Cooperation and Young Children’s Use of Mobile Touch Screen Technology

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Abstract

The rising presence of mobile touch screen technology (MTST) in the early childhood context presents opportunities as well as giving cause of concern. The unique features of MTST, such as its intuitive interface and portability, have led to an increase in its accessibility. However, there are many questions regarding its suitability for young children, specifically concerning its impact on their social development. This research aims to address the issue by investigating how cooperative behaviour can manifest through young children's use of MTST.

A scoping study (questionnaire) with parents (n=124) followed by semi-structured interviews with practitioners (n=9) were used to gather information on their attitudes towards young children and MTST. Although parents were cautiously optimistic about the potential benefits of MTST, they expressed several concerns, many agreeing that devices can take away from interacting with others. A thematic analysis of the practitioner interviews showed that they shared similar concerns and they noted the subdued and sedentary interactions with MTST.

The subsequent study investigated what forms of social and computer interactions occur when young children work cooperatively on MTST. It followed a design-based research method in which a learning activity was designed to promote cooperation while using MTST. Video data of children working in pairs (n=12) during the design and redesign of the activity was collected from two preschool settings. An analysis of the children's eye gaze, contact, and transfer of possession explored different cooperative elements during their interactions. Although there was variability across the different pairs, this research was able to provide evidence that MTST can be used in a cooperative manner amongst young children. The findings showed that the children were focused on the activity and shared long moments of joint attention. Additionally, specific features of the MTST correlated with an increase in specific types of cooperative behaviour.
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RQ1: What attitudes and opinions do parents have concerning young children’s use of mobile touch screen technology?

RQ2: What attitudes and opinions do practitioners have concerning young children’s use of mobile touch screen technology?

Summary and Reflective Analysis for RQ1 & 2

RQ 3: What forms of social and computer interactions occur when young children are encouraged to work cooperatively together on mobile touch screen technology?

Eye Gaze

Physical contact with tablets

Transfer of Possession

RQ 4: Can Designed Based Research increase cooperative interaction when young children are using mobile touch screen technology?

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Frequency, percentage and rate of Red Transfer of Possession

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“If we teach today as we taught yesterday, we rob our children of tomorrow”

(Dewey, 1944, p. 167)

This introductory chapter starts off with a personal perspective covering my own journey into this field and my interest in the topic. It then gives some background information on why young children’s use of technology is an important area of research that requires attention. This background section highlights the current problems and opposing viewpoints on the potential benefits and harmful aspects of mobile devices. Finally, this chapter provides an overview of my research including the research aims and contributions, and overall structure of the thesis.

1.1 Personal Perspective

Understanding the impact of mobile touch screen technology (MTST) on young children is a topic that has always been of great interest to me. As an early childhood teacher from 2010 – 2014, I worked in an early year’s school in Thailand that did not shy away from exploring and embracing new technology. The SMARTboard was introduced to my school while I was teaching, and iPads followed soon after. What fascinated me was how the children responded, their engagement, eagerness, and excitement to learn through these devices intrigued me. Almost every child appeared to be naturally drawn to the devices, and even children who found academic subjects frustrating would happily trace letters on an iPad.

During my time as a teacher, the Thai government announced an educational policy in 2011, the 'One Tablet Per Child' policy (OTPC) under the Yingluck government (Pruet et al., 2015). This
policy directly responded to the need for a significant educational reform that they believed could address the social divide and provide a learning environment that was more adapted to the demands of the knowledge economy in the 21st century. The policy promised to provide all primary school (year 1) students with tablets. By 2012 the Ministry of Education had distributed over 800,000 tablets across the nation. Unfortunately, The OTPC program had to come to a halt due to political instability in Thailand. Although, several foreseeable problems had already emerged, which also could have halted the program. The problems included the fact that learning was still 'passive', the materials on the device were not contextualized, hardware problems occurred, and a there was a need for better teacher training (Viriyapong & Harfield, 2013).

Furthermore, Pruet, Ang & Farzin (2016) also found evidence that students from rural areas who are not familiar with this type of technology expressed anxiety towards using tablets. However, it should be noted that initially, the policy was met with enthusiasm and excitement.

As mobile technology became more prevalent, I continued to observe how engaged children were with these devices. The high levels of engagement were not necessarily unique to just young children. Even amongst adults, we could relate to moments where we would get so immersed in our devices that we appeared to be ignoring our actual surroundings. Despite its presence, there were varying opinions on how much mobile technology should be incorporated into our day-to-day activities. For example, even amongst the teachers at my school, there was no unified opinion. Parents also viewed the technology with varying degrees of scepticism: while some strongly opposed the technology, others embraced it more openly, and some remained quite relaxed about it all. This technological transformation that fundamentally affected how we obtained new knowledge and made connection with other people was intriguing to me, especially from a practitioner who observed the differing opinion first-hand.
It is argued that MTST technology has given young people an unprecedented degree of connectivity among themselves and with the rest of the population (Oblinger et al., 2005; Prensky, 2001; Strauss & Howe, 1991). I have witnessed the cell phone transform from an expensive device to an essential tool that has become interwoven in our daily lives within my lifetime. In a generation where iPads, tablets, and laptops now seem like a staple in every household, this shift in our consumption of mobile technology indicates a change in how we access information, which will most likely become the norm for young children. Consequently, we must think carefully about how these technologies are to be integrated into young ones’ lives. As we begin to see the effects these devices have on how people interact with others, we can better prepare educators to use them in the most meaningful way. Given these interests and experiences, I went on to do my master’s in computing in Education with a focus on the early years. I then decided to apply for a PhD related to MTST. I believed that this was an area that needed more research, and a field to which I could bring my own experience as an early years educator to conduct meaningful research.

The research for the thesis began with a scoping study which involved a questionnaire for parents about their pre-school children’s use of MTST. This questionnaire helped to provide additional information in understanding what the views of parents were towards these devices. From this and my wider reading, I became interested in promoting social and cooperative activities in pre-school children as this would provide a way to counter the perception that the use of MTST limits social activities in young children. The following section explains why research with young children related to MTST needs to be undertaken.

1.2 Mobile Touch Screen Technology and Young Children

There are many arguments concerning the importance of research on MTST in early childhood, and this section provides an overview of some of the most important ones. Children and young
people born in the so-called ‘digital age’, which often means those born after the 1990s, have been given many names, including ‘Digital Natives’ (Prensky, 2001), ‘Generation Z’ (Strauss & Howe, 1991), ‘net generation’ (Oblinger et al., 2005), ‘iGeneration’ (Rosen, 2010) and ‘Homo Zappiens’ (Veen, 2007). The multitude of names reflects the differing outlooks and views on how to characterize these new generations of learners who had not experienced the world prior to the internet, or remember when they first used a computer (Green & Hannon, 2007). Names such as ‘digital natives’ & “Homo Zappiens’ carry the connotation that being born in this era of technological advancement meant children of this generation were more comfortable with technology and viewed it as an integral part of their lives. Both Prensky (2001) and Veen (2007) argued that there was a need to reform the education system to better fit the new characteristics of this generation who have learned to deal with information overload from MTST. Although there are differing views on how this generation of children are characterized, there is fundamentally an agreed-upon notion that technological advancement has heavily influenced the way children of this ‘digital age’ are learning and processing the abundance of information.

The 21st century and its technological advancement, particularly that of mobile technology, has brought about changes in the use of technology in early years settings (Dezuanni et al., 2015; Kucirkova, 2014; J. Lynch & Redpath, 2014). The rate at which these new technologies have globally found a way into many people’s daily lives has surpassed other forms of technology such as the telephone, television, or computers (Kalba, 2008). Whether pre-school children are directly interacting with these new devices or merely exposed to them, it has been argued that most “very young children today are growing up in a media-saturated environment” (Vandewater et al., 2007). The reason I have chosen specifically to research young children is due to a combination of issues, which I will outline in this section; I will also be outlining why I have chosen to look at mobile touch-screen technology (MTST), which includes tablet computers and smartphones, as
opposed to other digital devices. At the core of my rationale and arguments is a philosophical standpoint that,

“Neither stability nor change have any intrinsic value. The worth of stability is in the goodness it preserves, while the worth of change is in the goodness it brings about”

(Don Ely, 1976 cited in Moore & Ellsworth, 2014, p. 113)

In the broader realms of educational technology such statements could not be truer, but it is even more salient in the field of early years education where the debate is sometimes strongly polarized and the adoption of new technology can strike an emotional chord in many (Ernest et al., 2014). These reactions indicate strongly held beliefs as well as highlighting an awareness of the potential long-term repercussions, and the strong emotion of vulnerability that is associated with young children. When thinking of early years education, two immediate ‘gatekeepers’ are parents/caregivers and early years educators. These two main stakeholders, as well as children (see Figure 1.1) have been the focus of my research as it will be furthered outlined in this thesis.

![Figure 1.1 Stakeholders related to MTST and Young Children](image)

The desire to investigate young children’s interaction with MTST, stems not only from a need to better prepare young children to use these new forms of interactive technology, but also from what is already known about how young adults have adopted the technology. Mobile phones, particularly smartphones, have become so integrated into the daily lives of today’s teens that we can forget how ‘dependent’ they have now become on the tool, to the extent that some even see these items as part of their identity and an extension of the self (Lemish & Cohen, 2005; Roberts...
et al., 2014). This reflects the complex relationship we have with these technologies and the likely influence they will have on the next generation.

This global phenomenon has been accompanied by the growth of research that seeks to unpack the nature of these changes and the implications for teaching and learning. Many large organisations and institutions have continued to push and support research in this area, with ongoing publications such as the NMC/CoSN Horizon Report (Brown et al., 2020), Innovative Pedagogy (Kukulska-Hulme et al., 2021) and Child’s Use of Online Technologies in Europe (Ólafsson et al., 2014) that provide insight on the changing face of educational technology.

Despite these impressive initiatives, research in the early years is still significantly lagging behind other year groups. The very low number of educational technology research studies that focus on young children below the ages of 5, was the first key research gap identified in the EU Kids Online’s searchable European Evidence Database Report as can be seen in the Figure 1.2 graph (Ólafsson et al., 2014). The sense of urgency and the call for more research in the early years in relation to the use of technology has been raised numerous times in the past few years (Blanchard & Moore, 2010; Wartella et al., 2016).
In summary, there appears to be a disparity between the growing uptake of the technology in the early years group as well as concerns by parents and educators, in relation to the very low number of studies in this age group. Therefore, there is a need for further research about this age group so that we have a better understanding of this crucial period of development. Thus, in general terms, my research started off initially addressing this need for more research on the use of MTST with pre-school children in the early years setting.

1.3 Educational Context

Although this thesis sits at the cross-section of multiple disciplines (education, technology, human-computer interaction, and early childhood development), the study has been influenced by issues related to education. Explicitly contextualizing this research in the educational discipline helps explain the perspective I was using to approach the research questions. Contextualization in research is often presented in two main ways (Shehadeh, 2020) linking the research to established literature and situating the research in the specific context in which it was conducted (i.e. type of institution, geographical location). Given the educational context of this thesis, the literature review in chapter 2, specifically in section 2.4, critically examines relevant research that is primarily within the early childhood education sector. It should be acknowledged that given the nature of the study, there is a plethora of connected studies in the Human-Computer Interaction (HCI) field especially those that focus even more specifically on Child Computer Interaction (CCI), this research offer a different lens, but given my focus on the educational context this research has not been detailed in this thesis.

The setting of the study plays an important role in the analysis and interpretation of the data. Shedadeh (2020) recommends looking at the setting context on both a micro and macro-level. The micro-level is the specific type of institution where the study takes place, and the macro level
is the general setting of the study such as the geographic territory. On a micro-level this research was conducted in early childhood educational settings in London and Reading, further details are provided in section 3.5.3. On the macro level, both settings are based in England and therefore follows the Early Years Foundation Stages (EYFS) curriculum. The EYFS is the statutory framework of Early Years education in England with a focus on preparing children for a structured learning environment and formal teaching in Key Stage 1. The focus on preparation for a structured learning environment drives how early childhood settings in England often have a blended format of free play and structured learning activities. Understanding the context of this research, and the overall premise of the EYFS, provides the rationale for the decision to make the design of the activity a more structured and adult-led to align with the EYFS curriculum and the types of activities that the children were already experiencing in their classrooms. Additionally, the framework also highlights three prime areas of learning: (1) communication and language, (2) physical development (3) personal, social, and emotional development (PSED). It also is of relevance that one of the main learning goals within the area of PSED is building relations, “Children play co-operatively, taking turns with others...They show sensitivity to others’ needs and feelings, and form positive relationships with adults and other children” (Department for Education, 2017, p. 11). By placing this thesis in an educational context and directly relating it the EYFS it helps to frame the perspective that I have chosen to approach this research project.

1.4 The Research Aims

This research is a part of the Open World Learning (OWL) project by Leverhulme. The project aims to identify changes and challenges in open learning, as the adoption of technology has allowed for unprecedented access to educational information worldwide. The Open World Learning project objective is to contribute to the growing body of research that looks at finding out what role technology plays in learning in the 21st century.
The specific research aim for this thesis is to identify MTST and young children's current perspectives and investigate cooperative interactions when young children are using MTST. It is evident from the academic literature and the media that there are polarized opinions on the educational benefits and potential dangers of MTST and young children (Arnott, 2017). Therefore, as MTST becomes more prevalent in young children's lives, it is essential in moving forward that more attention is given to understanding how children are interacting with these devices. The conception of the four research questions that drive this thesis's narrative was based on the gap in the literature, which will be discussed in chapter 2. Additionally, the findings from RQ1 and RQ2, in conjunction with the academic literature, informed the development of RQ3 and RQ4, which was the main study of investigating cooperation and MTST. The four following research questions drove the thesis:

RQ1: What attitudes and opinions do parents have concerning young children's use of mobile touch screen technology? (Chapter 4)

RQ2: What attitudes and opinions do practitioners have concerning young children's use of mobile touch screen technology? (Chapter 5)

RQ3: What forms of social and computer interactions occur when young children are encouraged to learn cooperatively on mobile touch screen technology in pre-school settings? (Chapter 6)

RQ4: Can the activity design and re-design process increase cooperative learning when young children are using mobile touch screen technology? (Chapter 6)

Building upon previous works on MTST and young children, I first seek to understand some of the major concerns identified by parents and practitioners (RQ 1 & 2). Therefore, the initial scoping study was a survey to gather parental perspectives on MTST and young children. A significant concern presented by parents was that these technologies took away time from developing essential social skills and were often viewed as addictive and isolative in nature. This perspective and fear around the isolated nature of the MTST contradicted some of the fundamental values of
early childhood education, which emphasises the importance of social developments (Mertala, 2017). The scoping study findings helped frame the research questions 3 and 4 and inform the thesis’s focus.

Consequently, in the main study, a design-based research approach was used to design a cooperative learning activity using MTST to promote cooperative learning behaviours. This research aimed to better understand what types of behaviour emerged and its impact on promoting or hindering the pairs cooperative interactions. Through the multimodal analysis of eye gaze, types of touch, and transfer of possession, a more comprehensive picture was presented about the types of interactions occurring when children were using the devices in pairs. In summary, Table 1.1 provides a visualisation of the research questions methods used in this thesis, which will be described in more detail in chapters 3.

Table 1.1 Research questions and methods used in this thesis

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<th>Research Question</th>
<th>Scoping Study</th>
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<td>RQ1: What attitudes and opinions do parents have towards young children’s use of mobile touch screen technology?</td>
<td>Questionnaire (Section 3.3)</td>
<td>RQ2: What attitudes and opinions do practitioners have towards young children’s use of mobile touch screen technology?</td>
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<td>RQ3: What forms of social and computer interactions occur when young children are encouraged to learn cooperatively on MTST in preschool settings?</td>
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<td>RQ4: Can the activity design and re-design process increase cooperative learning when young children are using mobile touch screen technology?</td>
<td>Observations of Social Interactions (Section 3.5)</td>
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1.5 Thesis Structure

This section will provide an overview of the structure and flow of the thesis.

Chapter 2: Literature Review

The second chapter of this thesis presents a review of current research on (1) MTST and young children; (2) Parental and Practitioner’s Perspectives towards MTST; (3) Cooperation in the Early Years. These three main areas are the foundation of understanding the nature of this topic of research (see Figure 1.3).

Figure 1.3 Literature Review Areas

The first part of chapter 2 is focused primarily on young children and mobile technology, identifying past research on the potential benefits and major concerns. The second part of the literature review is focused on the perspective of key stakeholders towards digital technology and young children and their overlap. Finally, the third major part of this chapter reviews cooperation in the early setting and presents two key frameworks that are used in this research to identify features of cooperation. This chapter also provides a critical review of gaps in current knowledge and understanding, giving a rationale for the research questions addressed by this research.
Chapter 3: Methodology

This chapter begins with a discussion on my epistemological position, and the researcher’s paradigm. It then progresses into outlining the ethical concerns that have been taken into consideration when working with vulnerable participants (young children). Given that this research employed three different methods, the sub sections are organized with the first being about questionnaires, followed by semi-structured interviews, and then an overview of Design-Based Research (DBR). The chapter concludes with an explanation of the different phases of the DBR and the timeline of the research with regards to data collection. This chapter also provides a justification as to why each method was selected to answer the research questions, and how the findings from earlier research fed into the later parts.

Chapter 4: Parental perspectives and the common concerns around technology and social interactions

Chapter 4 is the first of the analytical chapters of the thesis and focuses on research question 1 (What attitudes and opinions do parents have concerning young children’s use of mobile touch screen technology?). It presents the findings from the parental questionnaires that were distributed in several early years settings and online. This results chapter includes analysis of questionnaires from 124 respondents. The quantitative results from the questionnaire analysis concern the use of MTST devices; this allows the reader to gain insight into the current usage trends and to consider whether the findings are similar to other nation-wide surveys. The second section explores parental perspectives based on the data from Likert scales and allows us to better understand how parents perceive the technology with regards to concerns and educational benefits.
**Chapter 5: Practitioner’s Perspectives of Technology and Cooperative Learning**

Chapter 5 is the second analytical chapter of the thesis and focuses on research question 2 (What attitudes and opinions do practitioners have concerning young children’s use of mobile touch screen technology?). This chapter presents a detailed thematic analysis of a subset of interview answers that specifically address the practitioners’ perspectives towards mobile technology and cooperative learning. The chapter describes the results of the qualitative analysis, which highlighted five themes regarding the benefits of mobile touch screen technology that practitioners perceived, as well as the major concern around passive consumption of this type of technology. The practitioners’ perspective on how much exposure and usage the children have with new technologies, reflects the growing statistics around young children’s adoption of these technologies.

**Chapter 6: Behavioural Analysis of Children’s Social Interaction when Using an iPad in Pairs**

Chapter 6 provides the findings from the video analysis of children’s interaction during their joint activity with iPads that are relevant to RQ3 (What forms of social and computer interactions occur when young children are encouraged to learn cooperatively on mobile touch screen technology in pre-school settings?) and RQ4 (Can the activity design and re-design process increase cooperative learning when young children are using mobile touch screen technology?). The analyses in this chapter presents the findings of form the eye gaze analysis, contact analysis, and transfer of possession analysis. They eye gaze findings provided insight on the level of children engagement and joint attention. The children demonstrated high levels of engagement with the iPad and activity, and overall the percentage of joint attention also remained consistently high across all pairs, whereas eye gaze towards their partner remained low. The touch section describes the different types of touch the children engaged with during the joint activity. The results from this section provide a detailed picture of how children were physically interacting with their iPads.
The last section in this chapter focused on the transfer of possession during the video analysis of children’s interaction while using the iPad in pairs. The section first addresses the issue of labelling and then outlines the role of negotiation and turn-taking as social skills that develop in the early years. A selection of the 6 transfers are then used as vignettes to describe in detail the complexities of these transfers and how the children behave differently, and what aspects promote or hinder their cooperation. This is then followed by an analysis of the number of times children transfer the iPad in their pair, and the quality of these transfers is then coded to explore what types of negotiation occur.

Chapter 7: Discussion
Chapter 7 revisits the research questions and presents a summary of the findings relating to each research question. A critical reflective analysis of the findings of research questions 1 and 2 is then presented; these two research questions are grouped together as they present the findings on the perspectives of two key groups of stakeholders which are parents and practitioners. The latter section of this chapter also synthesises the findings for research questions 3 and 4 using a critical reflective analysis approach, as they provide an overview of the findings from the video observation data.

Chapter 8: Conclusion
This final chapter summarises and outlines how this research has contributed to the field of educational technology and early childhood education. The chapter begins with a discussion about the contribution to knowledge, both methodological contributions and practical implications for practitioners, as well as a consideration of limitations and recommendation for future research.
1.6 Summary

This chapter highlights why furthering knowledge of children and touch screen technology is important for understanding pre-school children’s use of MTST and enhancing the quality of education. The chapter links these considerations with an overview of the research aims, before outlining the general structure of the thesis. The following chapter expands on the literature in this subject area, providing more understanding of how the research questions emerged.
Chapter 2  Literature Review

This chapter is comprised of 4 sections (1) Theoretical Background, (2) MTST and Early Childhood Education, (3) Parents’ and Practitioners’ Perspectives, and (4) Cooperation in Early Childhood Education. The first section covers the theoretical background, providing a rationale about why I have chosen the social cultural learning theory as the foundation for my study. Then section 2.2 expands on the overall points made in section 1.2 about the value of carrying out research concerning young children’s use of MTST. Section focuses on discussing research that has looked at the two key stakeholder, parents and practitioners, specifically their perspectives towards these new mobile technologies and how they perceive their impact on young children. This section links directly to the findings presented in 3.9 and Chapter 5, which include the parental questionnaires and the practitioners’ interviews. The following section 2.4 focuses on the topic of cooperation and provides a more detailed theoretical approach to cooperative activities than is usually provided by the sociocultural theory. The consideration of cooperation provides a rationale for the decisions used in the coding and observations of cooperative behaviours, which links to the findings of the video analysis of children’s cooperation which is presented in chapters 6. The conclusion in this chapter stresses the need for continual research in this field specifically with regards to young children, as MTST becomes more accessible and ubiquitous. In particular, research is needed to address and better understand the growing areas of concern that have emerged as a result of the new technologies and their impact on learning.

2.1  Theoretical Background to the Research

Identifying a theoretical framework that is appropriate for research about a topic is important not only because it serves as a guiding perspective but because it also helps provide a structured way
of interpreting the findings (Creswell, 2014). As can be seen by other empirical studies that have looked explicitly at MTST and young children, selecting an appropriate theoretical framework becomes necessary to help conceptualize these new types of interactions that are happening with new technologies (Arnott et al., 2016; Falloon & Khoo, 2014). There are several major theories relevant to early childhood development, and these theories are traditionally divided into three main categories: behaviourism, cognitivism, and constructivism. Although each of these approaches have their strengths and weaknesses with overlapping features, it is the differences that help educators and researchers select the most appropriate principles and conceptions which suit their contexts (Ertmer & Newby, 2013). Thus, in this section I will focus on learning theories that relate to the constructivist approach as this can be considered to include social processes related to the development of more complex understandings, and the development of more complex social processes involving cooperation. I will briefly mention some of the significant theorists that have emphasized the social aspects of learning before arguing why the sociocultural theory is the most applicable for this thesis. The decision to select the sociocultural cultural theory as the theoretical background is due to the fact that many of the principles in sociocultural theory contributed to the development of the constructivist theory and curricula (Jaramillo, 1996).

The rationale for selecting the sociocultural approach is due to the influence it has had on our current understanding of early years development and learning, and the emphasis this theory has put on social interactions as part of the early childhood development (Vygotsky, 1978). There are several other pioneers and influential developmental theorists that have been instrumental in reshaping the educational sector to take on a more child-centred and play-based learning approach, but for differing reasons that I will discuss, they have not been used as the primary theoretical lens for this thesis. Every developmental theorist has the potential to offer a unique perspective into this topic and listed below are prominent child developmental theorists that
relate closely to this area of research. This list is not exhaustive, but it aims to present some of the most established theorists and their perspective on early childhood development.

Jean Piaget’s (1971) work on understanding children’s cognitive processes and seeing them as active learners who construct their understanding of the world, has allowed educational practices to move away from a solely behaviourist stance. However, his stage theory about cognitive development has been argued to underplay the role of social factors in development (Winegar & Valsiner, 2013). In contrast, Erikson’s psychosocial stage theory that focuses on social interactions, puts an emphasis on the tension that arises in these interactions and ultimately focuses on whether the individual can overcome these crises. His theory has been problematic to evaluate and it has been criticised for concerning social expectations that are more prevalent in western cultures (Sacco, 2013). Another major theorist who highlights the role of social interactions is Bandura with his Social Cognitive Theory that focuses on learning through modelling processes. His work is particularly relevant to the premise of this thesis, since it acknowledges both the social influences along with external and internal reinforcement (Bandura, 2005). However, Bandura’s (2005) work is still focused very heavily on individual behaviour rather than looking at the co-construction of knowledge. Lastly, the work of Froebel (1896) and Montessori (1912) whose work have been explicitly focused on early childhood education, both adopt a constructivist theoretical approach towards learning. Often categorized as educational theorists their works are more pragmatic than many of the theories already mentioned. Montessori’s work, in particular, acknowledges the importance of the environment and creating opportunities for cooperation yet it would be hard to use her theory as a theoretical approach as it lends itself more towards a way of teaching rather than an approach to better understand childhood development. Similarly, Froebel’s work also focused heavily on elements of play and the holistic development of the child, and he has been instrumental in reframing play as an essential part of childhood development, but his work has been challenged because it has been
considered to be more focused on the physical aspect rather than engaging the mind as well (Yoneyama, 2012). For this thesis, Vygotsky’s ideas and sociocultural theory were the most comprehensive in addressing the issues of cooperation in the early years.

2.1.1 Sociocultural Theory

The sociocultural theory views learning as a construction of knowledge within a social context, in which interaction cannot be viewed separately from learning. The theory is often directly linked to the work of Lev Vygotsky (1978). This perspective conceptualises learning as a social construction, with Vygotsky’s work embedded in the belief that learning happens through social interactions, and that young children learn through their communications with their peers and adults. Despite his relatively short life span, Vygotsky left some key contributions in the field of early childhood psychology and education.

One of the most influential and explored ideas developed by Vygotsky was the notion of the ‘Zone of Proximal Development’ (ZPD). ZPD can be explained as the ‘potential’ level of development that can be obtained by a child if supported by their peer or an adult (Coltman & Anghileri, 2002; Vygotsky, 1978). This idea has become popular with the use of the term scaffolding, and the role of parents and educators who provide assistance in helping children to extend their skills and reach their fullest potential (Blackmore et al., 2011). Language played a fundamental role in Vygotsky’s theory of the cognitive development of a child. He valued play, particularly pretend play, as he saw that it was critical to the natural cognitive development of a child. He argued that through imaginary play, children were able to take on roles of adults, pretending to be different occupations and older family members such as mommy and daddy; simultaneously children learn the social norms that come with these roles. This play and interactions were important as ultimately it was through these social interactions that learning becomes internalized.
“Every function in the child’s cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals.” (Vygotsky, 1978, p.57)

The emphasis which Vygotsky puts on face to face social interactions as the foundation for development suggests that MTST might be undesirable as many aspects of the devices are not designed for social interaction. However, this interpretation depends on how the technology was introduced and used, as certain features of MTST can involve forms of face-to-face interaction (i.e. video calls) and would therefore provide enhanced social interaction. Hence, if MTST was introduced and scaffolded appropriately with an aim to encourage talk and conversation then it would be deserving of a place in the early years setting. This raises the issues of whether scaffolding and other techniques that are programmed into apps and learning design can facilitate and promote cooperative dialogue to occur. Furthermore, Moll and Tomasello’s (2007) paper on Vygotsky’s work on sociocultural theory and cooperation challenges the assumption that we are driven mainly by social competition (Humphrey, 1976), but rather there is a unique aspects of human cognition that is constituted by social cooperation.

“Vygotsky also emphasized the social dimension of intelligence, but he focused on cooperative things such as culture, collaboration, communication and teaching ... Vygotsky argued and presented evidence that the cognitive skills of human children are shaped by, or in some cases even created by, their interactions with others in the culture or with the artefacts and symbols that others have created for communal use.”

(Moll & Tomasello, 2007, p. 639)

Moll and Tomasello (2007) refereed to this as the “Vygotskian intelligence hypothesis”, and argued that regular participation in cooperative and cultural interactions leads children to construct uniquely powerful forms of cognitive representation. The sociocultural theory thus
became the foundation for this research as it laid the foundation on the importance of cooperation in the development of young children.

2.1.2 Summary

The recognition of young children are active social participants in their own learning is a similar theme that occurs across different contemporary theorists. Most theories, including those of Montessori (2004), Piaget (1964), Fröbel (1896) and Vygotsky (1978), valued the importance of children’s play with others and discovery as a means of developing their understanding of the world. Thus, laying the foundation that early childhood education should be child-centred, interactive, play-based, and authentic (Berk, 2013; Mooney, 2013; Vogler et al., 2008) and making these theories relevant to the topic of this thesis.

“Research in the last decades has impressively confirmed that children from an early age are explorers with boundless curiosity and that they are judicious decision makers and social actors each with their own unique goals, interests and ways to communicate feelings and intentions.” (UNCRC, Doek et al., 2006, p. 32)

The United Nations Convention on the Rights of the Child’s (UNCRC) opinion has been adopted and is embraced in many of the early years national curricula worldwide, in which the uniqueness of each young child is valued, and children are given ample opportunity to play with others.

In light of Vygotsky’s views on early childhood development, the argument can be made that there could be a place and time for MTST in the early years education, dependent on how it is introduced and adapted specifically with regards to the extent that it promotes social interactions. This section provides an overall reasoning for the selection of the sociocultural approach as the theoretical background for this research, while a further discussion of theories about cooperation and early childhood education is addressed in sections 2.4. In the following
2.2 Mobile Touch Screen Technology and the Early Years

This section aims to provide an overview of the recent literature and research that has been conducted in this area. Section 2.2.1 contains a discussion on the touch interface of tablets, a feature of mobile technology that has allowed tablet computers to become more accessible to young children. The intuitive nature of the touch interaction (Holzinger, 2002) and its unique immersive quality (Srinivasan & Basdogan, 1997) will be discussed in this section. The concept of touch will also be addressed later (section 2.4.4.2) as a way of assessing cooperation while using the devices. Then in section 2.2.2, recent research that has demonstrated some of the potential educational benefits through the use of MTST is presented. This will be followed by a section 2.2.3 that presents some of the concerns around MTST and the doubts that researchers and media figures have around the excess exposure to these devices. In the next section 2.2.4, a moderate approach is presented in acknowledging that the devices themselves will not determine the benefits or the harm but rather how the devices are being introduced and incorporated into teaching and learning practices. Thus, there continues to be a need for more research to address how new ways of incorporating the technology into the educational setting impact the children’s development. Therefore section 2.2.4 also provides an overarching rationale for the choice of Design Based Research methodology that was used and will be presented in Chapter 2.

2.2.1 Touch Interface

One of the unique features of tablet computers is the physical usability of these devices. The tablet computer offers a unique interface experience for young users without the need for their fine motor skills to be highly developed (Moyer-Packenham et al., 2015). Using a finger to execute
actions rather than a mouse or the qwerty keyboard has been described as the “most natural of all input devices” (Holzinger, 2002). Furthermore, the activation of the touch senses, creates a unique feeling of immersion (Srinivasan & Basdogan, 1997). It is the physical attributes of MTST, its mobility and interactive interface that desktops were not able to provide (Dhir et al., 2013) that suggests potential benefits of the devices in the early years settings. The intuitive touch screen interaction has allowed young children to operate the device with purpose and confidence. In 2011, only a year after the introduction of the iPad, Buckleitner (2011) was able to develop a “Taxonomy of Multi-Touch Interaction Styles, by Stage”, classifying intentional touch-related behaviours in relation to Piaget’s cognitive development stages (Buckleitner, 2011). He also clearly highlights the shift from mouse to touch:

“The Minimum User Competency (MUC) has dropped from around 2 1/2 years (for the mouse) to around 12 months (for the iPad) ... This presents new opportunities for children’s interactive media developers; nothing short of a new era in computing, as the user interface becomes increasingly invisible.” (Buckleitner, 2011, p. 10)

A later study conducted in Australia surveying over 700 parents found that there was “no evidence to support a negative association between the age of first touch screen usage and developmental milestones” (p. 6), on the contrary they found that earlier touchscreen use, specifically that of scrolling, showed earlier fine motor achievement (Bedford et al., 2016). Ralph (2017) argues that the touch interaction with the tablet computers is an influential part of extending the children’s understanding, and that haptic perception of physically touching the devices, is more than just scanning and browsing but is a more interactive behaviour (Mangen, 2010; Roskos et al., 2012).

This unique ‘touch’ interface that tablet computers offer not only has allowed for younger children to interact efficiently with the device but it has also opened another area of research on the multimodality of tablet use among young children (Nilsen et al., 2015). For example Davidsen
and Christiansen (2014) conducted a detailed analysis on the multimodal interaction of 8-9 year-old pairs collaborating around a touchscreen, concluding that children indeed “use their hands to constrain and control access, to construct and problem solve, and to show and imitate” (pg. 34). Additionally works by Kjällande and Monian (2014) have also looked at preschool children’s meaning making while engaging with tablet computers through a multimodal lens. These research studies have highlighted not only how the physical engagement with the device may influence learning but it also reiterates the fact that refined fine motor skills and even the ability to be able to read and write is no longer a prerequisite for children to engage with digital devices.

2.2.2 Research about the potential of MTST in the early years

Given the growing trend of tablets being used in educational settings, there has consequently been a growing number of studies that have explored the use of tablet computers in early childhood settings. To date there are currently two notable sets of systematic literature reviews that focus specifically on this age group: one published in 2014 (Sahin et al., 2014) which covered publications between 2005 till 2013 while the other review covered publications from 2009 to 2017 (Herodotou, 2018). The systematic literature review from 2014 of tablet computers in preschool education yielded 18 relevant peer reviewed articles that focused on tablets being used as support material in preschool education. All of the 18 articles were classified under one of the following categories: (1) Teachers’ view, (2) Children’s View, (3) Applications Point, (4) Other Related Studies. Overall the review indicated a positive outlook towards MTST, claiming that “if Tablet PC can be integrated in preschool environment a format in accordance with preschool education principles, there is a positive impact” (Sahin et al., 2014, p. 83). There were findings that acknowledge the children’s preference for the new digital tool over traditional tools (Couse & Chen, 2010), and an understanding that well designed games were able to support children on issues such as healthy behaviours, cognitive development, skill development, social interaction
and physical activity by providing them rich, fun and interactive learning experiences (Lieberman et al., 2009).

Herodotou’s (2018) literature review concerned more recent studies up to 2017 and portrayed similar findings in that 14 out of the 19 studies included in the review reported positive outcomes. The positive effects were seen in enhanced vocabulary skills (Teepe et al., 2017; Walter-Laager et al., 2016), reading and writing skills (Beschorner & Hutchison, 2013; Masataka, 2014; Neumann, 2014, 2016), enhanced math or science knowledge and skills (Alad et al., 2016; Mattoon et al., 2015; Miller et al., 2012; Schacter & Jo, 2016; F. Wang et al., 2016; Watts et al., 2016), earlier fine motor development (Bedford et al., 2016), improvements in literacy, numeracy, social interaction, and growth in confidence (L. Clarke & Abbott, 2016). A similar view is shared between Herodotou (2018) and Sahin et al. (2014) literature reviews in that touch screen technology has shown educational benefits in early childhood education. Another literature review that looked at MTST across all age groups in the school settings yielded a similar result in that there was a positive educational impact (B. Clarke & Svanaes, 2014). Additionally it has been suggested that MTST devices can promote soft skills such as creativity, play, engagement, and dialogue (Canning et al., 2016; Kucirkova et al., 2015; Kucirkova, Messer, Sheehy, et al., 2014; Marsh et al., 2015; Verenikina & Kervin, 2011). The positive impact that the technology appears to be having on literacy development also helps with the development of emotional competencies (Hatherly & Chapman, 2013).

Another way of assessing the benefits of MTST is looking at how previous research has shown its impact in relationship to a pedagogical framework. If the hope for MTST lies in some of its mobile learning features, under the pedagogical framework presented by Kearney et al. (2012), the tablet would be able to promote three essential learning features: authenticity, personalization, and
collaboration. Of the three features, collaboration has been studied from the perspective of young children by Fallon & Khoo (2014) explored young students’ talk in an iPad supported collaborative learning environment and Henderson & Yeow (2012) touched upon it in their case study of an iPad adoption in a primary school. The learning features of authenticity and personalization have not been explicitly addressed although they can be derived contextually from research that looks at apps which are more open-ended. Most of the research done on the use of MTST has been to observe its effectiveness in engaging young learners (Aronin & Floyd, 2013; Falloon & Khoo, 2014; Henderson & Yeow, 2012; Kucirkova, Messer, & Sheehy, 2014) or measuring its ability to increase specific academic skills (Beschorner & Hutchison, 2013; Masataka, 2014). In additional to the unique features that mobile technology can offer, its physical usability is an important feature to take into consideration when thinking about young children.

The review presented by Sahin et al. (2014) at the beginning of this section on potential benefits of MTST acknowledges how essential the design of the software is in ensuring the quality of the learning. Therefore, the rationale for the selection of apps used in each study is essential as they ultimately work towards different learning objectives. The majority of the studies have explicitly looked at instructional apps that work towards apparent learning objectives, such as number or letter recognition, letter tracing, or simple math computations. The substantial amount of research looking at these types of apps coincides with the abundance of learning apps that cater specifically towards learning these academic skills, also referred to as ‘instructive apps’ (Goodwin & Highfield, 2012), these are apps that are close-ended and have a very structured approach. However, less is known about apps that are more open-ended, also known as ‘manipulable’ or ‘constructive apps’, that work towards promoting soft skills sets such creativity, play, engagement, and dialogue.
The findings of these studies suggest the potential for MTST to engage and motivate learners, as well as to increase their reading and writing abilities. However, the correlation between the use of MTST and increased student engagement could be attributed to other factors such as novelty of the device rather than the actual functionality of the device. Despite a growing number of studies that highlight the potential benefits of the devices, there is still a sense of reluctance in adopting this technology with young children by both parents (McLean & Edwards, 2015) and practitioners (Palaiologou, 2016). Such sentiments do not exist in isolation and there have been some negative outcomes that recent studies have been able to unpack.

2.2.3 Concerns about harm and doubts about benefits of touch-screen technology in the early years

On this end of the debate the focus shifts to how the technology is replacing or taking time away from the ‘natural’ learning processes. There is a growing belief that screen time, and technology as a whole, could be compromising rich, quality parent-child play (Radesky et al., 2014; Wooldridge & Shapka, 2012). It is argued that the amount of face to face time has been reduced and quality time spent with family is either overtaken by work or the presence of an electronic media device (Sigman, 2009). There is now evidence of biological implications that may be reflected in the declining nature of social connection (ibid, 2009). Published back in 2000, a decade before the first iPad was even released, the document *Fool’s Gold: A Critical Look at Computers in Childhood* (Cordes & Miller, 2000), put forth some pressing concerns regarding the use of technology and childhood development; these topics of physical, emotional and social, intellectual, and moral hazards are still the major themes of concern regarding the use of MTST.

House passionately argues against any use of new technology in early childhood education, and claims that the experiences with these technologies are “intrinsically inappropriate for, and
harmful to young children” (House, 2012, p. 106), putting forward the theoretical standpoint that young children’s development of the senses can only flourish and develop strongly through human-human interaction. His argument against MTST is so definitive that he compares the choice of early exposure to these new devices as playing “grossly irresponsible Russian Roulette with their future wellbeing” (House, 2012, p. 106). Throughout his piece he stresses, like Vygotsky, the importance of human interaction and development of the senses, and that this artificial interaction with something non-human is interrupting children’s natural development. Although there are no specific studies that directly support his claim, there have been more recent studies that may validate some of his concerns. Krcmar & Cingel (2014) reported negative findings in terms of reading ability, in which children comprehended significantly less when using the electronic book versus the traditional book during parent-child interactions.

The strong commercialization is another negative association with MTST, and this is evident in the growing number of tablets and apps that are being designed specifically for young children. The quantity of devices and apps however, does not necessarily determine their appropriateness for young children. In addition to the media expressing its fair share of concerns around how the technology is damaging for young children (Joshi, 2016; Palmer, 2016b), research has also highlighted the sedentary nature of learning that is promoted through the use of these devices (Bath & Enriquez-Gibson, 2014; Cordes et al., 2004). There is a genuine concern for the negative consequences that using these devices might entail such as addictive behaviour (Bruner, 2006) and the so-called “loss of childhood” due to less time out interacting with the physical world (Buckingham, 2013; Postman, 1994).

The harm of MTST is also presented in the growing fear the early exposure will impact children’s ability to process knowledge in the long term. The possibility of information overload as well as an
inability to cognitively filter through all that information highlights a growing concern. There is emerging evidence that children have “lower recall of the information itself”, because they know they will be able to access that information later through the internet (Sparrow et al., 2011). This lower recall may also be a precursor for what researchers have called the “butterfly defect” (Salomon & Almog, 1998), which illustrates how children are fluttering through information, rather than pursing anything in depth. Learning thus occurs only at a surface level, “this fluttering leads – at best – to a very fragile network of knowledge” (Merriënboer & Kirschner, 2012, p. 161).

A fear with MTST is the interconnectivity that comes with access to the internet, and although it is not an immediate concern, since young children rarely operate directly with the internet, its long-term implication adds another layer of why MTST may not be appropriate for young children and the need for further research in this area.

2.2.4 Moderated approach to touch-screen technology in the early years

A more balanced approach towards this issue acknowledges the complexities around technology but more importantly focuses more on how its usage is moderated through adults and educators rather than viewing the technology in isolation. A series of working papers released by UNESCO although not specifically talking about young children is able to capture this idea across all types of mobile learning, for example as stated in their paper "The Future of Mobile Learning: Implications for Policy Makers and Planners":

"(T)echnology alone, regardless of its ubiquity and utility, will not determine whether mobile learning benefits large numbers of people. Designing effective mobile learning interventions requires a holistic understanding of how technology intersects with social, cultural and, increasingly, commercial factors. The technology itself is undeniably important, but equally if not more important is how people use and view technology, a point that has been largely overlooked." (UNESCO, Shuler et al., 2013, p. 7)
The American Academy of Paediatrics (AAP), one of the most internationally influential organizations outlining guidelines for technology use in the early years has recently made the shift to a moderated approach. Most literature would have previously associated them with focusing on the potential harm of the technology, as in 1999 they advised and advocated for zero screen time policy before the age of 2 years and focused heavily on the negative effects of media (Brown et al., 2011) These old guidelines influenced most of the Western world to adopt a similar and more conservative recommendation including but not limited to the UK (England, 2013), Canada (Lipnowski & LeBlanc, 2012), France (Bach et al., 2013), and Australia (Australian Department of Health and Ageing, 2014). However in October of 2016, the APP released a new set of recommendations entitled “Media and Young Minds” (AAP Council on Communications and Media, 2016). The recommendation reflected a more authentic approach towards incorporating technology in light of recent research and urged for families to be proactive and develop a ‘Family Media Plan’ to help mediate and moderate usage. The report acknowledges the potential of quality apps in enhancing the learning experience for young children, but still also highlights the associated health and developmental concerns particularly that associated with sleep and obesity based on research that we have observed research on television consumption. One of the most important recommendations as expressed in the report is that parents be their “child’s ‘media mentors’”. That means teaching them how to use it as a tool to create, connect, and learn (ibid, 2016). National (UK) guidelines for early years educators also voice a proactive tone in how digital technology can support early communication (National Literacy Trust, 2016).

Shortcomings in existing research have also been identified, and an absence of longitudinal and large-scale evaluations considering the use of tablets in HE has been noted. A review of empirical and theoretical findings by Dhir et al. (2013) investigated the instructional benefits of using iPads in classrooms and laboratories, and concluded that while tablets (iPads) could motivate learners, overall the research on the actual impact of tablet use on learning was limited. Additionally the
number of mixed findings that have been reported with regards to emergent writing skills and science knowledge and skills of older children (Herodotou, 2016; Patchan & Puranik, 2016; Schroeder & Kirkorian, 2016) highlights the problematic nature in trying to attribute any true benefit or harm to these devices. There also appears to be more focus on research on knowledge acquisition rather than, as Herodotou (2018) has suggested, studies examining possible impact of mobile devices on children's social and emotional development and gaining a fine-grained understanding as to why observed effects have been identified.

2.2.5 Summary

Despite the emerging evidence on the benefits of tablet computer use in the early childhood settings, there is still a need to develop a better understanding of how the devices can be used to promote the social skills or more active learning, and address some of the main concerns around the harm associated with MTST. Additionally, given the limited amount of research, drawing any definitive conclusion about the actual benefits and harm is challenging. Most theorists, including Piaget and Vygotsky, emphasise the importance of play and the concept of autonomy as methods to enhance children’s progress in the pre-school ages. From some perspectives MTST, which gives control to young children, is ideally placed to do this, especially when this is coupled with the potential of technology to support imagination and collaborative learning with peers. However, it also should be acknowledged that most of the apps used by pre-schoolers involve drill and practice software or simple repetitive games or as classified by Highfield & Goodwin (2012) pedagogical design as ‘instructive app’. Since parents and educators remain the main gatekeepers in young children’s exposure to the technology, it is important to have information about how parents and educators view mobile technology and their concerns about it, as well as the ways they think it may be beneficial for young children. Therefore the starting point for my
studies was to examine how parents (3.9), and later on in the semi-structured interview (Chapter 5) how educators, view MTST.

One of the strongest arguments against the use of the technology has been its removal of the child from human interaction. Although emerging research has shown the possibilities of tablets as tools to nurture cooperation (Davidsen & Christiansen, 2014), children are still using the device individually, also reports of collaborative usage in the family is also still not a norm, although when it does occur they are often positive interactions (Chaudron, 2015). More recent studies which have looked at the potential of MTST and young children, have shown a positive outcome, but this area is still significantly under researched (Falloon & Khoo, 2014; Kucirkova, Messer, Sheehy, et al., 2014). These concerns and differences in opinion mean that there is a need for further research to examine the social component of MTST.

2.3 Perspectives of Parents and Practitioners towards MTST

In the following section I will outline the findings of previous research concerning parental and practitioners’ perspectives about MTST. The first section 2.3.1 will address the parental perspective while section 2.3.2 will address practitioners’ perspectives. The section on parental perspectives is divided into 2 sub sections (pre-iPad and post-iPad), as it should be noted that most of the research which looks extensively at parental attitudes towards technology was primarily conducted before the introduction of iPads in 2010, thus these studies concern a variety of digital media that was available at that time such as computers, television, and electronic games; however, there are some key findings that may still be relevant to new types of technology, particularly tablet computers that have emerged post 2010. The research that has been conducted after the iPad made an appearance, focuses more on types of usage rather than parental perspectives on the potential or harm of the technology (Common Sense Media, 2013;
Cristia & Seidl, 2015; Marsh et al., 2015) and the data sheds light on the continual growth of parents incorporating this technology into young children’s lives. The section on practitioners’ perspective 2.3.2 will be presented in a different manner, first focusing on their perspective (section 2.3.2.1) before addressing the issues of adoption as this is often the main driving factor for research on practitioners’ perspective. This literature review section perspectives of parents and practitioners relates specifically to my research findings presented in 3.9 which focuses on parental perspectives, and chapter 5 which focus on practitioners’ perspective.

2.3.1 Ongoing Debate for Parents

The concerns around the usage of mobile tablets is an ongoing conversation and debate for parents who remain the main gatekeepers to these technologies for young children. The worries about how the device may cause developmental delay are often sensationalized in the media (Parry, 2016) but they are not unfounded as recent research has indicated that screen time may impinge on a child’s ability to develop optimally (Madigan et al., 2019). However, other research has suggested there can be a positive impact, particularly in the development of a child’s literacy and numeracy skill with the added benefit that they view learning as fun (Gray et al., 2017).

Parents have to independently weigh up these facts and make their own informed decisions on the extent their child should use tablets. It should also be remembered that,

“Childhood experiences often shape how adults act as parents but the technologies for children were not part of their parents’ upbringing. The lack of a model to inform this aspect of their parenting means that it is unexplored territory for a whole generation of parents and perhaps accounts for some of their uncertainty.”

(Plowman et al., 2008, p. 71)

Parents’ views about how they choose to introduce technology will undoubtedly be based on a complex matrix of their own values and attitudes (Harkness & Super, 1996). Consequently,
developing a better understanding of the differing reasons why parents choose to adopt or avoid the technology is important in relation to what experiences young children have in their homes, and these attitudes towards home use also may influence parental attitudes to what occurs in pre-schools at a time when there is also ambivalence from the professionals about the use of new technologies (R. Flewitt et al., 2015).

2.3.1.1 Parental Perspective Pre iPad (Before 2010)

One of the most prominent research studies done in this area was in the United States by Rideout and Hamel (2006). The research was based on a series of focus groups and a survey of over one thousand parents with children aged six months to six years old. The findings show the ways in which technologies have become ‘part of the fabric of daily life’ for young children (ibid, p.4). The study found that parents do not introduce technologies into their children’s lives so much for the educational benefits as for the benefits it offers parents: ‘uninterrupted time for chores, some peace and quiet, or even just an opportunity to watch their own favourite shows’ (ibid, p.5).

Another comprehensive study on parental perspective was conducted by Plowman, McPake, and Stephen (2010) in the UK. They surveyed 346 families and conducted extensive interviews with 24 parents. Their findings provide a counter to the argument of technological determinism, the belief that the device in and of itself is solely responsible for changing behaviour, and the growing negative perception that technology is transforming the ideal childhood experience. They stated that “[i]t was not the technologies that determined whether a family communicates, plays together, or supports their child’s learning but rather their cultural practices and values” (p.71). Although they found that parents on average did not view the technology as a major source of anxiety, “many parents were unsure as to how to respond to what some saw as contradictory accounts reported in the media” (p. 71-72). Parents therefore in general adopted a moderated approach, regulating exposure based on setting specific time and limits. However, some of the
major themes that emerged included issues of health concern, impediment to social interaction and inappropriate content which are consistent with the main issues raised by academics.

2.3.1.2 Parental perspective studies post iPad (After 2010)

Several studies have been conducted post the introduction of the iPad. Very few have taken a critical analysis in looking at parental choices with regards to the types of activities and apps they choose to use with their young ones. An online survey of about 450 French parents acknowledged the extensive use of the technology in the early years (Cristia & Seidl, 2015), with activities such as photograph viewing and video viewing being some of most popular amongst young children. This and other studies (Clark, 2015; Common Sense Media, 2013; Marsh et al., 2015) have focused mainly on the usage and type of usage rather than analysing how parents feel towards the technology. However, Marsh et al.’s (2015) comprehensive study with 2,000 phone surveys on technology and play, although focused primarily on usage, included questions regarding parental choices and motivation in downloading certain apps. The study confirmed that parents were the main gatekeepers as most of the time the decision to use a tablet was solely or mainly made by the parents. The study also showed that parents looked for a variety of features when selecting apps with the most important being that the app looked like it was fun, educational, and easy to use (ibid, 2015). This coincided with the main motivations that parents had for downloading apps for children which were to support their learning and to encourage play and creativity (ibid, 2015). It is also suggested that many of these young children’s uses are reported by parents as co-use, and that children are in fact not spending long hours using the tablets on their own.

Perhaps the most comprehensive qualitative study of this topic was a cross national student study that interviewed ten families across seven countries with children below 8 years old (Chaudron, 2015). This study involved interviews with over 70 families, and the findings reaffirmed ideas that digital technologies had become an important, but not dominant part of children’s lives (see also
Chapter 2.4). The concerns highlighted by the parents were almost identical to those brought up in previous quantitative research including, “incidental inappropriate content, health or social impacts” (Chaudron, 2015, p. 8). It should be noted that when discussing the potential benefits of technology in young children’s lives there lacks a consensus about this topic across different research studies. Although concepts such creativity, imagination, social skill, knowledge acquisition, hand-eye coordination and educational provision for future were identified in many studies.

The greatest difference between the findings pre and post iPad may be that parents during the pre-iPad era did not see as many educational benefits to the devices they were offering their child, and they acknowledged that often technology was given as a distraction so that parents could have some uninterrupted time. That is not to claim that this is not true post iPad, but it appears that parents see much more potential for the time on these devices to offer both an educational and creative outlet. It is difficult to draw direct comparisons between the two time periods, but the diversity in software that is now available for young children has allowed parents to open up to the possibilities the tool has in enhancing learning experiences. These investigations provide a strong foundation in understanding themes that have emerged surrounding parental choices, yet they do not focus on parents who have chosen not to introduce the technology to their child. Thus, in the initial stages of my research a parental questionnaire was used to investigate more broadly parental perspectives based on key themes that have already been identified in previous studies, and whether these statements of fear and hope are consistent across users and non-users of the technology. The aim was to replicate and extend previous research and to identify important issues for further research.
2.3.2 Practitioners’ Perspectives

Despite increased access and home adoption of mobile touch screen technology the actual use of this new technology in the classroom remains sporadic, especially in early years education (Wartella et al., 2010). In this section there is a consideration of the nature of previous research and the need for interview studies to complement the questionnaire-based research. An outline of research concerned with the adoption of technology is provided.

2.3.2.1 Research concerned with Practitioners’ Beliefs and Attitudes

Many studies have explored how teacher beliefs and attitudes toward technology influence adoption and usage, especially in relation to primary school age children (Ertmer, 1999; Ifenthaler & Schweinbenz, 2013). However, far less research has explored the perspective of teachers of preschool aged children, an important group given the current debate on the place of technology in the lives of these young children (Blackwell et al., 2013). As will be considered in more detail, the studies that have explored preschool teachers’ perspectives have often employed a quantitative approach in the form of surveys (Dong, 2018; Gialamas & Nikolopoulou, 2010; Hatzigianni & Kalaitzidis, 2018; Wartella et al., 2010). The findings from these surveys have often indicated a positive attitude towards MTST, but they are not able to provide a rich narrative and address the complexities of reasons behind the practitioners’ perspectives towards MTST.

Furthermore, the use of questionnaires has meant that it has been difficult to follow up on practitioners’ statements as information is usually limited to responses to pre-determined questions. A smaller number of qualitative research and mixed-methods approach studies have also been done, but these tend to involve focus groups which constitutes a limitation in terms of the social expectations from practitioners’ work colleagues (Hatzigianni & Kalaitzidis, 2018; Palaiologou, 2016).
As for the studies that have focused on interviews with practitioners, these either concern ICT in general (Mertala, 2017) or specifically computers (Alkhawaldeh et al., 2017). To date there appears to have been very limited studies that have interviewed practitioner’s perspective on the use of tablets or iPad. One published study conducted by Blackwell (2014) in the United States interviewing 9 practitioners on their attitudes to tablets in the early years classroom. Another study by Ludgate (2019) interviewed 12 early years practitioners, revealed that the intentions for practitioners wanting children to gain access to technology at an early age so that they would not be disadvantaged against their peer. However, this study was restricted to only looking at preschools in which the setting was already using iPads. Therefore, further interview studies to provide more insight into the practitioners’ perspective in both settings that are users and non-users of MTST are needed to better understand the educational context of young children in pre-school settings.

Understanding how the practitioners view the technology and what promotes or hinders practitioners in the early years sector to adopt any type of technology is critical not only because it is often a precursor to how the technology is introduced at the primary school level, but also because it may be a reflection of the gap between practice and pedagogy (Stephen, 2010).

2.3.2.2 Practitioners’ Attitudes to Adoption of Technology in Pre-school Settings

In order to better understand the complexity of practitioners’ perspectives on technology, it is worth looking at the broader literature that addresses teachers’ adoption of technology in the classroom. There is an extensive body of literature that looks at teacher adoption of technology, due to the perceived benefits as well as the large financial investments governments are making in ICT in schools (Buabeng-Andoh, 2012; Gardner-Mctaggart & Palmer, 2017; Nutt, 2010). Often in these studies practitioners’ perspectives are viewed as an important factor that determines the
extent to which they will integrate new technologies into their teaching (Ertmer, 2005; Zhao et al., 2001). Although many of the studies are not directly investigating attitudes but instead are focused on technology adoption and unpacking the barriers that are preventing teachers from embracing new technology, they give valuable insight into the positive and negative attitudes towards the technology.

Commonly used terms in studies on teachers’ technology adoption are first- and second-order barriers. These terms are often used to refer to the two main types of barriers at the teacher level that prevent the successful integration of technology into the classroom. Ertmer (1999) who further popularized the term from Brickner & Russell (1995) described first-order barriers as extrinsic obstacles including aspects such as the lack of access to devices and software, insufficient time to plan, and inadequate technical and administrative support. Second-order barriers were viewed as intrinsic barriers that prevent teachers from using the technology. These can be beliefs around the teaching, beliefs about the technology, established classroom routines, along with their own comfort level with the technology. At the most basic level, the first-order extrinsic barrier can be addressed through extra funding, providing more training and resources, whereas the second-order intrinsic barriers will require challenging the practitioner’s belief systems and a change in the institutionalized routines of their practice. Addressing one barrier may directly help resolve the other barrier, and thus the type of training that is given to practitioners can have an effect on breaking down both barriers. Therefore, in order to move forward with the integration of the technology in the education system, unpacking these barriers and making explicit the support needed by the teacher is necessary.

The two most prominent large scale surveys that have targeted early years practitioners and their adoption of new technology were aimed at identifying barriers to the adoption of new
technologies (Blackwell et al., 2013; Formby, 2014). Both studies were conducted at an early stage of the use of MTST in education. The first study by Blackwell et al. (2013) conducted in the United States surveyed 1329 early years educators to explore how different factors such as school environment, personal attitudes, and barriers to technology integration predicted the use of various digital devices. They applied the Unified Theory of Acceptance and Use of Technology model developed by Venkatesh et al. (2003). The findings suggested that although first-order extrinsic barriers such as school type, professional development, and school policy were a predictor of access to technology, second-order intrinsic barriers particularly positive beliefs on the affordance of the technology for young children predicted the actual use of technology in the settings. Given that the early years education community is being exposed to these new technologies, with evolving, and sometimes conflicting policies affecting classroom integration, this finding demonstrates specific areas that can help increase adoption of technology in preschool environments. Beginning with targeted professional development, clear technology policy for young children, to shifting the teaching attitudes of early childhood educators to further acknowledge the positive educational potential of technology, there are ways that can help better ensure the adoption of technology in the classroom.

In another survey, conducted in the UK (Formby, 2014), 362 practitioners were surveyed focusing on the use of tablet computers in the early years settings. Formby (2014) argued, based on the survey, that most practitioners had a positive view towards technology particularly in terms of its educational value, for example three-quarters of practitioners thought it is important to learn to use technology from an early age (74.8%) and two-thirds would have liked to increase the use of tablet computers in their setting (65.8%). However, the claim that “most practitioners have positive views about technology” (Formby, 2014, p. vi) should be viewed with caution as it was based solely on the response to two questions, one being that it is important to learn to use technology from an early age, and the other being their willingness to increase the use of tablet
computers. The answers to these two questions may not equate to a positive attitude towards the technology and do not address any of the concerns that practitioners may have regarding the technology. The main barrier that was identified from the survey was that of first-order extrinsic barriers including lack of equipment and financial reasons. On the whole the practitioners appeared optimistic and could be broadly categorized as positive and accepting of new technology (Formby, 2014). However it appeared that unpacking the second-order barriers would have been necessary in order to address some of the educators’ concerns that prevent them from adopting the technology.

Previous qualitative studies that have explored the issues of adopting technology in the early years through interviews and focus groups have raised concerns over the social development of young children. A study by Wood et al. (2008), which involved a survey and focus groups of 50 early years educators, found that although educators generally supported the integration of computers in the classroom, the educators had identified some critical concerns and limitations:

“Educators also suggested that computers may pose a threat to social development for very young children. Engagement with computers could limit social development in two ways. First, children would have less time to interact with peers, observe peer models, and engage in social problem-solving during these critical early years. Second, there was a concern that young children would be engaged with an inanimate object rather than with their peers... Interestingly, the educators here targeted only social concerns for younger children. Among the older children, computers were perceived as promoting cooperative activity and also providing an outlet for individual quiet time.” (Wood et al., 2008, p. 223)

The fear of technology taking away from young children’s social development has long been an ongoing and major concern for early years practitioners. It could be that the extent to which practitioners are able to justify or overcome these underlying concerns will influence the practitioner’s stance toward technology adoption. Paciga, Lisy and Teale (2013) refer to this dichotomy as a Continuum of Technology Adoption for Preschool Educators, with at one end being those who have already fully embraced the technology and at the other end those who are
reluctant to even start discussing technology and interactive media as viable tools for engaging preschoolers in learning. According to previous research most practitioners tend to be more on the acceptance end of the spectrum due to the presence of technology in their everyday life, however it seems that there still may be some underlying second-order barrier that is preventing them from fully embracing it in the psychological sense (Blackwell et al., 2013; Sandberg, 2002; Shade & Watson, 1990).

Researchers have argued that the differences of opinion among preschool educators about technology and interactive media use probably stems from deeply rooted philosophical traditions in early years education that have informed curriculum and instruction for a long time (Stephen, 2010; Teale et al., 2013). Firstly, preschool educators have long been committed to providing concrete, exploratory learning. Secondly, a bedrock of early years educational philosophy is the importance of relationships as the foundation for learning, both between children and adults as well as between children and their peers. Many preschool educators justify their reluctance to use computers and interactive media because such technologies seem to violate these two traditional foundations of preschool education (Mertala, 2017; Stephen, 2010). In addition to that, the early years educational environment can often be viewed through its dual purposes of a caring and nurturing institution as well as a place for structured support for physical, social, and cognitive learning. As Stephen (2010) has argued, this perspective and how early years education is often perceived has given it a distinctive tradition, often accompanied by a desire to maintain an identity that is separate from that of school-based education, which has affected their stance towards technology adoption.
2.4  Cooperation in Early Years Childhood Education

Section 2.1 discusses the overarching approach that I am adopting for this research, namely sociocultural theory to provide a more detailed consideration of the concepts of cooperation and collaboration. This involves the importance of cooperation in the early childhood settings, the issue of terminology, and the theoretical frameworks of cooperative learning that I used in my research. The similarities and differences between cooperation and collaboration are necessary to address, and I have used frameworks from both terminologies: (a) Collaborative Learning Framework (Dillenbourg, 1999) and (b) Cooperative Learning Framework (D. W. Johnson & Johnson, 2017) to conceptualize specific elements of cooperation. This research’s foundation uses Johnson and Johnson’s (2017) framework on cooperative learning, however, many aspects from the collaborative framework enhance and help to operationalize more subjective elements of the cooperative framework. It also should be noted that these frameworks focus on the process of learning as an outcome, whereas in my research the focus concerns the process of social interaction and ways to enhance this social interaction.

This section begins with an overview of cooperation in early childhood education (section 2.4.1) before addressing terminology (section 2.4.2). Then in section 2.4.3, I will present the two main frameworks that were used to help identify relevant behaviour between children. The section (section 2.4.4) concludes with an explanation of how I have chosen to operationalize certain aspects of cooperation and presenting a review of the respective literature.

2.4.1  Overview of Cooperation in Early Years Childhood Education

The growing body of research in this field has provided evidence about the educational benefits of cooperative activities in school instead of more individualistic and competitive approaches (Stevens & Slavin, 1995). Ideas about the social components of learning often are derived from the works of Vygotsky (1978), who explicitly argues that social interactions are the primary means
of learning, as children learn through their interactions with others before they can internalize the new knowledge. However, Piaget’s work has also considered the importance of social interactions, claiming that “social life is a necessary condition for the development of logic. We thus believe that social life transforms the individual’s very nature” (Piaget, 1928, p. 239). These theoretical concepts have been the foundation for researchers to investigate how social interactions impact children’s development.

Additionally, within the past couple of decades, there has been a growing interest in exploring the concepts of collaboration as ideas such as 21st-century skills and the Four C’s have gained international recognition. Collaboration falls under the interpersonal domain as identified by the National Research Council (Pellegrino & Hilton, 2012). There are also references to collaboration as ‘soft skills’ (Greenberg & Nilssen, 2015), ‘applied skills’ (Casner-Lotto & Barrington, 2006), or ‘transversal skills’ (Argyri, 2019). The interest in this area can be seen by companies investing more training and development in this area, thus a strong relationship between employability and these skills is expected (Andrews & Higson, 2008). There is an argument that fostering the development of these skills from a young age is essential. In the European Commission agenda for “New skills and jobs in Europe: Pathways towards full employment” in 2012 they state that,

“It is now widely accepted that ‘soft’ skills like creativity and entrepreneurship for innovation, or other ‘soft’ skills (such as interpersonal relations) are just as important for the expanding employment sectors like personal and social services. For many observers, soft skills mainly depend on personality characteristics which are shaped at an early age...” (European Commission Directorate-General for Research and Innovation, 2012, p. 37)

Much of the research on cooperative learning has however been carried out with primary or secondary school students (Greenberg & Nilssen, 2015; Newmann & Thompson, 1987; Zakaria & Iksan, 2007). The reason behind the limited research on cooperative learning with preschool-age
children group may be due to the belief that their egocentrism at this age (Piaget, 1928) hinders their ability and attention span to work with others. However, studies have shown that young children are less egocentric than Piaget had suggested (Donaldson, 1978) and there is evidence even in infants that suggest they can have an active role in taking the lead on specific social interactions (Trevarthen, 1977). More recent studies indicate that young children are capable of working effectively with others (Azmitia, 1988; Ding & Flynn, 2000; D. Wood et al., 1995).

Azmitia’s (1988) experimental study of eighty 4-5 year old students found that children who worked with a partner showed better outcomes in learning and an ability to generalize their skills as opposed to those working alone. Ashley and Tomasello’s (1998) study of cooperative problem-solving skills demonstrated that by 42 months, pairs of children could work cooperatively together and explicitly teach their peers. The work of Wood et al. (1995) on peer tutoring has shown how children in different age groups were able to support their peer, with the children aged 7 showing better ability to scaffold as opposed to the 3 and 5 years old. Unsurprisingly, findings from research vary about the success of cooperation, as there is considerable variability in the context and learning activities (Ashley & Tomasello, 1998; Brownell & Carriger, 1990; Ding & Flynn, 2000). However, there is evidence that even young children are capable of some forms of cooperative activity (Azmitia, 1988; D. Wood et al., 1995).

The encouragement of cooperation in the early childhood settings appears to be developmentally appropriate (Copple & Bredekamp, 2009). There is also an argument to be made that the promotion of cooperation in the early years aligns with many cultural values concerning relationships and socializing children with joint family practices (Molenda & Bhavnagri, 2009). These values are also echoed in the different early childhood curricula that have laid the foundation for many national curricula. Similarly, current assessment policies in the United Kingdom, that include the measurement of children’s social development from the age of 4
(Department for Education, 2017), reflect the importance of social interactions and cooperation in the early childhood setting.

Research into the development of cooperation, particularly in the emergence of cooperative networks in humans is proposed to be a central problem for biology and social science (Fehr & Fischbacher, 2004; Imhof et al., 2005). Past studies have also shown evidence that by two years, children already begin to engage in pro-social or helping behaviours (Morris et al., 2011; Warneken & Tomasello, 2006). Naturally at such a young age, children demonstrate these cooperative behaviours with their parents or other adults such as sharing toys (Hay, 1979), and interacting in cooperative activities with adults (Warneken & Tomasello, 2006). Additionally, research has documented how young children are attentive to friendship and cooperative peer relations as well (Brownell et al., 2006; Costin & Jones, 1992)(Brownell et al., 2006; Costin & Jones, 1992). Olson and Spelke (2008) have also shown that the three main principles at the root of adult human cooperative behaviour (preference for close relations, reciprocity, and indirect reciprocity) are also present in young children.

Furthermore, different early childhood curricula such as Montessori (2004), Regio Emilia (Edwards & Nimmo, 1994), and the Waldorf Approach (Ogletree, 1996), each put an emphasis on cooperation as an important feature of early childhood development. In the Montessori perspective cooperation is viewed as an important facet, particularly projected through their multi-age classroom, ensuring that children can learn from their younger and older peers. Malaguzzi (1993) explains that the Reggio Emilia Approach places a strong emphasis on children’s social construction of knowledge through their relationships, dialogue, conflict, and negotiation with their peers and adults. In the Waldorf education approach, despite its focus on the individual
pace of learning, cooperation takes priority over competition, and competitive sports are introduced with older students (Ogletree, 1996).

2.4.2 Terminology: Cooperation, Collaboration, Social Skills and Pro-Social Behaviour

In this section I define the term cooperation as used in my research, and in doing so I will also discuss it with regards to the term collaboration as the two terms are highly related. In the two subsections, I discuss the terms social skills and explain how it is used in this thesis. As well as the term pro-social behaviour, another term that is also closely related to cooperation and collaboration and outline the reason this term was not used in my research.

Initially, the term collaboration was selected for this research project as there was extensive literature in this area and based on Meyer’s (1991) claim that the social processes were of more interest than the final product, thus collaboration appeared to be the more appropriate term. However, upon unpacking the definitions further which will be discussed in this chapter and as the research developed what became apparent was that the term cooperative learning has been used to describe a more structured approach to the social interaction of students which was more in line with promoting joint activities with MTST and the design-based research approach that was used in this study. Therefore, the term cooperation is the term used for this thesis, however, given the complexity and inter-relatedness of the two terms, the theoretical frameworks for both collaborative learning (Dillenbourg, 1999) and cooperative learning (Johnson & Johnson, 2017) are used as the foundation. Both frameworks provide complementary ways of observing the benefits of working together.

The discourse about the terms collaboration versus cooperation is complex, mainly because the two concepts are viewed as synonyms and occasionally used interchangeably (Nunan, 1992). Works notably by Bruffee (1995) and Panitz (1999) have tried to outline some of the obvious and
the subtle differences between the two concepts. It is worth exploring how these terminologies intersect and where they diverge to better conceptualise the terminology that is being used in this thesis.

In some of the earlier works that tried to address the difference between the two concepts, Myers (1991) looked back at the origins of the words, while Panitz (1999) explored the educational traditions that have been related to these two terms. Myers argues that collaboration focuses on the process of working together, while cooperation focuses more on the outcome or the final product. The two concepts also appear to have originated from two different educational perspectives, with cooperative learning being grounded in the works of American philosopher John Dewey and psychologist Kurt Lewin that considered learning in various group dynamics. While the work on collaborative learning has British roots, in which English teachers wanted to explore ways to help students respond to literature by taking a more active role in their learning. Consequently, the two terms initially addressed different issues, with cooperative learning looking more structurally at what allowed group work to thrive with the teacher being the main facilitator. On the other hand, collaboration focused more on the process of learning in which the students take ownership of their learning while the teacher takes on a more observational role.

The research areas of these two fields have inevitably intertwined but in considering the specific definitions that some researchers have used, there are some interesting components that highlight the emphasis that each has been given. Dillenbourg defines collaborative learning as “a situation in which two or more people learn or attempt to learn something together” (1999, p. 1). In contrast, Johnson & Johnson (2017) explain cooperative learning as “the instructional use of small groups so that students work together to maximize their learning and each other’s learning.” (2017, p. 3). The main differences between these two definitions, is most notably
‘situation’ in collaborative learning versus ‘instructional use of small groups’ in cooperative learning. Oxford (1997) elaborates on this as one of the differences stating that cooperative learning is more structured and, therefore, more directive with about how students can work together in groups. This idea also aligns with other definitions of ‘cooperative learning’ such as the one by Cohen (1994), which states that “Cooperative learning will be defined as students working together in a group small enough that everyone can participate in a collective task that has been clearly assigned. Moreover, students are expected to carry out their tasks without direct and immediate supervision of the teacher” (E. G. Cohen, 1994, p. 3). The reason that Cohen added the emphasis on the autonomy of cooperative learning is to ensure that cooperative learning is perceived as more than merely a teacher-led approach. However, collaborative learning often appears to have a more organic conceptualization, and not always as structured.

In addition, Hord (1981) emphasises in her work that “collaboration is not possible without cooperation, but the inverse is not true” (Hord, 1981, p. 4), suggesting that cooperation does not necessarily involve an output that involves learning. Bruffee (1995) builds on these ideas by viewing cooperative learning and collaborative learning as potentially a linear development, in that cooperative learning should come prior to collaborative learning. This linear development was also reflected in the different age groups in that cooperative learning may be appropriate for young children, and collaborative learning for older children. Bruffee claims that the difference between the collaborative and cooperative activities should be aligned with the type of knowledge that is being taught, with foundation knowledge (basic knowledge) aligned with cooperative learning versus nonfoundational knowledge, which is more nuanced and complicated, aligned with collaborative learning. It is also implied that these two sets of knowledge correlate with different age groups. This was a strong argument from Bruffee in that cooperative learning was more appropriate for primary school children as it aligned more with teaching them the foundational knowledge to help them assimilate and join some of the
established knowledge communities available to them, while older children were better equipped to engage in collaborative learning.

Bruffee’s claims helped further clarify that the term cooperation was more appropriate with younger children, and that one is a building block towards the other. Therefore, for the purpose of the research in this thesis, the definition that was adopted for cooperation was the one used by Johnson and Johnson which states that cooperation is, “the instructional use of small groups so that students work together to maximize their learning and each other’s learning.” (D. W. Johnson & Johnson, 2017, p. 3). The focus on “instructional use of small groups” illustrates the deliberateness in designing an activity that is aimed at encouraging the students to work together, with the underlying belief and assumption that such teamwork could lead to a more meaningful learning experience. Although the two terms are often used interchangeably to simply describe situations when children are working together, there also are different interpretations of these two terms. Thus there the act of cooperation appears to be more harmonious and less output driven, although it also often is considered to involve influences from people outside of the target.

2.4.2.1 Social Skills

The term ‘social skills’ is used frequently across all aspects of education including in the early childhood field. The importance of teaching and promoting social skills is shown to lay the foundation for success both academically and with other work-related skills (McClelland & Morrison, 2003). It has also been suggested that many social skills and social behaviours are better learned among peers (Ladd, 2005), which implies that early year practitioners play a critical role in promoting these positive interactions in the classroom. However, the variability in what is regarded as social skills can differ greatly, ranging from taking turns to more complex behaviours such as showing empathy. While the definition of social skills varies depending on the context, it is
commonly accepted that young children need to demonstrate a certain level of social skills to be able to work with others.

Cooperation and social skills are very closely related, while some academics perceive social skills as fundamental behaviours needed for cooperation to occur (Johnson & Johnson, 2017), others see cooperation as a subset of social skills (Gresham & Elliott, 2008). Cooperation and social skill are therefore complementary to each other and depending on the nature of the research it is useful to define what types of social skills are being observed. For this thesis, I have adopted that definition used by Lynch & Simpson who specifically look at the social skill with regards to young children as “behaviours that promote positive interaction with others and the environment” (2010, p. 3). Some of the skills that are specifically highlighted include empathy, participation in group activities, generosity, communication, negotiation, and problem-solving.

Given the growing area of research around Social Skills, there has been an emerging body of research that works towards operationalizing social skills. Several norm-referenced assessments have been constructed to measure Social Skills. One of the most prominent and cited assessments is The Social Skills Improvement System Rating Scales (SSIS-RS; Gresham & Elliott, 2008), which is a revised version of the Social Skills Rating System (SSRS; Gresham & Elliott, 1990). The assessment has been used internationally and requires input from the teacher, parents, and students themselves. The assessment looks at seven social skills subdomains, including Communication, Cooperation, Engagement, Assertion, Responsibility, Empathy, and Self-Control. Within each subdomain there are subscales, the cooperation subscale includes behaviours such as following rules and completing the task. The limitation in using this assessment is the reflective aspect that it requires from the children, which is not necessarily appropriate for this age group. It
is important to be aware of these types of assessment, but it is not within the remit of this thesis, as the focus is not specifically on social skill.

2.4.2.2 Prosocial Behaviour

Batson & Powell explain that prosocial behaviours refer to “a broad range of actions intended to benefit one or more people other than oneself, behaviours such as helping, comforting, sharing and cooperating” (Batson & Powell, 2003, p. 263). Once again, the overlap between terminology requires attention because acknowledging the body of literature in this area provides further insight into research that has already been done in this field. Prosocial behavior can often be viewed in contrast to anti-social behavior (Batson, 2012), and its conceptualization came from trying better to understand this difference. The underlying question that researchers looking at prosocial behavior tend to ask is, “Do people act prosocially because they can expect a direct or indirect reward in the long run?” (Hinde & Groebel, 1991). There is a focus on the functions of prosocial behaviour. Although there is research on prosocial behaviour across all age groups, there is a focus on early childhood and the childhood years, as these behaviours are perceived as milestones and foundations of acceptable social behaviour later in life.

Furthermore, the literature around prosocial behaviour is intertwined with research on altruism. Altruism is similar to prosocial behaviour in that it is an action intended to benefit others, but the difference lies in the possibility of reciprocal action. Altruism is unidirectional, whereas prosocial behaviour also includes an element of reciprocity (Bouchard et al., 2015). This element of exchange makes prosocial behaviour also very closely linked to cooperation and cooperative learning. Given the importance of establishing the foundation of appropriate social skills, prosocial behaviour is a valued concept in the early childhood field.
The reason prosocial behaviour is not used as the main term in this study is that the term focuses more on the individual, whether a child provides help and support to another who experiences a difficulty rather than considering the longer process of social interaction and cooperation during an activity. It is also argued that there is a strong link between prosocial behaviour and altruism, and this takes on a more psychological approach in trying to understand the motivation behind the action, whereas the concept of cooperation has a more observational approach of trying to understand the actions of the dyad. Melis et al. (2016) argues in her paper on humans’ unique ability to turn-take that, “Alternating turns in obtaining a collaboratively produced resource does not require a prosocial concern for the other, but only strategic thinking that partners need incentives to continue collaborating.” (p. 989). Prosocial behaviour research therefore tends to focus on one child’s reaction to a certain social situation (Morris et al., 2011), rather than considering the dyad as a whole. Therefore, it did not appear to serve the purpose of this research, which aims to explore the types of interactions that occur in a dyad. There will be elements of prosocial behaviour that will be taken into consideration as viewing it from that perspective can help in this research. However, I will not be extensively unpacking these behaviours as this is not the main objective of this thesis.

Another significant part of cooperative learning is the children’s ability to take on the perspective of others which has been investigated extensively within the “Theory of Mind” literature (Baron-Cohen et al., 1985; Rieffe et al., 2010). This research is too extensive to review in any detail here. The consensus is that children develop to have an understanding of other people’s perspectives and are able to act upon it around the age of 4 years. Therefore, engaging in cooperation and developing those necessary skills are developmentally appropriate for this age group.
2.4.3 Cooperative and Collaborative Learning Frameworks

In this section two framework that were used to provide a context for the research in this thesis are outlined and then through the integration of both frameworks, a new perspective was created to specifically address the different aspects of cooperation that I wanted to observe and measure. As a foundation for my methods, the two frameworks of Dillenbourg (1999) and Johnson and Johnson (2017) were utilised. The next section describes and considers collaborative learning in the context of digital technology using Dillenbourg’s framework which attempts to consolidate multiple views on collaborative learning. Then the following section 2.4.3.2 concerns Johnson & Johnson’s framework which is the adaption from their classic framework (Johnson et al., 1984), a model that many practitioners have used as a foundation for incorporating more cooperative work in their teaching.

2.4.3.1 Dillenbourg (1999) and Collaborative Learning

Dillenbourg’ (1999) ideas about collaborative learning were part of a research program entitled 'Learning in Humans and Machines' (LHM)’ about research in the field of Computer Supported Collaborative Learning (CSCL). Dillenbourg’s writing on collaboration draws heavily from the works of Roschelle’s & Teasley (1995) who defines collaboration as, "... a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem" (Roschelle & Teasley, 1995, p. 70), Dillenbourg’s work contributed to the identification of the situation element of collaboration. Dillenbourg (1999) goes into detail in trying to deconstruct the different components of ‘collaborative learning’ in order to provide a definition of it. He argues that collaborative learning is a situation rather than a method. Through the consolidation of multiple perspectives, he claims that collaboration itself can be viewed from 4 different elements (situation, interactions, process - learning mechanism, and effects).
Under each of these 4 elements, there are criteria about how an element can be more or less ‘collaborative’, this is best illustrated in Figure 2.1. Figure 2.1 provides a visualization of the key elements that were presented Dillenbourg’s (1999) writing on What do you mean by Collaborative Learning?

The first element, *situation*, can be characterised as more or less collaborative (e.g. collaborative situation is more likely to occur between people with a similar status than between a boss and her employee, or between a teacher and a pupil). The second element, *interactions*, which takes place between the group members can be more or less collaborative (e.g. negotiation has a stronger collaborative flavour than giving instructions). The third element is *learning mechanisms* and some of these are more intrinsically collaborative (e.g. grounding has a stronger collaborative flavour than induction), even if, at a very fine level of analysis, learning mechanisms must be similar to those triggered in individual learning. The last element concerns the ‘effects’ of collaborative learning, not because this element is used to define collaboration itself, but because of the divergent views concerning how to measure the effects of collaborative learning. Given that collaborative learning is a situation where desired effects can be expected to occur, but are not guaranteed, Dillenbourg suggests the emphasis of research therefore should be on finding ways to increase the probability that certain interactions occur so that they trigger the learning mechanisms.

Figure 2.1 provides the key characteristics of collaboration according to Dillenbourg, but not all of these elements need to be present for the situation to be collaborative. Dillenbourg even acknowledges that not all these criteria are accepted by other researchers, for instance the criterion of common goals has been debated in that it is possible to collaborate on an action without sharing the same goal. For example, two people may collaborate on building a house,
with one person having that goal, but the other person’s goal may be to find a place to get rid of their wood. However, the criteria especially with regards to the situation and interactions help provide key elements that can be operationalized to see whether a pair of children are indeed collaborating.

Figure 2.1 Collaborative Learning Framework (adapted and constructed based on Dillenbourg, 1999)

According to Dillenbourg, the key for understanding collaborative learning is in the relations between the four elements. At a first glance, the situation generates interaction patterns, these interactions trigger cognitive mechanisms which in turn generate cognitive effects. However, Dillenbourg himself admits that such a linear causality is a simplification of his views, in fact most of the elements are reciprocal. The bi-directional link between the different elements demonstrates that it becomes difficult to isolate and measure each element as they are deeply inter-related. Viewing behaviour within this framework can help classify what elements trigger collaborative learning. Given that the work referenced in Dillenbourg’s paper was centred around school aged children or young adults, his discussion has not taken into consideration how a collaboration would look like in preschool children, who are at a very different developmental
stage. Thus, the reason for integrating Dillenbourg’s cooperative learning framework with Johnson & Johnson’s work (2017) is not only meant to bring in relevant elements of cooperative learning, but also help identify types of interactions that are considered cooperative and generate a coherent framework that is better suited for a younger age group.

2.4.3.2 Johnson & Johnson (2017) and Cooperative Learning

The second framework is Johnson and Johnson’s (2017) discussion of the elements of collaborative learning. There have been a couple of variations with minor changes to the different elements. The most recent framework Johnson and Johnson’s (2017) puts emphasis on the five basic elements that must be carefully structured for a lesson to be cooperative (see Figure 2.2). These five elements provide an important basis for the integrated framework used in this thesis. Johnson & Johnson’s work stems from Deutsch’s work on social interdependence theory (1962). The basic principle of social interdependence theory is that type of interdependence among student affects how they behave towards each other, and this subsequently determines instructional outcomes. Therefore, an argument is made that setting up cooperative situation can lead to promoted interactions, e.g., setting up a competitive situation leads to oppositional interaction and setting up individualistic situations leads to no interaction amongst the students.

Johnson and Johnson argued that the first of the five elements of a cooperative lesson is positive interdependence. Students should believe that they are linked with others so that one student cannot succeed unless the other members of the group succeed (and vice versa).

The second element is face-to-face, promotive interaction where students help, assist, encourage, and support each other’s efforts to learn.

The third element is individual accountability, where the performance of each individual student is assessed, and the results given back to the group and the individual.
The fourth element is social skills. Groups cannot function effectively if students do not have and use the needed leadership, decision-making, trust-building, communication, and conflict-management skills.

The fifth element is group processing. Processing enables learning groups to focus on group maintenance, facilitates the learning of social skills, ensures that members receive feedback on their participation, and reminds students to practise the small group skills required to work cooperatively.

2.4.3.3 Integrated Cooperation Framework

The reason for using both frameworks is to make use of Dillenbourg’s ideas in an integrated framework that can be used to investigate cooperative behaviour in pre-school children. Johnson and Johnson’s cooperative framework is used as a foundation, and I will draw on the similarities that are discussed by Dillenbourg. In Figure 2.3, I demonstrate elements of Dillenbourg (orange column) that have been integrated into the Johnson & Johnson cooperative learning framework (blue column). By integrating Dillenbourg’s framework, I was able to expand on the five original elements in the Johnson & Johnson framework. The yellow column outlines the ways that I
operationalised and measured elements of cooperation during pairs of children’s engagements with an iPad.

**Figure 2.3 Integrated Cooperation Framework**

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Positive Interdependence</td>
<td>situations that allowed for a shared goal</td>
<td>children sustained engagement on the task working towards the goal</td>
</tr>
<tr>
<td></td>
<td>Promotive Interaction</td>
<td>interactions that are interactive and/or negotiable</td>
<td>children communicate and negotiate what to do during the activity</td>
</tr>
<tr>
<td></td>
<td>Individual Accountability</td>
<td>situations that allow for division of labour</td>
<td>children spending equitable time on the resource given</td>
</tr>
<tr>
<td></td>
<td>Social Skills</td>
<td>a reflection of any learning mechanism that may have occurred</td>
<td>children demonstrate age-appropriate social skills while working with their peer</td>
</tr>
<tr>
<td></td>
<td>Group Processing</td>
<td></td>
<td>children reflecting on group learning</td>
</tr>
</tbody>
</table>

The first element of cooperative learning at the top of Figure 2.3 involves positive interdependence from Johnson & Johnson, this is linked with Dillenbourg’s idea of sharing a common goal. Although the idea of positive interdependence extends beyond just sharing a common goal, the notion of having a shared purpose is essential to beginning the process of learning together. This will be measured by looking at how frequently the pair share their attentions on the task at hand by observing their eye gaze (section 2.4.4.1).

The second element of cooperative learning investigated in the thesis is promotive interaction, this is linked to the interaction criterion from Dillenbourg’s collaborative learning framework. It is the process of learning from each other through talking, negotiating, and explaining important concepts. This peer-learning component is linked with the type and quality of talk that occurs in group work. This will be measured by isolating incidents where the children are negotiation and sharing the device (section 2.4.4.2).
Johnson and Johnson’s third element on individual accountability clearly links to Dillenbourg’s point about the division of labour. Dillenbourg addresses this in his explanation that for some academics, division of labour is the key concept that is used to differentiate between collaborative and cooperative. Cooperative learning manifests itself in the task being divided into smaller components and separately completed, whereas collaborative learning is doing the work together. This will be analysed through the duration and the types of touch the children perform on the devices, to record if equitable time between the pair is spent on the iPads.

The fourth element of Johnson and Johnson’s cooperative learning concerns the importance of social skills, this is perhaps the main element that is not addressed in Dillenbourg’s collaborative learning framework. This may be because the assumption is that these skills are already established before engaging in collaborative work, in contrast to cooperative learning, where social skills, "have to be taught just as purposefully and precisely as academic skills" (Johnson & Johnson, 2017). Similar to promotive interaction, this element will be measured through ‘transfer of possession code’ to see if the children demonstrate age-appropriate social skills while working with their partner and the sharing of the device (section 2.4.4.3).

The fifth element of group processing is similar to the learning mechanism in the collaborative learning framework. The ability to be reflective of the group’s performance is an important part of the learning process. Although this element does not map on explicitly to the collaborative framework, the latter contains the idea of a type of deeper learning that occurs in these situations. This element was not necessarily appropriate for this age group, asking the children to reflect on the performance can be challenging not just from the recall aspect but it is also harder for them to accurately verbalize their performance. Therefore, although a mode of data collection is presented in the yellow column of Figure 2.3, the fifth element was not collected as part of this age group.
2.4.4 Previous research that has investigated social processes in young children through eye gaze, contact and transfer of possession

The following sections consider previous research on behaviours that have been identified as being related to cooperation, that is eye gaze, contact and transfer of possession.

2.4.4.1 Eye Gaze and Joint Attention: Coding Positive Interdependence

Research on eye gaze has indicated that preschool-age children pay close attention to the direction of visual gaze of other people (K. Lee et al., 1998), and that children’s ability to use gaze direction to establish joint attention with other peers or adults underpins the development of a theory of mind (Baron-Cohen et al., 1985). The existence of ‘joint attention’ occurs early on in infancy and is viewed as a critical milestone in a child’s development. Corkum and Moore (1998) elaborate on the unique value of joint attention:

“Joint attention to objects and events in the world provides the initial means whereby the child can share experiences with others and negotiate shared meanings. Episodes of joint attention provide the context for the development of both knowledge about the world and knowledge about others as experiencers.” (p. 28).

Thus, in my study these moments of joint attention are considered to be a critical unit of analysis as it shows the children’s level of engagement as well as their shared goals. Joint attention can be measured though eye gaze and the extent to which children are looking at similar objects and events. The literature on the development of joint visual attention in children has indicated that a combined change in head and eye orientation is a more effective cue for joint attention—that is, for overt head turning in response to these cues (Butterworth & Jarrett, 1991; Corkum & Moore, 1998; Lempers, 1979).
The two types of eye gaze that are of interest in this study are dyadic eye gaze and triadic eye gaze. Dyadic eye gaze is often directly associated with face-to-face social interaction while triadic eye gaze occurs during joint attentional activity. Dyadic eye gaze is used primarily to determine if an individual’s eyes are directed at them or averted. Triadic eye gaze on the other hand, involves a third party (an object or a person) as the focus of attention of the looking individual, in this case it is the iPad. Although triadic eye gaze can also be used to regulate one-to-one social interaction, another major and unique function of triadic eye gaze is that it can be used to reveal an individual’s focus of attention and internal states (desire, goal, etc.).

In a collaborative task of using the iPad with young children, the extent of success can be partially measured by how long the children remain engaged in the activity and share that experience of joint attention. It has been argued that the gaze can also be a means of analysis of engagement and that “the change in the human gaze behaviour over the course of an interaction can provide useful information regarding the state of the interaction” (Baxter et al., 2014, p. 126). Thus, coding for eye gaze and joint attention can add insight into how the children are collaborating.

### 2.4.4.2 Contact: Coding Individual Accountability

Section 2.2.1 reviewed the touch interface of MTST and its usability with this particular age group, and although touch-based interaction is an important feature of digital learning environments, studies that look specifically at the way technology mediated touch enhances or hinders a child’s learning and development remain scarce (Price et al., 2015). It has been argued that from an embodied cognition theoretical perspective, in which the cognitive processes are engrained in the body’s interaction with the environment (Wilson, 2002), the use of touch screen technology can show an improvement in learning outcomes across all age groups (Bennett et al., 2015; McEwen & Dubé, 2015). Thus, there is research evidence which suggests that touch screen technology can
have important impacts on young children’s access to technology and it may facilitate learning, so observation of this process could provide useful insights into child-computer interaction.

Recent research that has looked at touch on MTST in children, has often used a qualitative approach (Davidsen & Christiansen, 2014; Fleck et al., 2021). Davidsen and Christiansen (2014) argues the need to look at these types of embodied and multimodal interaction because children’s physical interaction with the device can also provide valuable information in addition to their verbal communication. Furthermore, Flewitt (2006) specifically argues for the need to look at physical interactions in young children as it provides a more holistic description given how expressive and important their physical interactions are at a young age. Therefore, coding of children’s touch and contact with iPads can, like gaze, provide indications of the children’s cooperation. In general, it might be expected that pairs who are collaborating around a desired resource such as an iPad would spend similar proportions of time in contact with the iPads. The decision to use contact as a mode of analysis is to look at specific aspects of cooperation as highlighted by Johnson & Johnson (1984), including shared resources and symmetry of status (Dillenbourg, 1999; Ligorio, 1997).

2.4.4.3 Turn-Taking and Transfer of Possession: Coding Positive Interdependence and Promotive Interaction

The academic terminology of “turn-taking” is often viewed as a concept related to vocalisations and refers to the fundamental mechanism of how we are able to regulate ‘who is to speak and when’ during our daily verbal interactions with others (Sacks et al., 1978). Research on conversation turn-taking occurs across all age groups, and research on verbal turn-taking in the early years has yielded some insight on the complexities of these skills. Casilla (2014) claims that “This fundamental skill (turn-taking) of human interaction allows children to gain feedback, make
clarifications, and test hypotheses at every stage of development” (p.53). This language skill has been explored extensively as a critical communication skill (Stivers et al., 2009). However, the term “turn-taking” is not exclusively a linguistic phenomenon and extends into the physical exchange of resources. In the early childhood literature, the act of taking turns with an object may also be referred to as “turn-taking”. The term turn-taking is the act in which children can negotiate and understand the importance of giving other children an opportunity with a tool or toy. It appears to be an important skill that early childhood educators value as indicators of young children’s ability to work with others.

The notion of turn-taking is such an important feature of early childhood education as it appears across different early childhood curricula and frameworks (see Table 2.1). Furthermore, the concept of taking turns is such a sought-after skill that frequently in the children’s book section in bookshops there will be categories dedicated to turn-taking (Taking Turn Books, 2019).
<table>
<thead>
<tr>
<th>Curriculum</th>
<th>Country</th>
<th>Age</th>
<th>Excerpt</th>
</tr>
</thead>
</table>
| Early Years Foundation Stage (EYFS) | United Kingdom | 40 – 60 months | Personal, Social, Emotional Development: Making relationships  
Early Learning Goal  
Children play co-operatively, taking turns with others. They take account of one another’s ideas about how to organise their activity. They show sensitivity to others’ needs and feelings, and form positive relationships with adults and other children.  
(Department for Education, 2017, p. 11) |
| New York State Early Learning Guidelines | New York, USA | 3-5 years | Child navigates friendships with peers through cooperation and negotiation.  
• Negotiates with peers (e.g., takes turns, plans play) and communicates disagreement to other children  
• Understands the concept of “mine” and “theirs”  
• Chases other children and then turns and allows themselves to be chased  
(NY State Early Childhood Advisory Council, 2019, p. 84) |
| Early Learning for Every Child Today | Ontario, Canada | 2.6 – 6 years | Domain and Skills: 1.1 Making Friends  
Interactions: Engage in play with children. Offer toys. Take turns and exchange ideas in play. Modelling how to make friends and sustain play provides a positive example of social skills  
(Ministry of Education, 2007, p. 43) |
| National Early Childhood Care Education (ECCE) Curriculum Framework | India | 3 – 5 years | What children do:  
• Reveal feeling in dramatic play  
• Like to play with friends, do not like to lose  
• Share and take turns sometimes  
(Ministry of Women and Child Development, 2013, p. 41) |
| Making the PYP happen: A curriculum framework for international primary education | International Baccalaureate Organization (IBO) | 3-12 years | Social Skill:  
Cooperating - Working cooperatively in a group; being courteous to others; sharing materials; taking turns.  
(IBO, 2007, p. 22) |
| Te Whāriki – Early childhood curriculum | New Zealand | 0-6 years | Strand 3: Contribution | Children learn with and alongside others  
Young Children  
• Children’s developing capacities and understanding about rules and social strategies are fostered through such routines as sharing and taking turns.  
(Ministry of Education New Zealand, 2017, p. 39) |

Consequently, turn-taking has an important place in early childhood education. In my research I focussed on the transfer of possession as this can provide important information about the extent of sharing and co-operation between two children. The transfer of possession may be viewed as
'turn-taking’, and this term rather than ‘turn-taking’ is used as the behaviours that were observed were not so much a taking of turns as a more limited exchange in the possession of the iPads.

Further, turn-taking often implies a positive interaction and an agreement among both parties that the object will be shared or that one person speaks while the other remains silent. Therefore, the more neutral term, ‘transfer of possession’, is used to describe these exchanges and it refers to actions that indicate a clear movement of the iPad from one child to the other. This often meant the physical movement of the iPad from being used and positioned in front of one child to being used and positioned in front of the other child. The transfer of possession has been coded in this research using three different levels to indicate the type of transfer.

2.5 Summary

As mobile technology continues to become more prevalent, so do the growing concerns around how MTST may be affecting the behaviours of young children, particularly isolating behaviour. Given the importance of social interactions in the early years, and the focus of many early childhood curricula on building relationships and learning fundamental social skills, MTST is not perceived as a tool that can support this, on the contrary many parents and practitioners feel that the technology could be taking time away from developing this social skill. This chapter presented evidence on the growing body of literature that indicates the potential benefits that MTST could have on learning in general for young children. However, there is a gap in that not enough research addresses some of the prominent concerns that the key stakeholders including parents and practitioners have towards the technology, which is its effect on social development. Thus, the focus of this thesis was first to investigate the concerns of parents in a scoping study, then investigate the concerns of practitioners using a qualitative approach. These two research investigations led to further work to look at whether it is possible to promote cooperation
amongst young children when using MTST. By taking Johnson and Johnson’s (2017) framework on cooperation, I identified key aspects of cooperation that might be encouraged during children’s interaction with their peer. The synthesis of these different elements allowed for the following research questions to emerge. It should be noted that the results from RQ 1 and RQ2, helped shape RQ3 and RQ4.

1. What attitudes and opinions do parents have concerning young children’s use of mobile touch screen technology?
2. What attitudes and opinions do practitioners have concerning young children’s use of mobile touch screen technology?
3. What forms of social and computer interactions occur when young children are encouraged to learn cooperatively on mobile touch screen technology in pre-school settings?
4. Can the activity design and re-design process increase cooperative learning when young children are using mobile touch screen technology in pre-school settings?
Chapter 3  Methodology and Methods

3.1 Introduction

The previous chapter provided a review of the current literature about MTST and cooperation, highlighting the gaps which lead to the research questions that are addressed in this thesis. The purpose of this chapter is to provide the rationale and a description of the methodologies that were employed within and across the studies. In this chapter I will first provide an overarching timeline on the chronological development of the research study (sections 3.2). I will then address my theoretical perspective and the philosophical underpinning that lays the foundation of my methodological choices (sections 3.3). The next sections will describe ethical issues (section 3.4) and participants characteristics (section 3.5) for all the studies. I will then go on to describe the methods of my investigations in three separate sub-sections which concern: the initial scoping study involving a questionnaire about MTST to parents and caregivers (section 3.6), the use of semi-structured interviews about MTST with pre-school practitioners (section 3.7), and a description of the design-based research (section 3.8) that was used in the main study to investigate the nature of cooperation between pre-school children and whether this can be promoted. The content of section 3.6, 3.7, and 3.8 will also demonstrate how each method and type of analysis was used to address specific research question as outlined in Table 3.1.
Table 3.1 Methodology and Study Overview

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Scoping Study</th>
<th>Main Study</th>
</tr>
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<tbody>
<tr>
<td>RQ1: What attitudes and opinions do parents have towards young children’s use of MTST?</td>
<td>Questionnaire (Section 3.6)</td>
<td>RQ2: What attitudes and opinions do practitioners have towards young children’s use of MTST?</td>
</tr>
<tr>
<td>RQ3: What forms of social and computer interactions occur when young children are encouraged to learn cooperatively on MTST in preschool settings?</td>
<td>Observations of Social Interactions (Section 3.8.2)</td>
<td>RQ4: Can the activity design and re-design process increase cooperative learning when young children are using mobile touch screen technology?</td>
</tr>
</tbody>
</table>

3.2 Overview and Timeline

The chronological timeline and details about the different methods that were used throughout this research project are shown in Figure 3.1. The data collected for the scoping study which consisted of both paper-based and online questionnaires took place in 2017. The findings of this study helped inform the DBR, the data collection period of that study happened in 2018. A more in-depth breakdown of the DRB timeline is presented below, as the research project consisted of three main phases and will be discussed in further detail in section 3.7.
The details about the different phases and data collection that occurred in the DBR investigation are presented in Table 3.2. The data type refers to the types of data sources that were collected and analysed, the relevant findings are presented in chapters 5 (interviews) and in chapters 6 (video recordings).

Table 3.2 Design Based Research Timeline

<table>
<thead>
<tr>
<th>Phase</th>
<th>Date</th>
<th>Setting</th>
<th>Participants</th>
<th>Focus</th>
<th>Records and Type of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan – Feb 2018</td>
<td>London School (Reception)</td>
<td>Reception Teachers and Assistant Teachers (n=5)</td>
<td>Discussion with practitioners about learning activity, app explanation, introduction to children, iPad partner story feedback</td>
<td>9 interviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reading Nursery</td>
<td>Teachers and Assistant Teachers (n=4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>March – May 2018</td>
<td>London School (Reception)</td>
<td>Reception class children (n=10) Nursery class children (n=4)</td>
<td>Intervention enactment – sharing scenarios, iPad partner story, children using the Our Story App in pairs. This was the Initial session.</td>
<td>10 video recordings the London School 5 video recordings for the nursery 6 semi-structured interviews</td>
</tr>
</tbody>
</table>
3.3 Theoretical Perspectives and Philosophical Underpinning

It has been accepted that all research is grounded on some type of theory and therefore underpinned by epistemological positions (Flynn et al., 1990). These theoretical stances involving my ontological and epistemological position are critical in informing and justifying the research design and methods used (Crotty, 1998), as well the as the type of research claims that can be made (Avenier & Thomas, 2015). However, it has been argued that often a researcher’s theoretical stance is implicit and undefined (Braun & Clarke, 2006; Twining et al., 2017) which can lead others to misconstrue the findings. Consequently, I will outline my theoretical stance in order to show that there is alignment and consistency between my theoretical stance and the methods that I have used.

What is classically referred to as a researcher’s paradigm addresses the underlying philosophical views that are shared between researcher about the nature of reality (Khaldi, 2017). The ontology and epistemology of a researcher will naturally inform the type of methodology and research design that he or she uses. Ontology refers to the nature of truth (i.e. what is the nature of reality), while epistemology is concerned with how do we come to make sense and develop our understanding of the world (i.e. how can reality be understood) (Crotty, 1998). My beliefs about the nature of reality in this area of educational technology align with the relativist ontological view. Relativism assumes that there are multiple realities that can be researched holistically, and that ultimately “their realities are wholes that cannot be understood in isolation from their
context” (Lincoln & Guba, 1985, p. 39). Therefore, epistemologically, I hold the belief that knowledge and meaning are culturally defined, and that learning is a social process that takes into consideration both the individual and the environment (Kim, 2001).

The overarching research approach that was used was inductive and qualitative in nature, meaning that I allowed the data to drive the narrative about the findings. It should be clear that although the methodology was usually qualitative, the selection of methods used to collect data does not need to be exclusively quantitative or qualitative, but the methods should be the ones that best answer the research questions. In this sense, I adopted a pragmatic approach to research methods.

Thus, a mixed methods approach was adopted to holistically address the research questions. Mixed methods offer several benefits to addressing research topics, in what Cook (1985) called ‘critical multiplism’, highlighting how combining research methods can be helpful in combating the biases inherent to one research method that is used on its own. Therefore, the use of mixed methods provided a stronger understanding of the multiple issues associated with collaboration and mobile touch screen technology.

In the following section the ethics surrounding all the studies outlined in the introduction will be discussed, this is then followed by a detailed description of the methods used in all three of the research studies: an initial scoping study, semi structured interviews and an investigation using the design-based research approach.


3.4 Ethics

In this section I will discuss both the procedure taken (macroethics) and the daily ethical dilemmas (microethics) that occurred when collecting the data (Kubanyiova, 2008) to ensure the ethical rigour of the all the studies. Given that each study required a different set of ethical considerations they are dealt with in separate sections, with the last section concerning my positionality as a researcher.

3.4.1 Ethics for Questionnaire

The study followed the British Educational Research Association guidelines (BERA, 2011) and the British Psychological Society Ethics Guidelines for Internet Mediated Research (2013). It received ethical approval from the Open University Ethics Committee: HREC/2017/2560/Srisontisuk (Appendix 4). The questionnaire was considered a low risk study, and the all principles under the Ethics Guidelines for Internet-mediated Research were addressed. The first principle regarding, ‘respect for the autonomy, privacy and dignity of individuals and communities’ was addressed by first providing a simple consent paragraph which explained the nature of the questions, and the preservation of anonymity and confidentially. The paper-based questionnaire was designed to fit on 2 double sided pages (see Appendix 2: Paper Base Questionnaire Design) and an identical online version was also constructed, with 8 individual webpages as outlined in the survey map (see Appendix 3: Questionnaire Flow Chart). The Bristol Online Survey was used for the creation and distribution of the online surveys, as it complied with UK data protection laws, and all participants’ information was completely anonymised. On the information sheets the online survey was mentioned so that parents could respond online if they wished. Because of the low response rate from the distribution of the questionnaire at the pre-school settings, a shorter online version of the questionnaire was constructed and distributed in online open forums.
3.4.2 Ethics for Semi Structured Interview and Observations of Social Interactions

Ethical approval for the main study was given from the Open University Human Research Ethics Committee: HREC/2018/2785/Srisontisuk (see Appendix 4). The main study included data collection in the form of interviews from the practitioners and video recordings from the children. Prior to any data collection, all participants including the school, practitioners, and parents had given explicit consent by reading and signing the consent form (Appendix 5). All identifiable information including name were anonymised before analysis. All the recordings and data for this research was securely stored on OU protected servers. For the semi structured interviews the practitioners were also given participant information sheet prior the interview (Appendix 8).

3.4.2.1 Ethical Consideration when Working with young children

Due to the sensitive nature of working with children, it is essential to consider all the ethical concerns. My research was guided by the BERA ethical guidelines for education research. The ethical standards include: attention to privacy, awareness of potential exploitation, acquiring consent, avoiding deception, and understanding the cost benefit ratio of the research (Einarsdottir et al., 2009). The code of ethical standards applies to all human participants and each standard must be addressed when working with young children. Prior to entering school and working with the children, I obtained a Disclosure & Barring Service certificate to ensure that my background was suitable for this form of contact. I also had multiple meetings with administrative staff and the head of school briefed me on the health and safety concern around working with children for safeguarding purposes.

The issues of acquiring consent is a major concern when working with young children. Consent means receiving permission of the participant and the parent or guardian. Informed consent is a voluntary agreement to participate in an informed way and is the “informed, written consent of
the parent or guardian when seeking to engage children in research” (Einarsdottir et al., 2009, p. 286). Parent, practitioners, and the settings were given a combined Information Sheet and Consent Form. The Information Sheet explained the nature of the research. It should be noted that obtaining consent from young children is more complex as most of the children involved in this research were not able to read. Since they were not capable of understanding or signing a document, assent from the children was acquired instead. Assent differs slightly from consent, in that rather than a written form, it is an expression of approval or willingness to participate in the research. Assent in the field of early childhood research is often viewed as a child’s clear agreement to participate in research (Vitiello, 2003). The children were given an opportunity to provide assent through verbal confirmation, a yes or a no, or a non-verbal confirmation with a nod, or thumbs up.

The study was explained to the children in an age-appropriate manner using simple vocabulary (see appendix 9). It was also made explicit at the beginning and throughout the course of the research, they could if they wanted to, withdraw from the activity. There were children who opted not to take part and some left half way through the study, when I ask them if they wanted to take part or leave to do another activity. If they chose to leave, they simply returned to the ongoing activities happening within their settings.

In all the documents it was made clear that parents could withdraw their child from the study at any time by informing the research team in writing (sending an email) or verbally, in person or notify any of the staff in the early years setting. The parents were reassured that withdrawal would have no negative consequences for their child. It was also made explicit to the parents and settings all the information collected was treated as highly confidential and kept on password protected computers. No computer records were kept with identifiable information and every
precaution was taken to protect the children’s privacy. Research data, including all types of recording were held in a highly secured location with access restricted only to me.

Researchers have a responsibility to remain constantly vigilant in maintaining an ethical boundary that protects the investigator, the research, and the participants. As Punch (2002) concludes: “Researchers need to be reflexive throughout the research process and critically aware of the range of reasons why research with children may be potentially different from research with adults” (p. 338).

3.4.3 Researcher’s Positionality

At this research has many components in which I worked directly with a participant, the need to be explicit about my positionality as a researcher was essential. Particularly in working with young children, it requires even greater degree of reflexivity (McDowell, 1992) and being mindful of my positionality as an adult. I recognised that my experiences and different aspects of my identity whether it was gender, class, age, or ethnic background can impact the research design and my interpretation of data (Bourke, 2014). Therefore, I outline my own experience and educational background in order to allow the reader to make their own informed decision when reading this piece of research.

I am a 31-year-old Thai female, who went through both the Thai and American International school curriculum. I pursued my undergraduate degree at a university in the United States majoring in childhood education/special education. This teacher education program provided me with the opportunity to have my placement in different public school in New York state and I received my teaching certificate from the State of New York. When I returned to Thailand, I started my teaching career in a small international kindergarten school. I remained there for four
years as the lead teacher for both the nursery (3-4 years old) and reception class (4-5 years old). I then went on to pursue my master’s degree in the United Kingdom in the field of computing in education. It should be noted that my background was unusual for the course given my very limited technical skills around coding and computational thinking. However, that experience allowed me to develop a better theoretical understanding around the complex nature of technology and education. After that I moved back to Thailand and worked as an NGO focused on education in low income areas around Bangkok. My main role was as a teacher coach which allowed me to work with many passionate and dedicated educators.

Given that my background has always been in the field of education, but primarily in non-UK settings, I entered this research with limited understanding of the early childhood education system in the UK. However, my background as an early years educator has helped me tremendously in this research project, as my familiarity in working with the age group and the ability to communicate with other practitioners is grounded on my own experience as a teacher.

Although I was the lead facilitator in my study, I made a conscious choice to intervene as little possible during the pre-school activities. Being the leading adult in the room, was likely to have had some effect on the children, however, the time I spent in the classroom as an observer allowed me to familiarize myself with the setting and obtain the children’s trust. As a result, my presence in the classroom appeared to be accepted by the children and given that I had previously engaged with them more during their free play time, and did not ever exert any authoritative instruction, my perception was that they felt comfortable in approaching me for help with different task. I also read a story in a children’s book on what I did as a researcher (see appendix 10) to explain my role in the classroom.
3.5 Participants & Settings

In this section, I present information about the participants in the studies as well as an overview of the settings where the studies were conducted. This section includes three subsections. Each subsection provides an overview of the participants that were involved in the three studies (1) Questionnaire – section 3.5.1 (2) Semi-Structured Interviews- Section 3.5.2 (3) Observation of Social Interaction – Sections 3.5.3. Lastly, information regarding the settings where the design-based research took place is also presented in section 3.5.2.1.

3.5.1 Participants for Questionnaire

A total of 124 responses were received from parental online forums as well as from parents of participating schools that opted to distribute the paper-based questionnaires. Of the 124 responses, 14 had to be excluded. These were excluded due to their incompleteness as well as the possibility of the survey being falsified. From the remaining responses (n = 110), information was obtained about the child’s gender (female = 54, male = 54, null = 2) and age (mean age = 39.34 months, SD = 17.07 months, range = 4 – 71 months). Demographic information was also collected about the parents’ gender and age range of parent or caregiver. A question about educational background was also asked which provided a proxy for socio economic status (“What is the highest degree or level of education the parent of the child has completed?”). From this, it would appear that many in the sample had higher education degrees. For the purpose of this thesis, the data used for analysis was all the questionnaire responses obtained from February 1 until June 31, 2017. From the 110 responses 64 were the long version questionnaire and 46 were the short version questionnaire. Table 3.3 provides the demographic information of the participants who completed the questionnaire.
Table 3.3 Demographic Information from Questionnaire

<table>
<thead>
<tr>
<th>Gender</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>19% (n=21)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>81% (n=89)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 18</td>
<td>0% (n=0)</td>
<td></td>
</tr>
<tr>
<td>19 – 25</td>
<td>2% (n=2)</td>
<td></td>
</tr>
<tr>
<td>26 – 35</td>
<td>58% (n=64)</td>
<td></td>
</tr>
<tr>
<td>36 – 45</td>
<td>37% (n=41)</td>
<td></td>
</tr>
<tr>
<td>46 – 55</td>
<td>2% (n=2)</td>
<td></td>
</tr>
<tr>
<td>55 +</td>
<td>1% (n=1)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level of Education</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No formal education</td>
<td>3% (n=3)</td>
<td></td>
</tr>
<tr>
<td>GCSE or O Levels</td>
<td>7% (n=8)</td>
<td></td>
</tr>
<tr>
<td>A levels</td>
<td>8% (n=9)</td>
<td></td>
</tr>
<tr>
<td>Technical or Vocational Qualifications</td>
<td>10% (n=11)</td>
<td></td>
</tr>
<tr>
<td>Higher Education Degree</td>
<td>68% (n=75)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>27% (n=3)</td>
<td></td>
</tr>
</tbody>
</table>

3.5.1.1 Long Version questionnaire (Paper based & Online)

Thirty nurseries were initially contacted by email based on their ease of access for me and there were follow up phone calls to ask for help with the study. After agreement, a short meeting was arranged with the manager of five settings to explain the purpose of the survey as well as handing over the questionnaires to be distributed. Five hundred questionnaires were distributed across five nurseries in Milton Keyes and Reading and in one school in London that had a nursery and reception class attached to it. The managers were free to distribute the questionnaire in any way they saw appropriate. Later, a follow-up phone call was made 2 weeks after distribution to arrange for the completed questionnaires to be picked-up by me. In two of the settings an online version of the questionnaire was made available through the web site of the setting.
3.5.1.2 Short Version questionnaire (Online)

Due to the low response rate of the paper-based questionnaire, a shorter version of the questionnaire was produced which eliminated ‘part 4: Device usage’ and ‘part 5: App Selection’. This shorter version of the questionnaire for online distribution focused only on Part 6: Parental Perspective; a link was shared via social media including Twitter and Facebook. The questionnaire was also posted on UK-centred parenting websites forums; the selection of the sites was based on popularity of the site for the key search term ‘UK parenting forum’. The link was made publicly available, and respondents were encouraged to forward the link to others who fit the sample criteria of being a parent or caregiver to a child aged 5 and below.

3.5.2 Participants for Semi Structured Interviews

The following Table 3.4 provides information about the nine practitioners that took part in the interview.

Table 3.4 Information about practitioners’ gender, setting and teaching experience

<table>
<thead>
<tr>
<th>Participant #</th>
<th>Gender</th>
<th>Setting</th>
<th>Years of experience teaching in Early Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>Reading</td>
<td>17</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>Reading</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>Reading</td>
<td>&lt;1</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>Reading</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>London</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>London</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>F</td>
<td>London</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>F</td>
<td>London</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>F</td>
<td>London</td>
<td>6</td>
</tr>
</tbody>
</table>
3.5.2.1 Settings

Details about the two settings (1) Reading (2) London, at which the practitioners were employed, is provided in this section. The settings were recruited from the different nursery that was initially contacted and agreed to distribute the parental questionnaire. The recruitment of these two settings was done through practical sampling and by using Henry’s (2011) framework, and it is worth considering the variability between the two settings. Although the two settings were different in many aspects, including students’ background, one of the most relevant variables was the current usage of MTST in the settings. The Reading setting did not have any MTST readily available for their students, whereas the London setting had 20 iPads shared across two classrooms.

Setting 1: The first selected setting was a nursery situated in Reading. It has approximately 45 students in the age group of 3 to 5 years. Although the majority of pupils were White British, a small proportion were of Indian ethnicity. The catchment area has a high concentration of people of higher social economic status based on the national data provided on that area. There were 4 practitioners that worked directly with the students. In their most recent Ofsted inspection (2017) the nursery was rated Outstanding. The setting had touch screen desktop that were accessible for the children to use at specified times during the day but did not have any type of tablets for the children to use. The tablets were for the practitioners to use for documenting the children’s learning.

Setting 2: The second setting was a school situated in East London and involved their reception classes. There were approximately 68 students in the age group of 4 to 5 years many of whom live within the catchment area. The percentage of students from ethnic minority groups was much higher than the national average and many of these pupils were in the early stages of learning English as an additional language. The catchment area had a high concentration of people of
lower social economic status based on the national data provided on that area. There were 5 full time staff that worked directly with the specific age group of interest. In their most recent Ofsted inspection (2014) the early years sector of the school was rated Good. The setting had 20 iPads shared across all students, these were accessible for the children to use at specified times during the day. The setting also used interactive whiteboards in each classroom.

3.5.3 Participants for Observation of Social Interactions

This section provides an overview of the participant in this study and details about the settings where the data was obtained, a timeline for the study and the rationale for the app selection.

3.5.3.1 Participants

Practitioners & Setting

Details about the practitioners and setting who were involved in DBR have been given in section 3.5.2 & section 3.5.3.

Pre-School Children

Video recordings were made of a number of pairs of children at two time points, at the ‘initial’ session when the first set of instructions about cooperative behaviour was provided, and the later ‘redesign’ session, which occurred after modifications had been made to the initial support that was provided to encourage cooperative interaction. The first criterion used for the selection of the children was that the children remained with the same partner in the initial and redesign sessions. Due to practical issues that were beyond my control (i.e. absences, special needs children), not all the partnership remained consistent in the initial and redesign sessions. The second criterion was that there was enough video footage to capture most of the time that the children were interacting. If children moved out of frame for a period of more than 50% of the recording, their recording were excluded. There were 5 pairs who were excluded because of this
reason. Details about the gender, setting and age of 12 pairs of children are given in Table 3.5. The names are fictitious.

Table 3.5 Information about the children’s gender, setting, and age

<table>
<thead>
<tr>
<th>Name</th>
<th>Gender</th>
<th>Setting</th>
<th>Approximate Age Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tom</td>
<td>M</td>
<td>London</td>
<td>4-5</td>
</tr>
<tr>
<td>Kate</td>
<td>F</td>
<td>London</td>
<td>4-5</td>
</tr>
<tr>
<td>John</td>
<td>M</td>
<td>London</td>
<td>4-5</td>
</tr>
<tr>
<td>Jess</td>
<td>F</td>
<td>London</td>
<td>4-5</td>
</tr>
<tr>
<td>Sam</td>
<td>M</td>
<td>London</td>
<td>4-5</td>
</tr>
<tr>
<td>Steve</td>
<td>M</td>
<td>London</td>
<td>4-5</td>
</tr>
<tr>
<td>Lydia</td>
<td>F</td>
<td>London</td>
<td>4-5</td>
</tr>
<tr>
<td>James</td>
<td>M</td>
<td>London</td>
<td>4-5</td>
</tr>
<tr>
<td>Amy</td>
<td>F</td>
<td>Reading</td>
<td>3-4</td>
</tr>
<tr>
<td>Adam</td>
<td>M</td>
<td>Reading</td>
<td>3-4</td>
</tr>
<tr>
<td>Dom</td>
<td>F</td>
<td>Reading</td>
<td>3-4</td>
</tr>
<tr>
<td>Daniel</td>
<td>M</td>
<td>Reading</td>
<td>3-4</td>
</tr>
</tbody>
</table>

3.5.3.2 Our Story App Selection

The research plan was that pre-school children would carry out an activity in pairs using a suitable app on iPads. Within the educational app category, apps for young children dominate the sector, accounting for 58% of apps (Shuler et al., 2012). These apps have therefore been viewed as a new medium for providing educational content to children due to their availability and popularity (Shuler, 2009). Given that this Ph.D. research is part of the Open World Learning project, a key criterion was openness and accessibility of the app that was used. The Our Story app is a free, with no in-app advertisements and has been used in other research projects with young children (Kerawalla, 2014; Kucirkova et al., 2017). Additionally, the decision to use the ‘Our Story’ app in the study was based on the high ratings of the app when using two classification models of educational apps: Highfield and Goodwin’s (2012) and Cherner, Dix and Lee’s (2014).
The Highfield and Goodwin model classified apps from a pedagogical design perspective and looked at the cognitive investment required by the learner. The three types of pedagogical designs included (1) Instructive Apps, (2) Manipulable Apps, (3) Constructive Apps. Instructive apps were those that mimicked a more drill and practice approach to learning and were characterised by having prescribed tasks, therefore eliciting a homogenous response from the learner. It is believed that about 74% of the apps that were surveyed by Goodwin (2012) fell into this category. Manipulable apps were seen as requiring more cognitive investment as they allowed for guided discovery and experimentation, but within a pre-determined context. Lastly, constructive apps required the highest level of cognitive investment were characterised by a more open-ended design, which allowed the learner to create their own content or digital artefact using the app. As Goodwin (2012), positively pointed out through her research on the implementation of iPads in the classroom setting, “teachers believed that optimal use of the iPads were attained when students used content-creation ‘productivity’ apps as this developed higher order thinking skills and provided creative and individualised opportunities for students to express their understanding” (p.6, 2012)

The ‘Our Story’ app is classified as a constructive app, it is open-ended and allows for the learner to create their own personalised stories. Due to the fact that the app is open-ended it allows for more flexibility for me and practitioners to work around the app and create more diverse activities that aligned with the research question.

The Cherner, Dix and Lee (2014) model classified educational apps into 4 categories (1) Skill-based (2) Content-based (3) Function-based and (4) Educational Misfits. Skill-based apps are instructive in nature, they focus on the mastery of a specific set through recall, rote memorization, and instructions strategies. The content-based category is when the learner is provided with access to
large amounts of information, with more autonomy over navigating compared to the skill-based
apps. The third category, function-based apps, refers to apps that act as a platform to help
transform learning information into a usable form, these apps often offer an element of
connectively which allows the user to share their learning in various electronic forms. Lastly, the
category of educational misfits is simple apps that have little or no educational merit. The Our
Story app falls in the function-based category as it allowed for the young learner to transform
their understanding of the world into a digital story and share this story with other people. In
both models, when viewed from a Bloom’s Taxonomy perspective, a function-based app would
fall under the evaluating and creating level, where the educational objectives are of higher
complexity.

3.6 Scoping Study: Parental/Caregiver Questionnaire

In this section I provide a rationale for using a scoping study in the form of a questionnaire. This
scoping study, together with the literature review, led to the research questions related to the
design-based research. This section also provides details about the structure of the
questionnaire, type of questions presented in the questionnaire and the methodology of the
scoping study. The aim of this study was to address RQ1: What attitudes and opinions do parents
have towards young children’s use of mobile touch screen technology?

3.6.1 Rationale

A scoping study is usually considered to be a preliminary investigative process through the
synthesis and analysis of a wide range of research and non-research material to provide greater
conceptual clarity and understanding about a specific topic (Davis et al., 2009). The decision to
conduct an initial scoping study was to inform the formulation of the research question and the
development of the research design. Although the term ‘scoping study’ is often associated with a
form of literature review (O’Brien et al., 2016), the use of a scoping questionnaire survey is presented as one of the three main methodological approaches used in scoping (see Figure 3.2).

Figure 3.2 Scoping Study (from Davis et al., 2009)

<table>
<thead>
<tr>
<th>Methodological approaches used in scoping</th>
<th>Literature review surveys</th>
<th>Literature review plus stakeholder/key informant type consultancy</th>
<th>Literature review, policy and related documentary analysis plus stakeholder/key informant type consultancy</th>
<th>Questionnaire surveys</th>
<th>Literature review and questionnaire survey</th>
<th>Workshop focus groups, questionnaires and pilot evaluation of training</th>
<th>Focus groups, interviews and secondary data review</th>
</tr>
</thead>
</table>

3.6.2 Questionnaire Design

The questionnaire was targeted at parents or caregivers of young children. In this section the rationale for selecting this methodological approach is provided followed by a description of the content of the questionnaire.

**Justification** Questionnaires, like most methods of collecting information, have both disadvantages and advantages. It needs to be acknowledged that questionnaires are not a tool to understand the complex reasons behind attitudes or beliefs. In addition, there have been criticisms of attitude ratings such as Likert scales, because there are uncertainties about whether the “linear continuum is necessarily correct” (Oppenheim, 1992). However, Likert-scale questions have been one of the most commonly used methods for measuring affective variables and collecting opinions, particularly in the realm of education, and have offered one of the most feasible ways to quantify abstract constructs (Nemoto & Beglar, 2014). Further reasons for selecting a survey design approach using a questionnaire was the potential to collect descriptive
and factual information in a relatively short space of time which could be efficiently coded for analysis (Fowler, 2013), and the anonymity it allows.

**Content** A series of attitude statements were constructed in line with the previous literature about parental attitudes towards digital technology (see appendix 11 for the supporting literature of each Likert question). The questionnaire concerned a variety of issues and it included a combination of both closed and a few open-ended responses to allow parents to share additional thoughts and insight on the subject matter.

The questionnaire had five main sections (1) Introduction/Parent’s Use of Technology (2) General Information about the Children of the Parent’s/carer’s (age, etc.) (3) Children’s Device usage (4) Issues about Choice and Selection of App for Children (5) Parental Perspective about Children’s Use of Digital Technology. The sections on Device usage and App Selection were based on the items in a previous questionnaire (“Exploring Play and Creativity in Pre-Schoolers’ Use of Apps”; the first author of the report was contacted and granted permission for the adaptation. As for the parental perspective section, this was in part based on previous research and in particular on a cross national study “Young Children (0-8) and digital technology: A qualitative exploratory study across seven countries” (Chaudron, 2015). These in-depth parent and child interviews identified concerns of addiction, health, and the decline in children’s psychosocial development.

The initial questionnaire was piloted with 5 parents, one being a non-native English speaker to see how long the survey took to complete and to get feedback on any questions that were potentially confusing. On average the survey took less than 10 minutes to complete, and changes were made to make the instructions clearer. Copies of the two questionnaires are provided in appendix 2.
3.7 Semi-Structured Interviews with Practitioners

The semi-structured interviews was used to address two research questions. The first concerns RQ2: What attitudes and opinions do practitioners have towards young children’s use of mobile touch screen technology? The findings from this part of the semi-structured interview are presented in Chapter 5. The second concerns RQ4: Can the activity design and re-design process increase cooperative learning when young children are using mobile touch screen technology? This part of the interviews was used collect information about young children’s collaboration and their ideas about increasing collaboration. Their ideas about increasing collaboration are presented in chapter 5.2.2, as these ideas were part of Design Based Research to increase cooperation.

3.7.1 Rationale and Composition of Semi-Structured Interviews

The reason for choosing semi-structured interviews was because it allowed for similar questions to be asked of all interview participants (Silverman, 2000), while still allowing for flexibility to probe further or expand on relevant ideas. The semi-structured nature of the interview enabled the data to be comparable across participants, although there can be a risk in semi-structured interviews of losing an opportunity to see how the participants themselves structure their own ideas compared to a non-structured interview (Bogdan & Biklen, 1992). The appropriateness of using a semi-structured interview because of its adaptability and theoretically driven framework to gather information on the practitioner perspective is appropriately captured in this Galleta and Cross (2013) explanation on the benefits of using a semi-structured interview,

“It is sufficiently structured to address specific topics related to a phenomenon of study, while leaving space for participants to offer new meaning to the study focus...the arrangement of questions may be structured to yield a considerable and often multidimensional streams of data. A key benefit of the semi-structured interview is its
attention to lived experience while also addressing theoretically driven variables of interest” (2013, p. 24)

Thus, structure and progression of the questions were of great importance in framing the narrative. The questions at the beginning of each section in the interview were broad open-ended questions to get an overarching view of how the practitioners perceived the concept, before narrowing down the questions to more theoretically driven and more action-based issues.

3.7.2 Interview Content

The semi structured interview had four sections. The initial section of the interview included an opening to introduce myself and establish rapport with the interviewee. At the outset it was made clear that there were no right or wrong answers and that all the comments provided would be helpful toward increasing my understanding of the use of mobile touch screen technology with young learners. After this brief introduction, an explanation of how the interview was going to be anonymised was given, then consent was obtained, and the tape-recorder was turned on. The first few questions were aimed at getting to know each individual educator on a personal level as well as obtaining data regarding their professional background. Interviews are more productive when regarded by the participant as a social, interpersonal encounter rather than a data collection exercise (L. Cohen et al., 2013).

The second section concerned the practitioner’s general perspective on collaboration and cooperation in early years education. This section served the purpose of obtaining the practitioner’s perspective on their understanding of the term and concept of ‘collaborative learning’ in the early years that was relevant to research question 2. The interview questions were structured so as to give the practitioners an opportunity to provide concrete examples from their personal experience in teaching and expand on their understanding of the term.
The third section addressed the practitioner’s perspective of mobile touch screen technology, particularly where they stood in relation to the adoption of this technology in pre-school settings. The questions were aimed at exploring the benefits and barriers they felt that this technology had on the education of young children. In order to prevent the interview from being too onerous on the individuals involved, I also included a small interactive task, known as the “I See, I Think, I Wonder” adapted from Project Zero’s Visible Thinking website (Harvard Graduate School of Education, 2009). Participants were presented with an image of a pair of children playing on the iPad. They then had to describe what they saw (I see), what they thought about the image (I Think), and if they had any questions for the characters in the image (I Wonder).

The last section was on the process of designing a learning activity, and also the presentation of the app “Our Story”. This section outlined the software capabilities through a short demonstration and then engaged the practitioner in thinking about how they could incorporate it in their setting. More general questions regarding how they normally planned for learning activities were also asked to gather data on the general process of planning a learning activity.

Using a semi-structured interview approach allowed for more flexibility and the interview to be driven by the participant, which is more likely to encourage richer responses (L. Cohen et al., 2013). Furthermore, the interview questions were intentionally ‘open’ to provoke as much information from the participant as possible. Occasionally I would ask the participant to expand further on their answer. As the researcher, I had an overview of a structure that I followed (see Appendix 12), but I stayed flexible to collect relevant data.
3.7.3 Data Collection Process

To aid accurate data collection, the interviews were audio recorded with the participants’ permission using a digital recording device (Sony ICP-PX370) and with my phone (Samsung Galaxy S8) as a backup. This was less obtrusive when compared to video recording (Cohen et al. 2013) but did not capture the participant’s non-verbal expression. I made notes, where appropriate, to counter this concern. Each interview was conducted in a location chosen by the participant during school hours and lasted between 30-45 minutes. The choice of venue, which was usually in a classroom, was mainly for convenience but also to help the participant fell at ease.

The audio recordings allowed for playback and checking. Each interview was transcribed fully by me for analysis. The transcription of data is a crucial step for analysis but has potential for data loss and distortion (Cohen et al., 2013). Therefore, precautions were taken by using two recording devices in order to get the most accurate recordings. In order to preserve participants’ anonymity two steps were taken, pseudonyms were used and any specific places that could identify the participant were anonymised.

3.7.4 Data Analysis

The audio recordings for each semi-structured interview were transcribed verbatim. Thematic analysis (Boyatzis, 1998; Braun & Clarke, 2012) was used to code and analyse the transcripts. I employed a textual analysis approach, which involves coding statements based on their key concepts, clustering these coded concepts into themes, and revisiting themes several times to delineate and refine them (Fiese & Bickham, 1998). I adapted Braun & Clark’s 6 phases (2006) and Bryman’s 4 stage (2001) process as they both presented a systematic and similar way of approaching the data. The stages and examples from the original data source of each stage are outlined below. I used an inductive approach, meaning that it was a bottom-up approach and
allowing the themes to emerge from the data that specifically related back to the research question. This approach as opposed to a deductive approach also allowed for the mapping of themes to closely match the content of the data. The decision to take on an inductive approach and experiential orientation to the data was an active choice on my part, in wanting to stay true to what the practitioners had to say relative to their context and explore new concepts that have not been previously touched upon in other research findings.

The 4 stages included (1) Initial Read Through and Annotation, (2) Generating Initial Code, (3) Identifying Themes, (4) Relating general theoretical ideas to the text. The general framework of Bryman's 4 stages was followed, but the procedure used at each stage was developed to incorporate other components of analysis from other researchers (Braun & Clark, 2006). The 4 stages are discussed below and the product of the analysis in stages 3 and 4.

The first stage involved listening to the audiotaped interviews and reading the transcript to get a feel of the interview and familiarising myself with the answers. The questions that were asked in this stage to help think about the transcripts were taken from Braun and Clark (2018) and included: What kind of world is revealed through their accounts? A brief example from P2’s answer about the negative aspects of MTST illustrates this:

P2: “Bad things are I think some of them can just sit and sit and not interact with anybody else and there is no talking there. And their communication is just with colours, screen, a box. I don’t like them sitting on their own for too long cause of them will just stay and play”

The initial interpretation included (a) P2 is able to report negative feelings towards the technology, (b) lack of interaction with other children while using the technology, (c) when playing on the computer it is perceived as a one-way communication, and (d) not engaging in other
activities. The extract here shows the richness and complexity of some (but not all) of the transcripts and my analysis of such answers.

The second stage was re-reading the interview script and generating the initial codes. The codes that were generated were a mix of descriptive and interpretative. The codes were viewed as the building blocks of the analysis, they “provide a label for a feature of the data that is potentially relevant to the research question” (Braun & Clarke, 2012, p. 61). A code can provide a summary for that portion of data, and such descriptive codes were made at the semantic level. An example of this is “Lack of interactions with others” in Table 3.6. There are also codes that are more interpretative or latent codes, that offer a more conceptual interpretation of what the practitioner said. An example of this is “proficiency in using the technology”, because although the practitioner is not explicitly saying that they are proficient at using the technology it can be inferred from their re-telling of the story.
Table 3.6 Example of a Coded Transcript

<table>
<thead>
<tr>
<th>Transcript</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>R: I am interested in what I call Mobile Touch Screen Technology, so things that are portable like Tablets and mobile phones. So what do you think, if any, are the good and bad thing about it for young children?)?</td>
<td></td>
</tr>
<tr>
<td>P2: Bad things are I think some of them can just sit and sit and not interact with anybody else and there is no talking there. And their communication is just with colours, screen, a box.</td>
<td>Lack of interactions with others</td>
</tr>
<tr>
<td>I don’t like them sitting on their own for too long cause of them will just stay and play.</td>
<td>Lack of engagement in other activities</td>
</tr>
<tr>
<td>The good side is they’re communicating with their friends, like playing alongside and they can take their own pictures as well. We said as well, if we had say, Skype, just Skype to different children across the world, no but they ...</td>
<td>Possibilities of interactions with others</td>
</tr>
<tr>
<td>we had like a recorder down that end (points to another room) and they absolutely love recording themselves and like even making ...</td>
<td>Communications with others (virtually)</td>
</tr>
<tr>
<td>There were some that would put the record on and recording us like ... and we didn’t even know. And you look back and you are like they are recording us talking, we didn’t even know. It was just in the background, we didn’t know but they would like record us and you can hear us as well.</td>
<td>Connection to the internet</td>
</tr>
<tr>
<td></td>
<td>Children enjoyment of the technology</td>
</tr>
<tr>
<td></td>
<td>Proficiency in using the technology</td>
</tr>
</tbody>
</table>

The third stage was identifying the themes that were present in the codes. The codes were grouped together and checked for emerging patterns, for variability and consistency in and across the two settings. A theme was considered to “captures something important about the data in relation to
the research question and represents some level of patterned response or meaning within the data set” (Braun & Clarke, 2006, p. 82). It should be noted that the process of identifying a theme was a constructive process as opposed to passive process of trying to find the theme hidden in the data. The key to identifying a theme was the clustering and merging of codes that appeared to share some unifying features, and told a meaningful narrative found in the data. For example, in the data I noticed clustering around technology use and the future of technology, upon examining these in more detail they shared a common concept on the practitioner’s acknowledgement of technology being a prominent feature in our day to day lives. I then constructed a theme using all the codes relating to when practitioners talk about the presence of technology.

The final stage involved relating the general theoretical ideas to the transcript, recognizing that coding and identification of the theme is an essential part of the analysis, but interpreting and reviewing the potential themes is as important to see how the theme answered the research questions and related to larger theoretical ideas that are present in the literature. This involved revisiting literature with regards to a particular theme that was identified from the data or renaming the theme to better reflect what is represented. In this stage Bruan and Clark argue that the process should be driven by the question “So what?” What is relevant or useful here to answering my question? This process of telling an analytic narrative around the data extracts was undertaken for each of the themes. It is also important to point out that unlike quantitative research the process of analysis is not a fragmented process, coding and analysis are naturally interwoven in the qualitative research. In this stage, it was also important to consider how the theme related to the other themes, although each theme should be given its space, it should also be evident how it related back to the research question and to the other themes. The analysis needed to make interconnection between themes and say something overall about the data set.
3.8 Design Based Research

The literature review and the findings from the scoping study led to the formulation of RQ3 & RQ4 to investigate and promote cooperation when using MTST in the early years.

Research Question 3: What forms of social and computer interactions occur when young children are encouraged to learn cooperatively on mobile touch screen technology in pre-school settings?

Research Question 4: Can the activity design and re-design process increase cooperative learning when young children are using mobile touch screen technology?

The design-based research (DBR) approach appeared to be especially suitable way to promote cooperation between young children in an educational context (see chapter 2). However, the DBR approach does not lend itself to a neat methodological description because the interventions and evaluation are interwoven together. In this section, I first provide an overview of the activities that made up the DBR study conducted as part of this thesis and the rationale for the use of DBR. Then, details of the pre-school participants are provided together with details of the two settings in which the research was conducted, the rationale for the choice of an app as well as an outline of the timeline for the DBR. The next section provides details about what was done to promote cooperation. The last section contains information about the video recordings of cooperation, details of the recording process, and information about the coding of cooperative behaviour.

Overview of DBR and Rationale for its Use

Design-based research can be viewed as a methodology where there is a blend between an empirical educational research design and a theoretically-framed design of learning environments (Sandoval & Bell, 2004; The Design-Based Research Collective, 2003). The fundamental goal of this methodology is to develop effective learning environments and use these learning environments as a natural laboratory to study teaching and learning in an existing ‘real world’ context. Design-
based research is believed to help create and extend knowledge about developing, enacting, and sustaining innovative learning environments.

There are five components of this method of investigation and intervention outlined by The Design Based Collective (2003) to help ensure the quality of a good design-based research. Each component will be outlined and a brief explanation of how it is addressed is provided. The first component is that the learning environments and developing theories have to be intertwined. This component is addressed in the research for the thesis through a literature review on early childhood learning theories, MTST research, and the literature surrounding collaborative learning. Second, an element of continuous development is embedded in the research design, in which there is the process of iterative design, enactment, analysis, and redesign (Collins, 1992; Stanton et al., 2001). This particular component is present in the different phases of my research including a semi-structured interview, implementation with children, post-implementation interview, and redesign, allowing for a reflective process to occur. Third, the aim of the research should result in sharable theories that provide relevant implications to practitioners and other educational designers (The Design-Based Research Collective, 2003). In my research, the hope was that the findings will provide insights about the use of MTST in early childhood settings. Fourth, research should relate to the way designs function in authentic settings. The involvement of practitioners is fundamental in ensuring the authenticity of the study, as is the observation of children in a non-experimental naturalistic setting, and a rigorous analysis can give insight into the success or failure of the technology. Fifth, the development of such accounts should rely on methods that can document and connect processes of enactment to outcomes of interest. These procedures were followed by an intensive analysis, with a selected group of children, of an initial session and a later session after the redesign. These analyses of children’s activities provided the basis for a detailed consideration of cooperative behaviour.
Educational research in early childhood is an eclectic field that incorporates a broad range of areas ranging from educational psychology to social development, cultural psychology, and developmental psychology. In addition, there is also the layer of educational technology that has been added to the mix in my research. Thus, selecting an appropriate research methodology to address the research questions is essential. Design-based research was selected due to the nature of the research questions and because it appeared appropriate to involve practitioners in an iterative research process. Another important consideration was that DBR acknowledges the complexities of educational research, and the need for selecting a method that can take into the account the naturalistic context, the intricacies of the outcomes, and importantly the involvement of practitioners who bridge the gap between research and practice (Design-Based Research Collective, 2003).

3.8.1 DBR Study (Phase 1, 2, and 3): Activities and Processes to Promote Cooperation

This section begins with a description of three phases which make up DBR process, followed by section that outlines how part of the semi-structured interviews helped in the initial design of the activity used to support cooperative learning. Following this is a description of the initial activity and details about the redesign of the activity. Due to the nature of the redesign process, although an overview of the redesign of the activity will be presented here, a detailed account of what was used to redesign the activity which was based on a preliminary analysis of the video data and parts of the practitioner’s interview will be presented in Section 3.7. The decision to address the redesign of the activity in a separate chapter, was because it better showcased how the practitioner’s influenced the redesign process based on the findings presented in chapter 5. The methods used for observations and analysis with Phase 2 and 3 (video recordings), will be addressed separately in section 3.8.2.
3.8.1.1 Research Design and the Design Cycle in this Investigation

My research design utilized the DBR process that involves a design cycle based on models of predictive research, design research, and scientific research in education (Amiel & Reeves, 2008; Middleton et al., 2008). For my study I have divided the design cycle into three phases as outlined in Table 3.7, which summarises my description of the three phases. Table 3.7 also show where each method is discussed in this chapter.

Table 3.7 Design Based Research Overview

<table>
<thead>
<tr>
<th>Phase</th>
<th>Process of Design</th>
<th>Enactment &amp; Analysis</th>
<th>Using Re-design &amp; Later Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase 1</strong></td>
<td>• Naturalistic Observation and Interview with Practitioners</td>
<td>• Observation of Children’s Initial use of MTST and the learning activity</td>
<td>• Video Recordings of Children using MTST with the initial and redesigned learning activities</td>
</tr>
<tr>
<td><strong>Phase 2</strong></td>
<td>Semi Structured Interview of 9 early childhood education practitioner’s Section 3.5</td>
<td>Video recordings 12 students (6 pairs) to analyse interactions and guide redesign of activity</td>
<td>Video recordings 12 students (6 pairs) to analyse interactions in the redesigned activity Section 3.8.2</td>
</tr>
<tr>
<td><strong>Phase 3</strong></td>
<td>Thematic Analysis Reflection on Field Notes</td>
<td>Reflection on observations, discussion with practitioners of observations, discussion of selected recordings with research team</td>
<td>Systematic Video Analysis of selected pairs • Coding for Eye Gaze, Contact, and Transfer of Possession</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Analysis</th>
<th>What was Produced</th>
<th>What was Conducted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi Structured Interview of 9 early childhood education practitioner’s Section 3.5</td>
<td>Reflection on observations, discussion with practitioners of observations, discussion of selected recordings with research team</td>
<td>• Transcription of Interview recordings • Initial Activity Design o Digital Story o Activity Script</td>
<td>• Naturalistic Observation and Interview with Practitioners</td>
</tr>
<tr>
<td>Video recordings 12 students (6 pairs) to analyse interactions and guide redesign of activity Section 3.8.2</td>
<td>Systematic Video Analysis of selected pairs • Coding for Eye Gaze, Contact, and Transfer of Possession</td>
<td>• Redesign of Activity o Digital Story o Paper Based Planning o Activity Script</td>
<td>• Observation of Children’s Initial use of MTST and the learning activity</td>
</tr>
<tr>
<td>Video recordings 12 students (6 pairs) to analyse interactions in the redesigned activity Section 3.8.2</td>
<td></td>
<td></td>
<td>• Video Recordings of Children using MTST with the initial and redesigned learning activities</td>
</tr>
</tbody>
</table>

Phase 1. Phase 1 was the beginning of the process of design and involved an authentic exploration on the current situation of how mobile touch screen technology was being used in the
classrooms. It should be noted that procedure for the process of design involved 2 main components (1) practitioner’s perspectives, (2) naturalistic observation. The practitioner’s perspective was obtained through semi-structured interviews in the initial design and through informal meetings in the re-design. The ideas from the practitioner’s helped in the design of a digital story that was used at the beginning of the activity as well as the activity itself. The naturalistic observation on the other hand was critical in seeing how the children were currently interacting with the iPad in the setting. During the discussions, I worked in collaboration with the practitioner in developing a more comprehensive understanding of the situation as well as in the process of designing the cooperative learning activity. Additionally, there were classroom observations and field notes of activities including with iPads, the observations allowed the investigator to first see children in their natural context and how they were interacting with these devices. Their physical positionality and location of use showed that the devices were often used on the floor and a specific area was allocated for this. Initial observation also allowed me to see how comfortable they were with interacting with the device and their overall digital skills. It became quickly apparent that children operated the devices with a lot of confidence, and ease as mentioned in the interviews. A description on the how the activity was designed is presented in section 3.8.1.6.

The type of data collected in this phase were audio recordings of semi-structured interviews with practitioners as a formative assessment to help identify characteristics of cooperative learning as well as how technology was being used in the settings. The second part of the interview was specifically designed to engage the practitioner in discussing how the iPad could be used to enhance cooperation when it was used in pairs.
Phase 2. Phase 2 involved the implementations of the activity to promote cooperation with the pre-school children that was designed in phase 1. The main type of data collected in this phase were informal observations of the cooperation and video recordings of groups or pairs of children engaged in the designed learning activity (these were analysed in the third phase). The script and initial activity design to encourage cooperation, as well as the digital story created and presented to the children are described in section 3.8.1.3.

Phase 3. Phase 3 involved using what has been learned from phase 2 to improve cooperation. This phase is critical in staying true to the design-based research model, which is iterative in nature. Following the implementation of the initial activity design, meetings were conducted with practitioners from both settings, this was to provide feedback on what was observed by me and the type of cooperation and engagement that those children displayed. These meetings were often limited due to time constraints and the large workload the practitioners already had. However, through the formal meetings and informal conversations with the practitioner a redesign of the activity was undertaken to address some of the concern regarding children being unable to produce an actual story with the app. The redesign of the activities is presented in section 3.8.1.5, the redesign of the activity also included my own observation of the children’s engagement which contributed in certain features of the redesign such as including more concrete examples to scaffold their task.

3.8.1.2 Phase 1: Methods, Semi-Structured Interviews for DBR

The use of the semi-structured interviews to answer RQ2 has been described in the previous section together with the rationale for the use of this methodology. Here the use of the semi-structured interviews to address RQ2 and RQ3 is presented (see Table 3.8) for an overview of the semi-structured interviews).
Table 3.8 Questions and structure of the Semi Structured Interview

<table>
<thead>
<tr>
<th>Sections of the Interview</th>
<th>Relevant Research Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brief Introduction and Building Rapport</td>
<td>N/A</td>
</tr>
<tr>
<td>General Perspective on cooperation in Early childhood</td>
<td>Research Question 3</td>
</tr>
<tr>
<td>General Perspective on Mobile Touch Screen Technology</td>
<td>Research Question 2</td>
</tr>
<tr>
<td>Visible Thinking Routine</td>
<td>Research Question 3</td>
</tr>
<tr>
<td>Ideas about supporting cooperation with our Story</td>
<td>Research Question 3</td>
</tr>
<tr>
<td>Perspective about Teachers as designer/researcher</td>
<td>Research Question 3</td>
</tr>
<tr>
<td>Closing Comments/Questions</td>
<td>N/A</td>
</tr>
</tbody>
</table>

3.8.1.3 Phase 1 and 2: Initial Design of Cooperative Interaction

I worked with the practitioner to set up an activity that would promote cooperation when children were using iPads together. In this section, the design and re-design of the activities will be explained. One feature of designing the DBR intervention was creating a digital story for the children to facilitate the collaborative learning process (see Figure 3.3). The design of this story was created by me and presented to the practitioners for feedback. During the learning activity, I read the digital story on the iPad to each pair of children before the ‘initial’ session in order to scaffold and set guidelines for collaborative learning behaviours. The three key behaviours that were expressed in the story were identified by the practitioners during the interview as essential collaborative learning skills: (1) Turn-Taking/Sharing, (2) Listening, and (3) Talking to their peer.

Figure 3.3 The Digital Story Book to Promote Cooperation.
The digital storybook was shared for feedback with the teachers who participated in the study. Using an iPad, I read this story to the children. Customized storybooks are a common, important feature of research into children’s cognitive development (Houssa & Nader-Grosbois, 2016; Hutchins et al., 2014).

3.8.1.4 Phase 2: Implementing Learning Activity

In this current study the process of designing the learning activity was based on consulting with the practitioner as well as based on the EYFS framework and has sociocultural learning theoretical underpinnings. The two different settings that I was working in had different experience with technology which was an important to take into consideration while designing the activity, as the level of familiarity with the device could differ and the children’s understanding of how to handle the device may also have differed. Given the context of each setting, the learning activity also differed slightly to best suit the needs of the students in each setting. However the generic use of the app was the same, thus similar instructions were used to teach the children how to navigate the app (see Table 3.9) using a variety of visual cues to help young children navigate the app more easily despite their limited reading levels. A folder with randomly chosen pictures was used to have children explore and play around with app at first before being given the learning activity.

Table 3.9 Instructions used for Initial Activity

<table>
<thead>
<tr>
<th>Verbal Instruction</th>
<th>Image Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Find the our story App

2. Press the blue button Use Existing Story button

3. Press purple button for play of our first story.
   Purple = Play
   This is how your story may look like. We are going to look at a story about how to use an iPad with a Partner. This is how we swipe to the next page.

4. Press the yellow return button
   Yellow = Return

5. Press the green Create New Story button
6. You should see some photos, now you can drag the image of the ice cream into the storyline on the bottom. Now you can drag the image of the children into the storyline. Move the ice cream image to the front. Delete the flower image by drag the image up.

7. Give children some time to explore this before moving on to the instruction on taking and adding photos.

8. Press the camera icon to take photo

9. Press the ‘All photo’ folder to view photos

London School

In the London School the children’s learning activity was to re-create the story Jack and the Beanstalk and having each pair act out their own scenes. This was based on actions that had already been learned in class and were motions that could be performed individually. This involved taking photos of each other while acting out the story.

Reading Nursery

In the London School the learning activity was to create a story around the theme of “My Favourite Toy” and taking pictures of toys within the nursery that the children enjoyed playing with.
3.8.1.5  Phase 2 and 3: Re-Designing the Learning Activity

Following conversations with the practitioners, specific challenges were identified in order to produce a better design in the hope of further supporting the cooperation amongst the pairs of children. Based on the initial activity, it was observed that there were different incidents that seemed to trigger more cooperation, which included: (1) task explicitly requires both parties to participate (i.e. taking photos of each other); (2) revision of the story together, and (3) helping each other to find letters for spelling out thing that involved peer teaching peer of technical matters. In order to encourage these actions, I made the task more explicitly about the children creating a story about each other. A more detailed outline of how the task was redesigned is presented in the following section.

Observations of the sessions and looking at the video recordings indicated that, turn-taking appeared to be most dependent on the dynamic of the pair, for example one child being too immersed in the app and forgetting about their partner, and/or the inability of the child to convince the other why he/she should get a turn. In order to address this issue, I made a visual reminder (a printed piece of paper with images) about sharing, talking, and listening to their partner. These visual cues were used as a question prompt to intervene if there appeared to be a dominant character in the partnership.

A problem identified with the children re-creating Jack and the Beanstalk story on an iPad was an issue of re-call, the movement was a motion rather than still-frame pictures, thus it was harder to capture as picture and would have been better done as video recordings. Additionally, the children were more excited about interacting with the app rather than creating a story. This was addressed by creating a planning phase in which the children would fill in a planning sheet prior to using the iPad to create their story.
In general, more visual prompts were used to guide the children’s independent use because of their limited reading level and the redesign included five major changes as listed in Table 3.10.

Table 3.10 Redesign of cooperative learning activity

<table>
<thead>
<tr>
<th>Design</th>
<th>Addition/Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Learning prompt: We are going to create a story about you and your partner.</td>
<td>Change from Jack and the Beanstalk</td>
</tr>
<tr>
<td>2 Introducing how to add text to story</td>
<td>Addition</td>
</tr>
<tr>
<td>3 Visual Reminders: A paper based reminder of Sharing/Listening/Talking</td>
<td>Addition</td>
</tr>
<tr>
<td>4 Example Story: A sample story about me and my partner</td>
<td>Addition</td>
</tr>
<tr>
<td>5 Structured Written Planning Sheet</td>
<td>Addition</td>
</tr>
</tbody>
</table>

3.8.1.6 Activity Design

As part of the DBR process, the development of an instructional tool or, in this case, a learning activity is a fundamental part of this research methodology. DBR has no specific guidelines for
what needs to be incorporated in the learning activity or how the activity will be evaluated and analysed (Anderson & Shattuck, 2012; Scott et al., 2020). Instead, the process of designing the intervention should be grounded in theories of learning (Cobb et al., 2003), and measurable changes in students (Anderson & Shattuck, 2012). Another integral part of the DBR processes is that the activity’s design is drawn by the participants’ active participation (Amiel & Reeves, 2008). Therefore, designing this activity was driven primarily by the themes from the interviews, explicit suggestions from the practitioners, my suggestions, alongside recommendations and discussion with my supervisors. Each component is broken down in this chapter, and an overview of the redesign is addressed in further detail here as well. The interviews influenced the design of the cooperative activities in several ways. The activity design for my study comprised three main components: the facilitator script (how the activity is presented), the learning activity (what do we want the children to do), and the digital story (how to scaffold for cooperation). There were two sessions when pairs of children carried out a task on iPads, a ‘initial session’ and a session referred to as ‘redesign’. Both sessions were structured to promote cooperation, in the second session there was a modification to the initial support based on informal observations and input from practitioners. This chapter will outline the process of designing the learning activity, starting with how the practitioner’s response to the semi-structured interviews informed the design, and then presenting the actual learning activity and its redesign.

3.8.1.6.1 Brainstorming of activity design from Interview

Towards the end of the interview, in the last set of questions that covered ideas about supporting cooperation with the app Our Story, I demonstrated the default story on the app, and explained some of the basics features of the app. I followed this with this interview question:

*Interview Question 21: If we were going to give pairs of children ‘Our Story App’, how would you design the activities to encourage collaboration?*
Table 3.11 is a summary of all the participants’ responses to that question. Only one practitioner, P1, demonstrated some reluctance in the appropriateness of introducing the app to such a young age group and felt that a printed version was more appropriate. However, all the other practitioners felt that the children would be able to work in pairs on the app. P2, P6, P7, and P9 all mentioned the importance of some kind support and guidance by the facilitator. There was a focus on how the activity could be structured rather than the design of the learning activity itself. P3 and P4 felt that the app could be left more open-ended and explorative. P5 and P8 provided the most detailed description of a learning activity and a story that the children could focus on creating. The practitioners all appeared engaged when I was introducing the app and asking for their suggestions. All were enthusiastic about the possibilities, even P1 felt that the app was a useful tool to create a printed version of a digital story.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Summary of their response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>P1</td>
</tr>
<tr>
<td>---------</td>
<td>----</td>
</tr>
<tr>
<td></td>
<td>P2</td>
</tr>
<tr>
<td></td>
<td>P3</td>
</tr>
<tr>
<td></td>
<td>P4</td>
</tr>
<tr>
<td>London</td>
<td>P5</td>
</tr>
<tr>
<td></td>
<td>P6</td>
</tr>
<tr>
<td></td>
<td>P7</td>
</tr>
<tr>
<td></td>
<td>P8</td>
</tr>
<tr>
<td></td>
<td>P9</td>
</tr>
</tbody>
</table>

Overall, I found it difficult to obtain a clear and detailed plan from the practitioners of a learning activity that they wanted to use with the app. I think this could be attributed to different reasons, first and foremost was the already overwhelming amount of work that practitioners had to do. Throughout my data collection I witnessed first-hand interruptions during interviews from parental phone calls, and I had to reschedule video data collection due to an Ofsted inspection. Secondly, my positionality as an outsider conducting research created some distance between me and the staff. There appeared to be an underlying assumption that I would be leading the research, working independently, and that their involvement was not essential, which appeared to be their preference and they seemed content with that. It is worth noting that it was also never made explicit that their opinions were essential to the design of the research. Some of these barriers were overcome by initially volunteering at the school and scheduling my meetings during
their team meeting time, so all the teachers were present and aligned in their understanding of what I would be doing. However, the day to day demands of the practitioners meant that I also had to be flexible and make some informed independent decisions.

Table 3.12 shows how two of the themes from the interviews informed the activity-based design. Two of the themes, which are in bold with an asterisk, (1) Developing Social Skills and (2) Role Modelling played a major role in the design of the activity as these themes are grounded in the sociocultural learning theory and supported my previous literature in early childhood education. The importance of developing social skills is not only explicitly cited in the national curriculum (Department for Education, 2017), but has been repeatedly reported in studies that reinforce how development of social skills in the early years lay the foundation for later academic success (Lynch & Simpson, 2010; McClelland et al., 2000). Furthermore given that a key feature of the sociocultural theory, is the belief that all development starts with social interaction (Vygotsky, 1978), the importance of learning social skills is expected. Another main premise of the sociocultural theory also acknowledges that the learners can be supported by, a more experienced peer or teacher to role model appropriate behaviour (Brown et al., 1989; Tharp & Gallimore, 2013).
Table 3.12 Themes and Activity Design

<table>
<thead>
<tr>
<th>Themes from interviews</th>
<th>How the themes were incorporated into design</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mobile Touch Screen Technology</strong></td>
<td></td>
</tr>
<tr>
<td>The Ubiquity of Technology</td>
<td>The usage of the iPad was already a standard device for the children for the implementation of the activity.</td>
</tr>
<tr>
<td>Ability in Using MTST</td>
<td>The selection of the Our Story took into consideration these children’s ability to navigate on the iPad; the facilitator also had a clear script that explained verbally how to use and navigate through the app. Given what was known from the interviews and observations regarding their ability to swipe and tap, those specific skills did not need to be re-taught.</td>
</tr>
<tr>
<td>Use in Moderation</td>
<td>This theme was addressed by setting a designated time limit for the activity (15-20 minutes).</td>
</tr>
<tr>
<td>Value of MTST</td>
<td>The overall design of this study was to utilize and promote some of the potential benefits of technology – that it could support children’s learning.</td>
</tr>
<tr>
<td>Negative Aspects of MTST</td>
<td>The overall design of this study was to address some of these concerns, particularly children being too passive while engaging with the devices.</td>
</tr>
<tr>
<td>Children learning from other children</td>
<td>The overall design of this study was to utilize and promote some of the potential benefits of technology – that it could support children’s learning.</td>
</tr>
<tr>
<td><em>Developing Social Skills</em></td>
<td>This theme was used as the foundation for the digital story (see Figure 3.4). The skills that were highlighted in the digital story were: listening, communicating with peers, and sharing.</td>
</tr>
<tr>
<td>*Role-Modelling</td>
<td>This theme was used as the foundation for the verbal script for me to do an initial demonstration and the digital story. This theme was viewed in conjunction with the theme of scaffolding.</td>
</tr>
<tr>
<td>Developing Caring &amp; Empathy</td>
<td>This theme was not central to the design as it more accurately referred to older children working with younger children. However, aspects of sharing were emphasized in the digital story.</td>
</tr>
<tr>
<td>Terminology</td>
<td>This theme was not particularly relevant to the design. However, the word ‘collaboratively’ was used in the title page of the digital story, and the concept of pair work was discussed with the students.</td>
</tr>
</tbody>
</table>

In the final part of the semi-structured interview, which aimed to gather information from the practitioner to help with the activity design, I asked questions regarding their normal process of designing learning activities (see Appendix 12). After rereading through the interview transcripts, I identified two key concepts that emerged consistently in both settings, which were (1) Scaffolding and (2) Personalized Learning. These two concepts were incorporated into the design of the activity, as seen in Table 3.12. The concept of scaffolding is linked with role modelling, and as Hall (2007) explains their importance in the context of sociocultural theory,
“Modelling concerns providing examples of expert behaviour that include explanations ... and scaffolding is the provision of structure or prompts in the learning environment. These strategies all provide support both within a course structure and through individual or spontaneous feedback to help learners gain mastery in the use of new tools.” (Hall, 2007, p. 101)

Therefore, scaffolding was viewed in parallel with modelling during the design process, as presented in Table 3.12. Additionally, the concept of personalized learning that the practitioner bought up referred to the fact that when planning for any learning activity, the practitioners needed to keep in mind the children's different needs and ensure that the activities were meaningful and contextually relevant to the students. The term, personalized learning encompasses a wide range of possibilities (Bulger, 2016) but the type of personalized learning that the practitioner was referring to in this interview focused on ensuring that activity matches the learners' interest and experiences, also known as 'context personalization' (Walkington & Maull, 2011). Previous research shows that context personalization positively affects learning across different age groups (Cordova & Lepper, 1996; Kucirkova, Messer, & Sheehy, 2014).

Table 3.13 Key concepts in process of learning design used for the DBR activity design

<table>
<thead>
<tr>
<th>Key concept from interviews</th>
<th>How the concepts were incorporated into design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scaffolding</td>
<td>This approach was used as the foundation for the verbal script for me to do an initial demonstration and the digital story and was viewed in conjunction with the theme of role-modelling.</td>
</tr>
<tr>
<td>Personalized Learning</td>
<td>This was used as part of the learning activity, in that the children could create their interpretation of the story. They were guided to specifically take pictures of each other to create a sense of ownership and making the activity more personalized.</td>
</tr>
</tbody>
</table>

Figure 3.4 presents a concept map of how relevant idea from the interviews were expanded and taken into consideration during the design process. The digital story was incorporated into part of
the design to support role modelling and to scaffold the specific social skills needed during the activity. A clear facilitators’ script was used to ensure clear and consistent explanations across all the pairs. Lastly, the actual learning activity was grounded on the concept of allowing the children to feel a sense of ownership in the creation process, by having them take their own pictures and having them work on familiar storytelling ideas. Once the digital story, script, and activity were created, they were presented back to the practitioners for recommendations and feedback.

Figure 3.4 Activity Design - Mind Map

3.8.1.6.2 Initial Design of Digital Story for Session One

The design of the digital story was predominantly aimed at helping to role model and scaffold appropriate partnership behaviours. These specific behaviours were taken from the interviews as behaviours that practitioners wished to see in cooperative pairs. The three main ones being children listening to their peers, communicating their ideas to their peers, and sharing with their peers. These concepts were translated into three words more appropriately used to explain them
to this preschool age group, namely: share, listen, and talk. Table 3.14 shows an outline of the
digital story and which theme was addressed in each page.

Table 3.14 Digital Story Design Theme

<table>
<thead>
<tr>
<th>Social Skills</th>
<th>Role Modelling</th>
<th>Scaffolding</th>
<th>Personalized Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

The implementation of the learning activity, including the script that explains the actual learning
activity, is presented in section 3.8.1.3 includes details of changes that were made and other
components that were included in the redesign of the activity.
3.8.2  DBR Study: Observation and coding of student’s interactions – Video Recordings

In this section I will provide a rationale for conducting the observation of the student’s interactions through the use of video recordings, and then explain the choices of codes for cooperation as well as the systematic video analysis that was conducted with the data.

3.8.2.1  Rationale for Video Recording of Peer-Interactions with iPads

Video recording in educational research is often classified as a qualitative method (Bailey, 2008) which provides information about the activity that is of relevance to the research questions, however for this research project the video recordings provides a data source that allowed for specific behaviours to be quantified and take on a quantitative approach combined with a qualitative analysis (Roschelle, 2000). Given that video recording devices have become relatively inexpensive and significantly smaller in size has allowed for more enhanced observational recordings (Heath et al., 2010). In conducting research with young children, video recordings can be instrumental in capturing details regarding children’s facial expression, interactions, and dialogue with their peers and their surroundings. Flewitt (2006) argues in her paper on ‘Using video to investigate preschool classroom interaction: education research assumptions and methodological practices’ there are many benefits of using video recordings to collect data of young children,

“Video data unveil how young children use the full range of material and bodily resources available to them to make and express meaning, forcing a reconsideration of Vygotskian accounts of the relationship between thought and language by producing grounded evidence for a pluralistic interpretation of the construction and negotiation of meaning.”

(Rosie Flewitt, 2006, p. 25)

Consequently, it was believed that visual recordings of social interaction could provide a rich insight into children’s level of engagement and use of their Pads, and in this way provide information about cooperation during the sessions. This visual information is especially relevant
to young children as they express themselves physically in a different manner to adults.

Additionally, although their verbal communication is important, it should be noted that they may not always have the vocabulary needed to express themselves, therefore a holistic approach towards the data analysis is needed.

### 3.8.2.1.1 Video Data Collection Process

The process for video data collection was led by Jeremy’s Rochelle (2000) guide on “Choosing and Using Video Equipment for Data Collection”. The children’s interactions were video recorded using a camcorder (Sony DCR-SX44). It is sometimes suggested that the built-in microphones on camcorders are not ideal for data collection since they collect noise from all directions. Because of this I asked for the activities to take places in a separate part of the classroom, still a familiar place for the children, but with less audio interference. One of the most important technical accessories was the tripod, the videography tripods that was used had fluid head which allowed for smooth rotation as suggested by Rochelle (2000), and easily allowed for the adjustment of height. Placement of the tripod proved to be very important in both settings and required initial set up to get the right angle that would capture all the pairs of the children. In both settings the tripod was placed on a tablet and angled slightly down on the participants. The set for the video recording was slightly different for each settings as can be seen in Table 3.15. In the Reading setting I was able to record each pair independently as due to the class size, while in the London setting, I had to take 2 pairs at a time due to their scheduling and space.

<table>
<thead>
<tr>
<th>Table 3.15 Video Recording Set Up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading Setting</strong></td>
</tr>
<tr>
<td><strong>London Setting</strong></td>
</tr>
</tbody>
</table>


After each recording the video clips was transferred on to encrypted laptop and the recordings where deleted from the camcorder. The videos were then transferred to the video analysis software ELAN (see section 3.8.2.3.1)

3.8.2.1.2 Challenges with Video Data Collection

As with any type of methodology, video data analysis and collection comes with its own set of challenges. First and foremost video data that is collected as noted by Flewitt (2006) is not a simple ‘add-on’ to traditional data collection methods, and this particular type of data set does not necessarily translate neatly into two-dimensional verbal formats as with audio recordings. The main challenges with the video data collection is the technical challenge. The main technical challenges when video capturing children with MTST, is the possibility of the children moving around, this becomes extra challenging when I am also facilitating the activity. Thus although the activity is introduced as a stationary activity, if the children choose to move around it was more important to let them proceed naturally and readjust the camera accordingly, however this meant that parts of the video recording could be missing specific type of data. Therefore, it was crucial to take field notes and acknowledge these incidents when they occurred.

There are three dilemmas that arise with the video data collection as suggested by Rochelle (2000). The three dilemmas concern (1) detail vs context (2) Naturalistic vs quality video (3)
Storyline vs Overview. For the purpose of this research the emphasis was on detail, and naturalistic recordings to provide the best overview of the types of interaction that were occurring. The challenges that emerged was that the video recordings did not capture everything that happened, unlike the human eye the video recording are more static, and they are not able to focus or naturally zoom into a specific thing, and even if you choose to zoom on something in particular, you lose the broader activity.

3.8.2.2 The codes used to record iPad interactions
The following coding schemes were used to obtain information about cooperative and joint activities with the iPads (see rationale in section 2.4.4.2). The codes are separated into three categories (a) Eye gaze (b) Contact (c) Transfer of Possession. Following this is a description of the process of coding and data management.

3.8.2.2.1 Eye Gaze Codes
Table 3.16 and Table 3.17 provide the description of the codes used for eye gaze analysis of the observational video data.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Type of Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaze at iPad</td>
<td>The child is looking at the iPad. This includes photo taking activities even though the child is looking at the other children through the iPad.</td>
<td>On task behaviour</td>
</tr>
<tr>
<td>Gaze at Partner</td>
<td>The child looks at their designated partner.</td>
<td>On task behaviour</td>
</tr>
<tr>
<td>Gaze at Researcher</td>
<td>The child looks at the researcher.</td>
<td>On task behaviour</td>
</tr>
<tr>
<td>Gaze at Another Pair</td>
<td>The child is looking at another pair. This gaze is only applicable for the London setting as the activities were conducted in a group setting.</td>
<td>Off task behaviour</td>
</tr>
<tr>
<td>Gaze Elsewhere</td>
<td>The child is looking elsewhere, at a location not specified in the previous codes. For example, other children walking into room, worksheet, walls, so the child's gaze is on something other than their iPad, partner, researcher, or other pair.</td>
<td>Off task behaviour</td>
</tr>
<tr>
<td>Missing</td>
<td>The child is out of frame or their eye gaze is blocked by another person.</td>
<td>N/A</td>
</tr>
</tbody>
</table>
### Table 3.17 Codes for Head Orientation

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation towards iPad</td>
<td>The child’s head is orientated towards the iPad. This includes heads orientated downward when the iPad is on the table as well as when the iPad is held for photo taking activities, or when the child’s photo is being taken. This also includes when the child directly holds the iPad in front of their face.</td>
</tr>
<tr>
<td>Orientation towards partner</td>
<td>The child’s head is orientated towards their partner.</td>
</tr>
<tr>
<td>Orientation towards researcher</td>
<td>The child’s head is orientated towards the researchers or directly looking at the camera.</td>
</tr>
<tr>
<td>Orientation towards another pair</td>
<td>The child’s head is orientated towards the other pair/pairs in the group. This gaze is only applicable for the London setting as the activities are conducted in a group setting.</td>
</tr>
<tr>
<td>Orientation towards other</td>
<td>The child’s head is orientated towards any other thing that is not included above, including orientated away from the iPad and the activity.</td>
</tr>
<tr>
<td>Missing</td>
<td>The child’s entire head is out of frame or blocked by another person.</td>
</tr>
</tbody>
</table>

### Table 3.18 Codes for Contact

<table>
<thead>
<tr>
<th>Codes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Finger Touch (Touch 1)</strong></td>
<td>One finger tap or swipe on the iPad. This only includes when a child makes contact with the iPad, and does not include attempts of touching without contact, or hovering their finger above the iPad. For a one finger touch the other hand must not be touching the iPad.</td>
</tr>
<tr>
<td><strong>Hand holds and other hand touches (Touch 2)</strong></td>
<td>One hand holds or touches the iPad while the other hand touches or swipes on the iPad (excluding photo taking). This also includes when a child has their arm or any other part of their hand touching the iPad, demonstrating ownership of the device. When a child briefly lifted their hand from the iPad, and then tapped on the iPad again, this whole sequence was coded as a single hold and touch behaviour</td>
</tr>
<tr>
<td><strong>Hands holding and above table (Touch 3)</strong></td>
<td>Two hands rest (edge of screen) or hold the iPad, while part or all of the iPad is still touching the surface of the table. This code occurs during incidents of transfer of possession, reorientation of the device, or touches in between one finger touch.</td>
</tr>
</tbody>
</table>
Two Hands Above (Touch 4)

Two hands hold the iPad when the iPad is lifted above the surface of the table. This is usually photo taking behaviour.

Denies (Touch 5)

Obstruction – a child physically pushes and/or creates a barrier between them and their partner who wants to touch the iPad.

3.8.2.2.3 Transfer of Possession Codes

Table 3.19 contains the codes used to describe Transfer of Possession from the observational video data.

Table 3.19 Transfer of Possession Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>The transfer of possession appeared to be mutual with one child usually physically handing over the iPad to the other. The coding of this transfer did not always have to involve the handing over the iPad directly to the other child, but it could be one child leaning away from the iPad, to allow the other child to pick up the iPad with ease. This code often involved cooperative exchanges.</td>
</tr>
<tr>
<td>Yellow</td>
<td>The transfer of possession in this case was not fully cooperative, but there was also no clear conflict or denial to let the other child have a turn either. Often the transfer occurred too quickly or unexpectedly for the other child to react or the child in possession did not have any clear goals they were working towards therefore they appeared unconcerned about whether or not the iPad is taken away.</td>
</tr>
</tbody>
</table>
These are incidents where the transfer of possession was met with resistance, this often appeared in the form of tugging between the two partner or one child explicitly trying to cling on to the iPad. The degree of conflict varied from a clear tugging of the iPad, to the slight tensing of grip that clearly indicated an unwillingness to give up the device.

3.8.2.3 Data Management/Analysis for the codes of Video Recordings
The following sections describes how each set of codes were obtained and how they were subsequently analysed. Similar to the previous section the first section will address the use of the ELAN software then it will be divided into three subsection (a) Eye gaze (b) Contact (c) Transfer of Possession.

3.8.2.3.1 ELAN Video Analysis Software
ELAN is a computer analysis tool for audio and video recordings that was developed by the Max Planck Institute for Psycholinguistics (Tacchetti, 2017). The ELAN software provides many functionalities to code the video recording, but the main feature that was used for this research was being able to code different behaviours (e.g. gaze at iPad) each behaviour is called a tier in ELAN. The tiers that were created were time-aligned to the video recordings, and each tier that was created corresponded to a different code used to interpret the video recordings.

Table 3.20 provides an example of all the tiers that have been created for each video analysis, and the type of statistics that is produced by the software. For ease of analysis, selected tiers can be made visible or invisible at any given time to compare specific features.
An example of what the software looks like, and the tiers is given in Figure 3.5. Once the video is imported into the software, the recordings can be played back at different rates including a slow-motion version as can be seen on the control tab to the right. The ELAN software also allows for a magnification of a specific video passage, which helps with accuracy in detailing each code. This feature allows for more accurate coding to occur. During the analysis, the screen for the video recording shown in Figure 3.5 is enlarged, then a key stroke will be assigned to a specific code (i.e. spacebar for when a child does a finger touch). Once a tier is created it can be assigned different attributes, including the participant (name of the participants the tier is referring to), and tier type which defines the type of this tier (i.e. touch or eye gaze). In Figure 3.5, the different tiers that are presented in this specific example are of James’s touch, the total number of codes are given under the name of each tier. Additionally, different types of tiers can also be merged, so the total timeline of touches can be seen in the tier labelled ‘Total (James)’, which is the sixth tier down on the timeline. Figure 3.5 also provides an example of how the timeline is displayed in relation to each tier, and how the data can be visually interpreted once the codes are created. Additionally,
overlaps in tier can also be used by creating an additional tier from the data of two overlapping, this was used to for the analysis for ‘joint eye gaze’ (see chapter 8.1.1).

Figure 3.5 Example Timeline of Pair Coding

ELAN is distributed as a free and open source software, and is regarded as professional grade software that has been used across different academic discipline including education and human computer interaction (Giuliani et al., 2015). The version used for this study was ELAN version 5.3 and The ELAN files are stores as XML format (EAF). The following sections now provide an overview of how eye gaze, contact, and transfer of possession was analysed.

3.8.2.3.2 Eye Gaze
Each child’s eye gaze was coded independently, so that it was possible to assess the child’s level of engagement with the activities. Eye gaze was manually coded using a video data analysis software tool, ELAN, in which each type of eye gaze is coded in relation to the video timeline. Through the use of a specific functionality of the video analysis software called “segmentation mode”, separate labels (i.e. codes) were created, and the videos were coded according to different type of eye gaze. After eye gaze was coded, the time spent on each type of eye gaze
was converted to percentage duration and rate per 5 minutes. This was done to make it easier to compare sessions that lasted different lengths of time.

Due to the nature of dynamic interaction between the children some of the footage of the video recordings did not provide a direct view of the children’s gaze. The location of the child relative to the video camera often made it difficult to see the direction of their eye gaze. When this occurred head orientation of the children was coded as a substitute so as to provide a more complete record of what was happening. The use of head orientation has been supported by previous research (Langton et al. 2000; Stiefelhagen et al., 2002) as another appropriate mode of analysis to better understand the engagement and interest of individuals. Thus, when possible the missing data was coded for head orientation which directly related to the different types of eye gaze, as can be seen in Table 3.17. In Chapter 6.1, the analyses are based on a combination of the codes for eye gaze and head direction, although these codes are referred to as eye gaze.

Following the coding of the video data for eye gaze and head orientation, an additional code was created for joint attention. Triadic eye gaze towards the iPad involving the joint attention of both children was calculated in ELAN by finding the duration of overlap of eye gaze at the iPad from each child in the pair. Triadic eye gaze provided information regarding when joint attention occurred in their interaction timeline which provided insight into how long both children were looking at the iPad together.

3.8.2.3.3 Contact
Similarly to the eye gaze analysis, each child’s contact was coded separately, so that it was possible to assess the child’s level of physical contact and touches on the iPad. The type of contact made by each child was viewed using the video data analysis software tool, ELAN, in which each
type of contact was coded alongside the video timeline. These contacts were manually coded using the description in Table 3.18.

The development of codes was inductive by nature, given the limited amount of studies that looked at categorizing how children touch MTST devices. However, some of the fundamental features and method of labelling touch were taken from Buckleitner’s (2011) work on the Taxonomy of touch. After children’s contact was coded, the time spent on each type of contact was converted to percentage duration and rate per 5 minutes. This was done to make it easier to compare sessions that lasted different lengths of time. After contact was coded, the frequency of different types of contact were converted to percentages, which is presented in findings of chapter 6.2. This was to take account of differences between pairs in the length of the sessions.

3.8.2.3.4 Transfer of Possession
The contact codes provided data about possession and transfer of possession (contact codes). By merging all the contact codes for each individual child in ELAN, a timeline was produced on a computer screen that showed when one child was in possession of the device and the point at which the device was switched over to their partner. The transfer of possession was then reviewed from the video recording more rigorously to determine the quality of the exchange, which was then coded according to the ease of the transfer with green being a smooth transition and red indicating conflict (Table 3.18).

Transfer of possession only refers to incidents in which the iPad was successfully moved from one child to the other and does not include potential incidents where a child wanted possession and may have attempted to grab the device but was unsuccessful in gaining the possession. Another code label as ‘denies’ was used to identify when a child physically attempted to prevent their
partner from accessing, touching, or grabbing the iPad. Like the eye gaze coding, the transfer of possession was viewed using a video data analysis software tool, ELAN, in which each occurrence of the transfer of possession was viewed repeatedly to determine what coding was best appropriate.

For the validation of the coding scheme inter-rater reliability was undertaken (Hallgren, 2012). Inter-rater reliability is useful to determine if a particular scale is appropriate for measuring a variable. Once transfer was coded in all the participants, 11 incidents (transfers) were randomly selected and presented to two independent coders, whom were fellow PhD research students in the same department but had no prior exposure to the data set.

Table 3.21 Inter-rater Reliability

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Timestamp</th>
<th>Investigator</th>
<th>Coder 1</th>
<th>Coder 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2a</td>
<td>19.43</td>
<td>yellow</td>
<td>green</td>
<td>green</td>
</tr>
<tr>
<td>1.2a</td>
<td>19.53</td>
<td>red</td>
<td>red</td>
<td>red</td>
</tr>
<tr>
<td>2.2b</td>
<td>12.08</td>
<td>green</td>
<td>green</td>
<td>green</td>
</tr>
<tr>
<td>3.1a</td>
<td>5.30</td>
<td>yellow</td>
<td>yellow</td>
<td>yellow</td>
</tr>
<tr>
<td>4.1a</td>
<td>2.20</td>
<td>green</td>
<td>yellow</td>
<td>green</td>
</tr>
<tr>
<td>1.2a</td>
<td>14.32</td>
<td>yellow</td>
<td>green</td>
<td>yellow</td>
</tr>
<tr>
<td>4.1a</td>
<td>5.10</td>
<td>red</td>
<td>red</td>
<td>red</td>
</tr>
<tr>
<td>3.1a</td>
<td>6.08</td>
<td>red</td>
<td>red</td>
<td>red</td>
</tr>
<tr>
<td>2.2b</td>
<td>14.04</td>
<td>green</td>
<td>green</td>
<td>yellow</td>
</tr>
<tr>
<td>1.2a</td>
<td>14.5</td>
<td>yellow</td>
<td>green</td>
<td>yellow</td>
</tr>
<tr>
<td>3.1 b</td>
<td>2.23</td>
<td>green</td>
<td>green</td>
<td>green</td>
</tr>
</tbody>
</table>

Table 3.21 includes the timeline in which the incident occurred in, the numbering system used helps to identify the pair, setting, and initial or redesign activity. The second column is the timestamp, which is the point that the transfer of possession occurred. The last three column indicated how each rater coded that incident. Then the percent overall agreement for multiple
raters were calculated which was 87.88%. The percentage of agreement was calculated by the number of times a set of ratings agree, divided by the total number of units of observation that are rated, multiplied by 100. Although this percentage of agreement demonstrates a high level agreement, it does not take into account chance agreement between the rating, thus Fleiss’ Kapp was also used to calculate the reliability of the agreement between the three raters yielding a k value of 0.58 which Landis and Koch (1977) interprets as moderate agreement.

The findings from the analyses of these codes are presented in Section 6.1 (eye gaze), Section 6.2 (contact) and Section 6.3 (transfer of possession).

3.9 Summary

This chapter has described the three main methods of collecting information used in the research for this thesis. This involved: a questionnaire for parents and caregivers about their and their children’s use of MTST; a semi-structured interview with practitioners about their views concerning MTST and children, as well as their views about children’s cooperation and about ways to encourage this when using MTST, and the use of DBR to encourage children’s cooperation when using MTST. The following six chapters describe the findings based on these methods.
Chapter 4  Parental perspectives and the common concerns around technology and social interactions

In this short chapter a brief overview of the background to the study is presented, focusing studies that have been conducted post 2010 (see also Chapter 2.3.1.2). The findings and a discussion of the findings from the parental questionnaire will be then be presented in three sections (1) Device Use, (2) Parental Perspectives about Positive and Negative Statements, and (3) Parental Responses to Open Ended Questions. This is followed by a summary of these findings and their relevance to the thesis. The research question that will be addressed in this chapter is:

Research Question 1: What attitudes and opinions do parents have concerning young children’s use of mobile touch screen technology?

4.1  Introduction

The current public and academic debate around young children’s use of MTST reflects the increase in children accessing these devices. Therefore, understanding how parents perceive this new type of technology is needed. A majority of surveys conducted with young children’s parents have gathered data concerning usage and type of usage (Clark, 2015; Common Sense Media, 2013; Cristia & Seidl, 2015; Marsh et al., 2015). A more limited number of studies have tried to investigate how parents perceive technology's potential benefits and their concerns around MTST (Chaudron, 2015; Marsh et al., 2015; O’Connor, 2017). Findings from O’Connor (2017) expressed that a significant parental concern was that technology threatened the parent's perception of traditional play, which involves being physically active and interacting with nature. Similar points were made in Chaudron’s study (2015) concerning the potential adverse health and social impact. However, in the same manner, that these concern has remained consistent, an emerging trend that indicates how parents viewed the introduction of these technologies as an 'early investment
in learning how to use technology (O’Connor, 2017, p. 93) for their child’s future presents an interesting contrast of opinions.

These previous investigations have provided useful information about children’s use and about parental opinions. However, as technology changes so rapidly and there seems to be more availability of content for pre-school children it is important to carry out further studies to investigate whether child use and parental opinions have changed.

There is general agreement that parents are the first educator for most children (Bredekamp, 2014; Follari, 2010; Gallagher et al., 2004). Therefore, the decision to start with a parental questionnaire about MTST was a useful starting point to explore in a scoping study parents and children’s use of MTST as well as concerns and benefits that parent perceived that their child could gain from interacting with MTST.

4.2 Findings & Discussion

As already mentioned, the findings and a discussion of these findings are presented together as this provides an immediate interpretation of the findings together with an outline of how specific findings are related to previous research.

4.1.1 Device Usage

Information about parents’ and children’s use of MTST was obtained from the parents (see Figure 4.1), this was collected from the paper-based questionnaire and the online questionnaire (N = 110). Given the ubiquitous nature of MTST and the rate at which it has been adopted into our daily lives, most parents are currently users of mobile technology for long durations. This was confirmed, as parents reported an average daily use of over 2.5 hours per day. The average age that parents reported when they themselves had their first mobile phone was 23.8 years, which as we will see is very different to children’s current experience. Given their own extensive use of the technology, this is likely to influence their understanding of the device’s potential benefits and
harm. However, just because parents are extensive consumers of the technology, it does not
mean that this use can be mapped on to how they would like young children engaging with the
devices.

Twenty-eight of the 110 parental respondents stated that their young child did not use any touch
screen technology, 38 used both tablets and smart phones, while 36 used only tablets, and only 8
used just smart phones. These findings are similar to that of Marsh et al. survey conducted in
2015, which showed that young children were more frequently exposed to tablets rather than
users of mobile phone. The larger number of parents who only allow their children to use tablets
as opposed to other devices, suggest that the larger physical size appears to be more appropriate
for this age group and motor development that is present. The average length of time spent by
children on MTST was just under an hour, with more time spent on weekend than weekdays. This
may be because the young children are cared for by others during the week and contact time
between parents and children is more limited. The large standard deviations in reported use,
however, indicates that there is a considerable range in the amount of time parents allowed their
children to be on the device. This suggests that parents may have had different approaches
towards incorporating the technology into their children’s lives. Overall the findings suggested
reasonably high levels of use of MTST by young children, with just below an hour a day of use. The
findings also show that the children are spending more time on tablets during the weekend than
on weekdays which are similar to findings reported by Marsh et. al (2015). This figure is lower
than some reports (Marsh et al., 2015; Ofcom, 2020) but may be influenced by the comparatively
high number of children who did not use MTST.
4.1.2 Parental Perspectives to Positive and Negative Statements

Understanding how parents perceive the way these technologies affect their child can help better inform the type of research needed to address some of the major concern parents have around MTST. There were diverse parental opinions about MTST. The findings from the Scoping Study indicate that there were responses on both ends of the spectrum for each item that was asked regarding educational benefits and/or social benefits (see Parental perspectives on the educational gains that MTST might have on their child was varied, with a many parents indicating that they were undecided (e.g. Helps Maths, Helps Success at School). However, the majority of parents responded that MTST had more benefits in the areas of literacy, math and science resulting in a mean response above three. In contrast, the average response was just negative for an effect on arts and schooling more generally. These findings could relate to the type of apps that are currently available, with the majority of apps being focused on literacy and mathematics for this age group. This difference in opinion based on the subjects areas of apps have been reported in previous study of young children apps, which have focused on the educational design of math and literacy apps (Callaghan & Reich, 2018)

The highest level of agreement with the positive statements about MTST were about becoming familiar with technology and about giving children something interesting to do. Although the

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile – Weekday</td>
<td>157.88 mins</td>
<td>159.81</td>
</tr>
<tr>
<td>Tablet – Weekday</td>
<td>27.35 mins</td>
<td>62.85</td>
</tr>
<tr>
<td>Children</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile - Weekday</td>
<td>13.41 mins</td>
<td>28.10</td>
</tr>
<tr>
<td>Tablet – Weekday</td>
<td>32.96 mins</td>
<td>67.84</td>
</tr>
<tr>
<td>Mobile – Weekend</td>
<td>12.27 mins</td>
<td>26.10</td>
</tr>
<tr>
<td>Tablet - Weekend</td>
<td>40.42 mins</td>
<td>59.41</td>
</tr>
</tbody>
</table>
answer about familiarity is not unexpected, it is supports previous research that has discussed
how parents often want their child to have some familiarity with the technology (Chaudron,
2015). Familiarity with the technology implies that there are certain skill sets that are specific to
the use of digital device, in which previous exposure can help prepare children for the use of
these device); there were groups of parents who strongly agreed and strongly disagreed with
most of the statements about MTST. Such findings reiterate the polarized nature of this topic
specifically with regards to how it is often presented in the media (Solon, 2016).

Parental perspectives on the educational gains that MTST might have on their child was varied,
with a many parents indicating that they were undecided (e.g. Helps Maths, Helps Success at
School). However, the majority of parents responded that MTST had more benefits in the areas
of literacy, math and science resulting in a mean response above three. In contrast, the average
response was just negative for an effect on arts and schooling more generally. These findings
could relate to the type of apps that are currently available, with the majority of apps being
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familiar with technology and about giving children something interesting to do. Although the
answer about familiarity is not unexpected, it is supports previous research that has discussed
how parents often want their child to have some familiarity with the technology (Chaudron,
2015). Familiarity with the technology implies that there are certain skill sets that are specific to
the use of digital device, in which previous exposure can help prepare children for the use of
these device presents the ratings on a Likert scale for each item. There were some items that
involved a response to a positive statement about MTST and some that involved a negative
statement. Inspection of the responses to the positive statements in the top segment of Parental
perspectives on the educational gains that MTST might have on their child was varied, with a
many parents indicating that they were undecided (e.g. Helps Maths, Helps Success at School). However, the majority of parents responded that MTST had more benefits in the areas of literacy, math and science resulting in a mean response above three. In contrast, the average response was just negative for an effect on arts and schooling more generally. These findings could relate to the type of apps that are currently available, with the majority of apps being focused on literacy and mathematics for this age group. This difference in opinion based on the subjects areas of apps have been reported in previous study of young children apps, which have focused on the educational design of math and literacy apps (Callaghan & Reich, 2018)

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Parental perspectives on the educational gains that MTST might have on their child was varied, with a many parents indicating that they were undecided (e.g. Helps Maths, Helps Success at School). However, the majority of parents responded that MTST had more benefits in the areas of literacy, math and science resulting in a mean response above three. In contrast, the average response was just negative for an effect on arts and schooling more generally. These findings could relate to the type of apps that are currently available, with the majority of apps being focused on literacy and
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<table>
<thead>
<tr>
<th>Items</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helps Creativity</td>
<td>1</td>
<td>22</td>
<td>31</td>
<td>38</td>
<td>14</td>
<td>2.61</td>
<td>0.984</td>
</tr>
<tr>
<td>Helps Communication</td>
<td>6</td>
<td>22</td>
<td>21</td>
<td>36</td>
<td>17</td>
<td>2.63</td>
<td>1.161</td>
</tr>
<tr>
<td>Learn to focus</td>
<td>3</td>
<td>17</td>
<td>29</td>
<td>41</td>
<td>16</td>
<td>2.52</td>
<td>1.266</td>
</tr>
<tr>
<td>Helps Relaxation</td>
<td>3</td>
<td>42</td>
<td>17</td>
<td>22</td>
<td>22</td>
<td>2.82</td>
<td>1.244</td>
</tr>
<tr>
<td>Helps Literacy</td>
<td>5</td>
<td>41</td>
<td>32</td>
<td>16</td>
<td>11</td>
<td>3.14</td>
<td>1.049</td>
</tr>
<tr>
<td>Helps Maths</td>
<td>6</td>
<td>42</td>
<td>33</td>
<td>16</td>
<td>11</td>
<td>3.14</td>
<td>1.072</td>
</tr>
<tr>
<td>Helps Science</td>
<td>3</td>
<td>39</td>
<td>37</td>
<td>16</td>
<td>12</td>
<td>3.05</td>
<td>1.036</td>
</tr>
<tr>
<td>Helps Arts</td>
<td>3</td>
<td>31</td>
<td>36</td>
<td>24</td>
<td>12</td>
<td>2.90</td>
<td>1.036</td>
</tr>
<tr>
<td>Helps Success in school</td>
<td>0</td>
<td>16</td>
<td>50</td>
<td>19</td>
<td>18</td>
<td>2.62</td>
<td>1.040</td>
</tr>
<tr>
<td>Something interesting to do</td>
<td>16</td>
<td>47</td>
<td>11</td>
<td>19</td>
<td>12</td>
<td>3.33</td>
<td>0.954</td>
</tr>
<tr>
<td>Familiar with technology</td>
<td>32</td>
<td>61</td>
<td>10</td>
<td>2</td>
<td>3</td>
<td>4.07</td>
<td>0.839</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Items</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takes away time from other type of play</td>
<td>35</td>
<td>44</td>
<td>5</td>
<td>15</td>
<td>6</td>
<td>3.80</td>
<td>1.219</td>
</tr>
<tr>
<td>Takes away time from interacting with others</td>
<td>36</td>
<td>29</td>
<td>18</td>
<td>17</td>
<td>6</td>
<td>3.64</td>
<td>1.272</td>
</tr>
<tr>
<td>Damage eyesight</td>
<td>13</td>
<td>28</td>
<td>39</td>
<td>15</td>
<td>10</td>
<td>3.14</td>
<td>1.134</td>
</tr>
<tr>
<td>Not designed for children</td>
<td>20</td>
<td>26</td>
<td>25</td>
<td>30</td>
<td>6</td>
<td>3.19</td>
<td>1.215</td>
</tr>
<tr>
<td>Addicting</td>
<td>37</td>
<td>48</td>
<td>11</td>
<td>10</td>
<td>4</td>
<td>3.94</td>
<td>1.060</td>
</tr>
</tbody>
</table>

Table 4.1 Descriptive statistics: parental attitudes towards touchscreen technology (Paper based + Online)
Familiarity with the technology implies that there are certain skill sets that are specific to the use of digital device, in which previous exposure can help prepare children for the use of these devices as reported previously (Khasawneh & Al-Awidi, 2008; Marsh et al., 2015) and this suggests that parents would like their children to become more familiar with technology.

The parents also tended to agree with the negative statements about MTST (except there was not a strong negative response about the effects of the devices on their child’s eyesight). Additionally, over half of the parents (60.95%) agreed or strongly agreed with the statement that MTST takes away time from interacting with others. Similarly, about three-quarters of parents (75.24%) thought that the touchscreen devices take away time from other types of play. The parents also responded with overall agreement to the statement that MTST was not designed for children and that it was addictive. The latter being the most negative average response about MTST.

This set of findings about parental opinions support previous research (Khasawneh & Al-Awidi, 2008), about negative parental attitudes towards computer technology. For example, concern around their children becoming less active, and spending less time exercising and playing. This fear and negative sentiment towards technology is also the type of narrative that is often portrayed in the media ranging from addiction (Woollaston, 2013) to the perceived psychological harm of increased aggression and depression (Palmer, 2016b). This can be seen as part of a discourse over many years that privileges exploration of nature or traditional classroom materials (e.g., play kitchens, dollhouses) as developmentally appropriate, but keeps the latest technology out of the hands of our youngest children (Wolhwend, 2011).

There was an additional question about whether parents wished that they had access to these technologies when they were five, very few parents indicated that they wished for this (8 agreed,
85 disagreed and 17 responded ‘Do not know’). This appears to be a rejection of the positive aspects of technology on children as well as a possible wish that their child was growing up in an earlier context. Across the different statements about parental perspectives, most of the non-users (parents who do not allow their child to use the tablets and smartphones) and users (parents who allow their child to use tablets or smartphones) were similar in pattern. The one exception was the statement about the device helping a child relax, where there is a clear difference amongst users and non-users. A large number of parents who were users agreed that the device did have an impact on helping their child relax, whereas non-users mainly disagreed with the statement.

4.1.3 Parental Responses to Open Ended Questions

As well as the Likert scale items there was a set of open-ended question, in which parents could share their opinions on other negative or positive impacts from MTST (see Table 4.2). Slightly more parents made comments in the negative section, N = 41 than the positive section N = 36. The response varied in length from one word response to detailed stories, these answers offered a more holistic and in-depth insight into what aspect parents are concerned about and what issues they are hopeful about with the use of this new technology. It is worth noting that an analysis of these responses, showed that these issues were not necessarily an ‘additional’ impact as posed in the question, but were frequently an expansion of responses to previous Likert scale questions. In Table 4.2, the codes highlighted in red are themes that were already present in the Likert scale questions. Given the limited percentage of responses, no detailed analysis of the open-ended questions was carried out. However, all 77 comments were coded according to the presence of similar content (see Table 4.2), and a brief discussion is presented with illustrative quotes from parents.
Table 4.2 Open Ended Questions Analysis

<table>
<thead>
<tr>
<th>Positive Comments</th>
<th>Frequency</th>
<th>Negative Comments</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Frequency</td>
<td>Code</td>
<td>Frequency</td>
</tr>
<tr>
<td>Familiarity with technology</td>
<td>8</td>
<td>Addiction</td>
<td>10</td>
</tr>
<tr>
<td>Educational benefits</td>
<td>7</td>
<td>Decrease in physical movement</td>
<td>7</td>
</tr>
<tr>
<td>Hand eye coordination and fine motor skills</td>
<td>4</td>
<td>Restlessness and impact on sleep</td>
<td>6</td>
</tr>
<tr>
<td>Access to more information</td>
<td>3</td>
<td>Decrease in social development</td>
<td>5</td>
</tr>
<tr>
<td>Helps children with disability</td>
<td>2</td>
<td>Bad posture</td>
<td>5</td>
</tr>
<tr>
<td>Independent choice</td>
<td>2</td>
<td>Loss of imagination and creativity</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decrease in verbal communication</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inappropriate content</td>
<td>2</td>
</tr>
</tbody>
</table>

In this positive comment section around MTST and young children was on how exposing children to these type of devices at a young age allowed them to familiarize themselves with the device. One parent expressed that they felt that it was helping them to prepare for the continual advancement of technology,

“It prepares children for a life, when they leave schooling, in which I feel technology will be far more advanced than now and they will be expected to keep up with this in the workplace.” (C75)

The second most common type of comment in the positive section were statements regarding how the device help children learn. The idea of learning ranged from statements that specifically identified what children were learning (e.g., nursery rhymes and alphabet) to comments about educational games.

Example:

“They think they are playing a computer game and look 'cool' when in fact they are learning.” (C47)
“Helped her to learn colours, numbers and words” (C57)

“Learn a lot of things before nursery e.g. - rhymes and alphabets” (C27)

In the negative comment section, the issue of addiction was mentioned 10 times as a negative impact in the open-ended answers, so although this was already a question in the Likert scale part, the parents felt the need to reiterate this as fear and expand on the implications of it being addictive.

Example:

“Focus, attention span decrease. Apps/games etc rely on exploiting addictive qualities which could be harmful” (C76)

“Being addicted to 'screen time' & not enjoying a normal childhood playing outdoors.” (C61)

The second most mentioned types of comment in the negative sections, were statements regarding the decrease in physical activity, and sedentary nature of the devices.

Example:

“They need to be outdoors experiencing life enjoying it having adventures playing …” (C110)

“Spending too much time using technology encourages children to be sedentary and not get enough fresh air and exercise.” (C111)

The third most common theme in the negative section, which were parental concerns on how usage of the device appeared to be making their child restless and therefore affecting their sleep. The fact that this appeared six time in the open-ended question as a common theme reflected a concern for the behaviours impact these devices were producing.

Example:

“Restlessness after use of tablet and loss of imagination” (C24)

“Screen keeps awake before bed!” (C35)
“If they are left with no supervision, they may be viewing inappropriate contact and using the device for too long, impacting sleep and behaviour.” (C38)

These topics that emerged from the open-ended question provided additional insight on to potential benefits as perceived by the parents as well as other concerns that they are beginning to observe during their children’s use of the technology.

4.3 Summary of Use and Parental Opinions about MTST

Pre-school children were reported by their parents as using MTST devices on average 24.76 minutes per day. In addition, the findings from this questionnaire support findings from previous studies that some parents have positive views about the potential educational value of MTST devices (Chaudron, 2015). There also was evidence from the questionnaire answers that many parents thought that exposure to these types of technologies could help in preparing children to be familiar with these devices as they are becoming more prominent in our daily lives, another similar finding was also suggested in studies conducted in Jordan (Khasawneh & Al-Awidi, 2008).

The majority (75%) of the parents indicated that they would not have wanted access to the technology at the age of 5. The reasoning behind this response is uncertain, although the findings suggest that there is gap between what parents perceive as an ideal childhood versus the current reality about the use of MTST in their child’s daily lives. There are potentially a number of reasons parents feel the need to bring MTST into their child’s lives, the most obvious one being that parents may feel the need to use MTST as a device to engage their child while they get other things done. This type of behaviours has been recorded and described as the “pass-back” effect, which involves a parent passing over their mobile device to a child (Chiong & Shuler, 2010; Takeuchi, 2011) in order to temporarily occupy them. However, that fact that parents engage in this behaviour does not necessarily eliminate negative sentiments about the technology in
relation to pre-schooler’s use. As we already know, parents’ views about children’s use of technology will undoubtedly be based on a complex matrix of their own values and attitudes (Harkness & Super, 1996), therefore it is not surprising that despite their concerns about these devices, they still may allow children to use these devices. Thus, there appears to be a tension between how parents perceive the technology and allowing children to use these devices.

To conclude, many parents who were questioned allowed their children reasonably extensive use of MTST despite many of the parents being concerned about a number of issues related to digital technology. One particular concern of the parents was the use of MTST taking time away from interacting with others. These views provided a stimulus to address the issue of encouraging social interaction especially cooperation among pre-school children when using MTST. The next chapter continues to investigate adults’ views of young children’s use of MTST with a qualitative study involving pre-school practitioners.
Chapter 5  Practitioner’s Perspectives of Technology and Cooperative Learning

This chapter is divided into two subsections on practitioners’ perspective. The findings were attained through a thematic analysis of the semi-structured interview conducted with the practitioners. The first sections 5.1 concern the practitioners’ perspective towards young children’s use of mobile technologies and second sections 5.2 addresses the practitioners’ perspective towards cooperative learning. In each of the subsection a brief introduction followed by the findings along with discussion on each theme is presented. The research question that is addressed in this chapter is research question 2. This question looks at perspectives of practitioners who another main gate keeper of how mobile touch screen technology are is introduced in the early years.

Research Question 2: What attitudes and opinions do practitioners have towards young children’s use of mobile touch screen technology?

5.1 Early Years Practitioners’ Perspectives on Mobile Touch Screen Technology

The continual development of new technological devices and the extent to which mobile technologies have permeated our daily lives have significant implications for young children. This massive technological change, which has been accompanied by an abundance of digital devices and a diversity of application software, has led to the idea of ‘digital culture’ becoming a reality, which affects ways of raising and educating children (Lemon & Garvis, 2016; Marsh et al., 2015). This is a situation that educators must navigate to best prepare children for the realities of the world. Growing up exposed to these new technologies, and having to live in screen-saturated environments (Hutchby & Moran-Ellis, 2001), is becoming the norm for many young children. The
present study offers more insight into the practitioners’ perspective in one setting that was already using iPads and one that was not. The present study will add an important component of obtaining that holistic understanding of how technology is intersecting with the child’s world, by documenting the opinions of practitioners about MTST. Collecting data from the practitioners not only acknowledges the specific expertise that they bring, but also their role as another key gatekeeper in young children’s access to MTST.

5.1.1 Findings & Discussion

The themes that were identified in relation to the three topics of the semi structured interview are shown in Figure 5.1. There were five major themes that emerged from asking practitioners about their views on young children’s usage of MTST are highlighted in the figure and these will be the focus of this section. The five themes were (1) The Ubiquity of Technology (2) Ability in Using MTST (3) Use in Moderation (4) Value of MTST and (5) Negative Aspects of MTST. The following sections provide a more in-depth analysis of each theme and the similarities and differences amongst the practitioners. Please note the topic of collaborative learning is considered in the next section.
5.1.1.1 Theme 1: The Ubiquity of Technology

The theme of ‘ubiquity of technology’ refers to comments that the practitioners made regarding how prevalent MTST is in young children’s environment as well as in our daily lives as adults. This theme manifested itself in different ways. Either the teacher was explicit in saying that the technology is here to stay and therefore we must be prepared for it, or through anecdotal stories they explained the pervasive nature of it and how we all are becoming regular users of MTST. This was a major theme as it reflects the changing outlook amongst practitioners on the use of technology. It suggest a shift in the conversation from the binary question of whether or not practitioners should be using the technology towards a more constructive dialogue about how best to use the technology and to what extent it will yield the most educational benefit for young learners.
The questions which were most likely to produce statements related to the theme of the ‘ubiquity of technology’ were:

- Do you think MTST should be introduced into the early years settings? If so, how? If not, why not?
- Can you describe how you feel about young children’s current use of MTST in preschool and at home?

In relation to the first question all the practitioners in both the London and Reading settings agreed that the technology should be introduced. However, their tone and further explanation of why it should be introduced to children varied across individuals. A majority of the practitioners expressed the view that the need to introduce this type of technology is mainly due to how prevalent the technology is in our society nowadays. As one practitioner mentioned,

“I think it’s a good idea, because the world is moving so fast, I mean new things are coming up. If they don’t, if they’re not, you know, expose to all of this, then they’ll find it difficult later on. So it’s best that they actually know how to use things, it helps with their learning as well”

(P8, London)

There appeared to be a general recognition that MTST are becoming widely used and thus it becomes essential for early years practitioners to prepare children to use these types of technology appropriately. Similar perspectives on technology presence are reflected in other practitioners as they agree that the technology should be introduced:

- “I suppose because this day and age, technology is more in use.” (P7, London)
- “all the shopping we do at home, you do so much online now” (P1, Reading)
- “they just grow up with technology, so they always expect it” (P4, Reading)

The idea of technology presence as a rationale for introducing MTST in the early years appears to be an agreed upon notion, however the implication of technology presence, including the
perceived benefits and harm varied much more across individual practitioners and will be
discussed further in the theme ‘Use in Moderation” (Section 5.1.1.3).

In another example, the practitioner sheds light on ‘technology presence’ by making a comparison
to her own childhood, and highlighting the differences in how time is now spent:

“when I was little you’d go out and bike in the street and you went to play football, but
now children want to sit on the iPad, even my niece she is two years old, she can pick up
phone and can open it, she can sit there for hours, which I guess as a parent is really
useful sometimes but not all the time, I mean like she’s been taken to the park and what
not but it is concerning that so much time is spent on there” (P6, London)

This reflective thinking and comparison to one’s childhood can often be found in research
regarding uncertainty around new technology and parenting styles (Plowman, McPake, &
Stephen, 2008), and this is also true in teachers’ teaching philosophy. It is not uncommon to make
these comparisons, as we use our own experience as points of reference when working with
young children, and it becomes more challenging when practitioners are working with
technologies that have not been part of their own childhood experiences. Although the
practitioner is expressing her concern about the potential harm that the technology brings with it,
she has also highlighted another key component of technology presence and how it is re-shaping
the culture of young children. As children share their day-to-day experience with their peers or
teachers, stories about their weekend may include elements of watching a certain YouTube clip or
playing a new game on the iPad in addition to or replacing more traditional stories of going to the
park. This familiarity of the technology has led to children sharing and developing different skill
sets around technology use.

The theme of technology presence also presented itself in alternative ways, such as when I
questioned one practitioner who was very optimistic about the technology and commented on
how she thought the devices offered a lot of possibilities for learning. I asked her if she has always been receptive to new technology, and she replied, “I think since I’ve been teaching, it’s always been in the forefront. So I can’t really compare it to before” (P5, London). This is another perspective on technology presence, and it illustrates how technology is advocated in different educational settings, it gives insight into how the culture of the setting can influence the practitioner’s perspective towards the technology. It should be noted that this practitioner has also had experience teaching slightly older children, which may have shaped exposure and experience in using technology with children, as she also goes on to mention a project she did with her year 1 students using stop-motion animation. This perspective may reflect some practitioners’ experience based on their training and school cultures that are more proactive in supporting and engaging practitioners in the use of MTST in their teaching practices. An unexpected point that emerged from the theme of technology presence was how for some children, the presence of all this technology has changed the children’s accent, as one of the practitioners mentioned how they notice a student develop an American accent from all the YouTube videos that the child was watching.

**Discussion of The Ubiquity of Technology**

The interviews indicated that the practitioners were fully aware of the engagement that young children have with MTST. This awareness on the extent to which young children are given access to mobile technology supports previous survey research findings stating that media consumption of this age group, including use of mobile devices, is on the rise (Kabali et al., 2015; Marsh et al., 2015; Ofcom, 2020). The theme of technology ubiquity can be seen most clearly in the practitioners’ response to the question regarding the appropriateness of introducing technology to this young age group. All 9 practitioners agreed on the suitability of introducing the technology at this age. Although their rationale differed and their degree of cautiousness varied, it was
apparent that the suitability of this type of technology for the age group of children aged 3-5 was consistent.

As young children’s access to MTST in their home settings continues to grow, practitioners acknowledged its increasing existence and recognized its presence in the broader cultural context. Furthermore, some of the practitioners in both the London and Reading settings made comments that the technology was becoming a prominent feature in our day to day lives. While a majority of the practitioners embraced MTST presence as a fact of modern living, some practitioners, P6 and P2, lamented that the change has occurred. The findings from these interviews also extend the argument made by Yelland, Neal & Dakich (2013) that those who do not embrace new media will be in danger of losing touch with the popular culture of young children, thus the findings show that the early childhood practitioners recognized and responded to this challenge by the acceptance of the need to include MTST in the preschool classroom.

Another response that reflected the theme of technology presence was about the usage of technology outside of the school setting, particularly in the home setting. Although one practitioner was explicit in saying that there was no way of them knowing for sure how much time was spent on mobile devices outside the school walls, there were certain indicators that hinted at their use at home. These indicators were often demonstrated by the level of confidence the children had in using the devices, which will be explored in more detail (section 5.1.1.2).

Thus, the findings from this qualitative study confirm the limited previous research about preschool practitioners’ attitudes and beliefs about MTST. In particular, the theme of technological ubiquity in the practitioners’ conversations suggested a general acceptance by
practitioners that MTST is part of most people’s lives, including the lives or preschool children. This was accompanied by an acceptance that the preschool education should include MTST, but it is important to note that this acceptance by most practitioners was also accompanied by concerns about the effects of MTST use on young children. Both these responses seem to have become more prominent over time compared to earlier research reports (Blackwell et al., 2016; Dong, 2018; Gialamas & Nikolopoulou, 2010; Hatzigianni & Kalaitzidis, 2018; Wartella et al., 2010). The findings from this theme, however, give more evidence of a nostalgic feeling of the past and how this immersive technology can be seen as responsible for taking things away rather than adding new things.

5.1.1.2 Theme 2: Ability in using MTST

An important theme from the interviews was ‘Ability in using MTST’ amongst young children. This theme involved comments related to how easy, comfortable, and confident many of the children were in using MTST, because of how prevalent it is now in their home environment.

The question which was most likely to produce statements related to the theme of confidence in using MTST were:

• Can you describe how you feel about young children’s current use of MTST at home?

Many of the practitioners (5 out of 9) noted that they cannot be certain how much usage of MTST the children are getting outside of the school or nursery setting as it was not something they tracked, but there is certain behaviour that can be observed which indicates increased usage outside of the school environment. This related to how confident and knowledgeable the children were when using the devices, prior to any instructions. This theme was derived from the
practitioners’ comments that the children’s confidence in using the technology was the direct result of how much exposure or usage they were getting outside of school:

“Some of the children are, you can tell cause some of them are really confident to speak to you about the programs and all the stuff that they use on the iPads, like the YouTube videos. They’ll say like ‘Oh!, I saw this on the YouTube video’. They know a lot of games that they play on the iPad, so that’s how you know that they often on it at home. The majority do have access to iPad.” (P7, London)

Comments about children’s confidence in using the technology are echoed by three other practitioners. Although the practitioners do not address the more intuitive design of a touch-screen interface and the user-friendly nature of the devices that has made it more accessible to young children, one of the practitioners did comment on a gap in expertise (technical skills), and how children appear to more adept at using MTST than some adults. As one practitioner explains:

“These are guys (children) are too good, I think some of them are a bit too forward than the adults and they know a bit too much sometimes. I think with technology like that smart phones and iPhones they have it at home. So they are really equipped, especially the ones who have them readily available.” (P8, London)

Different practitioners viewed their confidence in using the devices from different angles: the tone varied from impressed at how adept they are at using it, to concern that other essential skills such as holding a pencil are not being nurtured at home. An example of a more impressed tone can be seen when one of the practitioners listed all the things a child was capable of doing:

“some of them know how to like turn the volume down, how to switch off. Yeah some of them, yeah it’s crazy, (they) know how to turn the volume, know how to turn it up, know how to brighten up the screen and I’m just like “Well, I don’t even know this”. And know how to get on it as well.” (P2, Reading).

As mentioned earlier, some practitioners took a more cautious view that although the children are able to easily navigate through these devices, it may come at the cost of not developing other essential skills such as mark-making and writing:
“It’s so interesting that some of them can come in and open the tablet, go around you know the different apps, when they’re barely, you know just turned 4, but they can’t pick up a pen, they can’t hold a pen to make a mark. And I think it’s getting the balance between the two.” (P6, London)

The practitioners appear to be keenly aware of a different skill set that preschool children have developed, which includes children using their fine-motor skills to use MTST devices. Being able to swipe and navigate through these tools with confidence, although such a skill set may appear to be more intuitive than using a mouse or writing with a pencil, is still a different competency that has developed as a result of more exposure to the technology.

Discussion of Ability in using MTST

This theme of ‘ability in using MTST’ that emerged from the interviews was the practitioners’ observation on the children’s ability to use the technology with little guidance because of the exposure to the technology outside of the school setting. This confirms previous reports, such as that provided in Marsh et al. (2015) and Plowman et al. (2010) about the increase and high level of home usage of tablet computers, and the learned technical skills that have developed from exposure in their home settings. More specifically the practitioners’ detailed descriptions of the ease and knowledge that children demonstrate when using these devices also supports previous research that has looked at young children’s physical interaction and manipulation of the iPad (Buckleitner, 2011). The children’s ease and confidence in using the devices was expressed in both a positive and negative light. While P2 expressed her observation of the children’s ability to navigate the device with a sense of amusement, and viewed in relation to her not knowing, she appeared pleasantly surprised at these new technical skills that the children were picking up in their home setting. On the other hand, P6 viewed the children’s confidence in using the device in comparison to their inability to hold a pencil, putting forth the argument of a need for balance. The usability and intuitive nature of the touch screen devices has undoubtedly added to the
increase in uptake by younger users and exposing them to learn new skills. Although these skills are arguably not as complex or require the same fine motor skills as holding a pencil or using a mouse, it does show how quickly the children are able to interact with the devices and the exposure they are getting to these devices outside of the school.

The surprise about the children’s ability was explicitly used in the description of the codes as it appeared to be a common feeling expressed by the practitioners where they talked about how the children had the knowledge to use the hardware so easily and confidently. The feeling of surprise can be explained by the novelty of the situation or the lack of expectation. This observation is not new and it has been so prevalent that some scholars have noted this change and ease of using digital devices new that they have given them the label of ‘Digital Natives’ (Prensky, 2001) or ‘iGeneration’ (Rosen, 2010). Similar observations were made a decade ago, when early childhood practitioners discussed their perspective on integrating computer technology into the early childhood education environment (E. Wood et al., 2008).

5.1.1.3 Theme 3: Use in Moderation

The term ‘use in moderation’ was employed to code for comments where practitioners talked about ensuring that children had exposure to the technology but also sufficient time to engage in other types of activity. This idea of balanced choices often manifested itself in practitioners commenting on the necessity of setting up ‘limits’ and ensuring that children were engaging in other learning activities as well. There was some mention around the potential difference in the home and school setting, where ensuring this balance at school was easier and might not be so easy in the home setting, where children may be spending significantly more time on the devices than appropriate. Although the theme was frequently expressed from the viewpoint of needing to
set limitations, I used the term ‘use in moderation’ rather than limits as I believed it was more reflective of the idea that practitioners still felt there was a place and time for MTST.

The question which was most likely to produce statements related to the theme of technology balance was:

• Do you think MTST should be introduced into the early years settings?

One practitioner explained how she structures it in her setting, and setting up clear time frames of usage:

“I think that it could be introduced as long as there are some limits, not all day long. We are here for half an hour; we switch off the computer. Go to that room, so we can enjoy that space, if it’s just something new and the game, maybe in the day half an hour morning and in the afternoon. For children to do some educational activities.” (P1, Reading)

The same practitioner goes on to explain how she also set limits for within her own household, and how that was made clear to her children, “You have to give limits, how long they can use it for? You have to give limits. This iPad, for me I’ve got two children, they only use on the weekend.” (P1, Reading). Three other practitioners also expressed almost identical views on setting up limits, “I think that it would be good to introduce with limits and not having certain things on there.” (P3, Reading). The idea of making a balanced choice, often requires the intervention of the practitioner to monitor their usage and ensure that certain children are not always on the devices:

“I think it’s fantastic, a fantastic learning tool for them. And obviously we limit the amount of time they’re on. There are some children that would obviously love to sit there, like all day long on the iPad, playing games and watching videos. So you do try and limit them.” (P5, London)
The theme of use in moderation is naturally linked with technology presence, and the concern that because the devices are so prevalent, children are not engaging in other learning activities. A practitioner explains this further:

“I think when they’re (MTST) used in the right way for an activity that it’s benefiting them. But I think it needs to be limited so that they’re getting other experiences, and I think especially we find with our children they do spend a lot of time on tablets and mobile phones at home. So we try to limit the time that they get on them in school.” (P6, London).

Discussion of Use in Moderation

The same fears around sedentary behaviours, lack of socialization, and ‘addiction’ associated with MTST that previously have been held by early years educators and parents in the past (Bath & Enriquez-Gibson, 2014; Cordes & Miller, 2000; Palmer, 2016a) are still echoed amongst this current group of educators. The findings from my research demonstrate that many of the practitioners expressed these concerns and were uneasy about the negative impact MTST may have on young children’s social and physical development. Due to the novelty of the devices for this age group, a lot of their concern is logically being projected from what they are witnessing happening to older children, and their own experiences as an adult who recognizes how reliant they are on their own devices. The practitioners expressed these concerns through anecdotal stories from their personal experience. Although there do not appear to have been any studies that look specifically at early years educators’ concern around the adoption of MTST, the comments of the practitioners that were obtained in this research resemble the same concerns that parents of young children have which have been found in other qualitative interview based studies (Plowman et al., 2010).
The findings also suggested that the first-order barrier of extrinsic obstacles, particularly that of limited resources, no longer holds the same influence as it previously did, and was not mentioned at all in this section of the interview. This is also reflected in the theme regarding the acknowledgment of ‘technology presence’ which highlights that practitioners do not see limited resource as being a problem. Even in the setting that did not have the technology (Reading setting), they felt that if introduced correctly, it was appropriate for young children to use these types of devices. It is the second-order barriers, which are the intrinsic beliefs on the potential harm of these devices, that are still present. The belief that fundamentally these devices take away time from the social development are still a relevant concern to many of the practitioners. Educators still do not feel that the technology can assist in helping children develop social competencies. This finding confirms a pervious study conducted by Wood et al. (2008), that looked at educators’ perspectives on the introduction of desktop computer technology in the early childhood education environment, where fifty early childhood educators completed a survey and participated in focus groups. They found that the educators identified social development as their main concern, indicating that the “use of computer technology was seen as inhibiting opportunities for social development by limiting social interaction (particularly among children with less developed social skills) and by having too much interaction with an inanimate object” (p.216). The fear of children being passive consumers of the devices and therefore not interacting with others, is a valid concern, particularly since we are witnessing some of the real consequences of technology ‘addiction’ amongst older children as well as adults.

Under the theme ‘use in moderation,’ the results from my research show that practitioners recognized that there are some benefits from MTST, but the concept of monitored and restricted use was mentioned multiple times, further highlighting their concern over how attached the young children appeared to be to these devices. The practitioners’ recognition of the positive impact should not go unnoticed, they realize that there was potential, but the practitioners
involved in this study spent more time discussing the dangers of technology than its creative potential, which is similar to the findings of Plowman et al.’s (2010) empirical study using surveys and case studies amongst parents. The teachers in my study agreed that structured exposure to certain educational apps is beneficial, but it must be balanced and monitored. Independent usage of the technology should be limited to a specific amount of time, and the practitioners felt the need to monitor the time spent on the devices. The practitioners across both settings would ensure that if a child were spending too much time on the tablets and computers, they would be encouraged to do something else.

In the use in moderation theme, although practitioners indicate willingness to use MTST in the classroom, their usage is still viewed as an isolated activity and not truly integrated into the learning process. The technology is not viewed as a tool to assist other ongoing learning activities but more as a tool to be used in isolation on a particular app, which is why monitoring time spent was required. The need to limit usage and time spent on a particular object is not necessarily unique to these devices, as practitioners would also have to monitor any sort of novel or limited tools/toys. The practitioners will often monitor usage so that other children can have a turn. This is different to why they feel the need to limit the time on the iPad, which is done more out of fear that the children do not engage in other activities, or that the device itself is not offering a rich enough learning experience.

5.1.1.4 Theme 4: Value of MTST

The fourth theme addressed concerned the practitioners’ comments about the positive values that MTST had in early childhood education. Although some comments referred exclusively to the three Rs (reading, writing, arithmetic), practitioners also talked about the positive attitudes that children had towards learning when using the devices as well as the ability for the technology
to extend their learning. This extension of learning is one of the unique features of mobile devices, involving instant access to information that these tools enable through the internet.

The question which was most likely to produce statements related to the theme of value of MTST was:

- Can you describe how you feel about young children’s current use of MTST?

The feature of being able to find information online, and research certain concepts in the present, allows the option to extend a learning opportunity further and also helps provide visual stimuli to explore and explain certain new concepts. One of the practitioners gives an example from her classroom:

“If someone comes up with a topic of discussion or something they’re interested in, I can just get google up, “Oh lets”, you know if you’re interested in harp, like Jack in the Beanstalk. Everyone was like what’s a harp, they weren’t sure. You know, it was easier to find pictures of harp and then to play some harp music them and give them that experience” (P5, London)

The interesting thing about this theme is how the practitioners went into detail and were able to give concrete examples about an incident where they were able to search something online to help show or explain something further to the students. This illustrates that practitioners have experienced the advantages and benefits of being able to access information at any given time.

“And know how to get on as well. We had a little girl she got onto google maps, and like I showed her where are nursery was and then I showed her London and where we live, and that was an interesting one. Yeah, and then we showed her the world. The world was on there, “We live in England … there is other people that live here”. And that was a good idea, and there was image … so I clicked on to here, there was an image that will come up of actual here. She was like “Oh! We come and play here, we come to nursery here”. So I was like “Yeah”. I thought that was pretty clever.” (P2, Reading)
The ‘values of MTST’ often viewed in a positive light, and practitioners expressed how accessibility allows for a more enriching experience for the children. The practitioners value this access to the internet:

“They do have the internet explorer that they can use if they want to find out about something. Usually I go on the iPad and I show them, then they’re aware of it, so then they can try and type out the word that they research. I personally like to use it for research” (P9, London)

**Discussion of Values of MTST**

The findings demonstrated that many of the practitioners recognized the potential educational benefits of the technology. One being the technology’s connectivity to the world wide web, with the instant access to information a tremendous asset to their teaching in extending the children’s understanding of the world. According to the view that early childhood teachers help facilitate how children develop their culture and foster their ability to practically produce knowledge (Ihmeideh & Alkhawaldeh, 2017; Khalaf, 2016), this instant access to information allows children to extend their learning. What the practitioners have expressed here is the important point of how learning is “extended” through the extra information that is accessed on the internet, and how it enables the teacher to immediately provide the children with more knowledge about a topic. However, such engagement is often teacher-led. The practitioners that discussed the value of technology, spoke about it with enthusiasm. They drew upon real-life examples where they used this feature to instantly find something on the internet to either extend the child's learning or engage them further in conversation and making it a rich teachable moment. The findings from this research supports the growing sentiment that practitioners feels towards a need to develop digital literacy in children in order to prepare them to “critically consume and create digital, multimodal texts” (Turner et al., 2017, p. 122). My findings suggest that further research needs to be done in the early years context where the pedagogical framework is more student-led.
findings may be specific to this young age group, and the perspectives from practitioners in this area may vary significantly from another age group.

5.1.1.5 Theme 5: Negative Aspects of MTST

The theme of ‘negative aspects of MTST’ demonstrates the different types of concerns that the practitioners had. There is a concern that when children are too immersed in technology, they become too independent and they do not communicate with others, or develop those essential physical, social, emotional skills that are at the core of early years education.

The question which was most likely to produce statements related to the theme of value of technologies was:

- What are your hopes and fears about the technology?

The subdued and sedentary interaction with the technology was viewed as almost an addictive behaviour, and that the children’s engagement with the technology is no longer productive once it takes away time from other essential types of play. A fear was expressed by one of the practitioners, “That the children will become so technology involved that they’re not interested in anything else. They’re not getting those practical experience of going out to run but now children want to sit on the iPad.” (P6, London). Another practitioner explains further why excessive passive interaction may hinder their cognitive development, “Fear is that they may become a bit passive, it’s already there they don’t have to think much it’s just click, click, click. That’s what I feel some time, more of that and less of thinking.” (P7, London). A practitioner from the Reading setting, explains her fear when a balanced choice is not made, and how the technology limits the children’s interactions with others, “Bad things are I think some of them can just sit and sit and not interact with anybody else and there is no talking there. And their communication is just with colours, screen, a box. I don’t like them sitting on there for too long” (P2, Reading).
Discussion of Negative Aspects of MTST

The findings demonstrated that some of the practitioners still had concerns around the technology. Many narratives around these concerns still resonate with previous research in this area, that there are underlying fears, particularly with regards to lack of social engagement with others (Blackwell et al., 2013; Ernest et al., 2014). The immersive nature of the technology is viewed as a negative aspect and portrayed as an addictive behaviour rather than as the child being engaged. The static consumption of these technologies is viewed in contrast to what the practitioners perceived should be the way in which children learn which is through physical interaction and movement. Wohlwend (Wohlwend, 2011) argues that this perspective of fear over the technology is because the practitioners may be viewing the child from a very specific lens or what she calls the ‘developing organism’. The developing organism being a rigid belief that the children develop through predictable socio-cognitive stages, and by learning through hands-on experiences with the natural environment (Hendrick, 1997) thus exposure to technology will be putting these developments at risk.

5.1.2 Summary

The interviews with practitioners confirmed and extended the findings of previous research about this group of individuals. The practitioners’ perspectives on how much exposure and usage the children have with MTST, reflects the growing statistics around young children’s adoption of these new technologies. Similarly, the ease with which the children can use tablets with minimal instruction is potentially evidence of how much they are using the technology outside of school as well as the intuitive design of tablets that has allowed for such young users to purposefully engage with them. The fear around the technology of being passive and children not engaging in other social and physical activity is still at the forefront of many practitioner’s concerns. These are the exact same concerns that were put forth earlier by early years practitioners about desktop computers (E. Wood et al., 2008), so the mobility of the device and the new software has not
been able to adequately address this major concern. The practitioners felt that limited use and balancing children’s interaction with the devices and other activities was the ideal solution. Interestingly enough the quality of the apps was not mentioned like in previous research (Chau, 2014; Colliver et al., 2020; Meyer et al., 2021), rather a main value of MTST that the practitioners commented on was the extension of knowledge, particularly connectivity to the internet. It was this feature that appeared to be the most beneficial. Instant access to knowledge and images was a feature they felt has enhanced the learning experience for their students.

Although there were some themes that were present across both settings, which highlights the commonality in hopes and concern around the devices, it should be noted that the tone and emphasis that each practitioner expressed on a theme would vary even within the settings. For example, in the London school, there was one practitioner who enthusiastically commented on all the potentials of learning that had arisen because of technology presence, while another practitioner was quicker to highlight the addictive behaviour that has occurred because of technology presence. The disparity of opinion between practitioners is a common phenomenon that reaffirms previous findings (Guha, 2003). Subtle differences in views are to be expected. However, extreme inconsistency amongst practitioners within the same settings may hint at a more significant problem in which there is either not enough evidence and research, a lack of policy or a commonly agreed approach within each setting to persuade practitioners one way or another. There is a need for more research with this age group to provide more evidence to practitioners and continue to engage them in the ongoing conversation around what type of interaction and engagement with technology are appropriate for young children.

In conclusion, my findings support previous research findings about the overall positive attitudes that practitioners have towards MTST (Blackwell et al., 2012) as they all agreed about the
appropriateness of introducing MTST into their settings. This idea is also reflected clearly in the first theme of technological ubiquity and the conversation being no longer about whether practitioners should use the technology but rather how they should use it, a form of thinking that was already present over a decade ago with regards to ICT (Wang & Hoot, 2006). However, the underlying fears particularly with regards to children’s lack of engagement with others and other activities is very much at the forefront when practitioners talk about use in moderation. Even as the technology continues to mature, certain views have remained dormant, indicating not enough has been done to address ongoing concerns. As Fisher (2006) claims that agency is often ascribed to the technology itself, and the false belief that the device are responsible for change, nevertheless it is the teachers who are the true social agents that can drive change, and therefore buildings up teacher’s positive attitudes toward the benefits of technology would produce more effective use.

5.2 Early Years Practitioners’ Perspectives on Cooperative Learning and Process of Activity Design

When a child first comes to a structured educational setting, one of the teacher’s goals is to help the child move from being aware only of himself or herself to becoming aware of other children. Therefore, in addition to the academic knowledge that the educational setting is aiming to provide, the development of social skills is also a key essential learning goal for young children. This belief is supported by several early childhood educational theories (Berk, 2013; Montessori, 2004; Vygotsky, 1978). The social skills include teaching children to learn to share, take turns, and show caring behaviours towards others. Structured activities which promote cooperation may be able to help bring about these outcomes. One of the most consistent research findings is that cooperative learning activities improve children’s relationships with peers (Slavin, 1980). When children begin to work on readiness tasks, cooperation can provide opportunities for sharing ideas, learning how others think and react to problems, and practising
oral language skills in small groups (McGroarty, 1989; Veenman et al., 2000). Cooperative learning in early years can promote positive feelings toward school, teachers, and peers. These feelings build an important base for further success in school (Slavin, 1989).

Although much of the research on cooperative learning has been carried out with older students, cooperative learning strategies may also be effective with younger children in preschool centres and primary classrooms. In addition to the positive outcomes just noted, cooperative learning promotes student motivation, encourages group processes, and fosters social and academic interaction among students (Slavin, 1989). Therefore, the interview questions on this topic explored how practitioners viewed cooperative learning in the early years setting and if they held similar beliefs to what previous research had shown.

When technology was first introduced into the field of education, some educators questioned its role in developing personal and social aspects of children’s personalities and its ability to positively affect their physical and motor development (Barnes & Hill, 1983; Cuffaro, 1984). It is known that children spend much time using modern technologies which reduce the time they could be spending on developing different requirements of physical growth—through moving, running, or jumping. They also spend long hours using these technologies alone which can hinder their social development (Donohue & Schomburg, 2017). The findings from previous research tend to highlight the lack of social interaction as one of the main reasons why mobile technologies can have a negative impact on a child’s development and this was also highlighted in the parental interviews (3.9), which confirmed that this a concern that is still shared amongst parents. Therefore, in moving into the realms of an educational setting were the focus of cooperative learning has played a more prominent role, it was important to investigate whether there is a way
to integrate mobile technology in this particular aspect of learning to alleviate some of the fears that parents had expressed.

5.2.1 Collaborative vs Cooperative Terminology

The topic of terminology is already covered in more depth in the literature review section 2.4.2 however this section will talk about the use of word as it specifically relates to this research project. Initially when conducting the interviews, the term ‘collaborative’ and/or ‘collaboration’ was used as this was best thought to address the higher cognitive level of thinking that was implied in group or partnered work. However, upon revisiting the literature and as result of the interviews in which one pre-school setting was not familiar with the term, it became apparent that the term ‘cooperation’ was more appropriate for this young age group. This is also the term that is more commonly used in early childhood curricula.

In order to stay true to the nature of the interview, for this chapter the term collaboration will be used in direct quotes from the interviews. However, as the themes that emerge from this section will reveal, the way in which the practitioners have chosen to conceptualize collaborative learning can also be classified as cooperative learning.

An overview of the terms is presented in Table 5.1; the purpose of this table is to show how, although these terms have different origins, they share more similarities than differences. The definitions given in this table are by no means satisfactory nor do they reflect the complexity of words and how they often overlap or in some instances are used interchangeably. However, identifying the conceptual differences helps to better inform the choice for using the word cooperative as opposed to collaborative.
Table 5.1 Cooperative versus Collaborative

<table>
<thead>
<tr>
<th>Word Origin</th>
<th>Cooperative Learning</th>
<th>Collaborative Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td>“Oxford English Dictionary: the term &quot;cooperate&quot; comes from the late 16th century: from the Latin cooperate (&quot;worked together&quot;), from the verb cooperari (from co “together” + operari “to work”)—in other words, to work together jointly to complete an educational operation” (Davidsen &amp; Christiansen, 2014, p. 20)</td>
<td>“Oxford English Dictionary: the term &quot;collaborate&quot; comes from the late 19th century: from the Latin collaborat (&quot;worked with&quot;), from the verb collaborare (from col “together” + laborare “to work”); thus, it means to labour with each other towards the same end” (Davidsen &amp; Christiansen, 2014, p. 20)</td>
</tr>
<tr>
<td><strong>Focus on product</strong></td>
<td>Myers, 1991</td>
<td>Focus on process (Myers, 1991)</td>
</tr>
<tr>
<td><strong>Focus on process</strong></td>
<td>American roots from the philosophical writings of John Dewey and Kurt Lewin</td>
<td>British roots, based on the work of English teachers exploring ways to help students respond to literature by taking a more active role in their own learning</td>
</tr>
<tr>
<td><strong>Use in disciplines</strong></td>
<td>sciences, mathematics and engineering, the social sciences, and professional programs (Davidson &amp; Major, 2014)</td>
<td>humanities, some in the social sciences, but rarely in other sciences or professional programs (Davidson &amp; Major, 2014)</td>
</tr>
<tr>
<td><strong>Critical features</strong></td>
<td>“Cooperative learning procedures are designed to engage students actively in the learning process through inquiry and discussion with their peers in small groups. The group work is carefully organized and structured so as to promote the participation and learning of all group members in a cooperatively shared undertaking.” (Neil Davidson &amp; Worsham, 1992, p. xi)</td>
<td>“there is wide variability in collaborative learning activities, but most center on the students’ exploration or application of the course material, not simply the teacher’s presentation or explication of it. Everyone in the class is participating, working as partners or in small groups. Questions, problems, or the challenge to create something drive the group activity.” (Smith &amp; MacGregor, 1992, p. 11)</td>
</tr>
<tr>
<td><strong>Definition</strong></td>
<td>“Cooperative learning will be defined as students working together in a group small enough that everyone can participate on a collective task that has been clearly assigned. Moreover, students are expected to carry out their task without direct and immediate supervision of the teacher.” (E. G. Cohen, 1994, p. 3)</td>
<td>“The broadest (but unsatisfactory) definition of ‘collaborative learning’ is that it is a situation in which two or more people learn or attempt to learn something together”. (Dillenbourg, 2007)</td>
</tr>
</tbody>
</table>

The research questions that are addressed in this chapter are research questions 2 and 3. These questions look at perspectives of practitioners but also focus specifically on how cooperation manifests itself with this age group.

Research Question 2: What attitudes and opinions do practitioners have towards young children’s use of mobile touch screen technology?

Research Question 3 What forms of social and computer interactions occur when young children are encouraged to work cooperatively on mobile touch screen technology?
5.2.2 Findings & Discussion

The themes that were identified in relation to the three parts of the semi structured interview are shown again in Figure 5.2. There were four major themes that emerged from asking practitioners about their perspectives on collaborative learning and young children, highlighted in Figure 5.2. These five themes were (1) Children learning from other children (2) Developing Social Skills (3) Role-modelling (4) Caring & Empathy (5) Terminology. The following sections provide a more in-depth analysis of each theme and the similarities and differences amongst the practitioners. In understanding how practitioners view cooperation, it helps guide the decisions made for the design of the activity.

Figure 5.2 Outline of themes from interview of answers concerning Cooperative Learning

Note: * This theme was only relevant to one setting
5.2.2.1  Theme 1: Children learning from other children

This theme was often mentioned as one of the main benefits of cooperation. In a couple of instances during the interview, the teachers explicitly said that during the children’s play or through more structured activities they had the opportunity to learn from their peers when working in small groups. Additionally, the theme of children learning from other children was also coded when the practitioner gave examples of the specific type of support that children gave each other.

The questions which were most likely to produce statements related to the theme of children learning from other children were:

- What is your general feeling about “collaborative” (cooperative) learning?
- What do you think are some of the features of “collaboration” (cooperation) in pre-school settings?

The theme of children learning from other children does not come as a surprise to the practitioners and it was clearly expressed in these examples.

Ex.1: “I think it’s a great opportunity for children to learn from each other ” – P6 (London)

Ex. 2 “Cause when the children work in like a group, they learn from each other” – P1 (Reading).

The act of learning from another child can happen in a multitude of ways and the practitioners gave some examples of how this could occur:

“I think collaborative learning is excellent ... there are some children you think aren’t participating but they are actively listening and taking in some of the information that other children are maybe feeding into the activity. I do think group collaboration is really important.” – P5 (London)

This belief also reinforced a more child-centred approach, in which rather than everything being initiated by the teacher, and children learning solely from a teacher, the children themselves could be teachers to their peers.
As indicated earlier, the process of children learning from other children can occur in a variety of ways such as children encouraging and motivating other children to take part in their imaginative play together:

“[Referring to Construction Play Area] They find a new build, or see something interesting, they’ll go and join, some of them will ask, ‘can I help you, can I make this’, or ‘let’s make this?’, it just gets them going and discussing their ideas, similarly in the art studio if one child is making something, that encourages another child, sometimes 2 or 3 children will get together. If one child got an idea she will explain to another children and they’re all working together to put that thing together” – P7 (London)

This practitioner also elaborated that part of ‘collaborative learning’ (cooperative learning) is how children motivate and encourage their peers.

**Discussion of Children Learning from Other Children**

This theme provided examples of the practitioners’ optimistic views on the educational value of collaborative learning, specifically focusing on how it allows for children to learn from one another. Following Vygotsky’s (1978) influential work on cultural context, it is now a widely agreed-upon notion that children learn from those around them. Gelman (2009) claims that “much of children’s knowledge is derived not from their direct experiences with the environment but rather the input of others” (pg.115). This belief resonated in the positive tones that the practitioners had from their confidence that children learn from their peers. What the practitioners shared and highlighted as examples of how children learn from each other coincides with previous research on how young children are capable of offering support, scaffolding, modelling, modifying a task, and helping their peers to complete the task (Tharp & Gallimore, 1998). This was also present in the interviews when the practitioners gave concrete examples of what they have observed in the classroom in how the children engage with others.
Previous research that has focused on the topic of children learning from other children has often employed the concept of “peer scaffolding” (Aschermann, 2001; Kirova & Jamison, 2018; Smith, 1993). Peer scaffolding is usually explained as when a more capable child helps another child, but it is also possible that it occurs between children with similar cognitive and social levels. In this specific theme, it appeared that what the practitioners were suggesting was that ‘peer scaffolding’ could occur amongst peers of the same ability level, in that peers could learn from each other while working towards the same goal rather than being a direct mentor. Specific examples of more capable children helping their peers were presented more in the format of demonstrating care and empathy as seen in theme 3 (i.e., older students helping younger students).

The practitioners’ responses also emphasized some of the complexities in trying to assess this phenomenon. In addition to more explicit behaviour where children are actively discussing with each other, learning can also occur in a more implicit form where the child is actively listening to their peers, which is not as easy to capture. It is known that children are not just passive and empty vessels that will take in anything, as a myriad of contextual and environment factors play a role in a child’s learning processes. Thus, the act of a child learning from another child is not merely just the fact that they take what another child says at face value but the whole interaction is a learning process.

5.2.2.2 Theme 2: Developing Social Skills

Another theme that emerged is the theme of ‘Developing Social Skills”, which addressed one of the skills that practitioners associated with collaborative learning. The social skills included the ability for children to share resources, take turns, and appropriately communicate with their
peers. From a different perspective these social skills were considered important to effectively cooperate with their peers. Overall, these social skills were perceived as an essential part of their general development.

The questions which were most likely to produce statements related to the theme of social skills amongst young children during cooperation were:

- What behaviours and signs indicate that “collaboration” (cooperation) is going well – and going badly?
- What can practitioners do to encourage “collaboration” (cooperation)?

When I asked about how it was possible to assess whether the children were working collaboratively together, in addition to comments about how the dynamic of the group or pair will appear more comfortable and cohesive, the practitioners also gave more concrete examples of specific social skills that are expected. These skills are also clearly a developmental milestone and reflect how the children are moving away from an ego-centric world view:

“The PSDE (Physical & Social Development) thing, listening to each other, being able to share things and I think we encourage that so much that they can work together. They need those PSDE skills to be able to work collaboratively. Cause if it’s just ‘me, me, me’, they find it very hard... I think that’s a massive part for us, of what we do in Reception. Making sure that they are taking turns and that they are listening to one another.” – P6 (London)

The emphasis that the practitioners give to social development is closely linked with how they feel that children’s ability to play and work with others is a fundamental skill that occurs within this age group. The skill involves the ability to be more empathetic about other people’s needs and to share and take turns, with “Turn taking” being one of the most frequently used terms that appeared across the different interviews:

“Turn taking, sharing, you have to know to share, when we are working as a group. Sometime working on the computer, sometime a child wants to do it all the time. You
need to learn that your friend wants to go as well, you know, so we take that seriously. Turn taking, sharing, social skill, good social skill, and be kind to their friend, they’re polite to their friends.” – P1 (Reading)

Children who have learned to share and take turns were viewed very positively. In addition to the act of sharing the practitioners talked about how turn taking was a socially expected norm when working in a group situation. They also acknowledged that children who are able to share and take turns have an awareness of their friends’ needs. Furthermore, a practitioner talks about how the ability to share develops other essential skills including how to effectively communicate and negotiate:

“And we just kind of say ‘it’s my turn to talk now’ or ‘it’s your turn to talk now’ so the children will [understand]. And like sharing, not taking toys off from each other – P4 (Reading)

The theme of social skills is certainly linked to children learning from other children, with a stronger emphasis on observable and concrete skill sets that allow children to interact appropriately in group settings. This theme confirms how practitioners are looking for actions that clearly indicate that a child is aware of their peers’ feelings and can engage their peers in a meaningful manner.

Discussion of Children Learning from Other Children

This theme directly reflects the more formal outcomes of collaborative learning that are reflected in the national curriculum, as some practitioners refer to the Early Years Foundation Stage (EYFS) framework. Of the three prime areas that are outlined as the areas of learning and development, the one that practitioners highlighted as correlating with collaborative learning is the area of personal, social, and emotional development (PSED). It is claimed that this area is “crucial for igniting children’s curiosity and enthusiasm for learning and building their capacity to learn, form relationships, and thrive” (Department for Education, 2017, p. 7). The area of PSED is recognized
as one of the main building blocks for supporting a child to succeed and is broken down into three aspects: (1) self-confidence and self-awareness (2) managing feelings and behaviours (3) making relationships. The formation of these relationships appears to be a foundation for the children to not only develop respect for others but also to develop the appropriate social skills to work in group settings.

The importance of focusing and developing positive social skills correlates and appears to be a precursor to other positive outcomes such as higher academic achievement and school adaptation (Alexander et al., 1993; D. H. Cooper & Farran, 1988; Ladd, 1990; McClelland et al., 2000). Given the emphasis that they are given in the early years' curriculum and the research that continues to demonstrate the importance of these skills in early childhood education settings, creating opportunities and experiences where children can apply their social skills is essential. The positive sentiments that were expressed by all the practitioners regarding the importance of developing social skills does not only reflect that these are positive skills to be fostered, but that promoting young’s children’s social skills is a key milestone in the early years context of their development.

5.2.2.3 Theme 3: Care and Empathy

The third theme concerned a child’s sense of care and empathy. This theme was not expected, as previous literature on cooperation is not associated with aspects of care or empathy. Additionally, given what is known about this age group, and theories around egocentric behaviour (Jean Piaget & Inhelder, 1956), in the literature there is more focus on self-care and being able to recognize their own emotions rather than others’ emotions. When asked for examples of collaboration (cooperation), the practitioners gave examples of care and empathy when children
were helping other children. These stories were told with a lot of affection and highlight the importance of these actions to the practitioners.

The questions which were most likely to produce statements related to the theme of care and empathy amongst young children during cooperation were:

- What behaviours and signs indicate that “collaboration” (cooperation) is going well – and going badly?
- What are your general feelings about “collaborative” (cooperation) learning?

Similarly, to the theme of developing social skills, the underlying assumption here is that children have an awareness of other people’s needs and value the human relationships that are being formed. However, this theme highlights how practitioners are keenly aware that children in this age group are developing an internal need to want to help and support others, and that this is the foundation of cooperative learning. The demonstration of a caring attitude for others indicates that children are being compassionate but just as important is that they understand the importance of the relationships around them and acknowledge the feelings of others:

“when you see the children helping each other, that’s a good behaviour, cause they see somebody struggling they go there to support them, you know helping that is very good.”

P3 (Reading)

It also became apparent that this caring and empathetic attitude is often displayed towards younger children. In both settings, the teachers gave examples of how the older children helped the younger ones and that this appeared to be a very natural and frequent occurrence. Similarly, to the social skills theme, the practitioners explained the benefits of this attitude in terms of developing children’s oral skills and encouraging them to verbally communicate with their friends:

“when they’re putting their coats on a couple of the children can do zips, not many of them. So they’ll go over to the children that can’t do it and help them fasten the zips together. And they kind of explain it to the other child. It’s really cute.”

P2 (Reading)
“Building, they like building up these things, making houses. They are always building, “I made this, what did you make?” and matching pairs, “Oh, I’ll help you if you can’t do it”. Also when we are going outside some of the younger ones are struggling to do their coats. Some of the older one will come up and like “You need some help?” yeah and then help them, which I think is really sweet of them. They’re like “If you need any help, like ask or” yeah like the older ones seem to take lead with the young ones” – P7 (London)

This theme relates closely to the next theme of role-modelling and children learning from other children. It appears that in this theme the practitioners further express how when children are confident in their own abilities, they are more proactive in helping others and enjoy being the knowledgeable one that can help and care for others.

Discussion of Developing Care and Empathy

Previous research has described empathy as a basic human capacity that can help regulate relationships, supporting pro-social behaviour and group cohesion (Rieffe et al., 2010). Empathy in particular is often viewed as the ability to respond affectively to others and act in a way that coincides with that person’s need (Decety & Jackson, 2004). The fact that it is so explicitly linked with behaviours that strengthen cooperation shows that, based on the interviews, practitioners are looking for a variety of signs that are either explicitly cooperative or are features of cooperation such as empathy. This caring attitude is viewed as a very positive behaviour, but it also shows that it is promoted when there are opportunities for children to interact with different age groups and have those experiences with younger children. Although there may be an element of role-modelling here as older children try to help young children, there is a clear acknowledgment that the older children recognize the needs of the younger children and are able to respond appropriately.
5.2.2.4  Theme 4: Role Modelling

The fourth theme concerned ‘role modelling’. The theme of role modelling in this context was both in terms of practitioners being role models for the children, but also the children being role models for each other. The act of practitioners being role models to the children is discussed more explicitly as an answer to the interview question, “What can practitioners do to encourage collaboration?”. While children being a role model to each other were often given as examples of what collaborative learning would look like, throughout the interview.

The question which was most likely to produce statements related to the theme of care and empathy amongst young children during cooperation was:

- What can practitioners do to encourage “collaboration” (cooperation)?

The act of modelling can be explained as an instructional strategy in which the teacher demonstrates a new concept or approach to learning and students learn by observing. In the early childhood setting, the need for teachers to be positive role models and consistently emulate appropriate and positive interactions is essential, which is emphasized in the practitioners’ answers about how they choose to model collaboration:

“At this point in time, it’s good for the staff to be a good role model as well, we are staff we work with them, whatever we see or doing sometimes they do it. Sometimes we are doing the group, we have the group time, somebody want to do something. We call another child, another person, another staff so that they will see, “can you come and help me take over for this group?” So it’s okay we say that’s fine, I’ll help you, they do it. When they see us working too, how we work together.” – P1 (Reading)

“I think cause they see us working well together, and the teamwork. Like me, P1, P3 work well as a team. They see that, they see it, I think and our body language, and how we communicate with one another.” – P4 (Reading)

The modelling mentioned above shows how cohesive the teaching team needs to be and how they need to be able to actively portray to the children that they can work together harmoniously.
Other practitioners also acknowledge the importance of modelling specific ways to communicate, such as thinking out loud to engage other people in their work:

“.. we need to model, and we need to show them, especially, language is a thing so talking, books, and things, and just helping them. Thinking out loud, so we’re doing like, ‘Oh I wonder what this could do?’. So thinking out loud could help, cause then it gets them thinking as well, and then they share ideas and ... they feed on that as well and then it expands and flourishes, it’s quite nice.” – P8 (London)

This theme has many overlapping sentiments with the third theme on care and empathy as the children were being role models to young children. However, in some instances the act of modelling can also be more teacher-led than student-led. For example, one practitioner describes the role of the practitioner to showcase the children’s’ strength to encourage other children:

“Sometimes it’s good to get that child to demonstrate to the other children. Like if you have a child that is good at singing or make up stories, stuff like that, you can get them in front of the class. Just encourage them to share their skills with other children.” – P9 (London)

Role modelling positive social interaction as well as encouraging children to be models for each other was viewed as one of the ways to encourage, promote and teach cooperation in the early years setting.

**Discussion of Role Modelling**

In the discussion on the theme of “children learning from other children”, the concept of peer scaffolding was presented as a way of learning which practitioners viewed as a positive output of collaborative learning. In this theme it appears that role modelling was expressed more in terms of the teacher-child interaction, and that essentially the teacher modelling of appropriate collaborative behaviour was the way to scaffold children to become more collaborative. Given that this theme emerged predominantly when practitioners were asked what they could do to
encourage cooperation, the act of the teacher scaffolding appropriate behaviour was the input or the way in which they perceived they could help teach children to work together better. This concept of role-modelling is presented extensively in the EYFS as what adults could do to promote different skills and learning objectives. In a document issued by the British Association for Early Childhood Education that supports Early Years practitioners in providing quality EYFS education called “Development Matters” (The British Association for Early Childhood Education, 2012), under the ‘Personal, Social and Emotional Development’ section of what adults could do, the authors mention promoting positive behaviour:

“Model ways of noticing how others are feeling and comforting/helping them... Model being a considerate and responsive partner in interactions.” (The British Association for Early Childhood Education, 2012, p. 9)

This was echoed in the interview on how the teachers had to demonstrate their ability to work cohesively as a team, but also model explicitly behaviours that can help children better interact in group settings.

5.2.2.5 Theme 5: Terminology

A theme that emerged only for one of the settings was an issue of terminology: the practitioners needed to clarify what was meant by ‘collaborative learning’. In all the interviews with the practitioners at the Reading nursery, they either asked what the term meant or attempted to define it first before asking for confirmation, or they asked me if they had the correct definition, before proceeding with answering the questions. However, with the interviews at the school in London, only one practitioner asked for clarification of the term and she had mentioned earlier in the interview that she was a non-native English speaker.

The question which was most likely to produce statements related to the theme of terminology amongst young children during cooperation was:
• What are your general feelings about collaborative learning?

Some of the uncertainty about the terminology may be due to the lack of usage and exposure rather than not truly understanding the concept of collaborative learning:

“What is that? (researcher gives an example of children working in pairs or working together) Ok, ok, ok. I think its good, cause its like team work, isn’t it?” – P1 (Reading)

In some instances, the practitioner expressed some uncertainty about the terminology: “Learning together?” (P3, Reading), which indicates a sense of uncertainty about the term. Although this finding did catch me by surprise, I decided to continue to use the word to remain consistent throughout the interview. The response that I gave to all the teachers was that collaborative learning could mean when children are working together. Arguably this is not the most accurate description of collaborative learning. I tried to provide a description of what collaborative learning would look like, rather than influencing their perspective with a technical definition.

Discussion of Terminology

The fact that issues of terminology appeared as a theme in only one setting raises some interesting questions regarding early childhood education terminology but also the culture and context of each setting. The fact that all the practitioners in the Reading setting needed clarification of the term, was a strong indicator that the ‘term’ was not appropriate for their context, however this does not mean that they did not value its importance. As seen in the other themes, the practitioners from the Reading setting did share their insights on why cooperation was an important feature for this age group. In looking at the national framework (Department for Education, 2017), the term ‘collaborate’ is not used but rather it is the term ‘co-operate that is listed as a learning goal under the ‘Personal, social and emotional development’ section:
“Making relationships: children play co-operatively, taking turns with others. They take account of one another’s ideas about how to organise their activity. They show sensitivity to others’ needs and feelings, and form positive relationships with adults and other children” (Department for Education, 2017, p. 11)

Therefore, the lack of awareness in terminology may be the results of the context of the settings, especially since the London setting nursery class is part of a primary school whereas the Reading setting was a standalone early childhood centre. The practitioners in the London setting may be more exposed to terms such as collaborative learning which is used more frequently with older children.

5.2.3 Summary

The concept of collaborative learning, the grouping and pairing of students for the purpose of achieving an academic goal, has been widely researched and advocated in the educational sector. Proponents of collaborative learning claim that the active exchange of ideas within small groups not only increases interest among the participants but also promotes critical thinking. According to Johnson and Johnson (Lew et al., 1986) there is persuasive evidence that cooperative teams achieve at higher levels of thought and retain information longer than students who work quietly as individuals. The shared learning gives students an opportunity to engage in discussion, take responsibility for their own learning, and thus become critical thinkers (Totten et al., 1991). In spite of these advantages, most of the research studies on collaborative learning have been done at the primary, secondary, and college levels. As yet, there is limited research on how collaborative learning takes place in the early childhood settings. The present research was designed to study how practitioners perceived the collaborative learning as it relates to anticipated learning outcomes at the early years level.

From this interview analysis, it can be concluded that collaborative learning, understood mainly as children learning together, is viewed as a key learning goal by the practitioners in early years.
settings. This coincides with how many of the early years curricula are founded on the social constructivist theory which highlights the co-construction of knowledge and the importance of children learning from other children. Practitioners perceive the benefits of collaborative learning to be the development of essential social skills, sharing, turn taking, and communicating with their peers. Unique to this age group may be the emphasis on how children’s ability to express care and empathy are perceived as collaborative learning, as this demonstrates to others that the child is able to see things from another person’s perspective and react appropriately. The analysis also highlights how, although the term may not be frequently associated with this age group, the overarching sentiments of children developing appropriate social skills and being a role model to their peers are essential components of collaborative and cooperative learning. Unlike the topic of MTST where there appeared to be more disparities in how the devices supported or hindered the learning in young children, the practitioners’ perspective on collaborative learning was presented as a more unified front. All the practitioners acknowledge its importance and some of them were also able to refer specifically back to the national curriculum to support their claim.
Chapter 6  Behavioural Analysis of Children’s Social Interactions when Using an iPad in Pairs

This chapter is divided into three main subsections on the behavioural analysis of the children’s social interaction when using an iPad in pairs. The data set that was used for the analysis were video recordings of children working in pairs on the iPad. The three subsections coincide with the three unit of analysis that were used as proxy to gauge the level cooperation amongst the pair which included (Section 6.1) Eye Gaze (Section 6.2) Contact with iPad (Section 6.4) Turn-Taking. In each of the subsection a brief introduction followed by the findings along with discussion on each type of code is presented. The research question that is addressed in this chapter is research question 3 and 4.

RQ 3: What forms of social and computer interactions occur when young children are encouraged to learn cooperatively on mobile touch screen technology in pre-school settings?

RQ 4: Can the activity design and re-design process increase cooperative learning when young children are using mobile touch screen technology?

6.1 Pre-School Children’s Direction of Eye Gaze when Using an iPad in Pairs

This section provides findings about the eye gaze analysis. The rationale for exploring eye gaze has been discussed in chapter 2.4.4.1 and the coding scheme used is described in chapter 3.8.2.2 (please note head and eye direction were combined and the combined codes will be referred to as eye gaze).

In this study, information about eye gaze is used to provide insight about children’s engagement with the task. Additionally, when young children are using iPads, the extent of success of the joint activity of the two children can be partially measured by how long the children remain engaged in
the activity, and their shared experience through joint attention, or are disengaged from the task and are looking away from their partner or iPad. Thus, gaze and joint attention can help provide information about how well the children are cooperating.

Information about each type of eye gaze is provided in a separate sub-section. In each section the relevant data are presented (total duration, percentage duration and frequency/5 minutes). For each type of eye gaze data is presented about the behaviour in the initial sessions and the redesign session, due to the differing durations for each session the times are presented as percentage duration and frequency rates to better compare the finding across the different pairs. The percentage durations are calculated for each individual. This was based on the (duration of a particular code (e.g. gaze at iPad)/total duration of all the gaze that was coded for that individual) x 100, an advantage of this figure is that there could be differences in the total durations between individual pairs because one individual has more missing data than the other. The frequency/5 minutes was calculated by total number of codes x 300/total duration to give an indication of the rate of occurrence for the behaviour. A table of these figures are presented for each type of eye gaze and any increase or decrease between the initial and redesign session are also presented visually with a colour coding scheme. Given the lower number of codes any changes that were only ± 1 code in frequency/5 minutes would be shown as no change.

For each eye gaze behaviour code there are two sets of commentaries about the findings. The first set concerns the overall nature of the child-computer interaction (CCI) which concerns general observations about the sessions and important features of the way the children interacted with the iPad. Few previous studies that have provided detailed observations about pre-school children’s behaviour with the iPad when working together. The second set considers whether the data provides evidence about changes in behaviour from the initial session to the
redesign that would suggest an improvement in cooperation, as will be seen in most cases
behaviour change across the six pairs is variable with few examples of consistent improvement
across all pairs.

6.1.1 Eye Gaze at iPad

Eye gaze at the iPad was coded for all the instances in which the child’s gaze and head orientation
was towards the iPad, this included photo taking activities even though the child may be looking
at another child, but the gaze is made through the lens of the iPad camera. Table 6.1 provides the
data for the duration, percentage, and frequency per 5 minutes of eye gaze at the iPad for each
child.

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Duration (seconds)</th>
<th>Percentage Duration</th>
<th>Frequency per 5 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom</td>
<td>286</td>
<td>610</td>
<td>84%</td>
</tr>
<tr>
<td></td>
<td>Kate</td>
<td>84</td>
<td>703</td>
<td>56%</td>
</tr>
<tr>
<td>2</td>
<td>John</td>
<td>103</td>
<td>444</td>
<td>99%</td>
</tr>
<tr>
<td></td>
<td>Jess</td>
<td>302</td>
<td>411</td>
<td>79%</td>
</tr>
<tr>
<td>3</td>
<td>Sam</td>
<td>346</td>
<td>508</td>
<td>85%</td>
</tr>
<tr>
<td></td>
<td>Steve</td>
<td>232</td>
<td>351</td>
<td>85%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia</td>
<td>400</td>
<td>274</td>
<td>85%</td>
</tr>
<tr>
<td></td>
<td>James</td>
<td>247</td>
<td>303</td>
<td>93%</td>
</tr>
<tr>
<td>5</td>
<td>Adam</td>
<td>514</td>
<td>286</td>
<td>83%</td>
</tr>
<tr>
<td></td>
<td>Amy</td>
<td>275</td>
<td>182</td>
<td>53%</td>
</tr>
<tr>
<td>6</td>
<td>Dom</td>
<td>170</td>
<td>506</td>
<td>88%</td>
</tr>
<tr>
<td></td>
<td>Daniel</td>
<td>167</td>
<td>454</td>
<td>77%</td>
</tr>
</tbody>
</table>

Key: ■ = decrease from initial session, ■ = increase from initial session, ■ = no change from initial
**Eye Gaze iPad: Child Computer Interactions.**

It should be noted that the children were encouraged to place the iPad in between them so that both children would have easy visual access to the device. None of the pairs followed this suggestion, however, when the device was in one child’s possession, the other child was still able to look at the iPad if they chose.

The general trend that can be observed across all the pairs is that eye gaze towards the iPad was consistently high both in the initial and redesign (> 53%). This suggest that throughout the activity the children remain engaged with the device and the activity at hand. None of the pairs navigated out of the targeted app (Our Story), therefore it can be argued that all the eye gaze towards the iPad is linked directly with the usage of that app and the activity. Most of the children had a relatively low rate of looks at the iPad which suggests their looks were reasonably long. Although the gaze data indicates a high level of interest in the iPad, further data are needed to establish whether this occurred irrespective of who held the iPad. This and other issues will be explored in more detail in the contact analysis chapter.

**Eye Gaze at iPad: Comparison of Initial and Redesign Session.**

It might be expected that the redesign would mean that both children would spend a higher percentage of time looking at the iPad in the later session due to more explicit instructions towards cooperation and sharing. However, there appears to be no consistent patterns regarding the change of eye gaze at the iPads from initial to the redesign sessions. For certain individuals such as Steve and Lydia, there appears to be a significant decrease in the percentage of this type of eye gaze. In total 6 children showed a decrease in eye gaze toward the iPad. On the other hand, 5 children showed an increase and 1 child percentage remained the same. It can be argued that
the redesign of the activity did not necessarily increase the engagement of the pairs, it also is possible that the percentage of gaze at the iPads was high so that further increases were unlikely.

### 6.1.1.1 Joint Attention Eye Gaze

The way in which joint attention was coded, was through the creation of a new code in ELAN that coded when both the children were gazing towards the iPad at the same time. Table 6.2 gives for each child the duration of gaze at the iPad, the amount of the time that joint attention occurred, and the percentage of this time that that joint attention was of their total time looking at the iPad. The joint attention percentage was calculated from Joint Attention Duration /Duration of Gaze at iPad x 100.

#### Table 6.2 Joint Attention Eye Gaze for each child

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Types of Gaze</th>
<th>Initial</th>
<th>Redesign</th>
<th>Name</th>
<th>Initial</th>
<th>Redesign</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tom</td>
<td>Gaze at iPad</td>
<td>286</td>
<td>610</td>
<td>Kate</td>
<td>84</td>
<td>703</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention Duration</td>
<td>81</td>
<td>565</td>
<td>81</td>
<td>563</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention %</td>
<td>28%</td>
<td>93%</td>
<td>96%</td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>John</td>
<td>Gaze at iPad</td>
<td>103</td>
<td>444</td>
<td>Jess</td>
<td>302</td>
<td>411</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention Duration</td>
<td>93</td>
<td>299</td>
<td>93</td>
<td>299</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention %</td>
<td>90%</td>
<td>67%</td>
<td>31%</td>
<td>73%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Sam</td>
<td>Gaze at iPad</td>
<td>346</td>
<td>508</td>
<td>Steve</td>
<td>232</td>
<td>351</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention Duration</td>
<td>154</td>
<td>327</td>
<td>154</td>
<td>327</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention %</td>
<td>45%</td>
<td>64%</td>
<td>66%</td>
<td>93%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Lydia</td>
<td>Gaze at iPad</td>
<td>400</td>
<td>274</td>
<td>James</td>
<td>247</td>
<td>303</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention Duration</td>
<td>183</td>
<td>149</td>
<td>183</td>
<td>149</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention %</td>
<td>45%</td>
<td>54%</td>
<td>74%</td>
<td>49%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Adam</td>
<td>Gaze at iPad</td>
<td>514</td>
<td>286</td>
<td>Amy</td>
<td>275</td>
<td>182</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention Duration</td>
<td>232</td>
<td>129</td>
<td>232</td>
<td>129</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention %</td>
<td>45%</td>
<td>45%</td>
<td>84%</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dom</td>
<td>Gaze at iPad</td>
<td>170</td>
<td>506</td>
<td>Daniel</td>
<td>167</td>
<td>454</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention Duration</td>
<td>112</td>
<td>431</td>
<td>112</td>
<td>431</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Attention %</td>
<td>66%</td>
<td>85%</td>
<td>67%</td>
<td>95%</td>
<td></td>
</tr>
</tbody>
</table>

Key ■ = decrease from initial session □ = increase from initial session ▲ = no change from initial
Joint Eye Gaze iPad: Child Computer Interactions.

As can be seen from Table 6.2, there were only seven instances from 24 possibilities, where joint attention was below 50%, and often there was a considerably higher percentage of joint attention than not at the iPad. For some pairs joint attention occurred 90% of time, meaning that every time a child was looking at the iPad, they were mostly likely looking at it together with their partner. The finding emphasise the interest the children had in the activities on the iPad and suggests a high level of joint engagement.

Joint Eye Gaze at iPad: Comparison of Initial and Redesign Session.

If the redesign had increased cooperation then the percentage of joint attention to the iPad might have been expected to increase. Instead, amongst the different pairs, the percentage in the joint attention gaze appeared to differ according to the characteristics of the pair. Of the 12 children, 7 children showed an increase in the percentage of joint attention, while 4 children showed a decrease in the percentage of joint attention, and 1 child remained the same. However, within each pair the change in joint attention appeared to show no consistency, in that if one child had an increase in the joint attention percentage this did not correlate with their partner’s joint attention increasing or decreasing across the two sessions. For example, Tom’s joint attention percentage increase dramatically from 28% to 93%, but his partner’s joint attention percentage decreased from 96% to 83%. This finding suggests a change in the way that the children engaged with their partner and that although the redesign of the activity does not appear to increase both children’s joint attention, the redesign may have changed individual children’s engagement with the iPad. It is also worth noting that in general the percentage of joint attention was very high across all pairs, and that the joint average percentage of joint attention across all pairs was at 66%. This means there were lengthy periods in which both children were looking at the iPad.
together regardless of how they engaged with the iPad; they shared a central point of interest. This suggests a high level of engagement with the task at hand.

6.1.2 Eye Gaze at Partner

Eye gaze at a partner was coded for all the instances in which the child’s gaze and head orientation was towards the child’s partner. Table 6.3 provides the data for the duration, percentage, and frequency per 5 minutes of eye gaze at a partner for each child.

Table 6.3 Duration, Percentage Duration, Frequency per 5 minutes of Gaze at Partner for each child

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Total Duration (seconds)</th>
<th>Percentage Duration</th>
<th>Frequency per 5 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom</td>
<td>8</td>
<td>4.3</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Kate</td>
<td>1.4</td>
<td>8.3</td>
<td>1%</td>
</tr>
<tr>
<td>2</td>
<td>John</td>
<td>1.2</td>
<td>2.8</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Jess</td>
<td>11.3</td>
<td>1.8</td>
<td>3%</td>
</tr>
<tr>
<td>3</td>
<td>Sam</td>
<td>2.2</td>
<td>5</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Steve</td>
<td>6.8</td>
<td>2.9</td>
<td>2%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia</td>
<td>1.4</td>
<td>8.6</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>James</td>
<td>4.5</td>
<td>12.2</td>
<td>2%</td>
</tr>
<tr>
<td>5</td>
<td>Adam</td>
<td>39.1</td>
<td>66.3</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Amy</td>
<td>4.3</td>
<td>5.5</td>
<td>1%</td>
</tr>
<tr>
<td>6</td>
<td>Dom</td>
<td>0.0</td>
<td>2.8</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Daniel</td>
<td>1.5</td>
<td>0.0</td>
<td>1%</td>
</tr>
</tbody>
</table>

Key ● = decrease from initial session ■ = increase from initial session □ = no change from initial

Eye Gaze at Partner: Child-Computer Interaction.

The eye gaze at their partner did not occur very often as shown by the total durations, percentage durations, and frequency per minute. However, it should be remembered that children were not
positioned for face-to-face interaction, they were sitting in close proximity so that they could see much of their partner in their peripheral vision, and they had an attractive object that they were working with (the iPad). Furthermore, the literature suggest that people tend to avoid direct eye-contact (Gallup et al., 2012; Laidlaw et al., 2011). Additionally, as observed through the eye gaze on the iPad, it appeared that despite not looking directly at their peer, the children were still communicating.

From my informal observations, the incidents of eye gaze towards a partner often happened under two circumstances. The first situation usually occurred during the process of photo taking, in which one of the children has an instruction that he/she feels they need to convey directly to their partner and lowered the iPad down to address them. The second situation occurred when the child’s eye gaze was towards their partner when they wanted a turn using the iPad, and therefore address their partner directly. In both cases eye gaze towards the partner often occurred as a precursor to direct negotiation, therefore eye gaze towards a partner was often followed by some form of verbal communication. The children’s apparent understanding that looking directly at their partner as being more personal and effective for collaborative communication is interesting. Also eye gaze towards their partner did not frequently happen at the same time for both children. Usually one child was looking at their partner to provide more emphasis when they were speaking, but the other child was often gazing at the iPad or something else.

*Eye Gaze at Partner: Comparison of Initial and Redesign Session.*

If the redesign increased cooperation then there is an argument that the redesign might have increased the gaze at their partner, although it is difficult to be sure about this prediction (for example more cooperation might mean it is less necessary to check on the partner). There appears to have been no consistent patterns regarding the change of eye gaze at their partner.
from initial to the redesign sessions. Given the low occurrence of these gazes, it appears to be most appropriate to look at the frequency per 5 minutes about this issue. For 3 of the pairs (pairs 1, 2, and 3) there appears to be a decrease in the eye gaze frequency towards their partner, while there appears to be an increase in eye gaze frequency towards a partner in 2 of the pairs (pairs 4 and 5), and for pair number 6 Dom shows an increase while Daniel does not looks at his partner at all in the redesign.

6.1.3 Eye Gaze at Researcher

Eye gaze at the iPad was coded for all the instances in which the child’s gaze and head orientation was towards the researcher. Table 6.4 provides the data for the duration, percentage, and frequency per 5 minutes of eye gaze at the researcher for each child.

Table 6.4 Duration, Percentage, Frequency per 5 minutes of Eye Gaze at Researcher for each child

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Total Duration (seconds)</th>
<th>Percentage Duration</th>
<th>Frequency per 5 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom</td>
<td>19.3</td>
<td>12.0</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Kate</td>
<td>36.7</td>
<td>26.0</td>
<td>24%</td>
</tr>
<tr>
<td>2</td>
<td>John</td>
<td>1.2</td>
<td>26.0</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Jess</td>
<td>5.2</td>
<td>19.4</td>
<td>1%</td>
</tr>
<tr>
<td>3</td>
<td>Sam</td>
<td>16.8</td>
<td>32.1</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Steve</td>
<td>21.6</td>
<td>26.0</td>
<td>8%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia</td>
<td>72.8</td>
<td>31.8</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>James</td>
<td>8.1</td>
<td>22.3</td>
<td>3%</td>
</tr>
<tr>
<td>5</td>
<td>Adam</td>
<td>20.1</td>
<td>12.8</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Amy</td>
<td>134</td>
<td>14.3</td>
<td>26%</td>
</tr>
<tr>
<td>6</td>
<td>Dom</td>
<td>11.2</td>
<td>31.2</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Daniel</td>
<td>19.7</td>
<td>23.2</td>
<td>9%</td>
</tr>
</tbody>
</table>

Key: ◼️ = decrease from initial session ▶️ = increase from initial session ▶️ = no change from initial
**Eye Gaze at Researcher: Child-Computer Interaction.**

Table 6.4 shows that the gazes at the researcher were usually a low percentage of the session and were not that frequent. In some respects, there were similarities in the profile of gazes at the partner and at the researcher, both appeared to usually be a lower priority than gazes at the iPad.

The eye gaze towards the researcher was classified as on-task behaviour, since these eye gazes are often associated with periods of time when the child is asking for assistance or is listening to an instruction given by the researcher. Usually these eye gazes were coupled with some type of verbal exchange but not all the time. In some incidents the eye gaze towards researcher were also signs of non-verbal communication for assistance in turn taking. Similarly, eye gaze towards the researcher also indicated that a critical event had happened, and the children were looking to see how the person in authority would engage with the situation. Eye gaze with the researcher can follow incidents of conflict or what the children feel may be an inappropriate use of the device. It also may be that the high percentages of this type of gaze in the initial session, particularly for Kate (24%), Amy, (26%), and Lydia (15%) were associated with the novelty of the activity and learning to use the app, which resulted in the children seeking help from the researcher.

**Eye Gaze at Researcher: Comparison of Initial and Redesign.**

There appears to be no consistent patterns regarding the change of eye gaze at the researcher from the initial to the redesign sessions. As some children had a very high percentage of gaze at the researcher due to seeking help in the initial session (Kate, Amy and Lydia), in the redesign session, there was a large decrease as the children became more familiar with the app, therefore the need to make eye contact with the researcher for support was less.
6.1.4 Eye Gaze at Another Pair

Eye gaze at the iPad was coded for all the instances in which the child’s gaze and head orientation was towards another pair who were in the room. This gaze was only applicable for the London setting (pairs 1-4) where the activities were conducted in a group setting. Table 6.5 provides the data for the duration, percentage, and frequency per 5 minutes of eye gaze at the researcher for each child.

Table 6.5 Duration, Percentage, Frequency per 5 minutes of Eye Gaze at Another pair for each child

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Total Duration (seconds)</th>
<th>Percentage Duration</th>
<th>Frequency per 5 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom</td>
<td>24.6</td>
<td>113.4</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Kate</td>
<td>6.2</td>
<td>11.6</td>
<td>4%</td>
</tr>
<tr>
<td>2</td>
<td>John</td>
<td>0</td>
<td>23.4</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Jess</td>
<td>49.3</td>
<td>20.3</td>
<td>13%</td>
</tr>
<tr>
<td>3</td>
<td>Sam</td>
<td>30.6</td>
<td>41.2</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Steve</td>
<td>9.8</td>
<td>152.2</td>
<td>4%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia</td>
<td>16.4</td>
<td>49.6</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>James</td>
<td>14.9</td>
<td>2.6</td>
<td>6%</td>
</tr>
</tbody>
</table>

Key: ● = decrease from initial session  ● = increase from initial session  ● = no change from initial

Eye Gaze at Another Pair: Child-Computer Interaction.

The eye gaze towards another pair in the room was considered as off-task behaviour because the children were focusing on something else rather than a shared goal with their partner. The eye gaze towards the other pair, was a significantly larger percentage of off task behaviour than the children being distracted by other things in the room. Although it is grouped as an off-task behaviour, I also observed, in many incidents the eye gaze towards other pair involved a child looking at how the other pair was interacting with the app. The eye gaze towards the other pair
was often instigated by two situations: firstly, a child appeared unengaged with (not in possession of) the iPad and therefore looked at the other pair as a form of distraction, and secondly when the other pair was being loud or interacting in a distracting or attention seeking manner, which caused either one or both children in the focal pair to look towards them.

**Eye Gaze at Another Pair: Comparison of Initial and Redesign Session**

There appeared to be no consistent patterns regarding the change of eye gaze at the researcher from initial to the redesign sessions. Although for certain individuals (Tom (15%), Kate (27%), and Lydia (12%)), there was a high percentages of eye gaze at another pair in the redesign. The increase in this off task behaviour may not necessary be a direct result of the redesign in the activity but may be due to the fact pairs were becoming more comfortable and vocal in their interactions drawing the attention of other pairs to look at them.

### 6.1.5 Other Gaze

Eye gaze was coded for looks elsewhere, at a location not specified in the previous codes. This included for example, other children walking into room, looking at the worksheet, or outside environment. Table 6.6 provides the data for the duration, percentage, and frequency per 5 minutes of eye gaze at the other for each child.

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Total Duration (seconds)</th>
<th>Percentage Duration</th>
<th>Frequency per 5 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom</td>
<td>0.9</td>
<td>18</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Kate</td>
<td>17.2</td>
<td>25.4</td>
<td>11%</td>
</tr>
</tbody>
</table>
**Other Gaze: Child-Computer Interaction.**

Eye gaze towards any other objects and/or things, is the least frequent type of eye gaze in this activity. This is consistent with the initial findings that the children are engaged in the activity and not as easily distracted by external stimuli. This may have been because they are in a familiar setting.

**Other Gaze: Comparison of Initial and Redesign Session**

There appears to be no consistent pattern regarding the change of eye gaze at others from initial to the redesign sessions. However, as this code of gaze is categorized as an off-task eye gaze, it is worth viewing this data set in contrast with the eye gaze at the iPad. It can be seen that if the child’s attention towards the iPad increased in the redesign of the activity than their eye gaze towards other things decreased, this is most likely due to the fact that if they were more engaged in the task, they are therefore less distracted by other stimuli. Similarly, if their eye gaze towards the iPad decreased, there usually was an increase in eye gaze at other objects. This appears to be
true for all the children except for James, who demonstrated a decrease in eye gaze towards other things and a decrease in his eye gaze on the iPad.

6.1.6 Comparison between Sessions: Eye Gaze at iPad, Off Task and at Partner/Researcher

To check on the overall pattern of child-computer interactions and changes in cooperation the codes were combined to give the overall percentage duration of off task behaviour, gaze at the iPad, and gaze at a partner and/or researcher. The percentages were calculated in relation to the gaze of each child. These data are provided in the Figure 6.1.

Figure 6.1 Comparison between Sessions of Percentage of Eye Gaze at iPad, Off Task and at Partner/Researcher

Overall Eye Gaze: Comparison of Initial and Redesign Session.

As already discussed it might be expected if there was an increase in cooperation that there would be more on-task activity and less off-task activity in the second session. A comparison of the different types of eye gaze across the two sessions, highlights the complexities and varying
levels of engagement presented by each individual child as well as the differences in each partnership. There appears to be no consistent change in the pattern of the eye gaze from the initial session to the redesign.

There was a higher percentages of off-task eye gaze in the redesign session for four children especially for Lydia and Tom, which obviously also was associated with a decrease in their eye gaze towards the iPad. Lydia’s off task behaviour will be further explained in the critical incident analysis (see section 6.3.2) and further illustrate how the circumstance and relationship surrounding individual pairs strongly influences their engagement with iPad activity.

Another feature of Figure 6.1 is that similar to the joint attention, there often appears to be a shift in the dynamic of the pair, in that if one child had an increased in the percentage of on-task eye gaze then their partner’s on-task eye gaze would decrease, this is also true for off task behaviour. The reason for this shift is difficult to understand from eye gaze alone. A more detailed analysis of the touch data in the following chapter presents a more holistic view of the physical interactions that occur.

6.1.7 General Discussion

Eye gaze provides a unique perspective in measuring how children engage with their peer and cooperating when working together with an iPad. The method of looking at eye gaze is more commonly found in infant studies due to the fact eye movement are among the few behaviour responses new born exhibit (Johnson et al., 1991). However, the fundamentals about eye gaze as a behavioural response to other people and to external stimuli remains true across all age groups. It is a useful way of measuring young children’s interaction, especially when they might not be as able to express themselves orally.

Based on the analysis of the video data the following behaviours were observed: all children demonstrated high levels of engagement with the iPad and activity, and overall the percentage of
joint attention remained high across all pairs in both sessions. Eye gaze towards their partner remained low, but that is consistent with previous research that shows people tend to avoid lengthy gaze at another person. However, eye gaze towards the researcher was higher than eye gaze towards their peer, which may highlight young’s children natural response to adults who are perceived as people in authority, and the need to look at an adult for confirmation of their actions. The higher percentage of gaze towards the researcher demonstrates that the role the researcher played in facilitating the activity impacted on their behaviour.

In relation to the change in cooperative behaviour through the analysis of eye gaze, specifically looking at joint attention there appears to be no clear or consistent change across the pairs. Although it cannot be claimed that the redesign of the activity did not necessarily positively impact joint attention, any negative impact was also not clearly apparent based on the redesign.
6.2 Pre-School Children’s Contact with iPads when Using an iPad in Pairs

In addition to the eye gaze analysis, contact with iPad can provide an in depth understanding of how cooperation occurs, particularly when looking at aspects of shared resources (Johnson & Johnson, 2017) and symmetry of status (Dillenbourg, 1999; Ligorio, 1997). Although previous studies (Hutchison et al., 2012; Kucirkova, Messer, Sheehy, et al., 2014) have looked at how young children interact with iPads while children are working in partnership or groups, none of the research to date has thoroughly explore the physical interactions that the pair engage with while using the devices. The rationale for specifically exploring contact in this context of understanding cooperation in early childhood education was discussed earlier in chapter 2.4.4.2.

The types of touch presented in this section includes touch type 1-4 as indicated in Table 6.12, in which all these touch types are mutually exclusive. The only touch type not addressed in the following section is Denies (touch 5), which is a different type of behaviour that will be presented and discussed in Section 6.3 in relation to transfer of iPads.

An overview of the touch and contact data will be presented and followed by data about the codes of ‘Finger Tap’ (touch 1 – section 6.2.2) and ‘hand hold and other hand touches’ (touch 2 – section 6.2.3). The following data will be presented for these two types of touch: the percentage frequency that each code was out of the total number of the touch codes, this is to provide an idea of the proportion of these codes were of all the touches of the iPads; a percentage of the duration the touch occurred (as in Section 6.1), and the frequency at which the code occurred/5 minutes (as in Section 6.1). For the two codes which involves holding the iPads, ‘hands holding and resting on table (touch 3 – section 6.2.4), and ‘hands holding and above table (touch 4 – section 6.2.5), the same data will be presented except that rather than the percentage frequency per 5 minutes of each code being presented, information is provided about the Percentage Duration of the code per 5 minutes [(duration of code x 300)/total duration]. This is because duration appears to provide a better representation of these longer events than frequency. The
decision to use duration over number of codes (frequency), is because the type of action that is being observed is better illustrated by how long the actions occur rather than how frequently they take place. Since there were differences between pairs in the total duration of the session, the percentages of duration and the rates of behaviours per 5 minutes have been calculated to provide comparable data.

As in the previous chapter, for each contact code there are two sets of commentaries about the findings. The first set concerns the overall nature of the child-computer interaction (CCI) and is focussed around the data, but also incorporates some more general observations of the sessions. The second set considers whether the data provides evidence about changes in behaviour from the initial session to the redesign which could suggests an improvement in cooperation, as will be seen in most cases behaviour change across the six pairs was variable with few examples of consistent change across all pairs. The expectation was that the redesign might result in the two children having a more equal frequency and duration of contact than in the initial session.

6.2.1 Overview of Touch and Contact Data

Table 6.7 gives the total frequency of the contact codes for touching and holding the iPads and the amount of time the children spent in contact with them the frequency is the number of codes recorded per session while the total duration provides the total length of all the codes combined. The total time of session is the duration of the video that was analysed omitting any instructional periods at the beginning; the time the session ended when one of the children handed back the iPad to me and/or left the premise of the activity. Although the total frequency of all contact and total duration will be influenced by the total duration of the session, these figures about the raw data can provide information about the nature of the interaction between the children in the pairs.
Table 6.7 Summary of the frequency and duration of iPad contact

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Frequency of All Contact (# of codes)</th>
<th>Total Duration of Contact (seconds)</th>
<th>Total time of session</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom</td>
<td>41</td>
<td>158</td>
<td>124.5</td>
</tr>
<tr>
<td></td>
<td>Kate</td>
<td>14</td>
<td>126</td>
<td>193.0</td>
</tr>
<tr>
<td>2</td>
<td>John</td>
<td>37</td>
<td>117</td>
<td>405.1</td>
</tr>
<tr>
<td></td>
<td>Jess</td>
<td>18</td>
<td>58</td>
<td>30.1</td>
</tr>
<tr>
<td>3</td>
<td>Sam</td>
<td>48</td>
<td>106</td>
<td>109.2</td>
</tr>
<tr>
<td></td>
<td>Steve</td>
<td>35</td>
<td>68</td>
<td>244.8</td>
</tr>
<tr>
<td>4</td>
<td>Lydia</td>
<td>30</td>
<td>13</td>
<td>81.1</td>
</tr>
<tr>
<td></td>
<td>James</td>
<td>89</td>
<td>85</td>
<td>258.3</td>
</tr>
<tr>
<td>5</td>
<td>Adam</td>
<td>39</td>
<td>28</td>
<td>532.4</td>
</tr>
<tr>
<td></td>
<td>Amy</td>
<td>71</td>
<td>65</td>
<td>79.0</td>
</tr>
<tr>
<td>6</td>
<td>Dom</td>
<td>16</td>
<td>108</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>Daniel</td>
<td>15</td>
<td>45</td>
<td>54.8</td>
</tr>
</tbody>
</table>

Key: "●" = lower duration than partner in the session

Eight of the children showed an increase in the total frequency of all contact codes from the initial session to the redesign, although this may be the result of the total time of the session. All sessions were longer in the redesign, but the large increase in frequency could indicate that children developed more familiarity with the app and were more confident in participating in the activity in the redesign. However, only five of the twelve children increased the duration of contact. Additionally, an analysis of the total duration of contact, provided a better understanding of how long a child was in possession of the iPad. Using the total duration as a proxy for the division of resource demonstrated which child had more physical contact with the device. It can be noted that none of the pairs in the initial or redesign sessions displayed an equal distribution of time spent on the iPad. However, the expectation that a resource is divided shared exactly in half, might be unrealistic. Even so, the imbalance of time spent in contact with the iPad...
within specific partnership such as pair 4, with James’ contact almost 4 times higher than Lydia’s could indicate a lack of cooperation in the partnership and lack of symmetry of status.

The colours used in the table highlight which child had more contact time (red) with the iPad in each session. The general trend that can be observed, is that 4 out of the 6 pairs had the same child who had more contact time with the iPad in the initial session as in the redesign session. This can be seen in Pairs 1, 2, 4, and 5. Although the proportion of interaction may have change, there appears to be one child who is more dominant and remains dominant in the redesign as well.

Figure 6.2 Average Percentage Duration for Each Type of Contact

![Percentage Frequency of Contact: Child Computer Interaction](image)

*Percentage Frequency of Contact: Child Computer Interaction*

To provide an overview of the different types of contact the Figure 6.2 gives information about the mean percentage duration of each of the contact codes from each child. The average for each type of contact was calculated, to provide an overview of what type of touch the children spent more time with.

Figure 6.2 indicates that most of the interaction with the iPad (i.e. duration), was spent holding the iPad with two ‘hands holding above table’, this relates to the design of the activity which
often requires the children to be taking pictures of each other and was an activity the children enjoyed. In contrast, the code with the shortest duration was ‘finger tap or swipe’, and this probably reflects the fact that this behaviour usually occurred rapidly, therefore the actual total time recorded was much shorter. The other two behaviours, ‘hand hold and other hand touches’ and ‘hands holding and resting on table’ appeared to have occurred for similar durations. The frequency of this behaviour related more to how the specific child chose to handle the device, as some children felt more comfortable with holding and touching simultaneously while other children preferred having the device flat on the table and using a single touch to manipulate while occasionally touching the iPad with both hands to orientate or regain possession. When comparing the type of contact in the initial and redesign sessions, there appears to be a slight decrease in all types of touch except for the one ‘finger tap or swipe’. This is noteworthy as the increase in the one finger touch is also a direct result of the redesign of the activity which were based on the suggestions from the practitioners to include more typing. It can be argued that these changes effected the way that the children interact with the iPad. This change will be explored further in the one finger analysis.

6.2.2 Finger touch

One finger touch contact was coded for all the instances in which a child made contact with the iPad with one finger in either a tapping or swiping motion. As specified in the coding scheme, this only includes when a child makes actual contact with the device, and does not include attempts of touching without contact, or hovering their finger above the iPad. For a one finger touch the other hand must not be touching the iPad, as this was coded as ‘hand holds and other hand touches’. Table 6.8 presents the data about the percentage frequency (for each child this was calculated as the frequency of one finger touch/total of all touch codes x 100), percentages of duration (for each child this was calculated as the duration of one finger touch/duration of session x 100) and rate of code (for each child this was calculated as frequency of one finger
touch/duration of session x 300), this was similar to the analysis of eye gaze. The rate of code per 5 minutes was calculated to compare the results of the initial and redesign.

Table 6.8 Percentage Frequency, percentage duration and frequency of finger touch for each child

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Percentage Frequency</th>
<th>Percentage Duration</th>
<th>Frequency of Code (per 5 minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom</td>
<td>33%</td>
<td>85%</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Kate</td>
<td>14%</td>
<td>54%</td>
<td>3%</td>
</tr>
<tr>
<td>2</td>
<td>John</td>
<td>6%</td>
<td>71%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Jess</td>
<td>79%</td>
<td>62%</td>
<td>1%</td>
</tr>
<tr>
<td>3</td>
<td>Sam</td>
<td>72%</td>
<td>71%</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Steve</td>
<td>50%</td>
<td>54%</td>
<td>1%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia</td>
<td>61%</td>
<td>31%</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>James</td>
<td>61%</td>
<td>71%</td>
<td>2%</td>
</tr>
<tr>
<td>5</td>
<td>Amy</td>
<td>67%</td>
<td>86%</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Adam</td>
<td>21%</td>
<td>60%</td>
<td>0%</td>
</tr>
<tr>
<td>6</td>
<td>Dom</td>
<td>88%</td>
<td>88%</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Daniel</td>
<td>60%</td>
<td>100%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Key  

= decrease from initial session  

= increase from initial session

Finger touch: Child-Computer Interaction.

It should also be noted that in this particular app, a finger touch could come in three forms (1) tap – a quick touch on the iPad, used to open or close images, type letters, navigate to different locations on the software (i.e. tap ‘x’ button) (2) hold and drag – a longer touch used to move image to the storyline (3) swipe- used to swipe up and down to scroll through picture or to swipe through the pages in the story created. All of these were coded as one finger contact, there was no need for a pinching touch used to zoom in and out as nothing in the app required that action.

As would be expected from the previous section, this code made up a relatively high proportion of the different types of contact with the iPads as it was often above 40% of the total frequency of
all codes (percentage frequency), but was only a very small proportion of the session durations (less than 6%). Thus one finger touch appeared to occur frequently but was short in duration.

In general, the children did not have major difficulties in engaging with the iPad through these behaviours. Occasionally, the press and drag motion did prove to be slightly more challenging for some children, and it was often coded as a lengthened one finger touch. Some of the children found it difficult to drag the images into the story line, as they had to press and hold for a short period of time before dragging. This difficulty led to children conferring with each other to find solutions or appealing to me to give them assistance. This difficulty reflected the children’s expectation from the technology to immediately respond to their touch. All the children understood that touching and pressing on the icon would open the software, they expressed an ability to control the pressure for touching that was appropriate and meaningful. The touches appeared intentional and reflected the findings from Buckleitner (2011) about touch taxonomy.

**Finger touch: Comparison of Initial and Redesign Session**

There appears to be a clear pattern in the one finger contact data set from initial to the redesign sessions. For this touch type, the rate seems to provide a better indication of what happened since each finger touch/tap or swipe usually happened in a matter of seconds, with the exception of hold and drag which was usually much longer. The pattern of occurrence that appeared with the one finger contact, was an increase in the rate of the behaviour across all the children except for Lydia. The increase in the one finger touch could be a result of the activity in the redesign session which required the children to do more typing which correlates with the one finger contact behaviour. The impact of the redesign on the behaviour of the contact, shows that activity can influence the actions of the pair. These findings suggest that the children might have been more cooperative in the second session as both members of the pair increased this important behaviour with the iPads.
6.2.3 Hand holds and other hand touches

The ‘hand holds and other hand touches’ was coded when the child had one hand holding or touching the iPad while the other hand taped or swiped on the iPad (excluding photo taking). This also included when a child had their arm or any other part of their hand touching the iPad, demonstrating ownership of the device. Table 6.9 presents data about the percentage frequency, percentages of duration, as well as the rate of this code. The duration of code per 5 minutes was conducted to compare the results of the initial and redesign.

Table 6.9 Percentage Frequency, percentage duration and frequency of hand holds and other hand touches for each child

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Percentage Frequency</th>
<th>Percentages of Duration</th>
<th>Frequency of Code (per 5 minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom</td>
<td>47%</td>
<td>0%</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td>Kate</td>
<td>14%</td>
<td>12%</td>
<td>1%</td>
</tr>
<tr>
<td>2</td>
<td>John</td>
<td>36%</td>
<td>14%</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>Jess</td>
<td>0%</td>
<td>21%</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>Sam</td>
<td>2%</td>
<td>10%</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Steve</td>
<td>19%</td>
<td>27%</td>
<td>14%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia</td>
<td>4%</td>
<td>8%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>James</td>
<td>16%</td>
<td>12%</td>
<td>26%</td>
</tr>
<tr>
<td>5</td>
<td>Amy</td>
<td>13%</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Adam</td>
<td>39%</td>
<td>15%</td>
<td>22%</td>
</tr>
<tr>
<td>6</td>
<td>Dom</td>
<td>0%</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Daniel</td>
<td>20%</td>
<td>0%</td>
<td>17%</td>
</tr>
</tbody>
</table>

Key  = decrease from initial session  = increase from initial session

Hand holds and other hand touches: Child-Computer Interaction.

For most pairs the percentage frequency and duration of ‘hand holds and other hand touches’ was much higher for one child than the other, for this child the percentage frequency was often above 40% and the percentage duration was usually above 10%. In addition, the rate for this
code was high for the more active and dominant child. For the other less dominant child the percentages and rate of use was usually very low. It can also be observed that in some instances that children did not engage in this contact at all, for example in the initial activity, Dom had no hold and touch contact, while in the redesign his partner Daniel did not do any hold and touch contact.

This type of touch was usually used for interaction in which the child was actively holding the iPad with one hand and touching with the other. This type of contact made it difficult for the other child to have a turn on the device, and unlike the one finger touch this type of touch meant that the physical positioning of the iPad was usually in front of the child engaging in this behaviour. In Table 6.9, as already noted, for many pairs one child was often coded as having a high duration and percentage of time using this code, while their partner was coded as having a low frequency and duration of this code. Furthermore, this type of behaviour unlike the one finger contact lasted for a much longer time and a higher percentage of the duration.

**Hand holds and other hand touches: Comparison of Initial and Redesign Session**

If cooperation was increasing it might be expected that there would be a more equal distribution of hold and touch in the second session. Across all the different pairs there appeared to be no consistent change from the initial to the redesign session. However, what is interesting to observe is that for three of the pairs (pairs 2, 4, and 5) there was one child in the partnership that remained consistently higher in this type of touch across the initial and redesign of the activity. Therefore, the large disparity across the pairs suggests an uneven sharing of the iPad, or at the very least the sharing of resources is often skewed to a particular child. Additionally when this type of contact occurred, it was difficult for the other child to physically engage with the device,
because when a child was holding and touching the device, the iPad is positioned directly in front of only one child and usually excludes engagement from the other child in the pair.

6.2.4 Hands holding and resting on table

The ‘hands holding and resting on table’ contact was coded when a child had two hands resting on edge of the tablet or holding the iPad, while part or all of the iPad was touching the surface of the table. This occurred during incidents of transfer of possession, reorientation of the device, or in between one finger touch. Table 6.10 presents the data of the percentages of duration and the duration of code per 5 minutes.

Table 6.10 Percentage Frequency, percentage duration and duration of hand holding and above table for each child

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Percentage Frequency</th>
<th>Percentage of Duration</th>
<th>Duration of Code (per 5 minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom</td>
<td>7%</td>
<td>12%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Kate</td>
<td>7%</td>
<td>16%</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>John</td>
<td>28%</td>
<td>8%</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>Jess</td>
<td>7%</td>
<td>13%</td>
<td>3%</td>
</tr>
<tr>
<td>3</td>
<td>Sam</td>
<td>13%</td>
<td>14%</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>Steve</td>
<td>16%</td>
<td>14%</td>
<td>1%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia</td>
<td>18%</td>
<td>8%</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td>James</td>
<td>11%</td>
<td>1%</td>
<td>6%</td>
</tr>
<tr>
<td>5</td>
<td>Amy</td>
<td>10%</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Adam</td>
<td>27%</td>
<td>11%</td>
<td>27%</td>
</tr>
<tr>
<td>6</td>
<td>Dom</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Daniel</td>
<td>20%</td>
<td>0%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Key: ▼ = decrease from initial session   ▲ = increase from initial session
**Hands holding and resting on table: Child-Computer Interaction.**

Table 6.10 show that in general with this type of touch the frequency remained relatively low, particularly in the redesign of the activity. The frequency as a proportion of all touches was often below 15%. However, the percentage duration was higher than the one finger touch, which might be expected as this type of touch was not a brief contact with the iPad. For some of the pairs it can also be seen that although they demonstrated a high percentage frequency in the initial activity, it decreased considerably in the redesign (i.e. Daniel, John, Lydia) or vice a versa (i.e. James, Jess, Kate). The inconsistent change between the initial activity and redesign suggests that the occurrence of this type of touch did not appear to be directly linked of any of the activity designed features. Therefore, the children decision to touch the iPad in this manner may be related to the child’s preference of touching the iPad, as opposed to the result of any instructional design.

For most pairs the percentage of frequency and percentage duration of ‘hands holding and resting on table touch’ was much higher for one child than the other, for this child the percentage frequency was often above 40% and the percentage duration was usually above 10%. In addition, the rate for this code was high for the more active and dominant child. For the other less dominant child the percentages and rate of use was usually very low. It can also be observed that in some instances that children did not engage in this contact at all, for example in the initial activity, Dom had no ‘hands holding and resting on table’ type touch, while in the redesign his partner Daniel did not have any hold and touch contact.

The two-hand table contact was coded separately to two hands above table, as the table played an important role in the assisting this activity. The presence of the table allowed for the movement of the iPad across the table top, and ease of repositioning, which would not have been
as easy on the floor. The positionality of the iPad at table top height also appeared to be a natural position for the children to engage with the device. The children were not constrained to the table and in some instances they moved and stood up to take pictures, but none of the children moved to use the iPad on the floor. Previous research (Zandvliet & Straker, 2001), has explored the intricate interplay between the physical, psychosocial environment, and new technology. The research along with the findings from this study suggest that educators need to consider carefully the physical space used to introduce the iPad, in order for the devices fullest potential to be realised.

_Hands holding and resting on table: Comparison of Initial and Redesign Session_

There appears to be no consistent pattern regarding the change of two hand table contact from the initial to the redesign sessions. This type of behaviour did not directly correlate with any specific redesign features of the activity, unlike the one finger touch which focused on the typing, and two hands above which linked with the photo taking action, the two hands table was more of a transitional motion. Therefore, it is not surprising that there appeared to be no change in this type of behaviour.

6.2.5 Hands holding and above table

The two hand above was coded for all the instances in which the child had both their hands holding the iPad and when the iPad was lifted above the surface of the table. This was usually photograph taking behaviour. Table 6.11 presents that data about the percentages of frequency, duration and the duration of code per 5 minutes was conducted to compare the results of the initial and redesign. As noted above the duration per 5 minutes was believed to provide a better indication of the social interaction.
Table 6.11 Percentage Frequency, percentage duration and duration of hands holding and above table for each child

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Percentage Frequency</th>
<th>Percentage Duration</th>
<th>Duration of Code (per 5 minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
<td>Redesign</td>
</tr>
<tr>
<td>1</td>
<td>Tom</td>
<td>14%</td>
<td>3%</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>Kate</td>
<td>64%</td>
<td>18%</td>
<td>3%</td>
</tr>
<tr>
<td>2</td>
<td>John</td>
<td>31%</td>
<td>8%</td>
<td>34%</td>
</tr>
<tr>
<td></td>
<td>Jess</td>
<td>14%</td>
<td>4%</td>
<td>63%</td>
</tr>
<tr>
<td>3</td>
<td>Sam</td>
<td>13%</td>
<td>4%</td>
<td>74%</td>
</tr>
<tr>
<td></td>
<td>Steve</td>
<td>16%</td>
<td>5%</td>
<td>67%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia</td>
<td>18%</td>
<td>54%</td>
<td>62%</td>
</tr>
<tr>
<td></td>
<td>James</td>
<td>11%</td>
<td>16%</td>
<td>30%</td>
</tr>
<tr>
<td>5</td>
<td>Amy</td>
<td>10%</td>
<td>11%</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Adam</td>
<td>13%</td>
<td>14%</td>
<td>13%</td>
</tr>
<tr>
<td>6</td>
<td>Dom</td>
<td>6%</td>
<td>4%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Daniel</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Key: ● = decrease from initial session, ■ = increase from initial session

*Hands holding and above table: Child-Computer Interaction.*

Although across all the pairs, there appears to be varying durations and frequency for this type of touch, for most pairs (except pair 6), every child at one point seemed to be engaging in this type of touch and were likely to be taking photos of their partner. It is worth noting that pair 6 (Dom and Daniel) did not engage in the photo taking component of the activity. The duration of this type of contact for some of the children were very high (Lydia and Sam), which suggest that this main type of iPad contact that the children engaged in. It should be noted that the code was chosen because the iPad activity encouraged the children to take pictures of each other to include in the story line. Therefore, the design of the activity directly impacted the way that the children physically touched the device.
Although the code hands hold above the table was often used when the children were taking photographs is also occurred during normal interactions with the iPad. Similar to the hands hold and other hand touch code, this type of contact made it difficult for the other child to have a turn on the device. What is noticeable from the data set is the percentage duration for certain children showed a high percentage of this type of touch, suggesting it that they spent the majority of their time when touching the iPad in this position. Therefore, duration of touch was the unit of analysis most of interest rather than the frequency of codes. This code is also unique in that although one child may be in coded as engaging more in this type of contact, the act of photo taking required the active participation from both children in the pair.

**Hands holding and above table: Comparison of Initial and Redesign Session**

There appears to be no consistent pattern regarding the change of two hand above contact from initial to the redesign sessions. Although the initial activity had more emphasis on the photo taking component, the redesign also had photo taking components. The instructions given to the students did not put any emphasis on how much time should be spent taking photos; therefore it is not surprising that there was no consistent change of this behaviour as some pairs engaged more with the photo taking part (pair 4), while others focused less on it (pair 3).

6.2.6 General Discussion

The types of touch with the iPad provide a more comprehensive picture of how children are interacting with the app. Although there have been previous attempts to classify the type of contact that children perform on these touch-based technologies (Buckleitner, 2011), very few studies have attempted to analyse in-depth the physical interactions that young children have with these tools.
The analysis of the video data provided information into the division of labour and the sharing of resources across the different pairs, it would appear that at least in terms of total duration of contact per child, none of the pairs came close to sharing the device equally. Although this type of sharing of resources is only a single component of cooperation, and an exact equal sharing of the resource does not necessarily result in better cooperation, it is still an important feature to capture in terms of how the tool is utilized between the pair. Additionally, the different types of contact that was documented and its frequency provides an overview on the nature of the child-iPad interaction. The fact that there were certain types of touch in which children would be holding the device with both hands demonstrates a certain type of dominance and ownership over what should be a shared object.

The lack of equality in the total amount of time that a child had on the device in comparison to their peer, showed that there was a tendency for one child in the partnership to have more possession of the device in both the initial session and the one after the redesign. The reason why one child appears to be dominant with regards to possession of the device may be the result of many factors such as leadership skills, communication skills, behavioural traits, and digital literacy skills. It is difficult to know which of these skills played the most important role in helping certain children gain more access to the device. One possibility that is worth considering is that some children with more previous experience with the iPad may and have learned some basic digital literacy skills, will naturally be more confident in taking ownership of the device.

Certain types of touch also presented themselves more frequently amongst a child who had more possession, for example the two hands table and the hold and touch were both positions, that physically made it harder for their partner to touch the device. These positions were more closed,
and acted as a barrier for the partner to access the tool. The “hands holding and resting on table”, is unique from two aspects, the first being that it explicitly requires the use of the table as another resource to assist in their interaction with the iPad. Also when a child engages in this type of touch, they did not appear to know exactly what they wanted to do on the iPad, but they choose to touch the sides of the iPad as if to demonstrate possession of the device.

Even though there appears to be no consistent patterns in whether cooperation increased or decreased across the different pairs, the analysis of the touch has demonstrated the impact of the redesign of the activity in the children’s behaviour on the devices. Across all the children except for Lydia, there was an increase in the rate of the one-finger touch in the redesign, and this was a direct result of structuring more opportunities for children to type on the device. Similarly, as presented in the findings for the two hands above contact, the frequency of the touch was the result of the design of the activity as this type of touch correlated with the photo taking position. This suggests that the way practitioners introduce and scaffold the activity on the iPad does influence their behaviour on the device.

### 6.3 Transfer of Possession during Social Interaction with iPad

Transfer of possession can provide important information about the extent and quality of sharing and cooperation between two children. The rationale for looking at transfer of possessions has been addressed in chapter 2.4.4.3. The transfer of possession may be viewed as ‘turn-taking’ and fundamental skill that practitioner aim to fosters. The importance of turn-taking has been reflected across multiple early childhood curriculum (Department for Education, 2017; Ministry of Education New Zealand, 2017; New York State Early Childhood Advisory Council, 2019). However, rather than calling it turn-taking which implies a positive interaction, a more neutral term, ‘transfer of possession’ is used to describe these processes (see Chapter 2) as this better reflects
the different types of actions that indicate an apparent movement of the iPad from one child to the other. This often involved the iPad's physical movement from being used and positioned in front of one child to being used and positioned in front of the other child.

This section begins by providing an overview of the coding scheme (section 6.2.1), then revisiting the coding scheme, presenting an example of how the codes from section 6.2 was used to indicate points of interaction where transfer occurred, before presenting the finding (section 6.3.2 & 6.3.3). The findings are structured into two main sub-section (1) Critical incident analysis and (2) Types of Transfer of Possession. The critical incident provides vignette of the three different types of exchanges that occurred. These “turn taking” behaviours or referred to her as transfers are a fundamental part of how young children demonstrate their understanding on the importance of behaving cooperatively (Melis et al., 2016; Olson & Spelke, 2008). The second section concerns: the frequency, the percentage that each form of transfer was out of the total number of transfers, and the rate of the three forms of transfer (i.e. average frequency in 5 minutes). The focus in this section is on the frequency of the different forms of transfer rather than on their durations, as the latter was not thought to be informative about the nature of the transfer process or differences between the sessions. The data about each type of transfer are considered in relation to the information they provide about the children interacting with the iPads and then in relation to whether there were changes from the initial session to the second session after the redesign.

6.3.1 Method Overview

This section provides a brief overview the codes used and how to interpret the timelines from ELAN. A more detailed description for the methods used in this section can be found in chapter 3. The transfer of possession was coded according to the ease of the transfer, with green being a smooth transition and red indicating conflict (see Table 6.12).
### Table 6.12 Transfer of Possession Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green</strong></td>
<td>The transfer of possession appeared to be mutual with one child usually physically handing over the iPad to the other. The coding of this transfer did not always have to involve the handing over the iPad directly to the other child, but it could be one child leaning away from the iPad, to allow the other child to pick up the iPad with ease. This code often involved cooperative exchanges.</td>
</tr>
<tr>
<td><strong>Yellow</strong></td>
<td>The transfer of possession in this case was not fully cooperative, but there was also no clear conflict or denial to let the other child have a turn either. Often the transfer occurred too quickly or unexpectedly for the other child to react or the child in possession did not have any clear goals they were working towards therefore they appeared unconcerned about whether or not the iPad is taken away.</td>
</tr>
<tr>
<td><strong>Red</strong></td>
<td>These are incidents where the transfer of possession was met with resistance, this often appeared in the form of tugging between the two partner or one child explicitly trying to cling on to the iPad. The degree of conflict varied from a clear tugging of the iPad, to the slight tensing of grip that clearly indicated an unwillingness to give up the device.</td>
</tr>
</tbody>
</table>

### 6.3.1.1 Example of Total Touch Codes and Interpretation of Timeline

This brief explanation outlines the nature of the timelines that were used to provide descriptive information about the critical incident analysis. An example as seen in Figure 6.3 are the different types of touch that were coded across the video timeline, in which each type of touch being was coded on a separate viewing of the video record. The beginning of the touch is indicated by the vertical line and the length of that touch is represented by the horizontal line. The end of the touch occurs when the horizontal line finishes. The one finger touch (labelled on the graphs as touch 1) tends to be short and have single vertical lines, and longer lines often indicates actions of dragging something on the iPad. The hands holding resting on table (touch 2) often appears during transfer of possession or when a child is trying to orientate the iPad. The hands holding above table (touch 3) and hands hold and touch (touch 4), also were often coded for longer periods of time.
Figure 6.3 is an example of this way of describing interaction. The independent codes are labelled on left hand side as touch 1, touch 2, touch 3, and touch 4, and all these four forms of contact are summed together and labelled as touch total in the bottom line. The merging of all the types of touch creates a total touch timeline for an individual child, this becomes important in isolating incidents of transfers.

**Figure 6.3 Example of total touch timeline**

![Total Touch Timeline]

Consequently, when reading the timeline, each vertical line coincides with the beginning of the code and the horizontal line indicates how long the codes last. In instances where there appears to be no horizontal line, often means the touch happened very fast. The time at the top indicates the time which the touch occurs, so multiple codes including, eye gaze and transfer of possession can be viewed in conjunction to provide a more holistic picture.

When all the types of touch are merged for a child, this will visually show when that child is in possession of the iPad. Therefore, isolating moments of transfer of possession can be apparent as the touch code of one child shifts to the other child, as shown in Figure 6.4. In this specific example, the overlap of touch codes between the pair as labelled transfer 1 indicates that both children had their hand on the device during the exchange. Contrary to the second transfer labelled transfer 2, the absence of code meant that neither child had their hand on the device, which meant that the iPad was most likely placed on the table when the transfer occurred.
6.3.2 Vignettes of Critical Incident Analysis

An adaptation of the critical incident analysis method, as suggested by Anastopoulou et al. (2008), helped form the foundation for selecting incidents to evaluate for the transfer of possession between the pair of children. For this thesis, these incidents were selected to illustrate different forms of transfer and better understand the data described in section 6.3. It should be understood that critical incident analysis usually examines a commonplace event rather than the dramatic event, the incidents are made critical through the analysis (Tripp, 1993). The selection criteria were based on Anastopoulou et al. (2008) descriptions of their approach towards selecting incidents, by looking at events that represented a ‘breakthrough’ or ‘breakdowns’ and through the lens of a predictable or an unpredictable event.

“They may either be predictable (e.g. the intervention may be aimed at producing conceptual change) or unpredicted (e.g. a child uses the technology in novel ways, or makes an unforeseen connection or conceptual leap)” (Anastopoulou et al., 2008, p. 6)

This method of analysis was adopted to provide an in-depth examination of six incidents across the different types of transfer to explore the reasons behinds the pairs’ behaviours, why they choose to transfer the iPad and what were indicators of success and failure. Table 6.13, outlines the different incidents covered and why they were selected. The selection of each incident was because it either provided a clear picture on a different type of transfer or it show cased an unexpected process in the way the transfer was coded. In the last column of Table 6.13 the term ‘expected interaction’ means that the transfer was a typical one. Unexpected interactions
provide examples of incidents in which a closer examination of the interaction shows the complexity of the transfer process. In the critical incident analysis a record from ELAN of the incident is displayed and supplementary observations from the video record are included, these are qualitative impressionistic observations rather than careful quantified descriptions.

Table 6.13 Critical Incident Analysis Selection Criteria

<table>
<thead>
<tr>
<th>Type of Transfer</th>
<th>Pair</th>
<th>Initial or Redesign</th>
<th>Explanation of Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Green</td>
<td>Pair 1</td>
<td>Redesign</td>
<td>Expected interactions that helped to define the coding scheme.</td>
</tr>
<tr>
<td>2 Yellow</td>
<td>Pair 2</td>
<td>Redesign</td>
<td>Expected interactions that helped to define the coding scheme.</td>
</tr>
<tr>
<td>3 Yellow</td>
<td>Pair 4</td>
<td>Initial</td>
<td>Expected interactions that helped to define the coding scheme.</td>
</tr>
<tr>
<td>4 Yellow</td>
<td>Pair 3</td>
<td>Redesign</td>
<td>Unexpected interactions that deviated from the norm.</td>
</tr>
<tr>
<td>5 Red</td>
<td>Pair 3</td>
<td>Initial</td>
<td>Expected interactions that deviated from the norm.</td>
</tr>
<tr>
<td>6 Red</td>
<td>Pair 4</td>
<td>Redesign</td>
<td>Unexpected interactions that deviated from the norm.</td>
</tr>
</tbody>
</table>

6.3.2.1 Vignette 1 - Green Transfer: Tom & Kate (Pair 1) – Redesign

Figure 6.5 Tom & Kate Green Transfer (video data images)
Observational Narrative from Figure 6.5 Tom & Kate Green Transfer (video data images): Images A through D show the pair of Tom and Kate taking turns on the iPad which was coded as a green transfer. Image A shows Kate passing over the iPad to Tom (first green transfer as identified in Figure 6.6). Image B shows Tom taking pictures Kate as part of the activity. Image C shows Tom working on the app while Kate is observing him. Image D shows Kate is taking the iPad from Tom, he allows Kate to take it without any resistance (second green transfer as identified in Figure 6.6).

Figure 6.6 Incident 1 - Green Transfer

<table>
<thead>
<tr>
<th>Total Touch (Tom)</th>
<th>Total Touch (Kate)</th>
<th>On Task Eye Gaze (Tom)</th>
<th>Off Task Eye Gaze (Tom)</th>
<th>On Task Eye Gaze (Kate)</th>
<th>Off Task Eye Gaze (Kate)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Qualitative Analysis: These two transfers represent an expected and typical green transfer, as the overlap in codes for total touch showcases the handing over of the iPad. Although both children had their hand on the device simultaneously, it was done respectfully with both sides' acceptance, acknowledging the transfer of possession. In this incident the contact of each child with the iPad is summarised in the row labelled Total Touch and the summary of gaze at the iPad or away from the iPad is also summarised for each child in a separate row. This example of a green transfer reflected a common situation in which the transfer occurred smoothly between the pair during the photo-taking incidents. In this pair, Kate was coded for the two-hand hold around the 00:10:30 mark, and she physically handed over the iPad to Tom. The exchange appeared to be a non-verbal interaction between the two, with minimal conversation occurring. As Tom was taking the picture, it could be seen that both their eye gaze was on task, at the iPad, as they both needed
to be engaged. The photo-taking activity promoted a key component of cooperative interaction, which is positive interdependence, in which the children perceive that they are linked with their partner in such a way that they cannot succeed unless their partner is also actively participating in the activity. Once the photo taking actions were completed when Tom proceeded to put the iPad down, Kate took the opportunity to take possession of the iPad, as she appeared to feel that she should make the choice of what picture of her should be included in the storyline. Once the possession moved over to Kate, in the second green transfer, what is noticeable is for a brief moment Tom’s eye gaze is off task. This is a common feature of transfer, so that once the iPad is handed over to their partner it can sometimes leave the other child disengaged.

6.3.2.2 Vignette 2 - Yellow Transfer: John & Jess (Pair 2) – Redesign

Figure 6.7 John & Jess Yellow Transfer (video data images)
Observational Narrative from Figure 6.7 John & Jess Yellow Transfer (video data images):

Images A through D show the pair of John and Jess’s transfer of possession which is coded as a yellow transfer. Image A shows Jess using the iPad while John observes what Jess is doing. Image B shows John reaching over to take the iPad while Jess appears surprised (yellow transfer as identified in Figure 6.8). Image C shows John working on the app while Jess observed from afar. Image D shows Jess leaning in towards the iPad and John in order to look at what her partner is doing.

Figure 6.8 Incident 2 - Yellow Transfer

<table>
<thead>
<tr>
<th>Total Touches (John)</th>
<th>Total Touches (Jess)</th>
<th>On Task Eye Gaze (Jess)</th>
<th>Off Task Eye Gaze (Jess)</th>
<th>On Task Eye Gaze (John)</th>
<th>Off Task Eye Gaze (John)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Qualitative Analysis: In general, this type of transfer is the most subjective of the three different types classified. The yellow transfer of possession is the most ambiguous, and are often incidents which are not fully cooperative, but there is also no clear conflict or denial to let the other child have a turn either. This particular incident best captures how Jess, who initially was in possession does not have any clear goals, therefore, when John reached over to type some letters, she appeared quite nonchalant about whether or not the iPad is taken away. Although the eye gaze in this case does not give much insight into the interaction, as they both appeared to be on task during the transfer, the physicality around the touch, is the most important aspect of this interaction. What is noticeable during this negotiation is that Jess was engaged with the iPad through the one-finger touch, trying to type something in the storyline, as can be seen the touch
was short and spread apart. This slower type of touching allowed for John to quickly swoop in and try to have a go as well. His first initial touch was with his left hand, and his physical body ended up blocking out Jess and becoming a barrier for Jess to re-engage with the device. Jess did not argue against the transfer, but she appeared slightly confused through her facial expression.

6.3.2.3 Vignette 3 - Yellow Transfer: Lydia & James (Pair 4) – Initial

Figure 6.9 Lydia & James Yellow Transfer (video data images)

<table>
<thead>
<tr>
<th>Image A</th>
<th>Image B</th>
<th>Image C</th>
<th>Image D</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image A" /></td>
<td><img src="image2.png" alt="Image B" /></td>
<td><img src="image3.png" alt="Image C" /></td>
<td><img src="image4.png" alt="Image D" /></td>
</tr>
</tbody>
</table>

**Observational Narrative from Figure 6.9 Lydia & James Yellow Transfer (video data images):**

Images A through D illustrates the pair of Lydia and James’s transfer of possession which is coded as a yellow transfer. Image A shows Lydia using the iPad while James has slid his hand under Lydia’s hand to grab the iPad from below. Image B shows James taking the iPad from Lydia who lets go of the iPad (first yellow transfer as identified in Figure 6.10). Image C shows James working on the app while Lydia leans back but is still observing what James is doing on the iPad. Image D shows Lydia putting her arm over James’s arm and pulling the iPad towards herself (second yellow transfer as identified in Figure 6.10).
This critical incident highlights the intermediate nature of the yellow transfer, and this was an expected incident in that demonstrated the reluctant and opportunistic characteristic that was typical of these type of transfers. If viewed in isolation the first yellow transfer in this example could have been coded as a green transfer as it appears that Lydia willingly passed the iPad over to James. However, previously James had actually put both hands on the iPad and attempted to pull the iPad away from Lydia. The attempt to pull the iPad away is classified as a ‘denies’ as James ultimately was not successful in taking the iPad away. After the Lydia’s success in remaining in possession of the device, it became apparent that she was uncertain of what to do on the device, so she willingly gave up the iPad to James. This reluctant hand over was the reason why this transfer was classified as yellow given the context and hesitant nature of the transfer. After James gained possession of the iPad, he was more confident and produced a number of touches and had a clearer idea of how he wanted to manipulate the iPad. The second yellow transfer was prompted by the lead investigator telling the children that it was time to wrap up the story, which appeared to make Lydia want to regain possession of the device before the activity was over. The second yellow transfer was a good example of a transfer that occurred too quickly and unexpectedly for James (the other child) to react. What can be observed in the timeline is the gap and lack of touch prior to Lydia taking possession of the device, behaviour such as this occasionally provided a window of opportunity for a child not in possession of the device to attempt to take it. These ‘opportunistic’ transfers were a characteristic feature of the yellow transfer and can be observed in the incident 4.
### Observational Narrative from Figure 6.11 Sam & Steve Yellow Transfer (video data images):

Images A through F demonstrates the pair of Sam and Steve’s transfer of possession which is coded as a yellow transfer. Image A shows Steve leaning in towards Sam as he is using the iPad. Image B shows Steve placing his hand on the iPad to take possession of the iPad from Steve. Image C shows Steve placing both hands on the iPad while Steve was still working on the iPad and hesitant to give up the device (first yellow transfer as identified in Figure 6.12). Image D shows Steve working on the app while Sam puts his arm around Steve and observes what he is doing. Image E shows Sam quickly grabbing the iPad while Steve was not touching it (second yellow transfer as identified in Figure 6.12). Image F shows Sam touching the iPad independently after gaining possession of the device.
Figure 6.12 Incident 4 - Yellow Transfer

**Qualitative Analysis:** This incident represents an unexpected yellow transfer, the set up to the transfer and the pairs positive initial interactions would have indicated that it could have been a green transfer. However, despite explicitly communicating that they knew how to share, their behaviours indicated otherwise. Sam and Steve's partnership had the highest increase in yellow transfers across the two sessions. What is noticeable about this pair, which cannot be interpreted by this data set alone was their strong relationship prior to the activity. Although not captured in this timeline, Steve told the investigator, “Pin, I’m letting (Sam) go first”. The clear verbal commitment foreshadowed the possibility that there would be more green transfers, but instead there appeared to be more yellow transfers, and this may be due to the more abrupt behaviour during the transfer, which made it inappropriate to classify it as green. In the initial yellow transfer that is coded in this timeline there was a period of time that Steve’s eye gaze was off task. Once Steve became engaged with the activity again and was looking at what was happening on the iPad again, he made a decision that it was his turn on the iPad. So Steve made a clear movement to get possession of the iPad by using both hands to grab the device, but it was met with slight resistance from Sam. Then Sam willingly let the iPad go to his partner. And while Steve was interacting with the device, Sam actually put his arm around his partner’s shoulder, so that he was closer in proximity and observed what Steve was doing on the device. The second yellow transfer on the other hand, happened more abruptly, in which Sam who at that point did not have possession was listening to instruction I was giving another pair, and his eye gaze was on me.
(coded as on-task behaviour). Once he finished listening to me, he very abruptly decided he wanted his turn on the iPad again, so as he glanced back at the iPad and noticed Steve was not touching it, he immediately took possession of the iPad. This appeared to catch Steve off guard and his face showed a slightly confused face, and the abrupt and opportunistic nature of this transfer was therefore coded as a yellow transfer.

6.3.2.5 Vignette 5 – Red Transfer: Sam & Steve (Pair 3) – Initial

Figure 6.13 Sam & Steve Red Transfer (video data images)

<table>
<thead>
<tr>
<th>Image A</th>
<th>Image B</th>
<th>Image C</th>
<th>Image D</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Image A" /></td>
<td><img src="image2" alt="Image B" /></td>
<td><img src="image3" alt="Image C" /></td>
<td><img src="image4" alt="Image D" /></td>
</tr>
<tr>
<td>Image E</td>
<td>Image F</td>
<td>Image G</td>
<td>Image H</td>
</tr>
<tr>
<td><img src="image5" alt="Image E" /></td>
<td><img src="image6" alt="Image F" /></td>
<td><img src="image7" alt="Image G" /></td>
<td><img src="image8" alt="Image H" /></td>
</tr>
</tbody>
</table>

Observational Narrative from Figure 6.13 Sam & Steve Red Transfer (video data images): Images A through H show Sam and Steve’s transfer of possession which is coded as a red transfer. Image A shows Sam leaning in towards Steve as he is using the iPad. Image B and C show Sam initially
trying to grab the iPad from the top with one hand and then using his other hand to get a better grip (first red transfer as identified in Figure 6.14). In images B and C, Steve held on to the iPad very tight forcing Sam to pull hard for the device. Image D shows Sam in possession of the device. Image E shows Sam now happily taking pictures of Steve as part of the activity. Image F shows Steve reaching his hand under Sam’s to grab the iPad. Images G and H shows Steve pulling the iPad away from Sam, while Sam continues to try and tap on the device (second red transfer as identified in Figure 6.14).

Figure 6.14 Incident 5 - Red Transfer

**Qualitative Analysis:** This incident represents an expected red transfer, specifically as an example of transfers that demonstrated how conflict emerged when a child felt that they should have a turn on the device and the other child is unwillingly to give up possession. As mentioned earlier the red transfer were easier to code as they were characterized by a more aggressive nature and a clear conflict between the pair, in which one child did not want to give up possession, and the other children clearly wanted a turn. This incident had all the indicators of a red transfer of possession, Sam had waited patiently for his turn and finally felt that it was appropriate to have a go. Although there were moments of off task behaviour Sam still did not intervene and demonstrated his ability to wait for his turn, however, when Steve did not offer a turn to Sam, Sam took initiative in taking the over the iPad. This was met with resistance and there was clear tugging and pulling of the device before Steve ultimately let go. A red transfer may indicate that as a pair they were unable to cooperate which results in conflict, however, from an individual
perspective it can be viewed positively as a child being proactive in ensuring that there is division of resource and understanding their role in the activity. The same type of struggle appeared again in the second red transfer. It is also worth noting that in following the red transfer the children were not upset with each other and once the transfer was made it was acknowledged that it was the other persons turn.

6.3.2.6 Vignette 6 – Red Transfer: Lydia & James (Pair 4) – Redesign

Figure 6.15 Lydia & James Red Transfer (video data images)

<table>
<thead>
<tr>
<th>Image A</th>
<th>Image B</th>
<th>Image C</th>
<th>Image D</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image A" /></td>
<td><img src="image2.png" alt="Image B" /></td>
<td><img src="image3.png" alt="Image C" /></td>
<td><img src="image4.png" alt="Image D" /></td>
</tr>
<tr>
<td>Image E</td>
<td>Image F</td>
<td>Image G</td>
<td>Image H</td>
</tr>
<tr>
<td><img src="image5.png" alt="Image E" /></td>
<td><img src="image6.png" alt="Image F" /></td>
<td><img src="image7.png" alt="Image G" /></td>
<td><img src="image8.png" alt="Image H" /></td>
</tr>
</tbody>
</table>

Observational Narrative from Figure 6.15 Lydia & James Red Transfer (video data images):

Images A through H concern the pair of Lydia and James’s transfer of possession which is coded as a red transfer. Image A shows Lydia leaning in towards James as he is using the iPad. Images B and C show Lydia initially trying to grab the iPad with both hands as she is standing above James and manages to take possession. James is also still trying to grab the device as well (first red transfer as identified in Figure 6.16). In image D Lydia tries to take a picture of James as part of the activity but James refuses to cooperate and turns his head away from the iPad camera. Images E shows
Lydia beginning to put the iPad on the table as James grabs it from her, they are both tugging at the iPad but James is able to take possession of it (second red transfer as identified in Figure 6.16). Image F shows Lydia playfully looking at James while he is working on the app. Images G and H show Lydia running around the table as James attempts to take a picture of her for the activity.

Figure 6.16 Incident 6 - Red Transfer

This incident is an example of an unexpected expression of a red transfer it was coded because although their behaviour indicated an inability to easily share the device, they pair ended up joking and appeared playful about their not giving the other child a turn. This red transfer happened as a result of a photo-taking interaction. In order to provide another layer of interpretation I have also included the brief dialogue that occurred during the transfer.

Lydia: Give me now

James tries to block a photo being taken by Lydia

James: She’s not taking my picture (looks at researcher)

Lydia: I did!

Throughout this interaction they were both smiling and giggling, and although this transfer could be coded as yellow, arguably due to the ambiguous nature of the transfer, it was apparent that during the period of transfer each child wanted possession and there was very distinct pulling of
the iPad, which is why the red code remained. However, both James and Lydia responses once they lost control of the device was more a sense of amusement rather than frustration. The pair was unique in many aspects, they did not come close to completing the redesign assignment and there was short period of time where much of their data was missing, as they were running around the table trying to take pictures of each other.

6.3.2.7  Summary

Critical incident analysis involved looking at transfers that were typical and also at some atypical incidents. This allowed for a reflection about the more conventional incidents rather than unusual dramatic incidents; additionally, it also "allows for the consideration of positive encounters as well as negative events" (Lister & Crisp, 2007, p. 48). The reflection about these incidents added to the complex narrative about the children's cooperative behaviours and helped shape the exemplars of different exchanges. It has already been established that turn-taking is a crucial component of cooperative behaviour (section 2.4.4.3). Therefore it can be implied that a green transfer would indicate more cooperative behaviour. The yellow and red transfers raised more questions about how cooperative the pair was, as their behaviour indicated their inability to take turns in the usual way. While the codes themselves provide an overall illustration of the different transfer types, the qualitative analysis offers more insight into what happens before the exchange or its consequences being green, yellow or red transfer.

By looking at specific incidents in detail, some keys findings can be summarised, although the classification of the incidents are tiered and may visually reflect either a positive (green) or negative (red) transfer of possession, the consequences and the way children resolve the dispute after the red transfer may bring about a cooperative interaction. As can be seen particularly in the red transfers, despite the dispute, the pair could still proceed with the activity. There was not a dramatic breakdown between the pair's dynamic, and they were capable of resolving the conflict
without the need for me as the facilitator to intervene and, on some occasions, without any verbal communication between the pair. Furthermore, the coding system used would resemble what most practitioners would see daily, a visual representation of what was happening. It would be hard for the practitioners to analyse all the subtle subtext in behaviour that the children may be experiencing. Therefore, these findings are evidence that despite the conflict over fighting over the device that can emerge, it may be beneficial to see how children resolve through that conflict.

The identification the yellow transfer has also shown us how confidence in using the device can allow children to gain more possession. The yellow transfer also presents a type of transfer that is more opportunistic. Rather than explicitly communicating that the exchange of possession should occur, the children found ways to gain possession when their partner was not looking or did not appear to be doing anything on the device. This type of transfer may be a natural progression in how children navigate the division of labour from the cooperation framework. However, practitioners can help better scaffold ways to move yellow transfers to a more green and smooth transitions. The abundance of green transfer is a strong indicator that children at this age are very capable of cooperating while using these technologies and understand how to take turns on them.

6.3.3 Types of Transfer of Possession

Figure 6.17 gives the average percentage of the three different types of transfer of possession across all pairs and gives information about the changes between initial session and the redesign of the activity. What can be seen is that the general pattern stays the same, in which the majority of transfers are green, followed by yellow, and the red type of transfer is the lowest in both the initial and redesign of the activity. However, there is an overall decrease in the green transfer across the sessions from 64% in the initial session to 52% after the redesign, while both the yellow and red types of transfer showed a slight increase. This trend suggests that there appears to be
more conflict after the redesign, and although the changes are not large there is indication that the redesign did not necessarily facilitate less conflicting negotiation and transfers of possession across the pairs, an important cooperative skill as indicated by the practitioners. In the following sections the behaviour of the six pairs relating to each type of transfer is presented.

**Figure 6.17 Average Percentage for Different Types of Transfer of Possession**

![Average Percentage for Different Type of Transfer of Possessions](image)

6.3.3.1 **Frequency, percentage and rate of Green Transfer of Possession**

The green transfer of possession was coded for all the instances in which the movement of the iPad from one child to the other appeared to be an agreed upon exchange, which is best displayed by one child physically handing over the iPad to the other. To provide comprehensive information about the transfers, data are presented about the total amount of times each type of transfer occurred, the percentage of each type of transfer (to take account of changes in overall frequency of all transfers; calculated from number of green transfers /total of all transfers x 100) and the frequency per 5 minutes of transfers (to take account of any differences in intervals between transfers; calculated from number of green transfers/duration of session in seconds x 300). The same information is presented for the yellow and red transfers.
Table 6.14 Green Transfer of Possession

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Total number of Codes</th>
<th>Percentage</th>
<th>Frequency per 5 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom &amp; Kate</td>
<td>4</td>
<td>7</td>
<td>44%</td>
</tr>
<tr>
<td>2</td>
<td>John &amp; Jess</td>
<td>3</td>
<td>9</td>
<td>60%</td>
</tr>
<tr>
<td>3</td>
<td>Sam &amp; Steve</td>
<td>10</td>
<td>4</td>
<td>71%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia &amp; James</td>
<td>5</td>
<td>6</td>
<td>56%</td>
</tr>
<tr>
<td>5</td>
<td>Amy &amp; Adam</td>
<td>1</td>
<td>1</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>Dom &amp; Daniel</td>
<td>4</td>
<td>5</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Green Transfer: Child-Computer Interaction.**

The green transfers occurred at least 4 times in a session for most of the pairs (except pairs 2 and 5) and the rate of these transfers ranged from 0.4 per 5 minutes to 5.9, with most pairs showing a rate above 2 per 5 minutes. For 10/12 of the sessions the percentage of these transfers was greater than 40%, suggesting that most transfers took place in a cooperative manner. These exchanges encapsulates the interaction that adults would promote in early childhood settings, a successful turn-taking routine, in which both children appear to be comfortable with the exchange of the possession of the device. Informal observations suggested in the initial session, the act of photo taking became instrumental in prompting the green transfers. This remained true in the redesign, but the more explicit division of labour in the redesign of the activity such as typing one’s name, also encouraged some of the green transfers.

**Green Transfer: Comparison of Initial and Redesign Session**

Overall, from the initial to the redesign sessions, 4 pairs increased the frequency of green transfers, only two pairs increased the percentage of green transfers indicating the proportion of these transfers declined, and three pairs increased the rate. In a number of cases these were not large changes. Consequently, there did not appear to be an increase in the green transfers as a result of the redesign.
What is noticeable in the data is the difference between pairs 5 and 6 who are the children form the Reading setting in comparison to the London setting children. The children from the Reading setting in the initial session have 100% green transfers which indicates that the only transfers were of this type. This may be due to the set up, in which the children were placed in another room specifically with their partner as opposed to the London setting, in which 3 pairs of children were given the iPad during each session. The direct attention from me with Reading nursery pairs could have affected and limited their interaction with the device. Additionally, it should be taken into consideration that the iPads were a novel device for the Reading setting, which could add an additional component for the children to pay more attention to the adult in the room and feel more compelled to follow the expected norm and guidelines. All this suggests that the initial instructions to the children may have been effective when they were closely monitored, but the effect may have declined in the second session.

6.3.3.2 Frequency, percentage and rate of Yellow Transfer of Possession

The yellow transfer of possession was coded for all the instances in which the movement of the iPad from one child to the other appeared to be not fully cooperative, but there was also no clear conflict or denial to let the other child have a turn either. These transfers were characterized as sometimes being quick and unexpected interactions, therefore not allowing one child from the pair to react, similarly it can also show that the child in possession does not have any clear goals they are working towards therefore they appear unconcerned about whether the iPad is taken away. Table 6.15 shows the raw data, the percentage of all transfers (for each pair this was calculated as the number of yellow transfers/total of all transfers x 100) and frequency of yellow transfers per 5 minutes (for each pair this was calculated as number of yellow transfers/duration of session x 300).
**Table 6.15 Yellow Transfer of Possession**

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Total number of Codes</th>
<th>Percentage</th>
<th>Frequency per 5 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom &amp; Kate</td>
<td>3</td>
<td>5</td>
<td>33%</td>
</tr>
<tr>
<td>2</td>
<td>John &amp; Jess</td>
<td>3</td>
<td>2</td>
<td>40%</td>
</tr>
<tr>
<td>3</td>
<td>Sam &amp; Steve</td>
<td>1</td>
<td>7</td>
<td>7%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia &amp; James</td>
<td>3</td>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td>5</td>
<td>Amy &amp; Adam</td>
<td>0</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>6</td>
<td>Dom &amp; Daniel</td>
<td>0</td>
<td>1</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Yellow Transfer: Child-Computer Interaction.**

For most pairs and most sessions the percentage of these transfers was 33% or less, so they were less common than the green transfers. These transfers of possession are intermediate in nature, in general this type of transfer is coded because the interaction is not clearly facilitatory or oppositional. This can appear in many forms from a delayed reaction of a child to a slight reluctance in letting go of the possession. However, this code offered insight into how the exchanges are not always clearly a positive or negative interaction, but there are many that lie somewhere in between, even for children at a young age.

**Yellow Transfer: Comparison of Initial and Redesign Session**

Unlike the red and green transfers, it was unclear whether increases or decreases in yellow transfers would indicate better cooperative behaviour. Table 6.15 demonstrates that in general this type of transfer remained relatively low in frequency and percentage, but there appears to be a slight increase in this type of transfer in the redesign as 4 pairs had a higher frequency of yellow transfers in the second session.
Looking at the pairs in more detail, Sam and Steve demonstrated the largest increase in this type of transfer, and the reason for this will be explored in more detail in the following section. A similar trend and increase in the yellow transfer, as for the green transfers, can also be observed with the children from the Reading setting, pairs 5 and 6, in which their exchanges in the initial activity was never coded as yellow. Overall, it would appear that there was no marked change in yellow transfers between the two sessions.

6.3.3.3 Frequency, percentage and rate of Red Transfer of Possession

The red transfer of possession was coded for all the instances in which the movement of the iPad from one child to the other appeared to be carried out in an non-cooperative manner, and that the exchange was met with clear resistance by one of the child, such conflict could be in the form of tugging between the two or one child explicitly trying to cling on to the iPad. Table 6.16 shows the raw data and the percentage (for each pair this was calculated as the number of red codes/total of all codes x 100) and frequency of red codes per 5 minutes (for each pair this was calculated as number of red codes/duration of session x 300).

Table 6.16 Red Transfer of Possession

<table>
<thead>
<tr>
<th>Pair</th>
<th>Name</th>
<th>Total number of Codes</th>
<th>Percentage</th>
<th>Frequency per 5 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial</td>
<td>Redesign</td>
<td>Initial</td>
</tr>
<tr>
<td>1</td>
<td>Tom &amp; Kate</td>
<td>2</td>
<td>3</td>
<td>22%</td>
</tr>
<tr>
<td>2</td>
<td>John &amp; Jess</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>Sam &amp; Steve</td>
<td>3</td>
<td>1</td>
<td>21%</td>
</tr>
<tr>
<td>4</td>
<td>Lydia &amp; James</td>
<td>1</td>
<td>5</td>
<td>11%</td>
</tr>
<tr>
<td>5</td>
<td>Amy &amp; Adam</td>
<td>0</td>
<td>2</td>
<td>0%</td>
</tr>
<tr>
<td>6</td>
<td>Dom &amp; Daniel</td>
<td>0</td>
<td>1</td>
<td>0%</td>
</tr>
</tbody>
</table>

Red Transfer: Child-Computer Interaction

For 10 out of the 12 sessions the percentage of red transfers was low and less than 25%.

Furthermore, in 4 of the 12 sessions there were no red transfers. Although this type of transfer
would indicate less cooperative behaviour, its importance as a learning experience should not be underestimated. Peer interaction offers opportunity to explore a variety of social behaviour such as disagreement, cooperation, competition, and aggression that might not be experienced in the same ways as in a child’s relationship with adults (Hartup & Moore, 1990). Therefore, although the red transfers are classified as uncooperative, the circumstances around the negotiation process could still be considered a positive learning process lending itself towards cooperative behaviour. Furthermore, there were no instances of red interactions that involved clear aggression or behaviour that would be unacceptable in a pre-school setting such as shouting or physical conflict.

**Red Transfer: Comparison of Initial and Redesign Session**

Table 6.16 demonstrates that in general this type of transfer was relatively low in both sessions, which is a good indication that in general the children were not always in conflict over possession. However, an increase in the red transfer in both percentage of all transfers and the frequency per 5 minutes for pairs 4, 5, and 6 raises some concerns and arguably illustrates that the pairs were less cooperative after the redesign; however, it should be noted that for pairs 5 and 6 the increase was from no red transfers during the initial session so the ‘base rate’ was very low.

It is possible that the familiarity with the app resulted in the children wanting more ownership of the device, or if a child feels strongly there has been an imbalance in the distribution of resource, they may be more forceful in insisting it is their turn on the iPad. Interestingly this was not true for Sam and Steve, who had a decrease in red transfers after the redesign of the activity. The dynamic of this pair and the decrease in the red transfer of possession can be attributed to the redesign. As can be seen from incident 5 (section 6.3.2.5), the lack of a clear structure for turn taking in the initial design was the cause of the red transfer therefore in the redesign when it
became more clear when it was their turn, less red transfers occurred. Overall, there appears to be no consistent decrease across all the pairs regarding the red transfer possession from initial to the redesign sessions.

6.3.4 Conclusion

Current theory about cooperative learning (Johnson & Johnson, 2017) looks particularly at the outcomes of cooperative learning, but positive interdependence remains one of the most essential components of the theory. It is through the positive interdependence that promotive interactions are believed to occur, and these are probably best represented by the green transfers. Although at first glance the marginal decrease in green transfers in the redesign did not provide a promising indication that the redesign of the activity helped to scaffold more cooperative behaviour, the critical incident analysis suggested that even yellow and red transfers did not always involve very negative interactions that caused an end to cooperation.

The red transfer by definition highlighted incidents of tension or conflict. However, the ability of children to physically and emotionally navigate these interactions is an important social skill that is also mentioned in cooperative learning theory. Therefore, being able to appropriately respond to these tensions is a social skill that needs to be learnt, whether it is for the child who gains possession of the device or the child who loses possession. It is evident from the critical incidents of red transfers that despite the dispute of possession, both parties continued with the activity and positively handled the transfer of possession.

The children’s behaviour that occurred during the transfers supports introducing the device to young children in pairs. As the cooperative learning theory is often viewed in contrast to competitiveness or individualist learning, it is worth noting that none of the children appeared competitive or isolated as a learner. The transfer of possession is related to one of the four elements in cooperative learning, namely social skills, which are emphasised in several of the
national early childhood curriculum. Exploring these interactions has provided a detailed
description of the way a mobile device is transferred between young children and although there
was not a marked change in the three types of transfer seen between the two sessions as a result
of DBR, there was evidence that children maintained a high level of gaze and interest in the iPads
(Chapter 6.1) despite potential conflicts over ownership.
Chapter 7  Discussion

The previous chapters have focused on the specific analysis and findings from each study. In this chapter, I will be outlining how the findings relate to each research question. The four research questions, as listed below, were addressed in the three studies (questionnaire, interviews, and video recordings) that were conducted as part of this thesis.

Research Questions

1. What attitudes and opinions do parents have concerning young children’s use of mobile touch screen technology?
2. What attitudes and opinions do practitioners have concerning young children’s use of mobile touch screen technology?
3. What forms of social and computer interactions occur when young children are encouraged to learn cooperatively on mobile touch screen technology in pre-school settings?
4. Can the activity design and re-design process increase cooperative learning when young children are using mobile touch screen technology?

Before considering the findings related to each research question in the next sections, I will provide a short overview of the links between the investigations. Each research question builds upon the literature review as well as being influenced by my own findings. The literature review in chapter 2 helped form the overarching argument of why there was a need for more research to be considered in this field, especially with an increasing number of apps targeted at this age group (Shuler et al., 2012), and the comparatively limited amount of research conducted with young children in this area (Ólafsson et al., 2014).

The findings from the initial scoping study of parental perspectives (Chapter 4) helped to identify a gap in research regarding young children’s use of mobile touch screen technology in a
cooperative manner. This topic was considered worth addressing given that there was a major concern around tablet usage and particularly about the passive and isolated nature of such activities (Cordes & Miller, 2000; Madigan et al., 2019). Furthermore, the parental survey also highlighted specific concerns regarding young children’s lack of interaction with others while using the iPad. In suspecting that the home usage of this type of technology is often centred around games and keeping a child engaged for brief moments, I chose to explore how pre-school educational settings could take on this concern and worked towards promoting cooperation when using mobile touch screen technologies, through a design-based research methodology (Chapter 3). These findings led to further investigation to consider if the implementation of cooperative learning activities using mobile touch screen technology in an early childhood setting context could address some of these concerns and help me better understand how children interact with these devices.

The interviews with the practitioners (Chapter 5) provided new insights into a key stakeholder’s perspective about young children’s use of mobile technologies. Engaging practitioners and drawing upon their knowledge and expertise through semi-structured interviews allowed me to co-design the cooperative learning task best suited for the two settings. The implementation of the cooperative activity was then captured through video recordings of the children and analysed. The activity was structured around the use of the “Our Story” App and was designed so that the pair of students in each setting worked together on creating a story. The details of the pre-session instructions and the specific guidance I gave as the facilitator were suggested by the practitioner and were tailored to each setting. The activity was conducted twice with modifications to the instructions as outlined in chapter 3. An in-depth analysis of different types of behavioural response including eye gaze, types of touch, and transfer of possession provided details and an overall description of what occurred during the children’s use of the iPad with their partner.
The findings related to each research question are presented in separate sections. The sections are accompanied by a discussion which is derived from the process of critical reflective analysis (Fook, 1999; Osmond & Darlington, 2005); one of these ‘reflective’ sections follows the consideration of research questions 1 and 2, and another follows research questions 3 and 4. Critical reflective analysis has long been a core aspect of teacher education and has helped encourage critical discourse and emphasise power relations and social structures. As Fook (1999) expressed in his work, “A critically reflective approach, therefore, relies upon knowledge which is generated both empirically and self-reflectively, and in a process of interaction, in order to analyse, resist and change constructed power relations, structures and ways of thinking” (p. 202). Her approach involved the use of reflective questions and prompts. Although the critical reflection that is presented by Fook is primarily focused on how the individual such as a teacher or social worker is affecting a situation, a similar process can be used to unearth, understand and change very deeply held or fundamental assumptions. The reason for using this type of approach is to challenge the ongoing discourse around young children's use of mobile technologies. The research results of these studies presented in the following section are relevant to the polarising views that many parents and practitioners have towards mobile touch screen technologies, and the digital skill gap that is becoming more apparent. Furthermore, this study has raised further questions about the purpose of tablets and iPads in early childhood education and how it should be introduced.

The three studies in this thesis, i.e. the parental questionnaire, the practitioners’ interviews and the video analysis of children, explored the influence of new digital technologies on young children’s educational experience. In the following sections, the key findings will be discussed in relation to each research question.
7.1 RQ1: What attitudes and opinions do parents have concerning young children’s use of mobile touch screen technology?

Most people would agree that parents are the first teacher for most children (Follari, 2010). This was an important basis for the decision to begin with parental opinions towards children’s use of mobile touch screen technology as the starting point for my research. Given the ubiquitous nature of mobile technologies, and the rate at which it has been adopted into daily lives, it is not surprising that most parents in the parental survey were currently avid users of mobile technology. Therefore, they were likely to have a reasonable understanding of how technology can affect their lives and a broad understanding of the device’s potential benefits and perceived harm. However, just because parents are consumers of technology, it does not mean that their understanding of their usage can be mapped on to how their young children engage with these devices. Understanding how parents perceive how technology affects their child can help better inform the type of research needed to address some of the major concerns parents have around this emerging technology. The findings from chapter 4 about parental perspectives on their child’s use of the devices can be summarised as follows: (1) there were diverse opinions towards MTST, from strongly positive to strongly negative specifically when considering educational benefits (2) making children familiar with MTST was an important reason to introduce technology at such a young age and (3) there were significant concerns about technology taking away time from interacting with others. The findings of each of these topics are summarised below.

For each Likert scale question in the survey regarding general feelings towards MTST, there were groups of parents who were strongly positive or negative. The high standard deviation across all the questions (regarding parental attitudes towards MTST) indicated that the answers were very variable. Such findings reiterate this topic’s polarized nature, for example, the parental responses appeared to sometimes reflect media concerns about high levels of use and potential negative
consequences (Palmer, 2015). Furthermore, the ‘undecided’ response option never contained the majority of answers suggesting that parents often felt quite strongly about the consequence of exposing children to MTST.

The question within the survey that most parents agreed about was that exposure to technology made the children more familiar with technology. Previous research (Khasawneh & Al-Awidi, 2008; Marsh et al., 2005) states that parents clearly expressed that a significant consequence of early exposure is that children became more familiar with specific computer functions including technological and computer concepts. Approximately 90% of my survey participants either agreed or strongly agreed with the statement that MTST allowed their children to become more familiar with the technology. Although, this appears to be an obvious response, what is essential to consider is the idea that familiarity with the technology can lead to the development of digital skills sets such as navigating through apps, tapping, pinching, swiping, that are specific to the use of the digital device. In a previous study by Plowman & McPake (2013) interviews with parents demonstrated similar findings in which parents felt the need to introduce technology into their children’s lives to prepare them for school and adulthood, where the use of technologies is essential. However, not all agreed with the sentiment. A small number of parents argued there would be no real benefit from an early start, as whatever knowledge children gain today around technology will likely be redundant in the future as technology is changing so rapidly (ibid).

Additionally, when looking at parental perspectives on the educational gains from using MTST, their responses in my study were also mixed, with 31% of parents indicating that they were undecided. When asking parents specifically about the benefits of MTST in different subject areas including literacy, maths, science, and the arts, there were a slightly higher number of parents who thought that it had more benefits in the areas of literacy and mathematics as opposed to
science and the arts. This finding aligns itself with the currently available apps, with most apps being focused on literacy and mathematics for this age group. Overall parents remained hopeful and appeared convinced that some exposure to technology did offer educational benefits. Still, they were also aware that there are many unknown aspects of how prolonged usage may affect their child. Particularly physical effects such as damage to eyesight was a statement that 37% of parents indicated they were undecided about.

The questionnaire study’s findings also aligned with previous research findings (Khasawneh & Al-Awidi, 2008), about parental attitudes towards computer technology, in that parents expressed similar concerns around their children becoming less active, spending less time exercising and playing. In my survey, most parents (60.95%) indicated that they believe MTST took away time from interacting with others and three quarters (75.2%) felt that it took time from other types of play. This fear and negative sentiment towards technology is also the type of narrative often portrayed in the media. My questionnaire did not investigate the underlying causes of these fears, However, Wohlwend (2011) suggests that the abundance of literature on play research and practice have been based on a discourse that privileges exploration of nature and playing with physical material as developmentally appropriate. This results in concerns about technology as it does not fit with a traditional concept of play.

In conclusion, the findings from the parental questionnaires reaffirmed results from previous studies that a majority of parents are cautiously optimistic about the potential educational value of MTST (Khasawneh & Al-Awidi, 2008). Parents thought that exposure to MTST was useful in making children familiar with these devices as they become more prominent in daily lives. However, there were also concerns about the addictive qualities and other negative implications such as less interaction with others.
A limitation of any form of survey is the nature of the type of data that can be collected. Although open-ended questions were also included to allow parents to share their thoughts, it did not provide in-depth insight into their concerns or hopes for the technology. Because of this issue it was decided to obtain an in-depth understanding of practitioners’ views about MTST, especially as there have been few previous investigations of this topic using semi-structure interviews. However, it should be acknowledged that the questionnaire study allowed me to identify that many parents were concerned about the isolating nature of MTST and felt that using MTST had dangers in taking away time from their child interacting with others, highlighting an issue that was worth investigating further.

7.2 RQ2: What attitudes and opinions do practitioners have concerning young children’s use of mobile touch screen technology?

As discussed in chapters 5, the practitioners’ interviews and subsequent thematic analysis of the transcripts gave rise to 5 themes concerning how practitioners perceived MTST and early childhood education (see Figure 5.1). These themes included (1) Ubiquity of technology (2) Ability in using MTST (3) Use in moderation (4) Values of technologies (5) Negative aspect of technologies. These themes clarified the extent to which practitioners acknowledged the presence of technology inside and outside an educational setting. Additionally, as MTST is becoming a more prominent type of device in young children’s lives, the practitioners are also beginning to report on the behavioural consequences of MTST usage observed in their settings.

Previous research examining technology and practitioners has often focused on identifying what prompts technology use or adoption in primary, secondary, and higher education (Aldunate &
Nussbaum, 2013; Buabeng-Andoh, 2012; Zhao et al., 2001), with there being a much more limited number of studies in the early years (Blackwell et al., 2013; Jeong & Kim, 2017). Riel & Becker (2008) found that technology use is a multi-faceted phenomenon in school aged children. Different teacher characteristics, such as teaching philosophy and technological proficiency, were important traits in determining how practitioners were using technology in the classrooms (ibid). The need to identify what allows or prevents technology adoption is understandably a growing area of research as policymakers and schools often want to know what can be done to increase technological adoption. The literature review in section 2.3.2 discusses previous research in the primary school sector that looks at barriers affecting a teacher technology adoption process. Although this is an important objective, the aim of my interviews was to report and explore early years practitioners’ positive and negative opinions about MTST and early childhood education.

My findings support previous research findings, mostly based on questionnaires (Blackwell et al., 2013; Formby, 2014), about the overall positive attitudes but with some reservations that practitioners have towards MTST (Flewitt et al., 2014). In my interviews, all practitioners agreed about the appropriateness of introducing MTST into their settings. This idea is also reflected clearly in the first theme identified from the interviews, that of technological ubiquity and that the debate is no longer about whether practitioners should use technology but rather how they should use it, a form of thinking that was already present over a decade ago with regards to ICT (Ernest et al., 2014; X. C. Wang & Hoot, 2006). However, there were also underlying fears, particularly with regards to lack of social engagement with others, and play activities were very much at the forefront when practitioners talked about use of MTST in moderation. These views have been expressed by practitioners in previous studies (Blackwell et al., 2013; Ernest et al., 2014), ever since the introduction of digital technology into education, yet it is a still an issue worthy of further examination and where more research is required. These concerns regarding decreased social interaction with peers may be stronger in early years practitioners whereas
teachers in primary school and secondary school focused on how the technology could increase engagement with learning activities (Carver, 2016; Domingo & Garganté, 2016; Hutchison & Reinking, 2011). Many of the fears and hopes for the technology were similar to the parental attitudes reported in Chapter 4, with a concern around how the use of digital technology is often passive and takes away time for other types of play, yet all the practitioners recognized the potential benefits and similar to primary school teachers acknowledged how engaged children were when working on these devices.

Another set of questions which aimed to explore the practitioners’ perspectives on cooperative learning yielded a separate set of themes. Although the main purpose of the initial analysis was used as the foundation for the design of the activity, further analysis was able to demonstrate a more comprehensive view of how the practitioners perceived what ‘cooperation’ was in the early years setting. They all acknowledged how important group work and partner work was for early childhood development. All the practitioners were able to communicate the benefits of cooperative learning and how peer learning enhanced the quality of learning for the child. They identified the impact of modelling both in terms of practitioners being role models for the children, but also the children being role models for each other. Unlike the topic of Mobile Touch Screen Technology where there appeared to be more disparities in how the devices supported or hindered the learning in young children, the practitioners’ perspective on cooperative learning was presented as a more unified front.

The analysis presented here provides valuable insight into how practitioners perceived MTST in early childhood setting. Although there was large variability in how optimistic the practitioners were about the technology even within the same the setting, there was a consensus that MTST should be introduced into early childhood settings given certain constraints on its availability.
These constraints were exemplified by the ‘use in moderation’ theme in which practitioners commented on the necessity of setting up ‘limits’ and ensuring that children were engaging in other learning activities as well. Mertala (2017) found in his interview of 17 practitioners in Finnish early year settings that “practice-related beliefs, educators' general pedagogical beliefs were mainly constructivist/student-centered, but their ICT pedagogical beliefs were mainly traditional/teacher-centered.” (p.204). In the context of the findings from my interviews a similar perspective was present in the general value given to the learning of social skills, and that MTST could fail to support this process with its positive impacts being linked more to academic skills acquisition and independent use.

7.3 Summary and Reflective Analysis for RQ1 & 2

In this section, I will begin with an overview of how the findings from research question two reiterate the importance of cooperative learning in the early year’s curricula. I will then explore how similarities around the types of concerns of technology usage amongst young children are shared between both parents and practitioners. These concerns also lay the foundation for how the DBR study was structured and rationalized. This section will end with a reflective analysis addressing the conflict between how practitioners and parents see the technology as a hinderance to natural social development as opposed to the potential these devices have in encouraging cooperative learning.

Cooperative learning, understood mainly as working in groups, often is viewed as a key learning goal for this age group (Copple & Bredekamp, 2009; Jean Piaget, 1928). Many of the early years curricula are based on the social constructivist theory which highlights the co-construction of knowledge and the importance of children learning from other children during co-operative activities (Department for Education, 2017; Golbeck & De Lisi, 1999). Practitioners perceive the
benefits of cooperative learning to be the development of essential social skills, sharing, turn taking, and children communicating with their peers. Despite the complexity and the fluid nature of what cooperation and socialization are, as Mills (2000) writes that “socialization is reciprocal, dynamic and contextualized; is not one-sided, static, and in vacuo” (p. 20), it appears that pre-school settings play a vital role in promoting this form of socialization. In the interviews (Chapter 5) all the practitioners acknowledged the importance of cooperative learning and some of them were also able to refer specifically back to the national curriculum to support their claim. So, there was a consensus about the importance of cooperation, coupled with concerns about the impact of MTST in relation to social activities, this suggests there would be an interest in exploring how MTST could be used in a cooperative manner.

Current use of MTST in schools and at home is either individual, such as using digital textbooks, games, or apps mimicking computer games (Marsh et al., 2015). There seems to be little educational use of apps designed for two users working constantly alongside each other, as in chess, and less discussion of their possibilities for groupwork other than the sharing of individually created products (Yuill et al., 2011). People naturally use technology in shared ways, even with devices designed to be personal (Rogers et al., 2009). Thus, mobile learning has flourished, with people handing over devices and ‘shoulder-surfing’. If tablets are not being widely used for group work in educational settings and it is a concern that both parents and practitioners have highlighted, it is argued that we need to assess technologies’ potential strengths and weaknesses for supporting cooperation (Yuill et al., 2011). The findings from my research suggest that it is worth looking at whether the technology should be introduced as a cooperative learning tool given the predominant design for individual use. Findings from the scoping study with parents as well as the interviews with practitioners suggested that the fear of the technology being a passive and isolating device was a shared concern across practitioners and parents alike. However, there has been only limited research to address this concern. The DBR methodology allowed for further
exploration regarding the potential for practitioners to use the technology in a group-work orientated way. This objective is challenging given the limited resource and given that it is not traditionally how tablets are perceived as being used. However, my study demonstrated that practitioners did see the possibility of use in pairs, and if cooperation was encouraged while using MTST, it was important to investigate what types of social and computer interaction could be observed.

Wohlwend (2011) argues that the way we perceive a child interacting with technology can be viewed through three different lenses: (1) the schooled child (2) the developing organism (3) the digital native. Focusing only on one lens and omitting the others leads to the differing and segmented view towards the technology. Although she recognizes that these are exaggerated positions, they provide a structured way of interpreting findings and explain why there are such diverse opinions about technology. The schooled child lens is when there is a heavy focus on learning as purely an academic phenomenon, and childhood is viewed as a period of preparation or apprenticeship for later work. Thus, people who view technology from this lens will perceive technology as only being acceptable based on the extent that technology helps to strengthen academic skill such as letter recognition. In the developing organism lens, there is a more protective element in which an adult is expected to hover and intervene to prevent the child’s overexposure to technology. And lastly through a digital native lens, in which early introduction to technology facilitate an early adopter disposition and intuitive skill set of new digital literacies skill that is argued to be inevitably needed for the future.

The perspective of the developing organism still resonates strongly in the findings from this research where the parent’s belief is that young children are a work in process, developing through predictable sociocognitive stages, furthered by hands-on experiences with the natural
environment (Hendrick, 1997). In this view, early exposure to potentially harmful influences (in this case, MTST) threatens not only a child’s current state, but risks derailing future development.

For example, the headline in a 2011 American Academy of Paediatrics (AAP) press release warned parents and caregivers that “babies and toddlers should learn from play, not screens” (American Academy of Pediatrics, 2011). The findings from both the questionnaire and interviews portrayed that there were still concerns and reluctance around MTST, and that its functionality appeared to be hindering the natural social development processes in children.

Despite the polarizing views amongst practitioners and parents, a majority of educators and parents understand that children will require technological competencies in order to succeed later as adults in the workplace. This is reiterated in my findings that show how a majority of the parents agreed that early exposure to technology, familiarizes children with it and some have made the comment that it betters prepare them for the future. For example, in United States, Australia, the early years learning framework learning outcome 5 states that “children able to use information and communication technologies to access information, investigate ideas and represent their thinking” (Department of Education and Training, 2018, p. 47). Additionally in the USA, NAEYC (2012) released a position statement on young children and technology (3-8 years) that supported the use of technology that provided opportunities for co-engagement, collaborative play, and creative expression. Therefore, although there appears to be a growing narrative to promote the use of MTST in a more cooperative and collaborative manner, many practitioners have not considered that possibility and still view the devices as a hinderance to those natural social developments. If the practitioners continue to view the devices as a tool to be used independently and further removing the child from interacting from others, the way in which devices will be integrated into teaching and learning can be limiting. Thus, it is worth exploring what types of cooperative interactions can occur when children are encouraged to use the iPad in pairs, this is explored in research question three and four.
7.4 RQ 3: What forms of social and computer interactions occur when young children are encouraged to learn cooperatively together on mobile touch screen technology in pre-school settings?

As presented in chapter 6, the detailed coding analysis of the video recordings of children’s play gave rise to new understandings of how pairs of children cooperated when using an iPad. The coding explored complex interactions by looking at specific behavioural actions and focusing on the critical events of transfer of possession (turn-taking). This type of analysis offers a unique contribution in the field of Early Childhood Education by providing further insight into how engaged the pair were (eye gaze), their physical interaction with the device (types of touch), and the extent to which they can share the iPad (transfer of possession). Previous research has focused more on the types of talk that occur in this age group (Falloon, 2015; Kucirkova, Messer, & Sheehy, 2014) particularly with reference to what Mercer (1996) refers to as ‘exploratory talk’ - the type of talk that occurs when partners engage critically but constructively with each other’s ideas. Given the emphasis on oral communication, there is largely an absence of detailed descriptions of the physical behaviours. Observation of the physical behaviours are an essential dimension of analysis given the young age group; their physical expression can be a significant addition to our understanding of their thinking as their language skills are still developing at this age.

My research involved video analysis of six pairs of children across two very different pre-school settings that had different experiences with MTST, enabling a broader spectrum of circumstances to be considered. The data analysis through systematic coding and identifying specific behavioural actions provided an in-depth look at the elements of engagement, how the children interacted with the device, and aspects of negotiations.
These types of embodied and multimodal interaction, or what Davidsen & Christiansen (2014) refer to as ‘intelligence-as-action’ include looking at the children’s physical interaction with their learning environment and trying to understand what this tells us about the children’s cooperative or collaborative interaction as opposed to focusing on just their verbal communication. It has been suggested in previous research with primary school children that when using a tablet computer, “free hands open a venue for collaboration, not only in the execution of actions on the screen but also in negotiating which problems to solve, and in the division of labour when doing so” (Davidsen & Christiansen, 2014, p. 49). More recent work with older children has also suggested that tablets change the nature of coordination leading to more turn taking during collaborative episodes (Fleck et al., 2021).

The selection of codes concerning children's interaction with the iPads was related to my interest in cooperation. I use data obtained from children's eye gaze and different types of touch to measure how attentive the children were to the task at hand. The eye gaze provides information about the two children's interest and how their focus alters throughout the activity. I go on to discuss how the tablet (hardware) impacts on the types of touch which also provides a broader picture of their physical positionality relative to their peer, between the pair, and then I focus on specific incidents when a transfer of possession occurs and the type of negotiation that takes place.

7.4.1.1 Eye Gaze

While there is growing evidence that most young children show a strong interest MTST (F. Wang et al., 2016), the coding of the children’s eye gaze in my study provides useful information about the extent of this interest. Based on the analysis of the video data the following behaviours were
observed: all the children spent a very high percentage of time gazing at the iPads and not looking at other things, demonstrating high levels of engagement with the iPad. The percentage of joint attention to the iPad when both children were looking at the iPad at the same time, also was consistently high across all pairs, averaging 80% of the gaze across all the pairs. Overall the children demonstrated higher on-task behaviour (at tablet, partner, facilitator) as opposed to off-task eye gaze, which reiterates previous research that suggested that MTST devices can promote soft skills such as creativity, play, engagement, and dialogue (Kucirkova, et al., 2014; Kucirkova et al, 2015; Verenikina & Kervin, 2011; Marsh et al., 2015; Canning et al., 2016). However, eye gaze towards their partner remained low, and this is consistent with previous research that shows that both adults and children avoid lengthy gaze at another person (Binetti et al., 2015; Kendon & Cook, 1969). Therefore, the low percentage of eye gaze at partner was not a good indication of cooperation. Eye gaze towards the researcher, on the other hand was higher than eye gaze towards their peer, which may reflect young’s children natural response to adults who are perceived as people of authority, and the need to look at an adult for confirmation of their actions through social referencing (Gewirtz & Peláez-Nogueras, 1992). The slightly higher percentage of gaze towards the researcher demonstrates that the role I played in facilitating the activity impacted the children’s behaviour.

The eye gaze data also showed the difference in behaviour for each child compared to their partner, with regards to where their attention was focused. This variability across all the pairs highlighted how the characteristic of the individual child played an important role in how they behaved. The ‘eye gaze’ data alongside the ‘contact’ data similarly showed a tendency for one child in the partnership to have more possession of the device in both the initial session and the one after the redesign. The reason why one child appears to be dominant with regards to control of the device may be the result of many factors such as leadership skills, communication skills, behavioural traits, and digital literacy skills. It is difficult to know which of these skills played the
most important role in helping certain children gain more access to the device. One possibility that is worth considering is that some children with more previous experience of MTST may have learned some basic digital literacy skills and will naturally be more confident in taking ownership of the device.

7.4.1.2 Physical contact with tablets

Contact duration with the iPads, and other different types of physical touch with the devices was used as a proxy for division of labour. Additionally, the different types of touch provided insight into the types of action that children at this age produced. Although there have been previous attempts to classify the type of touch that children perform with MTST (Buckleitner, 2011), very few studies have attempted to analyse in-depth the physical interactions that young children have with these devices. Previous research has been concerned with primary school age children and the way physical positionality played an important role in collaborative learning (Davidsen & Christiansen, 2014; Fleck et al., 2021).

The analysis of the video data provided information on the sharing of resources across the different pairs, in terms of time spent touching the devices, but none of the pairs came close to sharing the device equally. Although this type of sharing of resources is only a single component of cooperation, and an exact equal sharing of the resource does not necessarily result in better cooperation, it is still an important feature to capture in terms of how the tool is utilized between the pair. The disparity in time spent touching the device may also indicate that when the device is shared in this age group, there is often a child who is more dominant or in possession of the device.
There was a total of four types of contact that were coded (1) Finger Touch (2) Hands hold and other hand touches (3) Hands holding and resting on table (4) Hands holding and above table. Each type of touch offered insight into how the pair was interacting with the iPad, the two most prominent types of touch were touch type 3 and 4 (both variants of the hands holding). The hands hold essentially meant that the child was holding on to the device with both hands. The hands holding and resting on table, meant the device was still in contact with the table, while the hands holding and above, meant the child was holding the device in both hands above the table. The hand holds and other hand touches in this research physically portrays incidents when only one child takes ownership of the device. If both hands are touching the device, the likelihood is that the device is not being placed in the middle and is placed directly in front of one child. This positionality can appear at a glance non-cooperative, as it indicates the devices are not being shared and visual access to the tablet may be obscured or denied. However, in the context of this research, the hands holding and above table usually reflected times when the child was taking pictures of their partner. Although this particular type of touch could appear to be an independent action and non-cooperative action, where only one child uses the device, the ‘hands holding and above table’ type of touch, reflected moments when there was positive interdependence. This positive interdependence, or circumstances in which the children had to rely on each other to achieve the goal, emerged as a direct result of the app’s structured learning activity and functionality that allowed the children to take pictures of each other. They understood that they needed to communicate with each other and that the photo-taking part required both to take on different roles in order to be successful.

The ‘hands holding and resting on table’ touch was often more aligned with non-cooperative behaviour and what could be perceived as ‘physical blocking’. This type of touch is made possible because of the size and portability of the tablet so it makes it easy for children to reoriented it and physically put themselves in between their partner and the device. This action of hovering over
the device is often perceived as a ‘negative’ behaviour, as it limits interaction and physically isolates the partner. However similar behaviours that have been observed around multi-touch tabletops and tangibles, suggest that it may serve multiple purposes and in some cases it is done so that the child can protect their own ideas or suggestions as part of a process of negotiation (Falcão & Price, 2009; Fleck et al., 2021). This may be true in older groups in which after blocking they are able to reintroduce their partner, but this was not observed with this age group, therefore this type of behaviour often further isolated the two children. Additionally, the ‘one hand holds and other hand touches’ which also lends itself to individual usage rather than cooperative behaviour occurred when the child was really focused on the task. Certain aspects of the app, such as dragging images or typing text required both hands on the tablet with one hand stabilizing it while the other hand manipulated things on the app. The different types of touch that were recorded and analysed could not be viewed in isolation as each type of action reflected the assigned task, whether it be picture taking, dragging pictures, or typing letters. However, the type of touch analysis provided a detailed representation of how the children were physically interacting with the device and their partner, which previous research has not captured in this detail. These physical interactions will often be what practitioners observe in their setting, thus acknowledging how to promote or limit certain types of touch can be incorporated into how practitioners introduced tablets in partnership settings. The physical and visual access that both children have on the tablet play an important role in promoting cooperation and maintaining joint attention. In the same way that the device could be easily taken away, in some instances they also deliberately placed or oriented the tablet towards their partner to ensure they also had access.

7.4.1.3 Transfer of Possession

Transfer of possession as reviewed in Chapter 2.4.4.3 can provide important information about the extent of sharing and cooperation between the two children. This transfer of possession may be viewed as ‘turn-taking’; however, I did not use the term ‘turn-taking’ because it often implies a
positive interaction and an agreement on both parties that the object will be shared or that one person speaks while the other remains silent. An analysis of this was particularly important for this age group, as such action showed that they could negotiate exchange and understand how to cooperate with their partner. The different types of transfer of possession were coded according to three categories: transfers that are positive (green), followed by uncertain types of transfer (yellow), and conflicting behaviour (red), which is the lowest in both the initial and redesign of the activity. This coding also suggested that children were able to mostly cooperate while using the tool. In current theory around cooperative learning (Johnson & Johnson; 2017) there is interest in the outcomes of cooperative learning, and positive interdependence remains one of the most essential components of the theory. It is through the positive interdependence that promotive interactions occur, and this was evident in the findings from the current data set of the green transfer that reflected incidents in which the structure of the activity determined how children positively interacted with each other. As the activity required to take pictures of each other and they were explicitly told to work together, green transfer showed moments when the device was willingly given to their peer. The green type of transfer was the most predominant type of transfer making up 64% of all types of transfer in the initial design and 52% in the redesign.

The red transfer by definition of the coding scheme highlighted incidents of tension or conflict. However, the ability for the children to physically and emotionally navigate these interactions are an important social skill that is also mentioned in the cooperative learning theory (see Chapter 2). The tugging and pulling of the device which is more unique to this age group can reflect a self-centred mindset (Cowell et al., 2015; C. E. Smith et al., 2013). Therefore, being able to appropriately respond to that tension when it emerges is a skill that needs to be learnt, both for the child who gains possession of the device and the child who loses possession. It is evident from the critical incidents of the red transfer that despite the dispute of possession in that moment,
both parties continued with the activity and eventually positively handled the transfer of possession, with no major disruption to the activity.

The yellow transfer of possession highlights the complexity and the unique dynamic within each pair. The yellow transfers were characterized as sometimes being quick and unexpected interactions, for example when a child quickly takes the tablet away from the other child and does not give their partner time to react. In some instances, it can also show that the child in possession does not have any clear goals they are working towards therefore they appear quite nonchalant about whether the tablet is taken away. Although some similarities can be drawn in terms of the different groups of transfer of possession, overall, there appears to be more variability within each partnership than there is consistently across all the pairs.

As cooperative learning is sometimes contrasted with competitiveness or individualistic learning, it is worth noting that none of the children appeared competitive or isolated as a learner. The transfer of possession (turn-taking) appears to be successfully addressing one of the four elements in cooperative learning, which is developing social skills; an important element in the national Early Years Foundation Stage (EYFS) curriculum (Department for Education, 2017). The critical incident analysis on each type of transfer showed that positive turn taking was much simpler to code and either occurred as a result of positive communication, such as asking for a turn, or the nature of the activity enforced that transfer to occur, such as photo taking, or typing their name. When a child feels more knowledgeable about something that is task related the negotiation happens more naturally as shown in Chapter 6.3. However, conflicts can emerge when the child wants to have go but does not have a rationale for it, and therefore their option for getting access to the device is taking it away from their partner without verbal negotiation.
7.5  RQ.4: Can the activity design and re-design increase cooperative learning when young children are using mobile touch screen technology?

Previous findings suggest that DBR can have a direct impact on children’s behaviour (Majgaard et al., 2011). For my study, there is no conclusive evidence that the redesign was able to increase cooperation across all the pairs, the results were mixed with some pairs demonstrating more cooperation than others.

A comparison of the different types of eye gaze across the design of the activity, highlighted the complexities and varying levels of engagement presented by each individual child as well as the differences in each partnership. There appeared to be no consistent change in the pattern of the eye gaze from the initial session to after the redesign. There did appear to be higher percentages of off-task eye gaze in the redesign session although relative to the on-task behaviour it remained a very low percentage. The analysis of the touch suggested there might have been an impact of the redesign on the children’s behaviour with the devices. Across all the children except for one (Lydia), there was an increase in the rate of the one-finger touch after the redesign, and this appeared to be a result of structuring more opportunities for the children to type on the device. This is important in that it emphasises how the design of the activity could affect how children engage with the technology. Although the redesign was not able to uniformly increase cooperative behaviour in this study it did change a certain type of physical interaction (e.g., writing name in story led to more one finger touch). The more structured nature of the redesign of the activity appeared to foster more effective cooperation in some of the pairs as exemplified through Sam’s and Steve’s interactions in Chapter 6.3.2.4. The structure provided more concrete ways for the children to know when to take turns. In addition to how previous studies have shown that open-ended apps give children the opportunity to engage in more effective collaborative
conversation (Falloon & Khoo, 2014), a more structured closed-ended activity could also promote cooperation.

As already mentioned, the transfer or possession or the movement of the tablet from one child to the other, was rated on a coloured scale of green (positive), yellow (neutral) and red (negative). Although at first glance the decrease in green transfers in the redesign did not provide a promising indication that the redesign of the activity helped to scaffold more cooperative learning, the critical incident analysis (chapter 6) demonstrated the variety of reasons for turn taking in the yellow transfers and how the red transfers did not necessarily equate to a negative social interaction. Although the action can be coded green, yellow, and red, the ability for the pair to resolve that conflict or how they engaged with that conflict in possession is a better indicator of how well they can cooperate. There was a decrease in the green transfer possession of the iPad across the sessions from 64% to 52% while both the yellow and red types of transfer increased. This suggests that there appears to be more conflict that emerges in the redesign, and although the changes are not large there is indication that the redesign did not necessarily facilitate better negotiation and transfer of possession (turn-taking) across the pairs, an important cooperative skill as indicated by the practitioner. Lawarence (2018) claims in her study of young children and the iPad, that competition for resource control is not unusual among preschool children during digital play or traditional play. The resistance to sharing or turn taking may have more to do with their relationship with their partner rather than the goal of the activity. Examples shown in Chapter 6.3.2.2 demonstrate that the pair, John and Jess, had a clear understanding of the activity, but they found more amusement in challenging rather than cooperating with their peer, which created conflict in the pairing.
7.6 Summary and Reflective Analysis for RQ3 & 4

In a reflective analysis approach of trying to conceptualize how cooperative behaviours manifest themselves in this age group and more specifically how MTST can promote these behaviours, it is useful to refer back to Johnson and Johnson’s (1986) model of the 5 essential components of cooperation. The first main element being positive interdependence, in which group members share a common goal and perceive that it is only through the participation of all team members that they can succeed. My research highlights how features in MTST can encourage positive interdependence. As part of the activity design, children were told to take a picture of their partners doing different types of actions and in this instance, they could only do that by relying on their partner to take photos. Although arguably, there is a front facing camera that could potentially allow the children to take selfies, the children did not use that feature and it was easier for them to utilize the normal camera with the help of their partner. The positive cooperative outcome was further supported by evidence presented in chapter 6.3, where positive turn taking was documented during these explicit exchanges of photo-taking actions.

For the second element of face-to-face promotive interaction, these are instances where “students help, assist, encourage, and support each other’s efforts to learn” (Johnson & Johnson, 2017, p 4). These were the type of behaviours highlighted more explicitly in the practitioners’ interviews on their perspective of cooperation in the early years (Chapter 5), i.e., the image of a caring and empathetic child teaching a younger child how to button up a coat. The act of one child overtly choosing to support their peer during the MTST activity was not as easily observed. On the contrary more often when a child demonstrated more knowledge about a specific aspect of the activity such as having more confidence navigating through the app or finding the letters on the keyboard, the child would dominate the ownership of the device as opposed to teaching these skills to their partner. This tension of wanting to gain ownership over the device as opposed to sharing it to achieve their group goal is documented by the high number of ‘two hand touch’, which indicates that a single child had both hands on the device. It is possible that the appeal of
MTST can act as hindrance to cooperative interactions. This impacts the third and fourth elements of a cooperative lesson, which are individual accountability and social skills.

Individual accountability, which is the belief that everyone will be accountable for her/his performance and learning can be difficult to structure with this age group, although in many ways it bears a strong resemblance to positive interdependence. With older children individual accountability is often encouraged through individual assessment of knowledge post activity. In this research, the redesign of the activity helped encourage individual accountability through structuring the task so that each child had to write their name in the story. The children were individually able to contribute to the task as they had this unique piece of knowledge. The redesign made it easier for the children to take turns as they had a clear reason to take ownership of the device given that their partner did not usually know how to spell their friend’s name. Creating opportunities where the child’s personalized knowledge is an asset to the activity allows for ownership and individual accountability.

Naturally with the fourth element of social skills, pairs were unable to function effectively if “students do not have and use the needed leadership, decision-making, trust-building, communication, and conflict-management skills” (Johnson & Johnson, 2017, p 4). At this age many social skills are still being developed and some instances such as red transfers of possession in which conflict was imminent, some of the pairs did demonstrate an ability to resolve those tensions. However, MTST itself does not appear to directly facilitate any of these skills, but rather it is in how MTST is introduced as a cooperative tool, and explicitly modelled to teach social skills. Therefore, in the story used to show children how to work in pairs on the iPad, the focus was specifically on social skills of communication and turn-taking.
Lastly the final element of cooperation is ‘group processing’; this reflective process of discussing what worked and what did not can be difficult with this age group. Although a post activity interview with the children was conducted, the analysis was not presented in this thesis, as it became apparent that the children found it difficult to reflect back on the activity and often focused on their individual performance as opposed to their peer. Therefore, although Johnson & Johnson’s cooperative learning model (2017) did provide a structure to conceptualize some fundamental aspects of cooperation including positive interdependence, promotive interaction, and social skills, certain aspects were harder to observe in young children. The fact that some elements could be easily observed and documented shows that cooperation was prevalent in this age group. MTST has the potential to be used as a cooperative tool. However, the lack of promotive face-to-face interaction reiterates the tension that these technologies pose. The physical design of the tablet which is designed for individual use in many ways prevents children from sharing the device and it takes a concerted effort from either the practitioner or the facilitator to actively try and get the children to cooperate as it does not occur organically.

7.7 Chapter Summary

This study started with obtaining parental and practitioner’s attitudes towards MTST as they are the main gate keepers to when and how young children are introduced to MTST. The varied responses and diverse opinions from both the parent group and practitioners showed conflicting opinions towards MTST. However, overlap around major concern of isolated use and MTST taking away time for interacting with others that were expressed by both parents and practitioners laid the foundation for the second part of the study. In the second part of the study, the focus was on child computer interactions and social interactions of young children’s participation in a purposefully designed digital activity aimed at promoting cooperation. Findings from 6 pairs across two sessions of the initial design and the redesign of the activity conducted in different preschool settings revealed that young children exhibited a range of social behaviours as they
engaged with their peers. Generally, children seemed to have a mutual understanding that they were working together and an expectation about sharing. Despite the scaffolding for the device to be placed in the middle so that both children could see the device, the ‘contact’ findings showed that this was rarely adhered to. In most pairs there appeared to be a more socially dominant peer partner. It seemed that the pair’s success in cooperating was more dependent on individual characteristic than the activity.

As children participated in the designed activity, they appeared engaged, interacted with the device and their peer, negotiated, and rejected the design of the story they were creating together. Specific elements in the design of the activity did affect the children’s behaviours, such as photo-taking, which promoted positive interdependence. Pre-planning the story on paper, so each child was typing different parts of the story allowed for a more structured way for the children to negotiate the division of resource. In addition to how the activity shaped the way the children interacted, the composition of dyads and the presence of an adult during these sessions may have influenced the interactions that took place.
Chapter 8  Conclusions

This final chapter aims to summarise and outline how this research has contributed to the field of educational technology and early childhood education. The chapter will begin with a discussion on the unique contribution to knowledge which this research adds to this area, both methodological contributions and practical implications for practitioners. Section 8.2 will then discuss the limitations of the research and the chapter provides recommendations for future research in section 8.3.

8.1 Contribution to research

Literature in early childhood education has shown the importance of cooperation in the early years' settings (section 2.4.1). Previous studies have demonstrated the growing use of mobile touch screen technologies in the early year’s settings (section 2.2). However, few studies have explored how these technologies can affect cooperation in the early childhood context. Earlier empirical studies have focused more on older children (Davidsen & Christiansen, 2014; Fleck et al., 2021). Those conducted with young children focused on verbal communication between the partnership (Åberg et al., 2015; Falloon & Khoo, 2014). It has also become evident that the more established frameworks used as the foundation for exploring the concepts of cooperation have not been designed with young children’s developmental stages in mind.

Additionally, given the subjective nature of ‘cooperation’, it becomes challenging to operationalize what types of behaviour are considered cooperative, specifically within the early year’s context. Arnott has captured the complexities of understanding a children’s social experience during their interaction with digital devices; her work highlighted how, her work
highlighted how “technological affordances may be secondary to children’s agendas and the latter is likely to determine how positions (owner, participant and spectator) emerge” (2013, p. 109).

This became evident in the findings from my research, as the design of the activity or the presence of technology itself even when scaffolded was not the key determinant of how the interactions of the pair would cooperate. The child’s social status relative to their partner and their perceived position with the iPad played an important role in determining the type of interactions that would emerge. These differences in the unique dynamic amongst each pair could be captured by observing the differing approach the children had with their partner when manipulating the device (type of touch- chapter 6.1), their gaze and focus (eye gaze-chapter 6.2), and the ability to negotiation ownership of the device with their pair (transfer of possession- chapter 6.3). Therefore, in looking back at the integrated framework of cooperation, many of the elements that Johnson & Johnson (2017) put forth such as ‘individual accountability’ or ‘promotive interactions’ are accounted for and have previously been measured through the children’s verbal communication as this is feasible with older children. However, this can be much more limiting with young children who may not have the rich array of vocabulary to express all their thoughts, therefore adaptations are needed to be made to the framework to make it more applicable for younger children.

The systematic analysis of certain physical features of touch and non-verbal communication that was presented in this research allowed me to isolate and observe when cooperation did occur and investigate what prompted it. To my knowledge, there is currently no published research which focuses on looking at the non-verbal communication between young children during cooperative task while using MTST. The importance of analysing the negotiated process and the verbal communicative process are not unique to this research per se, as it has always acknowledge as important feature when analysing data (Rosie Flewitt, 2006). The significance of looking at the non-verbal forms of communication (i.e. gestures, gaze , and bodily orientation) has
been proved to be an vital unit of analysis in previous empirical studies and in different modes of analysis such as the interaction analysis (Jordan & Henderson, 1995). Furthermore, building upon Davidsen and Christiansen’s idea of ‘intelligence-as-action’ (2014) there is a need to look at embodied and multimodal interactions, specifically at how children physically interact with MTST and their surroundings. Thus, this research provides a unique contribution in looking at physical interactions from a more detailed and micro unit of analysis across all the pairs throughout the entire interaction as opposed to just isolating key events.

8.1.1 Methodological Contribution

The findings demonstrated the potential value of using a DBR approach and recognizing the invaluable expertise that practitioners were able to offer. Although challenging in its own aspect, allowing practitioners to share their experience, and becoming an active part of the research project allowed them to reflect and actively think about the possibilities of using MTST in partnership which they may have never considered before. The challenges that emerge in any type of participatory research that involves practitioners has been previously documented, with teachers potentially misunderstanding the research, mistrusting the university research (Zhou, 2012), or a lack of time due to the heavy teaching load (Ulla et al., 2017). Thus, my difficulties in engaging with practitioners were not unique to my research, however the process of DBR allowed for the flexibility for me to take more initiative as a researcher; suggest ideas and present it back to the practitioners. Although arguably this may be viewed as more researcher-led, it allowed the research to progress, and keeping open-communication so that practitioners felt comfortable to share their input at any point. Although the aim was to always co-generate knowledge through inclusive interactions, the practitioners were often quite relieved to have the research independently conducted. Being explicit at the beginning of the process and outlining everything
in planned group meetings was useful to establish that rapport. Additionally, introducing myself to the children as a researcher through a storybook allowed for the children to familiarize themselves with me and ask questions about what I was doing in their setting (See Appendix 10). The semi structured interviews at the beginning of the DRB process helped to demonstrate the diverse some often contradictory beliefs, which was expected as reported by previous research (Chen, 2008; Parker & Neuharth-Pritchett, 2006). However, Mertala (2017), mentioned in his study the notable contrariety between educators’ general and ICT pedagogical beliefs, and the significant role of outside influences in educators’ ICT pedagogical beliefs, a phenomenon he called “wag the dog”. This is when educators’ beliefs of what is good ICT-enhanced pedagogy is not based on their beliefs about the pedagogical core of preschool education, but on the technology itself or the model and guidance received from others, and that is what shapes their ICT pedagogical beliefs the most. This could be visibly observed in my research as well.

Incorporating quantitative measures of multimodality, such as measuring eye gaze, touch type and transfer of possession, to examine the complex behavioural interaction is also a methodological contribution. Previous work on collaborative learning and young children relied primarily on qualitative evidence through the analysis of the children’s talk (Falloon & Khoo, 2014). Although these findings are extremely valuable, it provides only one facet to the complexities of interaction. This is evident particularly when dealing with young children, as they are still developing their language skills and the way they communicate may be more physical and verbal, by including data related to measurable student behaviours. Compared to looking at critical incidents, it allows for more multifaceted insights into an established problem. Therefore, it is worth considering in future education research how we choose to conduct behavioural analysis of young children’s cooperative skills.
8.1.2 Practical Implications

The findings outlined in this thesis have practical implications for practitioners who work in early childhood educational settings and for those who work with younger primary school aged children. The following are targeted practical suggestions to support practitioners who wish to use digital technology in a cooperative manner. These recommendations are intended for more formal activities, but can be adapted as appropriate.

1. **Decide the social context of using the iPad, in terms of an independent learning activity, pair work or group work, and support the chosen social structure.** The findings from the video of analysis particularly with regards to types of touch (Chapter 6.2), showed that physical interaction of the device was still based on solitary use as the children would not share and put the device in between themselves. Therefore, it is important to keep in mind what the learning objectives are and introduce the use of the iPad in a related manner.

2. **Practitioners need to remember to moderate the interaction and encourage cooperative behaviour.** While the MTST offered unique potential as a shared, public learning device, the pedagogical role of the teacher in acting as a facilitator is essential (Fallon & Khoo, 2014). The findings with regards to the children’s eye gaze (Chapter 6.1) showed that children would still look to me for support and needed me to resolve conflict and encourage cooperative behaviour. Given their young age, the ability to independently resolve disputes is often a challenge and may require an adult to facilitate.

3. **Explicitly teaching and modelling to students how to work cooperatively with their peers when using MTST.** The act of modelling appropriate behaviour was identified as a way to scaffold for cooperation. Demonstrating to children prior to the activity how to share the iPad and using their words to communicate with their peers had to all be done
explicitly. Recent research shows how physical interactions can shape the way children interact when using devices (Davidsen & Christiansen, 2014; Fleck et al., 2021), this might involve scaffolding and explaining how certain blocking position can be a hinderance to cooperation.

4. **Being aware of the type of app selected and understand how constructivist (open-ended) apps vs instructivist (close-ended) apps promote different types of cooperation.**

More open-ended exploration promotes more negotiable dialogue. It is important to select developmentally appropriate apps, however despite the larger number of apps targeted for young children there is a limited number of resources to evaluate their quality (Kucirkova et al., 2014; Lee & Cherner, 2015). Papadakis et al., (2017) has designed an educational app rubric for preschool teachers that does include a social interaction evaluation section. Though open-ended tasks might give children the opportunity to engage in more effective collaborative conversation (Falloon and Khoo, 2014), more recent work by Fleck, Vasalou, and Stasinou (2021) demonstrates that closed tasks can also foster effective collaborative conversation. Although an open-ended app was used in this research, the design of targeted helped focus the child’s attention on the task at hand.

5. **Utilize the photo taking feature of the device to engage children to work more in pairs.**

Findings from this study about transfer of possession and the critical analysis of incidents where positive transfers occurs (Chapter 6.3) reiterates Narelle Lemon’s (2016) statement that young people should be trusted and scaffolded to use digital cameras. The hand-held and portable nature of this technology enables them to become digital image-makers, but it also promotes active turn-taking and communication.
Many early childhood pedagogies which have their roots in the constructivist learning approach recognise the importance of cooperative learning (Fröbel, 1896; Maria Montessori, 1912; Yusof et al., 2012). Cooperative learning is commonly recognised as a pedagogical practice that promotes socialization and learning among students across all age groups (Gillies, 2016). Results from the practitioners’ interviews (see chapter 5) has supported the consensus that cooperative learning is an essential skill that early years practitioners want to nurture in their classrooms. Previous studies show similar results of early childhood educators demonstrating a positive attitude towards cooperative learning in their classroom (Mena, 2014). Additionally, the benefits of cooperative learning have also been shown to enhance the learning of concepts, improve motivation, help children feel a part of the learning process, and foster positive relationships among students from various backgrounds (Ambrose et al., 2010).

Cooperative learning can manifest itself in many forms, the 5 elements of cooperative learning that have been outlined by Johnson & Johnson (2017) provides a good foundation for the assessment of successful cooperative learning experiences. Cooperative interdependence in particular allows for children to truly rely on each other to accomplish a certain goal. Structuring the activity where children need the help of their peers (i.e. photo taking) to complete a task encourages children to communicate and negotiate. Choosing age-appropriate apps that either have turn-taking integrated into the activity or constructivist apps that utilize the photo-taking feature of the iPad are some steps to better use the device as a cooperative learning tool.

As discussed in the literature review, the intuitive nature of the iPad's touch interface has allowed very young children to be able to interact with the device (chapter 2.2.1), making the tablet a unique technological tool that has the potential to be used in the early childhood classroom. However, the physical design of the devices is centred around independent usage. Similarly,
children's observation of iPad usage in their environment will most likely be in a single-user set-up. Therefore, if the device was to be used in pairs and shared, it will require explicit modelling as it is not an interaction that children are necessarily familiar with. Tablets and iPads also pose the additional complexity of being a tool that requires maintenance, is expensive, and is also more fragile than other children's tools/toys. Thus facilitation by the practitioner during initial pair usage is needed which may not always be practical given the setting or student-teacher ratio.

Additionally, as observed in the vignettes of 'red' interactions, the portability of the device may result in children grabbing the device or in some circumstances even running with the device. Setting up specific rules and areas for the use of the device is necessary. On the other hand evidence of positive cooperative interactions from this study shows that young children have the self-management skills needed to use the device in pairs. The high level of engagement highlights the potential of the device as a tool that could be used cooperatively depending on the app selected and how the activity is designed. The role of the practitioner in the integration of iPad for cooperative learning is of utmost importance, as Keengwe and Onchwari (2009) reiterates that,

“Technology is not a substitute for good instruction; effective teachers strive to integrate technology into their lessons to engage multiple learning styles of diverse learners and abilities in the classroom.” (pg.215)

8.2 Limitations & Future Research

This thesis presents a mixed-methods analysis of the different data sources that were collected, including surveys, semi-structured interviews, and video data. Although steps were taken to ensure the rigour, reliability and validity of the research, there should be an acknowledgement of several limitations. There is the unpredictable and challenging nature of observing young children in school settings, the constraint on sampling size and time, and the use of video, although providing very rich data can also be limiting in different aspects.
The DBR study could be criticized as having limited generalisability. The participants in this study may not necessarily represent early childhood students because of the small sample size of 12 children (6 pairs) and nine practitioners. Only children whose parents gave consent took part in the study. However, this limitation is standard in most children studies (Ralph, 2017). The participants in this research were recruited pragmatically due to the sensitive nature of accessing school settings; therefore, the schools were not selected randomly. The study, however, did not aim for generalisability. Instead, it was intended to explore if the children were cooperative when using the iPads in pairs and to unpack the complexities of the topic under investigation. This in-depth multimodal behavioural analysis is one of the first empirical investigations to explore cooperation in this manner. Thus, a larger sample size may not have allowed for such a detailed analysis. Future research could include a more extensive and more diverse sample. Also given what is known now on how vital the partnership’s dynamic is, a more systematic process in pairing the children to explore other variables that might play a role in how the children cooperate could yield exciting insights.

Given that the present study was undertaken over a couple of weeks in each setting, the results may differ if the research had a longer time scale and if the time between the initial design and redesign was longer. Given the school timeline, I was unable to run a full analysis before the activity redesign. I was only able to conduct a preliminary analysis of the findings before redesigning the activity. As such, it would have been useful to conduct a more extended study to allow for a more in-depth analysis to inform the redesign and allow time for rapport building and further engagement with the practitioners. This is because design-based research methodology emphasizes practical research methods. It allows room for me to navigate the educational setting’s unpredictable nature and time to proceed accordingly. The design-based research
methodology is one of the newer research methodologies (AL Brown, 1992; Collins, 1990). Given how young this method is and the emphasis as practical research method, it allows room for me to navigate the unpredictable nature of educational setting and proceed accordingly.

Although several measures have been taken to enhance credibility, given that I was both the researcher and facilitator being the same person in this study is likely to have affected the findings. My investment in wanting the children to cooperate could have affected my positionality, tone of voice, and deliverance of the activity. Additionally, the children were also fully aware of my role as a researcher and as an external person rather than a teacher in their school. However, I addressed this limitation by consistently visiting the settings and making myself present while observing the children before conducting the video data recording, and the children became familiar with me. Similarly, my experience as an early childhood educator also provided me with the basic skill set needed for simple group management skills and using age-appropriate vocabulary. Additionally, I had a general understanding of approaching children’s questions and how to give instructions to children in this age group.

Based on the findings from this study, specifically, when looking at types of touch and transfer of possession, it became clear that sharing the devices was a source of conflict for this age group. Even though scaffolding was put in place to remind children to place the iPad in the middle between the pair, almost none of the children followed through with this as it appeared to be asking too much of the children. Therefore, it may be worth looking at how cooperation could still occur if children had their own devices and were working in a group towards a common goal. Rather than providing only one device which appeared to result in issues about ‘ownership’.
The Covid-19 pandemic has resulted in dramatic change in the education sector that has led to a distinctive rise of e-learning as schools and learning centres have been physically shut for extended periods of time. Although this thesis focuses heavily on the face-to-face aspect of cooperation, there are elements of digital learning and young children that can help to inform future research. This thesis highlights the difficulties that they have in sharing the tools, but it also sheds light on the high level of interest that children have while using these tools. Future research should look at cooperation in alternative forms where devices do not need to be shared, but the task itself is designed to be cooperative.

8.3 Concluding Remarks

At the beginning of this thesis, I mentioned a quote from John Dewey highlighting the progressive nature of education. This sentiment was the underpinning foundation in the exploration of how new technological tools that have heavily infiltrated daily lives impact on the way young children socialize. This study reaffirmed that many of the previously held fears around mobile touch screen technology not only still exist but are justifiable as the design and the types of apps available are not built with the purpose of social interaction and cooperation in mind. The mixed and varied sentiment of hope and fear surrounding MTST that was presented in the findings from both the questionnaire and interviews with parents and practitioners demonstrates the ongoing need for research to address some of these concerns and provides practical guidance on how the technology can be introduced in different settings. The findings also suggest that we are at a point in which the ubiquitous nature of technology is generally excepted by practitioners and parents, and that there is an understanding that early exposure will allow children to begin to develop the technological competencies needed for their schooling. However, some parents and practitioners may still view the technology as a barrier to what is perceived as quality play and interaction with other children. If MTST continues to be viewed as a tool that hinders
cooperation, then it will be hard to integrate the technology into a curriculum that heavily values cooperation.

In using a DBR methodology, this research attempted to look at ways of increasing cooperation but also to gain a better understanding what types of interactions were occurring in pairs of children working on the tablet. Although no significant change was observed in the redesign of the activities, this research was still able to provide evidence that MTST has the potential to engage and provide another medium of learning. If learning activities are appropriately scaffolded, practitioners could implement effective and novel ways of using the iPad in the classroom to enhance cooperation. The consistently high eye gaze from the children on the iPad despite not being in possession of the device demonstrated that the children were actively involved and reiterates the appeal that these devices appear to have to young children. Additionally, specific features like photo taking can be used to promote positive interdependence. Creating a structured activity while using an open-ended app can help give structure to the children’s transfer of possessions (turn-taking). The results of this study will hopefully engage parents and practitioners to rethink how the devices are being introduced and what purpose they want these tools to offer in an educational context.
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Appendix 1: Ethical approval for Questionnaire

This memorandum is to confirm that the research protocol for the above-named research project, as submitted for ethics review, has been given a favourable opinion by the Open University Human Research Ethics Committee by Chair’s action as it is thought to be low risk. Please note that the OU research ethics review procedures are fully compliant with the majority of grant awarding bodies and their Frameworks for Research Ethics.

Please make sure that any question(s) relating to your application and approval are sent to Research-REC-Review@open.ac.uk quoting the HREC reference number above. We will endeavour to respond as quickly as possible so that your research is not delayed in any way.

At the conclusion of your project, by the date that you stated in your application, the Committee would like to receive a summary report on the progress of this project, any ethical issues that have arisen and how they have been dealt with.

Kind regards,

Dr Louise Westmarland

Chair OU HREC
Appendix 2: Paper Base Questionnaire Design

Part 1: Parent's Perspective

25. What is the main reason your child does not use a tablet/IPad or phone?
   - Too expensive
   - Child too young
   - Inappropriate content
   - Health concerns for child
   - I don't know
   - Not Approvable
   - Other reasons (please state):

27. Do you agree with the following statements?
- The tablet or phone helps my child communicate with others.
- The tablet or phone helps my child become familiar with technology.
- The tablet or phone is a tool to teach my child about mobile apps.
- The tablet or phone is a tool to teach my child new skills.
- The tablet or phone helps my child learn through new apps.

28. Are there any additional positive aspects of tablet and mobile phone use for young children?

29. Are there any additional negative aspects of tablet and mobile phone use for young children?

Thank you for participating in this survey.
Please return this form to the office or your child's teacher.

Part 1: General Information

1. Do you wish you had access to a mobile phone or tablet when you were 5 years old?
   - Yes
   - No
   - I don't know

2. Do you remember at around what age, you got your first mobile phone or tablet? (Please state)

3. On the most recent weekday, how many hours did you spend on your mobile phone or tablet? (Please state)

4. On the most recent weekday, how many hours did you spend on your tablet/IPad? (Please state)

Part 2: Parent's Information

5. Please select the age:
   - 11-15
   - 16-19
   - 20-24
   - 25-36

6. Please select your gender:
   - Female
   - Male

7. What is the highest degree or level of school completed?
   - High School
   - University
   - Bachelor or Vocational
   - Masters or Graduate
   - Other

Part 2: Child's Information

5. Please complete this questionnaire on behalf of your child/children who is aged 5 or above. Make sure which child you have selected the questionnaire for and state their exact age in years and months.

Child's age: _______ Years _______ Months

6. What gender is your child?
   - Male
   - Female

7. Which of the following does your child use?
   - Tablet / iPad
   - Mobile Phone
   - Both tablet and mobile phone
   - None

If you selected "None" and your child does not use a tablet or phone, please go to pg 4 (question 26)

Now please go to question 27, do not answer question 26.
Appendix 3: Questionnaire Flow Chart

Flow chart for Online Survey

Flow chart for Paper-Based Survey
Appendix 4: Ethical approval for Main Study

Human Research Ethics Committee (HREC)
From: Dr Duncan Banks
The Open University Human Research Ethics Committee
Email: duncan.banks@open.ac.uk
Extension: (6) 59198
To: Pitsuda Srisontisuk, IET
Project title: Supporting pre-school children’s collaborative learning with digital technology.
HREC ref: HREC/2018/2785/Srisontisuk
Date application submitted: 02/02/18
Date of HREC response: 03/02/18

Memorandum

This memorandum is to confirm that the research protocol for the above-named research project, as submitted for ethics review, has been given a favourable opinion by the Open University Human Research Ethics Committee.

Please note the following:

1. You are responsible for notifying the HREC immediately of any information received by you, or of which you become aware which would cast doubt on, or alter, any information contained in the original application, or a later amendment which would raise questions about the safety and/or continued conduct of the research.

2. It is essential that any proposed amendments to the research are sent to the HREC for review, so they can be recorded and where required, a favourable opinion given prior to any changes being implemented (except only in cases of emergency when the welfare of the participant or researcher is or may be affected).

3. Please include your HREC reference number in any documents or correspondence. It is essential that it is included in any publicity related to your research, e.g. when seeking participants or advertising your research so it is clear that it has been reviewed by HREC and adheres to OU ethics review processes.

4. You are authorised to present this memorandum to outside bodies such as NHS Research Ethics Committees in support of any application for future research clearance. Also, where there is an external ethics review, a copy of the application and outcome should be sent to the HREC.

5. OU research ethics review procedures are fully compliant with the majority of grant awarding bodies and where they exist, their frameworks for research ethics.

6. At the end of your project, you are required to assess your research for ethics related issues and/or major changes. Where these have occurred you will need to provide the Committee with a HREC final report to reflect how these were dealt with using the final report template on the research ethics website -

Best regards
Dr Duncan Banks
The Open University Human Research Ethics Committee

www.open.ac.uk/research/ethics/ November 2017
Dear Sir/Madam,

My name is Pinsuda Srisontisuk (Pin), I am currently a PhD researcher at the Centre for Research in Education and Educational Technology at the Open University. I have a professional background in Education, with teaching certification from New York State, and then worked as an Early Years educator in an IB-based international school in Thailand for four years. The research is being supervised by Prof. Messer, Prof. Kukulka-Hulme and Dr. Canning.

My time spent interacting with young children and parents has made me want to better understand practitioner’s attitudes to the use of new technologies in their pre-school settings. I am writing to ask whether you and your school would be willing to help me collect information regarding children’s usage of new digital technologies and what type of collaboration occurs while they working in pairs on the iPad.

Your participation would involve allowing access to your setting and allowing the lead investigator to video record children whose parents has given written consent for their child to participate in the study. The study will also involve short interviews/conversation with the practitioner and the children. The conversation concerns the children personal feeling towards using the specified App.

The project complies with BERA ethical guidelines and has been approved by the Open University Ethics Committee. Your setting, parents, staff, and children have the right to withdraw from the research at any time and to ask that any computer records are deleted before June 2019.

I very much hope this study will be of interest to you and that your setting would like to help with this research.

If you have any questions please contact me by email or telephone.
(pinsuda.srisontisuk@open.ac.uk. Telephone 07510 930850).

Yours sincerely,

Pinsuda Srisontisuk,  
PhD Researcher

Name (Please print)…………………………. Name of Setting…………………………..

Signed …………………………………………..       Date ……………………………
Appendix 6: Consent Letter to Parents

Parental Permission for Participation of a Child in a Research Study:
Supporting pre-school children’s collaborative learning with digital technology

Description of the research and your child’s participation

Your child has been invited to participate in a research study conducted by Pinsuda Srisontisuk from the Centre of Research and Educational Technology. The purpose of this research is to better understand what type of collaboration between pairs of children occur when they are using iPad together. In this way it is hoped to be able to reassure parents and practitioners that digital technology can have positive educational effects on young children.

Your child’s participation will involve participating in a researcher-led activity using an app called Our Story app which allows the creation of personalised digital stories by children. You child will be video recorded during their regular interactions with different types technologies and video recorded while they are engaging in partners with the app. The expected amount of time required for your child’s participation will be approximately 20-30 minutes per week per child.

Risks and discomforts

There are no known risks associated with this research.

Potential benefits

This research may help us to better understand what type of educational effect digital technology young children has working in pairs.

Protection of confidentiality
All information collected will be treated as highly confidential and kept on password protected computers. No computer records will be kept which identify individuals. You have the right to withdraw your child from the research at any time and to ask that any computer records are deleted before September 2018. Every precaution will be taken to protect your child’s privacy.

**Voluntary participation**

Participation in this research study is voluntary. You may refuse to allow your child to participate or withdraw your child from the study at any time. Your child will not be penalized in any way should you decide not to allow your child to participate or to withdraw your child from this study. Your child will also have ample opportunity to express whether they want to take part in the activity.

**Contact information**

If you have any questions or concerns about this study or if any problems arise, please contact Pinsuda Srisontisuk) by email or telephone

Email: pinsuda.srisontisuk@open.ac.uk.
Telephone 07510930850

**Consent**

I have read this parental permission form and have been given the opportunity to ask questions. I give my permission for my child to participate in this study.

Parent’s signature_______________________________ Date:_______________

Child’s Name:_______________________________
Dear Sir/Madam,

My name is Pinsuda Srisontisuk (Pin), I am currently a PhD researcher at the Centre for Research in Education and Educational Technology at the Open University. I have a professional background in Education, with teaching certification from New York State, and have worked as an Early Years educator in an IB-based international school in Thailand for four years. My interactions with young children and parents have made me want to better understand the use of new technologies in pre-school settings. This research is being supervised by Prof. Messer, Prof. Kukuslka-Hulme and Dr. Canning.

The purpose of this research project is to develop a better understanding of practitioner’s perspective towards young children’s use of interactive touch-screen technology and collaborative learning. This is a research project being conducted by Pinsuda Srisontisuk at the Open University. You are invited to participate in this research project because you are an educator working with children ages 5 or below.

Your participation in this research study is completely voluntary. If you decide to participate in this interview, you may withdraw at any time. The research involves your active participation in helping to design and introduce a learning activity app called Our Story (http://www.open.ac.uk/creet/main/projects/our-story) or other similar story apps which allows the creation of personalised digital stories by children. Your participation will be confidential, and we do not collect identifying information such as your name. To investigate whether the support is effective, observations and video recordings will be collected of the children’s collaboration before they are given the support. Then similar observations and video recordings will be obtained after the children have been given the support. The children will also be asked about what they think about working together. All information collected will be treated as highly confidential and kept on password protected computers.

If you have any questions about the research study, please contact the researcher at pinsuda.srisontisuk@open.ac.uk. This research has been reviewed and approved by the Open University Ethics Committee. If you agree to participate please sign and date this consent form below.

Yours sincerely,

Pinsuda Srisontisuk
PhD Researcher

Name (Please print)............................................................................................................

Signed ...........................................       Date ...............................................
Appendix 8: Participant Information Sheet

Participant Information Sheet

Please take time to read the following information carefully. Please feel free to ask the researcher if there is anything that is not clear or if you would like more information.

Research Project Title

Collaborative learning through the use of mobile touch screen technology with young children

What is the aim of this research?

Mobile touch screen technology (MTST), particularly tablet computers and mobile phone are becoming a norm in our daily lives. However, these devices are often used in isolation and not much research has been focused on the implications of how this technology is effecting the social development of young children.

This phase of the research project aims to investigate how early years practitioners view the use of mobile touch screen technology amongst young children, and its potential to support collaborative learning.

Why have I been chosen?

You have been chosen because you work directly with children ages 4-5 years old and as an early year’s practitioner, you are knowledgeable in working with young children. You will have critical insight about how mobile touch screen technology can be used for the purpose of collaborative learning.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part, you will be able to keep a copy of this information sheet and you will need to indicate your agreement on the consent form. You can still withdraw at any time without having to give a reason.

What will happen to me if I take part?

You will be asked to take part in a 45 minutes interview to find out about your perspective regarding young children’s use of touch screen technology and collaborative learning.

What are the possible disadvantages and risks of taking part?

Participating in the research is not anticipated to cause you any disadvantages or discomfort. The potential physical and/or psychological harm or distress will be the same as any experienced in everyday life.

What are the possible benefits of taking part?
It is hoped that this work will have a beneficial impact on understanding how to better introduce mobile touch screen technology into the early year’s settings. Results will be shared with participants in order to inform their professional work.

Will my taking part in this project be kept confidential?

All the information that we collect about you during the course of the research will be kept strictly confidential. You and your setting will not be able to be identified or identifiable in any reports or publications. Data collected may be shared in an anonymised form to allow reuse by the research team and other third parties. These anonymised data will not allow any individuals or their institutions to be identified or identifiable.

Will I be recorded, and how will the recorded media be used?

You will be recorded using a voice recording device. The audio recording will be transcribed by the principle researcher and anonymised. The audio recordings will be kept strictly confidential.

What will be talking about?

The interview will ask you about your opinions and current practices in relation to MTST and collaborative learning in the early years. Your views and experience is what the research is initially interested in exploring.

What will happen to the results of the research project?

Results of the research may be published. You will not be identified in any report or publication. Your institution will not be identified in any report or publication. If you wish to be given a copy of any reports resulting from the research, please ask the researcher directly.

What if I have other questions?

If you have any other questions please contact the principle researcher: Pinsuda Srisontisuk (details are below). Alternatively, if you have any concerns about the project you can also contact the principle supervisor (Professor David Messer) or any other member of the research team.

Thank you for taking part in this research

Contacts for further information

**Principle Researchers**

Pinsuda Srisontisuk  
Email: pinsuda.srisontisuk@open.ac.uk

**Supervisory Team**

Professor David Messer  
Email: david.messer@open.ac.uk

Professor Agnes.Kukulska-Hulme  
Email: agnes.kukulska-hulme@open.ac.uk

Dr. Natalie Canning  
Email: natalie.canning@open.ac.uk
Appendix 9: Script asking for verbal consent from children

Introduction & Verbal Consent for Video Recording

The lead investigator will already have established some rapport with the children, as the researcher will be going in 2-3 weeks prior to the study to familiarize herself with the children.

Hi, my name is Pin. So I don’t know if you remember but I am also going to big person school like you and I am trying to understand how teachers use iPads in the classroom, because it may be good or it may be bad for children, I don’t know yet. I have a video recorder here to video tape what you are doing, so I can remember what you are doing. It will just stand here and not disturb anyone, is it ok if I turn on so that it record you and your partner? (Wait for reply and for verbal consent – if they child appears shy a physical reply will also be offered, “if it’s ok please give me a thumbs up, if it’s not ok please give me a thumbs down” – and model both gesture to the children) If you want me to turn it off you can ask me and I will turn it off, can I turn on or off? (Wait for confirmation again, if appropriate also suggest a gesture of a thumbs down to turn off the video recording) Do you have any questions you want to ask me?
Appendix 10: Introduction Story Book

Do big people go to school?

We know that children go to school.

Children go to school to learn.

Children go to school to make new friends.

Children go to school to play.

Children go to school to see new animals.

But do big people go to school? When do we start?

Some big people are teachers.

Some big people are farmers.

Some big people are engineers.

Guess what? I go to school too, just like you. I go to a school called the Open University and I am learning about young children. That is why I am here in your school. I am trying to find out more about how young children play and learn. Sometimes you will see me working, that’s so I can remember what I see so I can talk about it when I go back to the big people school. Sometimes people call big people who go to school, “researchers” but you can call me Tim. I will be here every Thursday morning for the next few months. I look forward to learning with you.
### Appendix 11: Questionnaire design and supporting literature

<table>
<thead>
<tr>
<th>Attitude Statement</th>
<th>Positive or Negative</th>
<th>Previous Studies &amp; Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tablet or phone helps my child be more creative.</td>
<td>+</td>
<td>Dezuanni, Michael, et al. iPads in the early years: Developing literacy and creativity. Routledge, 2015.</td>
</tr>
<tr>
<td>The tablet or phone helps my child communicate with others.</td>
<td>+</td>
<td>Plowman, Lydia, and Joanna McPake. &quot;Seven myths about young children and technology.&quot; Childhood Education 89.1 (2013): 27-33.</td>
</tr>
<tr>
<td>The tablet or phone is a tool to teach my child science.</td>
<td>+</td>
<td>Goodwyn, Kristy, and Kate Highfield. &quot;iTouch and iLearn: An examination of &quot;educational&quot; apps.&quot; early education and technology for children conference. 2012.</td>
</tr>
<tr>
<td>The tablet or phone is not designed for young children.</td>
<td>-</td>
<td>Plowman, Lydia, Joanna McPake, and Christine Stephen. (2012) &quot;Extending opportunities for learning.&quot;</td>
</tr>
<tr>
<td>The tablet or phone is not designed for young children.</td>
<td>-</td>
<td>Ernest, James M., et al. &quot;Extending the global dialogue about media, technology, screen time, and young children.&quot; Childhood Education 90.3 (2014): 182-191.</td>
</tr>
</tbody>
</table>

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Appendix 12: Semi-Structured Interview Questions with Practitioners

OPENING

A. Introduction and explain the research background.
B. Mention the time allocated for the interview and general structure.
C. Explain data integrity, privacy policy, and give the interview the option to opt out of answering questions or terminate the interview if they no longer want to participate.
D. Seek permission to record the conversation.
E. Mention to the practitioners that there is no right or wrong answer – this reassurance strategy will be employed throughout the interview particularly with regards to issues that they may feel more sensitive about.

BRIEF INTRODUCTION & BUILDING RAPPORT

1. What is your position in the Early Years setting?
2. For how long have you been working in this sector, with young children?
3. Could you please summarise your career path that got you to your present position?

GENERAL PERSPECTIVES ON COLLABORATION IN EARLY CHILDHOOD

4. What are your general feeling about collaborative learning?
5. Can you give me an example of two children working collaboratively together?
6. What do you think are some of the most important components of collaboration in pre-school settings? (follow-ups – if not mentioned ask about relevance of features identified in research – some people think these are features of collaboration…….)
7. What behaviours and signs indicate that collaboration is going well – and going badly? Is there anything else? – If you look at the works afterwards [Prompts]
8. What can practitioners do to encourage collaboration – situations, guidance/instructions, choice of children etc.
9. Are there activities that children do better collaboratively - and do better alone – what are they?
10. Do you have any general guidelines for collaboration? What are these? Do you have to often remind children about the guidelines?

GENERAL PERSPECTIVES ON MTST
11. What do you think are the good and bad things about using MTST in school and at home?
12. Do you think MTST should be introduced into the early years settings? If so how? If not, why not?

VISIBLE THINKING ROUTINE

I see, I think, I wonder
I see – Stating more factual statements with as little prejudice and assumptions (i.e. There are two children in this picture, holding an ice cream cone, one has brown hair, one has blond hair etc ...)
I think – Stating any assumption of what participant think is happening in the picture (i.e. I think the boy is looking at the girl holding the ice cream, I think he looks excited, I think the girl is excited about eating the ice cream)
I wonder – Stating any questions that the participants has for the people in the image (i.e. I wonder if they are hungry? I wonder if the boy wants the girl’s ice cream. I wonder if they don’t’ usually get to eat ice-cream?)

Visual Prompt Example Picture Children and MTST Picture

GENERAL PERSPECTIVES ON MTST AND COLLABORATION IN EARLY CHILDHOOD

13. Do you think MTST promotes or hinders collaboration between children? Please can you explain why you think this
14. Do you have any guidelines for pairs of children using MTST to better prepare them to work collaboratively together?

IDEAS ABOUT SUPPORTING COLLABORATION WITH OUR STORY

15. If I were going to give pairs of children OS how would you suggest I structure the activities to encourage collaboration? Would there be anything you do with OS/MTST that you would not do if the activity was not OS/MTST? Alternative ways of phrasing the question: How do you think you could introduce an activity with MTST? What would you do, is there anything you could do? –Not pressuring the participants to immediately come up with an ideas. Do you want a bit of time to think about it?
16. What do you see as the issues that often prevents collaboration with MTST? Are they relevant to OS?
   • Follow up issues about specific ideas – i.e. verbal instructions and commands at beginning, laminate sheet, instructions on the iPad, monitoring/interventions during session

17. If you were able to change the software of the app are there any things that you would recommend/do?

18. What do you think will be the most important features to include?

This part should end with an agreed strategy about how best to maximise collaboration with OS

PERSPECTIVE ABOUT TEACHER AS DESIGNER/RESEARCHER

This section has two parts the first part, is to gather information regarding their general perspective towards research? Do they view it as positive, negative, something doable or beyond their scope of knowledge? The second part is aimed at specifically getting their views on them as researcher.

19. When you hear the term ‘research’, what do you usually think about it?
20. Do you think you conduct any research in the classroom? If so, why? If not, why not?
21. When you introduce a new activity in the classroom, what do you look for to make that allows you to make the judgement to continue or discontinue the activity?

Follow up - I have started to see discussion about trying to improve education by empowering practitioners to have more voice in the current research that is being done and the use of terms like – teacher as designer, teacher as researcher. – How they interpret it? What do you think of that this means?

22. What do you think of this idea of “teacher as researcher”?
   • What do you think are the barriers?
   • Do you think this happens anyway on an informal basis?
23. What do you think of this idea of “teacher as designers”?
   • What do you think are the barriers?
   • Do you think this happens anyway on an informal basis?
24. In terms of pre-school settings what do you think could be done to encourage these ideas?

CLOSING COMMENTS/QUESTIONS

25. Is there anything else that you would like to add to this discussion?
26. Do you have any questions or suggestions for us with regards to our conversation