the children I taught meant I already knew them, I already had a rapport with them, and I didn't need to spend time getting to know them or creating a safe, warm environment to introduce my project. There was a level of trust with the parents, they knew me and knew I would have the children's best interests at heart. The disadvantage came with my research being my second focus throughout the session. I could not just observe the children as they engaged with the digital devices, but had to remain the educator observing all the children in the class and supervising the other staff present.

If I was to conduct this project again knowing what I know now, I would wear just one 'hat' – the researcher. My focus would be solely on gathering evidence of children's engagement with digital devices, rather than split between supervising the whole group and gathering evidence. This means I

would probably not be able to research within my own classroom and would need to establish an alternative relationship with a colleague and another group of children. The methods used for gathering the evidence would also be changed. For example, I would set up a fixed camera to capture the children's engagement with the computer or iPads continuously, rather than when I suddenly anticipated an episode might be valuable. This footage would also provide insight into the length of time children spend on the devices and capture social interactions that occur around the device. I would also prepare the children for the project in more depth. I would use the first few sessions to explain the functions of the devices, and to gather more information around their movement from exploratory to imaginative behaviours. This would be important because the data and findings suggest that children needed time and knowledge to explore the functions of the devices before moving on to more sophisticated activities. It would be important to know more about how this movement from exploratory to imaginative behaviours with digital technologies occurs to further develop implications for practice to assist educators to make pedagogical decision that encourage children's more mature imaginative play behaviours.

7.4 Data analysis

As stated in the methodology chapter, coding was a challenge in this project. A need for a more robust approach to coding emerged during this project and data analysis. In future studies I realise I need to be clear about the rules of inclusion and exclusion of data and the way in which included data is to be analysed. Despite this, the demands imposed by having to double (or triple) code much of the data brought a richness to the analysis by allowing me to see how concepts integral to the second research question were evident within the more descriptive analysis made in response to research question one.

7.5 Conclusion

The chapter has summarised the findings of the thesis and how these have informed the generation of four implications for practice. The chapter has also considered my role as 'a teacher as researcher' and how I might conduct research into the use of digital technologies in early childhood education in the future. I have suggested that significant questions that require further research are associated with power issues in the selection of digital technologies in early childhood settings, the use of apps on iPads and how children move from exploratory to imaginative play using digital technologies. These proposed areas of research move beyond concerns about whether or not children are digital natives and what educators do with technologies, into more pedagogical concerns about children's learning through play with digital technologies in early childhood settings.

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Appendix 1: Information letter for parents

AUSTRALIAN CATHOLIC UNIVERSITY

INFORMATION LETTER TO PARENTS / GUARDIAN

TITLE OF PROJECT: Children's activities on digital devices.

PRINCIPALSUPERVISOR: Susan Edwards

STUDENT RESEARCHER: Jo Bird

PROGRAMME IN WHICH ENROLLED: Masters of Philosophy

Dear Parent,

I am conducting a research project towards a Masters of Education at Australian Catholic University. Your child is invited to participate in this research project because they attend the kindergarten where I am the teacher. As part of the existing kindergarten program children have the use of a computer and digital camera. This project will be introduced to the children by asking them what they think about using the computer and digital camera at kindergarten. I will then ask the children what other technologies ie ipad and flip camera they might like to use.

The discussion will include how they like to use the technologies and what they learn from them. The children will be observed using digital devices and the discussions will be sound and video recorded.

The research will be conducted within the kindergarten program and children will not be required to do anymore than participate in the program offered. The data will be collected over a 4 week period, 12 sessions in total.

The children will be observed, photographed, sound and video recorded as they engage with digital devices within the kindergarten program. If children do not consent to being photographed or recorded they will not be. Photographs may be taken for the child's portfolio, but without consent it will not become research data.

This research will benefit participants through the opportunity to engage with digital technology in kindergarten. The aim is to publish the research findings in a thesis, a book and journal articles that influence educator's practice when providing digital devices in kindergartens. The research will give insight to the early childhood field as to how digital technology supports children's play.

Participants can refuse their consent and not take part in the research. Participants are free to withdraw from the research at any stage and without giving a reason. If participants withdraw from the research project it will not affect their kindergarten experience in any way. Children who do not take part in the research will continue to access all activities and experiences within the kindergarten program.

As data being collected may include photographs and video recordings, the researchers cannot guarantee partipants' anonymity. Each participant can chose to use their first name or a pseudonym and these will be used when reporting data and in any publications. Photos of participants will only be used in publications with the participant's consent. If your child wishes to have their first name used in any publications this can also be catered for.

Faculty of Education

115 Victoria Parade
Fitzroy VIC 3065

T: 03 9953 3000

There are no foreseeable risks involved with this research. Activities and experiences are the same as the regular kindergarten program.
Any questions regarding this project should be directed to the Principal Supervisor and the Student Researcher:

Associate Professor Susan Edwards
Australian Catholic University
Level 8, 250 Victoria Parade, East Melbourne, VIC 3002
suzy.edwards@acu.edu.au

Jo Bird
James Cook Kindergarten
63 James Cook Drive
Endeavour Hills VIC 3802
03 9700 2462
james.cook@kindergarten.vic.gov.au

Research findings as a result of this research will be available to participants by contacting the Student Researcher on jo.bird@acu.edu.au

This study has been approved by the Human Research Ethics Committee at Australian Catholic University and the Department of Education and Early Childhood Development.

If you have a complaint or concern, or a query that the Investigators have not been able to satisfy, you may write to the Chair of the Human Research Ethics Committee:

VIC: Chair, HREC
C/- Research Services
Australian Catholic University
Melbourne Campus
Locked Bag 4115
FITZROY VIC 3065
Tel: 03 9953 3158
Fax: 03 9953 3315

Any complaint or concern will be treated in confidence and fully investigated. The participant will be informed of the outcome.

If you agree to participate in this project, you should sign both copies of the Consent Form, retain one copy for your records and return the other copy to the Student Researcher.

Associate Professor Suzy Edwards

Jo Bird

Appendix 2: Parent consent form

AUSTRALIAN CATHOLIC UNIVERSITY

PARENT/GUARDIAN CONSENT FORM

Copy for Researcher / Copy for Participant to Keep

TITLE OF PROJECT: Children's activities on digital devices.
PRINCIPAL INVESTIGATOR: Susan Edwards
STUDENT RESEARCHER: Jo Bird

I ..... (*the parent/guardian*) have read (*or, where appropriate*, have had read to me) and understood the information provided in the Letter to the Participants.

Any questions I have asked have been answered to my satisfaction.

I agree that my child, nominated below, may participate in this research through being observed, taking photos and participating in discussions, and that I can withdraw my consent at any time (without adverse consequences).

I understand that agreeing to take part means that I am willing to allow

..... **(insert full name of participant) to:**

Be observed by the researcher	☐ Yes	☐ No
Be interviewed by the researcher	☐ Yes	☐ No

Documented observations of my child may be used in the thesis or any resulting publication or conference presentations.

☐ Yes ☐ No

I agree to my child's first name to be used when reporting data	☐ Yes	☐ No
or		
I want a pseudonym assigned when reporting data	☐ Yes	☐ No

(preferred pseudonym)- **.....**

and

I understand that my child's participation is voluntary, that we can choose not to participate in part or all of the project, and that I can withdraw my child at any stage of the project without being penalised or disadvantaged in any way and that the data of my child can be withdrawn from the project at any time of my choosing.

I agree that research data collected for the study may be published or may be provided to other researchers in a form that does not identify my child in any way, unless I have agreed for my child's first name and photographed to be used.

NAME OF PARENT/GUARDIAN: .....

SIGNATURE .....DATE:.....

NAME OF CHILD .....

Faculty of Education

115 Victoria Parade
Fitzroy VIC 3065

T: 03 9953 3000

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Appendix 3: Parent consent for filming form

PARENT/GUARDIAN CONSENT FORM

Copy for Researcher / Copy for Participant to Keep

TITLE OF PROJECT: Children's activities on digital devices.

PRINCIPAL INVESTIGATOR: Susan Edwards

STUDENT RESEARCHER: Jo Bird

I ..... (*the parent/guardian*) have read (*or, where appropriate*, have had read to me) and understood the information provided in the Letter to the Participants.

I understand that agreeing to take part means that I am willing to allow

..... (insert full name of participant) to:

Be photographed	☐ Yes	☐ No
Be video recorded	☐ Yes	☐ No
Be sound recorded	☐ Yes	☐ No

My child's image may be used in the thesis or any resulting publications or conference presentations. ☐ Yes ☐ No

NAME OF PARENT/GUARDIAN: .....

SIGNATURE: .....DATE: .....

NAME OF CHILD: .....

Faculty of Education

115 Victoria Parade
Fitzroy VIC 3065

T: 03 9953 3000

Appendix 4: Children's assent form

Children's Assent Form

You know me, I am Jo your kindergarten teacher. While you are at kindergarten, I would like to watch you use technologies, like the computer and digital camera.

I would like you to talk about these technologies.


I would like to take photos of you.


I would like to record what you say using a video camera or iphone voice recorder.


I would like to write a book. Can I use your name in my book?


If no, what name can I call you in my book? _____

Can I use your photo in my book?


Thank you

Name:

Appendix 5: Information letter to assistants

AUSTRALIAN CATHOLIC UNIVERSITY

INFORMATION LETTER TO ASSISTANTS

TITLE OF PROJECT: Children's activities on digital devices.

PRINCIPALSUPERVISOR: Susan Edwards

STUDENT RESEARCHER: Jo Bird

PROGRAMME IN WHICH ENROLLED: Masters of Philosophy

Dear Assistant,

I am conducting a research project towards a Masters of Education at Australian Catholic University. You are invited to participate in this research project because you teach at the kindergarten where I am the teacher. As part of the existing kindergarten program children have the use of a computer and digital camera. This project will be introduced to the children by asking them what they think about using the computer and digital camera at kindergarten. I will then ask the children what other technologies ie ipad and flip camera they might like to use.

The discussion will include how they like to use the technologies and what they learn from them. The children will be observed using digital devices and the discussions will be sound and video recorded.

The research will be conducted within the kindergarten program and children will not be required to do anymore than participate in the program offered. As an assistant, you may asked to record discussions, take photographs or observe children's activities on digital devices that be valuable to the research project. Your participation will not be different to what you do in regular role as a kindergarten assistant. The data will be collected over a 4 week period, 12 sessions in total.

The children will be observed, photographed, sound and video recorded as they engage with digital devices within the kindergarten program and you may also appear in this data.

This research will benefit participants through the opportunity to assist children to engage with digital technology in a kindergarten. The aim is to publish the research findings in a thesis, a book and journal articles that influence educator's practice when providing digital devices in kindergartens. The research will give insight to the early childhood field as to how digital technology supports children's play.

Participants can refuse their consent and not take part in the research. Participants are free to withdraw from the research at any stage and without giving a reason. If participants withdraw from the research project it will not affect their employment or work at the kindergarten in any way.

As data being collected may include photographs and video recordings, the researchers cannot guarantee participants' anonymity. Each participant can chose to use their first name or a pseudonym and these will be used when reporting data and in any publications. Photos of participants will only be used in publications with the participant's consent. If you want your first name used in any publications this can also be catered for.

Faculty of Education

115 Victoria Parade
Fitzroy VIC 3065

T: 03 9953 3000

There are no foreseeable risks involved with this research. Activities and experiences are the same as your regular kindergarten program.

Any questions regarding this project should be directed to the Principal Supervisor and the Student Researcher:

Associate Professor Susan Edwards
Australian Catholic University
suzy.edwards@acu.edu.au

Jo Bird
James Cook Kindergarten
63 James Cook Drive
Endeavour Hills VIC 3802
03 9700 2462
james.cook@kindergarten.vic.gov.au

Research findings as a result of this research will be available to participants by contacting the Student Researcher on jo.bird@acu.edu.au

This study has been approved by the Human Research Ethics Committee at Australian Catholic University and the Department of Education and Early Childhood Development.

If you have a complaint or concern, or a query that the Investigators have not been able to satisfy, you may write to the Chair of the Human Research Ethics Committee:

VIC: Chair, HREC
C/- Research Services
Australian Catholic University
Melbourne Campus
Locked Bag 4115
FITZROY VIC 3065
Tel: 03 9953 3158
Fax: 03 9953 3315

Any complaint or concern will be treated in confidence and fully investigated. The participant will be informed of the outcome.

If you agree to participate in this project, you should sign both copies of the Consent Form, retain one copy for your records and return the other copy to the Student Researcher.

Associate Professor Suzy Edwards

Jo Bird

Faculty of Education

115 Victoria Parade
Fitzroy VIC 3065

T: 03 9953 3000

Appendix 6: Assistant consent form

AUSTRALIAN CATHOLIC UNIVERSITY

ASSISTANT CONSENT FORM

Copy for Researcher / Copy for Participant to Keep

TITLE OF PROJECT: Children's activities on digital devices.
PRINCIPAL INVESTIGATOR: Susan Edwards
STUDENT RESEARCHER: Jo Bird

I ..... have read (*or, where appropriate*, have had read to me) and understood the information provided in the Letter to the Participants.

Any questions I have asked have been answered to my satisfaction.

I agree to participate in this research through being observed, taking photos and participating in discussions, and that I can withdraw my consent at any time (without adverse consequences).

I understand that the researchers cannot guarantee my anonymity as I may be present in photographs and video recordings.

I understand that agreeing to take part means that I am willing to allow

Be observed by the researcher	☐ Yes	☐ No
Be interviewed by the researcher	☐ Yes	☐ No

Documented observations may be used in the thesis or any resulting publication or conference presentations.

☐ Yes ☐ No

I agree to my first name to be used when reporting data ☐ Yes ☐ No

or

I want a pseudonym assigned when reporting data ☐ Yes ☐ No

(preferred pseudonym)- .....

and

I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any stage of the project without being penalised or disadvantaged in any way and that the data collected on me, can be withdrawn from the project at any time of my choosing..

I understand that research data collected for the study may be published or may be provided to other researchers in a form that does not identify me in any way, unless I have agreed for my first name and photographs to be used.

NAME: .....

SIGNATURE ..... DATE:.....

Faculty of Education

115 Victoria Parade
Fitzroy VIC 3065

T: 03 9953 3000

Appendix 7: Department of Education and Early Childhood Development Ethics Approval Form

Department of Education and Early Childhood Development

Office for Policy, Research and Innovation

2 Treasury Place
East Melbourne, Victoria 3002
Telephone: +61 3 9637 2000
DX 210083
GPO Box 4367
Melbourne, Victoria 3001

2011_001246

Ms Jo Bird
Australian Catholic University
Locked Bag 4115
FITZROY 3065

Dear Ms Bird

Thank you for your application of 14 July 2011 in which you request permission to conduct research in Victorian government schools and/or early childhood settings titled *Children's activities on digital devices.*

I am pleased to advise that on the basis of the information you have provided your research proposal is approved in principle subject to the conditions detailed below.

1. The research is conducted in accordance with the final documentation you provided to the Department of Education and Early Childhood Development.

2. Separate approval for the research needs to be sought from school principals and/or centre directors and this is to be supported by the DEECD approved documentation and the letter of approval from a relevant and formally constituted Human Research Ethics Committee.

3. The project is commenced within 12 months of this approval letter and any extensions or variations to your study, including those requested by an ethics committee must be submitted to the Department of Education and Early Childhood Development for its consideration before you proceed.

4. As a matter of courtesy, you advise the relevant Regional Director of the schools or early childhood settings that you intend to approach. An outline of your research and a copy of this letter should be provided to the Regional Director.

5. You acknowledge the support of the Department of Education and Early Childhood Development in any publications arising from the research.

6. The Research Agreement conditions, which include the reporting requirements at the conclusion of your study, are upheld. A reminder will be sent for reports not submitted by the study's indicative completion date.

7. If DEECD has commissioned you to undertake this research, the responsible Branch/Division will need to approve any material you provide for publication on the Department's Research Register.

I wish you well with your research study. Should you have further enquiries on this matter, please contact Kathleen Nolan, Research Officer, Education Policy and Research, by telephone on (03) 9637 3244 or by email at nolan.kathleen.j@edumail.vic.gov.au.

Yours sincerely

Dr Elizabeth Hartnell-Young
Group Manager
Education Policy and Research

13/09/2011

enc

Appendix 8: Australian catholic University Ethics Approval Form

ACU
AUSTRALIAN CATHOLIC UNIVERSITY

Human Research Ethics Committee
Committee Approval Form

Principal Investigator/Supervisor: Susan Edwards Melbourne Campus

Co-Investigators: Melbourne Campus

Student Researcher: Jo Bird Melbourne Campus

Ethics approval has been granted for the following project:
Children's activity on digital devices from a Vygotskian perspective.

for the period: 22/09/2011-30/11/2011

Human Research Ethics Committee (HREC) Register Number: V2011 103

Special Condition/s of Approval
Prior to commencement of your research, the following permissions are required to be submitted to the ACU HREC:
Department of Education and Early Childhood Development
City of Casey (received)

The following standard conditions as stipulated in the *National Statement on Ethical Conduct in Research Involving Humans* (2007) apply:

(i) that Principal Investigators / Supervisors provide, on the form supplied by the Human Research Ethics Committee, annual reports on matters such as:
- security of records
- compliance with approved consent procedures and documentation
- compliance with special conditions, and

(ii) that researchers report to the HREC immediately any matter that might affect the ethical acceptability of the protocol, such as:
- proposed changes to the protocol
- unforeseen circumstances or events
- adverse effects on participants

The HREC will conduct an audit each year of all projects deemed to be of more than low risk. There will also be random audits of a sample of projects considered to be of negligible risk and low risk on all campuses each year.

Within one month of the conclusion of the project, researchers are required to complete a *Final Report Form* and submit it to the local Research Services Officer.

If the project continues for more than one year, researchers are required to complete an *Annual Progress Report Form* and submit it to the local Research Services Officer within one month of the anniversary date of the ethics approval.

Signed: ..... Date: .....22/09/2011.....
(Research Services Officer, Melbourne Campus)

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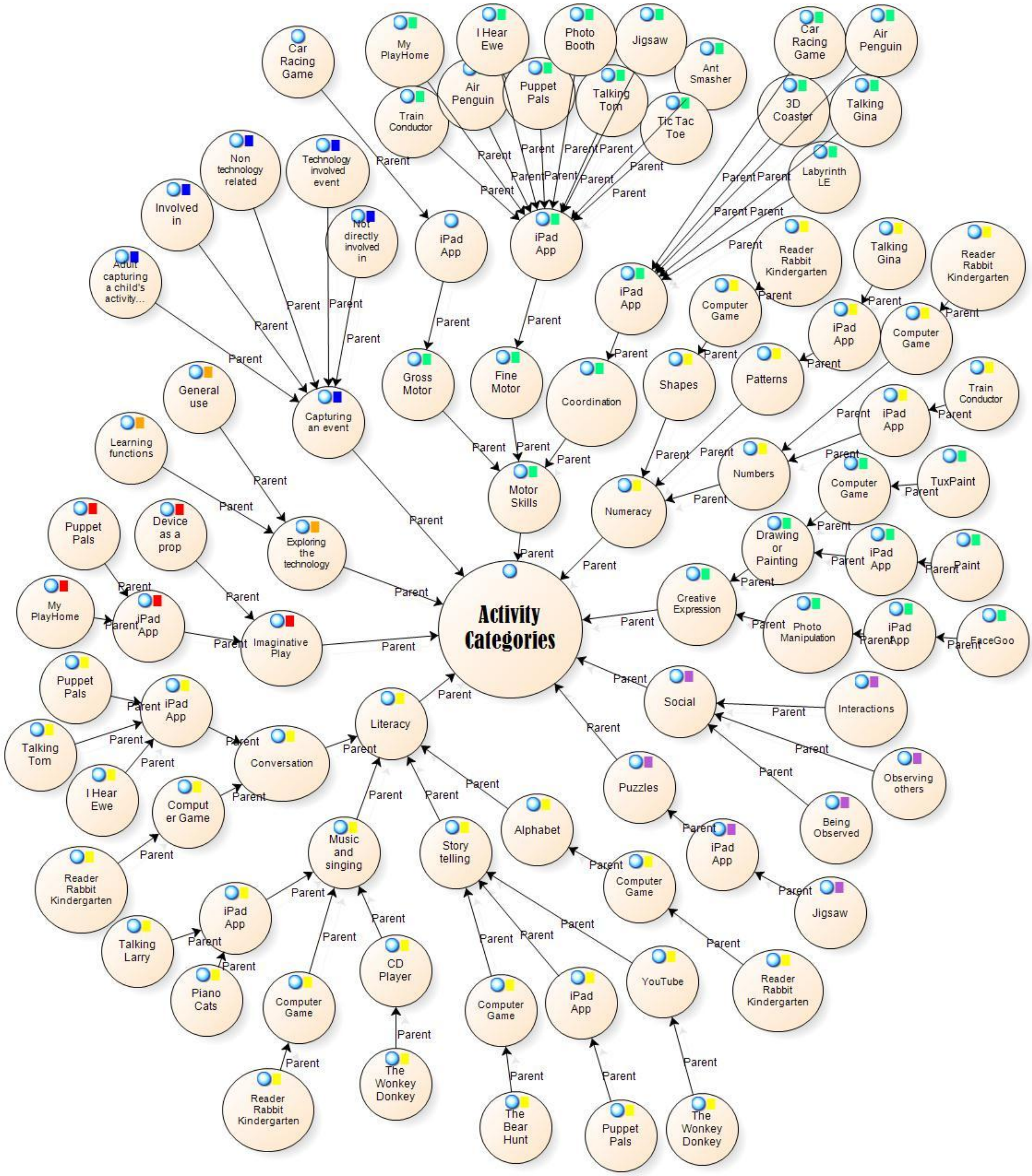
Appendix 9: Activity nodes



Appendix 10: Vygotsky nodes