AN ECOLOGY OF TECHNOLOGY: INFANTS, TODDLERS, AND MOBILE SCREEN DEVICES

by

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Abstract

Within a bio-ecological systems framework, this study explored the presence and use of mobile screen devices (MSDs) within family homes of infants born into a Digital Age. A mixed methods approach was used to gather and analyze data from an online questionnaire completed by 292 Canadian parents with a child birth to three years old, as well as from home-based observations and interviews with 28 families. There were three research questions: (1) How do the presence and use of MSDs relate to factors of the family environment? (2) Do parent knowledge and beliefs predict the reasons that parents provide MSDs to their children? and (3) Do parent knowledge and beliefs predict how much time a child spends using MSDs? Results for question 1 found MSDs to shape the physical, social, and psychological family context. On average, families owned 6 MSDs, the parent used MSDs for 7 hours per day, and 60% of children directly used an MSD. Themes of concerns about technology included impacts on the child, the parent and family, and society. Parents' beliefs about MSDs for children were more negative than positive, and child MSD products were negatively evaluated. On measures of developmental knowledge and parenting sense of competence, scores were average and above average, respectively. Results for question 2 found that child age, maternal education, the number of MSDs, the interaction of positive MSD beliefs with the number of MSDs and the interaction of maternal education with parenting sense of competence predicted parents' provision of their MSD to their child. Results for question 3 found that child age, number of family MSDs, and positive beliefs in MSDs for children were predictors for child use of MSDs, while child age, maternal education, parent time using MSDs, and knowledge of development predicted the amount of time children used MSDs. The complex interplay between sociodemographics, parent provision of MSDs to infants and toddlers, and parent knowledge

and beliefs that form a climate of new demands for parents in their child-raising roles is discussed in terms of implications for developmental researchers and practitioners working with infants, toddlers, and/or their caregivers.

Preface

The content of this thesis is based on original unpublished work conducted by the graduate student, Michaela Wooldridge, with supervision from the research supervisor, Dr. Jennifer Shapka. In collaboration, the graduate student and research supervisor developed the research design and recruited participants. The student was primarily responsible for the data analysis and writing components of the present study. Therefore, this thesis is representative of the graduate student's work as co-investigator and lead author. The research conducted as part of this study was approved by the University of British Columbia Behavioural Research Ethics Board (BREB) under certificate number H13-01958.

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For my Parents

Who So Much Wanted to Share this Moment

To my Mother: Ja, es ist nun endlich fertig!

To my Father: I reached for the stars…

CHAPTER 1

INTRODUCTION

> We live invested in an electric information environment that is quite as imperceptible to us as water is to fish.
>
> –McLuhan, *Counterblast*, 1969

Born Into Technology

Recent innovations in handheld information and communication technologies (ICTs) have television/computer screen devices and their associated functions immensely portable and therefore increasingly accessible to everyone, including very young children. While the American Academy of Pediatrics (AAP) is anticipating an update to their policy statement in 2016 regarding child media use in light of these recent innovations (Brown, Shifrin, & Hill, 2015), since 1999, policy statements have advised parents against the use of screen media by children less than two years old (AAP, 2001, 2011). The current recommendation emerged from research conducted with stationary screens, such as televisions or desktop computers. However, with the advent of mobile screen devices (MSD), such as those found in mobile phones, e-readers, laptop computers, and tablets (along with newer touch-screen operations associated with these screens), consumption of screen media is rising exponentially for adults (comScore, 2012; Nielsen, 2012a, 2012b; Ooyala, 2012), as well as for children (Gutnick, Robb, Takeuchi, & Kotler, 2011; Moses, 2012; Ofcom, 2012). Indeed, parents and caregivers often have these devices on hand at all times, which likely makes it difficult to implement a 'no screen' policy. Moreover, with the explosion in infant-directed programs and applications (apps), infants and toddlers have increased options for engagement with mobile screens, and many are often readily provided with screen devices by parents as part of daily activities (e.g., Brighton, 2013;

Qualcomm, 2012). This is exacerbated by the development and marketing of mobile devices that are designed specifically for infants and toddlers (e.g. *InnoTab 2* and *Da Vinci* tablets), as well as the embedding of mobile screens into toys and equipment (e.g., strollers and child seats). Thus, despite the AAP recommendation having been re-issued in 2011 to discourage the viewing of screen media for children less than two years of age (including mobile screens, as well as a recommendation that parents limit their own use of screen time in the presence of young children), it appears that screen exposure by infants and toddlers is on the rise (AAP, 2011). There has been very little research or assessment of how this increased exposure to screens may be altering the most primary developmental environments of very young children (e.g., Courage & Howe, 2010). As an example, it is notable that a popular measure of the infant-toddler environment, the IT-HOME (Caldwell & Bradley, 2003) does not list media technology (beyond books) as a potential characteristic of the home environment. Furthermore, despite concerns about psychological impact for adults related to the overexposure of these technologies such as Internet Addiction (e.g., Rosen 2012; Widyanto & McMurran, 2004; Young, 1996), and technology-related stress and anxiety (e.g., Bawden & Robinson, 2009; Boyles & Rainie, 2012), there is a dearth of research as to the impact these technologies may have for parents in their caregiving roles with very young, dependent children. The current work will begin to explore this question.

Theoretical Framework

In light of the pervasive influence of mobile screen technologies on patterns of human interaction and activities of daily living for adults (e.g. Jordan, 2004; Richtel, 2010) and children (e.g. Gutnick et al., 2011), the goal of the present research was to begin an examination of the technologically changing environments in which infants develop. Bronfenbrenner's

bioecological theory of human development (the 2001 reformulation of the original 1977 ecological systems theory) provides a highly suitable theoretical framework for examining the dynamic nature of the modern family context in which infants are born and raised (Bronfenbrenner, 2005). The original ecological systems theory articulated a nested model of environments that provide proximal and distal factors to influence the developing person. The most proximal level is the *microsystem*: "the complex of relations between the developing person and environment in an immediate setting containing the person" (Bronfenbrenner, 1977, p. 514). The next level is a set of microsystems, termed the *mesosystem*: "the interrelations among major settings containing the developing person at a particular point in his or her life" (p. 515). The next, more distal level is the *exosystem*: "an extension of the mesosystem embracing … specific social structures, both formal and informal, that do not themselves contain the developing person but impinge upon or encompass the immediate settings in which the person is found, and thereby delimit, influence, or even determine what goes on there" (p. 515). Most distal is the *macrosystem*, the level involving culture, macroinstitutions (e.g. government), and public policy, and the level of the system that influences how all the other levels interact to inform the course of development.

To complete the theory, Bronfenbrenner and his colleagues (e.g., Bronfenbrenner, 2001; Bronfenbrenner & Ceci, 1993, 1994; Bronfenbrenner & Crouter, 1983; Bronfenbrenner & Morris, 1998), by way of 10 propositions, worked to integrate the 'missing' levels of the developmental system—biology, psychology, and behaviour—into the ecological systems framework, and hence the new label of "bioecological" (Bronfenbrenner, 2005, p. xv). The newer framework acknowledges the individual at the centre of the circles as an active agent in his or her own development, by way of dynamic interactions within "his or her temporally

embedded, multilevel ecology" (p. xviii). Further, the interactions between an individual and a multilevel ecology "constitute the driving force of human development" (p. xix), as direct and indirect pathways of influence across levels of the ecological system may be traced.

Bioecological Model and Technology: Indirect and Direct Pathways

The current study invokes a bioecological systems framework for looking at the implications of mobile screen technology on early development. The proposed model for examining the predictors of mobile screen devices (MSDs) in the infant's developmental context is presented in Figure 1. Within the infant's microsystem, at least two pathways of influence may be delineated, which may be termed "direct" and "indirect" (note that this is simply to distinguish them – not to deem either as having a more powerful influence *a priori*).

The direct pathway reflects the child's engagement with the physical environment, and includes the infant's and toddler's direct access to, and consumption of, screen media, whether environmentally-embedded or via a manipulative device. This includes infant caregiving materials that have electronic screen functions (e.g., strollers, seating systems, playmats, beds), toys and manipulative materials designed for infants (electronic books, infant versions of cellphones, tablets, or toys with computer-chip functions), and infant programmes and applications loaded onto adult devices and used by infants both alone or with adult participation. For the purposes of this study, data were collected on the infant's engagement with MSDs (in contrast to stationary screens such as televisions or desktop computers), which included smartphones, tablets, e-readers, laptop computers, and handheld gaming devices, whether these items were adult or child iterations.

The indirect pathway of influence reflects the child's relational (social) environment, and examines the use of MSDs (e.g., mobile phones, tablets, e-readers, portable gaming consoles,

laptop computers) by parents/caregivers in their caregiving roles. The data on adults' *en masse* adoption of, and adaptation to, MSDs reflects both opportunities and challenges associated with changes in family communication patterns, parenting behaviour, and cognitive and psychological functioning (Fiehn, 2010; Kubey & Czikszentmihalyi, 2002; Lorinc, 2007; Thomée, Härenstam, & Hagberg, 2011). For example, access to more information faster is associated with a rise in psychological problems such as information anxiety, loss of identity, fractured information, and focus on novelty that change the way in which we view and manage information (Bawden & Robinson, 2009). On the other hand, videochat technology has the capacity to improve the quality of relationships where partners are geographically separated (Neustaedter & Greenberg, 2011). The current study focused on the implications for the development of infants and toddlers that emerge from the role of MSDs in the specific context of parenting and caregiving beliefs, attitudes, and practices.

The current research involves examination of direct and indirect effects of MSDs in the early developmental environment. Existing models seek to explain how proximal and distal factors of the environment interact to produce differing health and developmental outcomes, (e.g. Halfon & Hochstein, 2002; Hertzman, Power, Matthews, & Manor, 2001). Often, such models represent dynamic systems of cumulative risk and/or resiliency made up of biological, social, and environmental factors in developmental research (e.g. Hopper et al., 1998; Burchinal, Vernon-Feagans, & Cox, 2008; Hoff, Laursen, & Tardif, 2003). The current work is informed by the Life Course Health Development (LCHD) model, which describes how health trajectories result from an accumulation of multiple risk and protective factors that "are programmed into an individual's biobehavioral regulatory systems during critical and sensitive time periods in development" (Halfon, Russ, & Regalado, 2005, p. 7). The LCHD model has shown that the

most sensitive period for the programming of risk and protective factors appears to be during the first three years of life, with both individual and population measures representing the timing and sequence of biological, psychological, cultural, and historic events (Fox, Levitt, & Nelson, 2010; Halfon et al., 2005). Similarly, a cumulative risk model by Burchinal and colleagues (2008) has shown a pathway of risk (as measured by cumulative risk factors of low-income and geographically-isolated address, as well as social risk variables such as maternal education, family income, single parent status, number of children, negative life events/stressors, parent unemployment, and neighbourhood safety) through parenting (during the first 15 months of life) to child outcomes. As such, the current research explored the factors of the family context that predict children's earliest access to and engagement with mobile devices in light of infants' and toddlers' reliance on their primary caregivers to provide opportunities and restrictions to developmentally supportive experiences.

Study Objectives

Given the complex and multi-layered interplay of influences on early development, and that every technological innovation—particularly technology that enhances communication, such as the telephone—has made demands on us, and alters the ways in which we live and engage with the world (Alliance for Childhood, 2004; Postman, 1998), it is surprising that there is a paucity of research exploring the influences of the near-universal adoption of mobile digital technologies within the infant's ecological system. The proposed study aimed to address the lack of research on infants developing in the context of the omnipresent mobile technology.

The objectives of the current work were three-fold: (i) to develop a better understanding of the ways in which MSDs are used by parents in their caregiving roles with infants, (ii) to develop a clearer view of the interrelated factors of the infant's physical and social environment

that make new technologies available for infant consumption, and (iii) to inform policies that direct educational, health and social programs and services designed to serve families, caregivers, and educators of children in the early years of development as to developmentally-appropriate use of MSDs with and around very young children.

To address the objectives, a mixed methods approach framed the design of the research project. More specifically, a "within-stage mixed model" design with two methods of data collection was created (Johnson & Onwuegbuzie, 2004, p. 20). The first method of data collection was a questionnaire that contained primarily closed-ended questions and a few open-ended questions, as well as previously published measures. The questionnaire was made broadly accessible via a password protected website. The target respondent group was B.C. parents with a child between birth and three years of age. The questionnaire asked parents about their use of mobile screen devices, their child's access to, and purposes for using these devices, as well as several parent cognition factors (beliefs about MSDs for their child, knowledge of infant development, parenting sense of competency, caregiving experience). The second method of data collection involved collecting data directly from a subset of questionnaire respondents who volunteered for a home visit. The home visit employed a predominantly qualitative approach comprised of interviews and observations, as well as a published scale measure.

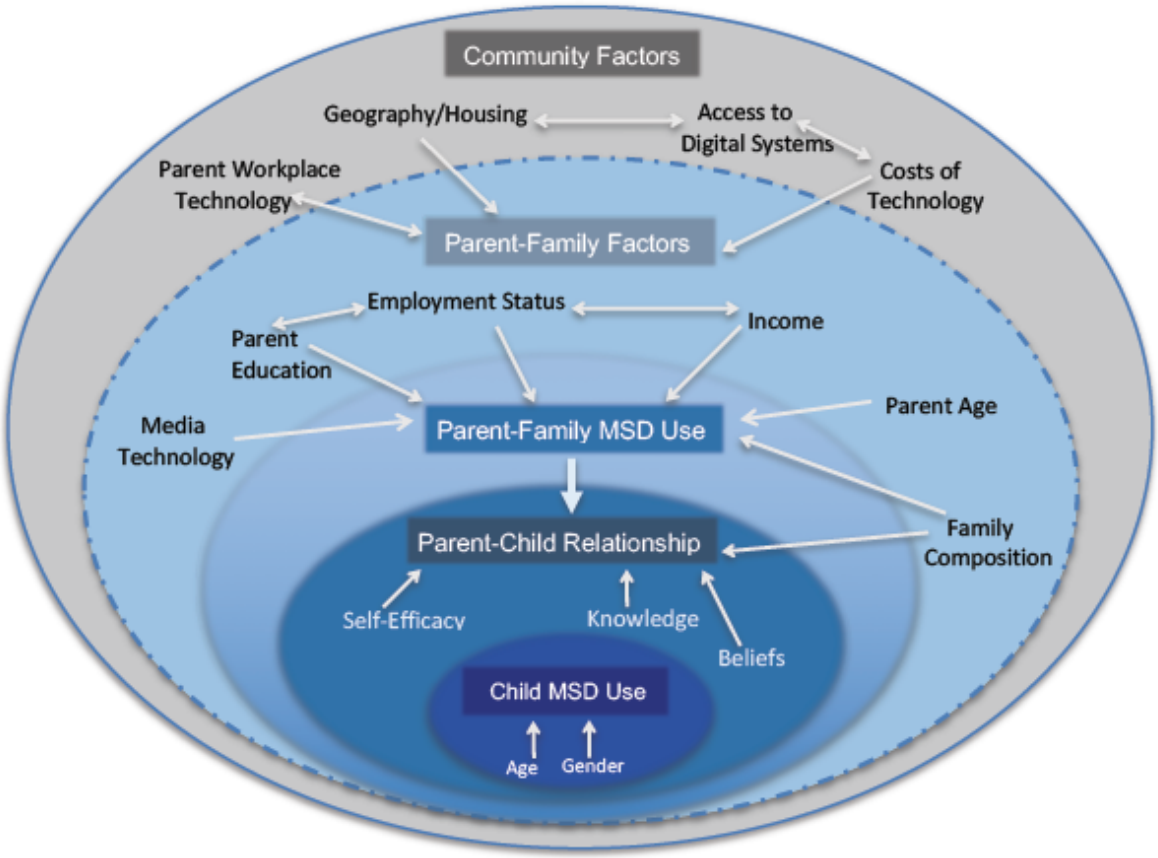

Figure 1. Model of microsystem and exosystem predictors of infant MSD use.

CHAPTER 2

REVIEW OF LITERATURE

Environmental Social Determinants in Developmental Contexts

The family forms the principal context in which human development takes place (Bronfenbrenner, 1986, p. 723), and the parent-child relationship constitutes the initial microsystem for development (e.g. Ainsworth & Bell, 1974; Feldman, 2007). Factors of the infant's microsystem are known to generate powerful determinants for developmental wellbeing with effects across the lifespan (Bronfenbrenner, 1986; Shonkoff & Phillips, 2000). Since families reside in both a physical and a social world (Bradley, 1999; Evans, Kliewer, & Martin, 1991; Wachs, 2000), in order to begin to understand the influence of technology on early development, data on the presence, purpose, and usage patterns of these devices in the child's first environment needs to be collected, as well as consideration given to the actual and potential implications of these devices as microsystem factors in family social interaction patterns and caregiving practices.

The family system as a whole offers a variety of well-established sociodemographic factors that confer or minimize risks to the child's developmental course insofar as these factors uniquely cluster and combine to form ecological 'niches'—"regions in the environment that are especially favorable or unfavorable to the development of individuals with particular personal characteristics" (Bronfenbrenner, 2005, p. 111). Research on environmental social determinants for development has relied heavily on selected factors (e.g., family income, family composition, and ethnicity) or composite measures of sociodemographic status (SDS) or socioeconomic status (SES) (Garbarino & Ganzel, 2003; Sameroff & Fiese, 2003). For example, a large body of literature examines children of low SES (e.g. combined low income, single parent, low maternal

education, and housing problems; Evans & Kim, 2007), to be at increased risk for poor developmental, educational, and health outcomes (e.g., Lupien, King, Meaney, & McEwan, 2001).

Less commonly considered, but rapidly gaining attention, is consideration of interaction effects of a wider range of psychosocial factors as social determinants (e.g., Anand & Krosnick, 2005; Hertzman et al., 2010; Rhoades, Greenberg, Lanza, & Blair, 2011). For example, broader social factors pertaining to specific aspects of the child's *experiences* in the home environment have been explored, such as parental responsiveness and availability of stimulating play materials, and have been found to relate more strongly to developmental status than factors of socioeconomic status (Bradley et al., 1989). Recently, a study confirmed the enduring association between early maternal sensitivity and social and academic competence across childhood, adolescence, and well into adulthood, even after examining "second-order paths to capture transactional processes" (Raby, Foisman, Fraley, & Simpson, 2015). Indeed, the "media explosion" with young children, which "is probably more rapid and wide-reaching than at any previous point in history" (Halfon, Larsen, & Russ, 2010, p. 12), makes it important to include a wider range of social factors as potential developmental determinants in contemporary research designs. Moreover, traditional adult networks (e.g., families, institutions) that serve to buffer children from the negative impacts associated with environmental change can no longer keep pace with "change that is so rapid and its nature so unpredictable" (p. 13). To illustrate, one area in which the "unfiltered" impact of social change on children is observed is in increases in health morbidities, such as rising obesity, substance use, and mental health challenges (e.g., Gluckman, Beedle, & Hanson, 2009, as cited in Halfon et al., 2010, p. 13).

The current work aimed to gather data on many of the variables that are known to contribute to developmental outcomes, including parent factors (age, education, employment status), family factors (marital status, family composition, caregiving arrangements), and community factors (urban status, housing type). In addition, data were gathered for variables of parent beliefs regarding the presence, use, and purposes of MSDs. As parent beliefs are strongly related to a variety of factors that constitute the child's early caregiving environments (e.g., Benasich & Brooks-Gunn, 1996; Bugental & Goodnow, 1998; Grusec, 2006; Sigel & McGillicuddy-deLisi, 2002), this additional data, as related to factors of social demographics, will help us to better understand the "ecology of technology" in which today's infants develop. Data were also gathered using direct observation and semi-structured interviews with parents, that focused on more specific factors of the child's home experiences (such as parental responsiveness and availability of play materials), as well as the knowledge and beliefs parents hold as they structure family life, adapt to, and raise children within a climate of technology-driven social changes.

With screen media technology as the backdrop, the rest of this chapter reviews the body of research related to factors of influence most proximal to the child within the family microsystem, including factors related to the family as a whole, the home, family members, caregiving interactions and child-specific factors. To this end, the four main sections of the literature review are the infant home environment, the context of parenting, parent factors, and the psychological environment comprised of parent knowledge and beliefs as aspects of the environment progressively more proximal to the infant in the environment.

Digital Technology in Infant Environments

To date, research on the influence of technology in a young child's world has been limited to the impact of viewing television screens (microsystem level effect) or to the quality of the content that is being shown on the screen (exosystem or macrosystem level effect; e.g. MediaSmarts, 2012). However, as the tandem elements of mobility and interaction via touch-screen (and emerging voice-activated) innovations become standard tools of use within the microsystem, they increase access to more distal levels of media influence via infant-directed content and applications, with potentially profound effects for developmental foundations. In effect, all levels of the ecological system have become saturated with media technology devices (Nielsen, 2012a, 2012b, 2011a, 2011b). For example, Freedman (2009) outlines the proliferation of screens in public spaces, such as restaurants or airports, where there is no choice in media consumption, a concept termed "captivity" or "compulsory media." In addition, as we use our personal media devices in public spaces, others are subjected to our chosen media choices. According to the bioecological model, as families make decisions about the adoption and use of these devices, new relationships among multiple microsystems form "developmental niches" which, as noted above, are where the environmental social determinants for early childhood and lifelong development take root (Bronfenbrenner, 2005, p. xiii). Indeed, as part of a comprehensive survey of media use by children 2-18 years at the end of the 21st century, Roberts and colleagues (1999) called for research using complex models to examine how children and parents, along with media and technology, form systems within their own cultural niches, and how these are situated within the larger culture.

Infants as consumers of screen media technology. The research looking at media and infants dates back a mere two decades and primarily focuses on TV screen viewing (Rideout &

Hamel, 2006). As such, the body of literature relevant to infants' screen viewing is more recent and smaller than the extant body of literature on television viewing for older children. Recent work has, however, looked at usage patterns and developmental outcomes for a range of infant-directed media (videos, *Baby-TV*; e.g., Vandewater et al., 2007), including programmes and products that have been heavily marketed to, and adopted by, parents and caregivers under the guise of giving infants and toddlers a learning advantage (Anderson & Pempek, 2005; Fenstermacher et al., 2010). Contrary to marketing claims, much of this research has found associations between infant screen viewing and a range of negative developmental outcomes (AAP, 2007), primarily showing negative influences on play (e.g. Evans, 2003; Kirkorian, 2004; Schmidt et al., 2008), but also on creative opportunities (e.g. Resnick, 2006), parent-child interaction (e.g. Kubey 2009), and language development (Christakis et al., 2009; Tinamura, Okuma, & Kyoshima , 2007). Indeed, class-action lawsuits in the U.S. forced one manufacturer to withdraw education claims and led to a buy-back offer of the infant-directed videos (e.g. Golin, 2009) and another manufacturer to cease operations entirely (Hirsch & Law, 2012). Research on young children's use of interactive touch screen technology is nascent, with early suggestions for the increased presence of multiple devices in young children's environments as a likely explanation for the increased time children engaged with mobile devices over a two-year period (Rideout, 2013), and for different engagement practices with interactive screens as compared to non-interactive, viewed content (e.g. Barr et al., 2013; Kirkorian, Choi, & Pempek, 2013).

Infant screen viewing skills. Infants and toddlers have limited screen viewing skills (Anderson & Hanson, 2010; Courage & Setliff, 2010). One of the main findings to come out of the work described above is that children under approximately 30 months of age consistently

demonstrated a "video deficit," which means they had more difficulty comprehending and making use of two-dimensional representations without extensive "training" (e.g., Troseth, 2003). A developmental understanding of infants' cognitive growth from the three-dimensional world to the more symbolic two-dimensional worlds (e.g., screens; books) is one source of explanation for the lack of benefit derived from infant screen viewing. That is, although very young children can imitate actions from 2D screen images, their cognitive limitations preclude them from transferring their understanding between dimensions—2D to 3D and vice versa (Barr, 2010; Zack et al., 2009; Zack, Gerhardstein, Meltzoff, & Barr, 2012). Moreover, despite the video deficit, screen images inherently capture the child's attention. This attention is neurologically obligatory during the first several months of life (Landau et al., 2007; Posner, 1992; Richards & Gibson, 1997), and has been shown to interfere with infants' and toddlers' attention to play activities. Importantly, this effect persists even when the screen is simply a visual or auditory presence in the peripheral environment (e.g., TV on in the background; Evans, 2003, Kirkorian, 2004; Pempek, Kirkorian, & Anderson, 2014; Schmidt et al., 2008). Indeed, research has found that even adults are distracted by visual media – often without awareness (Kubey & Czikszentmihalyi, 2002).

The above research has led the AAP (2001, 2007, 2011), as well as numerous other jurisdictions and developmental professionals, to conclude that the presence and viewing of screens in the environments of infants and toddlers does not appear to play a supportive role to developmental wellbeing, and increasingly has been found to proffer risk factors to development for some children (e.g., Christakis, 2008; Sigman, 2012a). Based on this, and as noted earlier, the AAP recommendation, for more than a decade, has been to advise *no* screen viewing for children under two years, and only minimal, judicious use of high-quality programming, and co-viewed

with adults, for children aged three to five years (AAP 2001, 2007, 2011). Unfortunately, recent research looking at infants' and toddlers' screen time indicate that children less than three years of age are spending *more time*, not less, engaged with screen devices (e.g. Linn, Almon, & Levin, 2012; Rideout, 2013).

Infant use of MSDs. Despite the evidence that screens are not beneficial for infant development, infant versions of MSDs, and infant-directed apps for adult mobile screen devices, are increasingly being produced, often with unsubstantiated claims of benefits (similar to those made by infant video producers). For example, *V-Tech's InnoTab 2* for children one to nine years old was released in 2013. *V-Tech* claims that the device is associated with early learning and developmental gains, as well as an assist in caregiving tasks, such as helping the child sleep. In addition, a vast array of accessories are available to make adult MSDs easier to use by very young children, such as the controversial Fisher-Price Newborn to Toddler Apptivity™ seat for iPad® device, and/or to protect the devices from damage that may result from young children's use (e.g. Bradford, 2012; iMums, 2011).

Questions and concerns about the effects of MSDs on children's development are global, as reflected in media and news articles, postings, and headlines from the U.S. (e.g., Allday, 2011; Goday; 2011), Great Britain (e.g., De Lacey, 2012), Australia (e.g., Baker, 2011), India (e.g., Salomi, 2012), Indonesia (e.g., Jakubek, 2011), Korea (e.g., Sun-young, 2012), Canada (e.g., Coubrough, 2013), as well as multi-country comparison studies (e.g., GSM/NTT Docomo, 2010). That said, infants cannot gain access to screen devices, including mobile devices, unless they are made available within their environments. Therefore, it appears that a variety of adult-level factors (parents, caregivers, educators, community settings) are creating the conditions for

which very young children are increasingly exposed to and/or engaging with technology (including MSDs).

One family factor that has been extensively studied is the impact of socioeconomic status on the materials in an infant's environment (e.g., Evans, 2004). For example, a study comparing low and middle income neighbourhoods found that children in low-income areas had less access to all manner of print materials (books, signage, labels, logos, and school-based as well as public reading spaces; Neuman & Celano, 2001). Other work has shown that the physical environments of young children are negatively impacted in low-income households due to a lack of materials such as learning resources at home (toys, books, etc.; Duncan, Brooks-Gunn, & Klebanov, 1994; Smith, Brooks-Gunn, & Klebanov, 1997). Similarly, children in low-income houses have less access to computers, but watch more television (e.g., Gentile & Walsh, 2002). Finally, with the growth in entertainment media, a recent study found that 6- to 11-year-old children had greater opportunities to engage in sedentary behaviour in low-income households, where television, DVD players, and video game consoles were more prevalent in children's bedrooms, and materials for active play (e.g., bicycles, jump ropes) were less available (Tandon et al., 2012). The current study includes measures of family income, parent education levels, parent employment, and family composition as predictors of infants' access to, and direct use of, MSDs in order to extend our understanding of how infant environments and experiences may differentially impact early development.

MSDs in the Context of Parenting Infants

Parent-child relationships. The first and most proximal environment for an infant is relational, with the mother the most common primary attachment figure (e.g., Bretherton & Munholland, 1999; Kail & Cavanaugh, 2010) and, according to the NICHD's 16-country

longitudinal research data, the adult who most commonly spends the most time in one-to-one interaction with infants. Indeed, there is evidence that this primary relational context has prenatal origins and that the developing fetus is highly sensitive to the mother's lifestyle, behaviour, and psychological functioning (e.g., DiPietro, 2010). As across cultures (and species, e.g., Curley, Mashoodh, & Champagne, 2011), the mother tends to spend far more time in direct interaction with infants (e.g. Geary, 2005), much of the literature is mother-centric (c.f. Stern, 2002, for microanalytic research of mother-infant interactions).

However, a growing body of research has confirmed this link for other types of caregiving relationships and developmental wellbeing (e.g., Allen & Daly, 2007; Johnson, 1996). For example, recent examinations of the psychological functioning of fathers illuminate an "indirect" pathway to child outcomes (e.g., Goeke-Morey & Cummings, 2007). In an extensive literature review conducted by Johnson (1996) for the National Center on Fathers and Families (University of Pennsylvania), it appears that men's *psychological* care and *emotional* generosity (expressiveness and intimacy) with their children have the greatest long-term implications for children's development. As fathers tend to use digital devices more extensively than mothers, (Dworkin, Walker, Connell, & Doty, 2012), how fathers both provide screen devices for their young children, and how they, themselves, use these devices in their caregiving roles are likely important factors in the child's developmental context. Further, in two-parent families, the infant's caregiving context is triadic in nature, with the relationship between parents influencing each parent's relationship with the infant (e.g. Bouchard & Lee, 2000; Clarke-Stewart, 1978; Goeke-Morey & Cummings, 2007; Lamb, 2004; Pruett, 1988). Therefore, for the current study, data was collected on the composition of the family as a demographic variable for the infant's caregiving context.

Parenting quality. Research has shown that developmental wellbeing is critically influenced by the *quality* of the child's earliest relationships (e.g., Shonkoff et al., 2004) and that children have the best outcomes when they have responsive, caring adults who provide for the opportunities for them to grow, learn, and socialize in a developmentally appropriate manner (Brooks-Gunn & Markham, 2005; Pivik, et al., 2011). A cluster of maternal attributes—attentiveness, warmth, stimulation, responsiveness, and non-intrusion or restriction—has been identified in the extant literature as particularly supportive to early developmental wellbeing (e.g., for intellectual development, Beckwith et al, 1976; Clarke-Stewart, 1978; Lewis & Coates, 1980; for social-emotional development, Clarke-Stewart, 1973; for school readiness and school achievement, Estrada, Arsenio, Hess & Holloway, 1987; for adult academic outcomes, Raby et al., 2015).

The quality of parenting behaviour is also associated with demographic factors, most notably factors of low SES (Slack et al., 2004; Trentacosta et al., 2008). For example, low-income parents tend to be less responsive, harsher and more punitive, beginning as early as infancy (e.g., Magnusson & Duncan, 2002; McLoyd, 1998). Low-income families are disproportionately headed by a single parent (usually mother), a factor of family composition that is also linked to parenting practices being less conducive to desired developmental outcomes (e.g., Amato, 2005; Thomson, McLanahan, & Curtin, 1992). In addition, both low-income and single-parent families are greater consumers of entertainment media via television, DVDs, and gaming systems (Certain & Kahn, 2002; Pagani, Fitzpatrick, Barnett, & Dubow, 2010; Rideout & Hamel, 2006). Only starting to emerge are data on the relationship between family socioeconomic demographics and the use of MSDs. Although the findings across studies are highly variable, researchers tend to find greater use of MSDs associated with middle-to-higher

incomes (e.g., Dworkin et al., 2012; Magid Media Futures, 2012), but also find a global rise in access to MSDs across all income levels (e.g., Crawford, 2013). Therefore, the current study collected data on family income, parent education, parent employment status, and family composition to examine the relationship between factors of socio-demographic status and the use of MSDs.

Family psychological environment. While the mother-child dyad is the most common primary relational context for infants (e.g., Bretherton & Munholland, 1999; Stern, 2002), this dyad is situated within a network of family systems that is transactional in the nature of its influence (Belsky, 1981). A growing body of research demonstrates qualitative differences in the family psychological environment related to the involvement or the absence of the father (e.g., Bouchard & Lee, 2000; Lamb, 2004; Pleck, 2007; Townsend, 2002). The resulting variety of relationships in the family—father-child, mother-child, mother-father, and mother-child-father—create a "psychological ecology" for the child, where factors of adult personalities influence the child's developmental wellbeing (Johnson, 1996, p. x). For example, when observed in naturally occurring dyadic and triadic situations, maternal behaviour is affected by parallel spousal behaviour (Pedersen, Yarrow, Anderson, & Cain, 1978). More specifically, a meta-analytic review of 68 studies examining the link between the quality of the marital relationship and the quality of the parent-child relationship, found them to be more correlated than previously thought (Errel & Burman, 1995). The nature of interactions between parents, directly with the infant or on the child's behalf, creates changes in individual parent internal states that contribute to the aforementioned psychological ecology (Krampe & Fairweather, 1993).

Chaotic Family Environments. One aspect of family life that appears to be associated with maladaptive outcomes is a chaotic family life (e.g., Coldwell, Pike & Dunn, 2006). Factors

at each level of the ecological system are implicated in creating the conditions for a chaotic family life (Evans & Wachs, 2009), and it is "characterized by frenetic activity, lack of structure, unpredictability in everyday activities, and high levels of ambient stimulation" (Bronfenbrenner & Evans, 2000, p. 121). Parental distraction or self-absorption, inconsistent or non-existent routines, high levels of stress, and maladaptive communication patterns, all associated with emotional unavailability, are also factors characteristic of chaotic homes (e.g., Pianta, Egeland & Erickson, 1989). Parental emotional unavailability (see Biringen, 2000, for a four-construct composite measure including *parent-centeredness/insensitivity, disengagement*, *warmth* and *hostility)* is also associated with a chaotic family life and has been linked to physiological stress and stress reactivity in children, especially for infants (e.g., Sturge-Apple, Davies, Cicchetti & Manning, 2012), which, in turn, is strongly linked to a variety of maladaptive development outcomes (e.g., Juster, McEwen & Lupien, 2010).

Technology and chaos. While chaotic home environments have been associated with poorer developmental outcomes (e.g., Evans, Gonnella, Marcynyszyn, Gentile, & Selpekar, 2005), what is known about the role of technology in contributing to chaotic environments is limited, particularly in regard to MSDs. In general, an inverse relationship has been shown to exist between the number of digital devices in the environment and the amount of face-to-face social interaction between people (e.g., Sigman, 2009). This means that as technology increases in the child's environment, infants and toddlers spend more time viewing screens and less time interacting with their primary caregivers in quality ways, which is known to benefit developmental wellbeing (e.g., the power of face-to-face interactions for emotional connection; Kirkorian et al., 2009; Masur & Flynn, 2008; Weitzman & Greenberg, 2002). To this end, it is known that pervasive ambient stimulation (e.g., background television) has a negative impact on

the development of language, play skills, and attentional processes (e.g., Pempek et al., 2014; Schmidt et al, 2008). Also, there is evidence from television research that viewing increases when there is more stress in families (Anderson, Collins, Schmitt, & Jocobvitz, 1996; Henggeler et al, 1991; Tangney & Feshbach, 1988), suggesting that chaotic families may exacerbate this effect.

My previous experimental work that explored the quality of parent-toddler interaction in the presence of non-screen digital electronic toys (e.g., electronic books; electronic shape sorters) as compared with non-electronic toys found depressed quality of mother-child interaction in the digital toy condition (Wooldridge & Shapka, 2012). It is likely that if this study were replicated with today's more sophisticated and pervasive electronic toys (e.g., the addition of screens, such as MSDs), the strength of this finding would be heightened. Indeed, a report of parent use of technology found that parents were using an average of just over 10 devices in their daily lives (Dworkin et al., 2012) and that two-thirds of American 2- to 5-year-old children used tablet devices (Communicus, 2014). Thus, as the extent of home and personal technology expands to include the use of multiple MSDs, it is highly plausible that their ubiquitous presence may pose unique or additional risks to the infant's early development. A 2004 report by The Alliance for Childhood stated that once technological devices enter the environment, "their mere presence often alters…the way parents engage their children—or stop engaging them" (p. 108). The current study obtained self-report data on the ways in which parents use MSDs with and around their very young children.

MSDs in the Parent Caregiving Role

In addition to the number of screen devices, the extent of their use, or the quality of programming/apps, it is *how* and *why* screens are used by parents and caregivers *in their*

caregiving roles that are of interest in the current study. Parents today perform their caregiving duties as part of the highly connected, technologically-dependent world across the globe. For example, a 2011 California survey of four "generations" (teens/iGen, young adults/NetGen, middle adults/Gen-X, older adults/Baby Boomers) found that 42% of the oldest group and 64% of the youngest adult group checked their text messages every 15 minutes or less (Rosen, 2012). Parents report both benefits (social support) and challenges (stress) associated with increased use of new media devices.

Technology-related benefits. Parents in general, and new parents in particular, are more active users of social media than are non-parents (Bartholomew et al., 2012; Duggan, Lenhart, Lampe, & Ellison, 2015; FacebookIQ, 2016). Mothers tend to be more actively engaged with social media platforms such as *Facebook* and *Pinterest* while mothers and fathers are equally active platforms such as *LinkedIn and Twitter*) (Duggan et al., 2015). In general, while skeptical of much of the parenting information available online, parents find their social networks highly supportive (e.g., Dworkin, Connell, & Doty, 2013). Other areas in which mobile technologies show promise as an aide to parenting is via online forums, such as support groups, and parenting education and support services delivered online (print and/or video). While research as to the efficacy of online parenting support is just starting to emerge, there is some evidence for the supportive forums for parents of children with specific needs or developmental disabilities(e.g., Clifford & Minnes, 2013), as well as for online versions of parenting education classes (e.g., Sanders, Baker & Turner, 2012).

Technology-related challenges. There is also increasing evidence that adults are experiencing new challenges associated with the rapid and continual need to adjust to the adaptive demands associated with technological innovations. For example, research has found

elevated levels of perceived stress for adults who are required to adapt to and manage new technologies in the workplace (e.g., Boyles & Rainie, 2012; Dworkin et al., 2012; Hair, Renaud & Ramsay, 2007), blurred distinctions between adult roles in work and personal life (e.g., Noonan & Glass, 2012; Pedersen & Lewis, 2012), anxiety associated with disconnection (Rosen, 2012 – finds up to 34% GenX & 51% NetGen & iGen have moderate to high anxiety when not able to check tech as often as desired), and concerns about online safety and privacy (e.g., Culnan & Armstrong, 1999; more so with smartphones—TRUSTe, 2013). Moreover, Internet addiction is a growing concern, as evidenced by the development, validation, and application of various versions of the Internet Addiction Test (IAT; Altstötter-Gleich & Brand, 2013; Pawlikowski, Widyanto, & McMurran, 2004; Young, 1996) with adults and teens in numerous nations (e.g. China—Lai et al., 2013; Cyprus—Adalier & Balkan, 2012; France—Khazaal et al., 2008; Greece—Frangos, Frangos & Kiohos, 2013; Hong Kong—Shek & Yu, 2012; Iran—Hasanzadeh, Beydokhti & Zadeh, 2013; Korea—Lee, et al., 2013; Malaysia—Chong et al., 2013), and with its own form of treatment (Young, 2011). Recently in the U.K., a four-year old was reported to be the youngest person undergoing treatment for addiction to an *iPad* (Ward, 2013).

Technology-related stress. To date, research on the social psychological effects of ICTs—dubbed "technostress" (e.g., Weil & Rosen, 1998)—has been largely conducted with adolescents and adults in their workplaces rather than in caregiving contexts (Ayyagari, Grover, & Purvis, 2011; Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008; Thomée et al., 2011). Psychological stress associated with computer use (e.g., increased physiological arousal, somatic complaints, mood disturbances—especially anxiety, fear, and anger—and reduced job satisfaction, Smith, Conway & Karsh, 1999), and physiological stress as measured by increased

cortisol levels in the face of computer system problems (e.g. Riedl, Kindermann, Auinger, & Javor, 2012;), are now also emerging for problems associated with mobile devices (e.g., slow speeds, dropped calls, and unwanted calls and texts—Boyles & Rainie, 2012). Although there is no research on technology-related stress for infants, there is one study that was specific to parents' use of technology. The findings indicated that one-third of parents reported that new technologies made them feel overwhelmed, and one-third reported that it made their lives as parents more complicated (Dworkin et al., 2012). Such findings suggest that increasing use of multiple digital devices may contribute to an environment of constant minor parental hassles, with negative implications for the family relational climate (Crnic & Greenberg, 1990).

Technology-related distraction. Adult distractibility due to technology is well documented in the workplace (e.g., Joyaux, 2012; Mir, 2011), while driving (e.g. Strayer & Johnston, 2001), and as a pedestrian (Leung, 2012; Stavrinos, Byington, & Schwebel, 2011). Adult distractibility due to technology is also starting to be documented as a factor in home life, including while parenting and caregiving (Christopher, 2012; Deerwester, 2012; Hetter, 2011; Turkle, 2011), and as facilitating parenting information overload (Dworkin et al., 2012; Power, 2012; Tiemann, 2008). Distracted parenting due to engagement with MSDs may well pose a new hazard to the health and safety of very young children who depend on mindful supervision by adults. For example, there are recent concerns from the medical professions regarding a sudden increase in injuries to very young children under the supervision of adults reported to be distracted by their mobile devices (e.g., Rock, 2012; Worthen, 2012). One measure used to assess caregiver supervision considers children birth to five years to be left 'unattended' when the adult and child are more than 10 feet apart and/or the child is out of the adult's sight line for 10 seconds or more (Morrongiello, 2005). Yet, with the growing use of MSDs, it is highly

observable, and self-reported, that these devices can provide instant child-minding as the parent can simply hand the child their device whenever they need to distract or keep the child momentarily occupied. Indeed, a recent survey conducted by a grocery chain in the U.K. found the mobile phone to be replacing the traditional pacifier in mothers' efforts to quiet their babies (Asda, 2012). Further, more than a decade ago, concern was noted for the likelihood of newer media in homes to provide greater child freedom from adult supervision of, or comment about, the messages children receive from media (Roberts, Foehr, Rideout, & Brodie, 1999).

Regarding child-directed media, research across child age groups demonstrates the benefits of media co-viewing and joint media engagement (c.f. Takeuchi & Stevens, 2011), yet the primary reason parents give for using screens with infants is for purposes of child-minding (Christakis, 2008; Rideout & Hamel, 2006). The success of the novelty factor for keeping infants occupied by mobile screen devices has spawned the creation of child-versions of cell phones, computers, tablets, and the like. Similar to letting infants view non-mobile television screens so that parents can view their own programmes (Rideout and Hamel, 2006), infant-specific iterations of these mobile devices allow the parent freedom to pursue their own activities on mobile devices. If child distraction or child-minding is increasingly accepted as a real utility of MSDs, then infants could be at increased developmental risk as a result of spending less time in interaction with the adults on whom they depend to buffer media content and who provide the opportunities for developmentally necessary experiences.

Adults as social models. As toddlers adeptly imitate the behaviour of those around them (e.g., Meltzoff, 1999), especially their family members, there are additional concerns about the effects on infants and toddlers from watching how adult models interact with mobile devices and home technologies. While very young children are more likely to be the victims of adult

distraction via a digital device, they are also vividly learning from adults about how to engage with these devices in both useful and deleterious ways. A combination of the child's age, gender, the amount and frequency of exposure to television viewing, ease of access to television, and the effects of social learning from adult models multiply the likelihood of children becoming heavy screen viewers (Sigman, 2012b). Regarding overall media use, parent media habits may serve as a powerful influence on young children's engagement with media (Bleakley, Jordan, & Hennessy, 2013).

As the literature around adult technology management increasingly reports higher stress levels, higher anxiety, poorer coping skills, and more cognitive problems associated with increased use of both traditional and mobile computer devices (Fiehn, 2010; Kubey & Czikszentmihalyi, 2002; Lorinc, 2007; Thomée et al., 2011), very young children are actively observing the behaviour of adults, often in situations marked by chaos, uncertainty, emotional volatility, and frenetic energy—all less conducive to developmental wellbeing. They are also observing adults turning to television viewing as an activity to manage stress (e.g., Anderson et al., 1996; Derrick, 2013), and older children turning to the Internet for social support in times of stressful life events (e.g., Leung, 2007).

Home observations and interviews with parents can assess the behaviour of adults as models to their children for using these devices. Using an observational measure, along with parent interview to more closely examine the relationships between parents' use of MSDs, their belief systems regarding infant development, and their sense of efficacy as parents, the current work provides an enhanced portrait of the current ecology in which developmental trajectories take root.

Parent Knowledge and Beliefs

Parent beliefs are cognitions that make up a dynamic model of belief systems (Sigel & McGillicuddy-DeLisi, 2002), and have a powerful influence on infant developmental processes (e.g., Grusec, 2006). Parent beliefs refer to "thoughts, constructs, theories, ideas, and attributions" (Sigel, McGillicuddy-DeLisi, & Goodnow, 1992, p. xiii). As there is no general agreement on the concept of 'belief,' the extant literature is replete with a variety of terms: parent cognition (Sigel et al., 1992); attitudes, beliefs, thoughts and feelings (Grusec & Danyliuk, 2014); attributions (Dix, Ruble, & Zambarano, 1989), attitudes (Daggett, O'Brien, Zarolli, & Peyton, 2000), dynamic belief system (Bornstein, 2002). In this study, the term 'parent knowledge and beliefs' was chosen to include any parent thoughts, perceptions, attitudes, beliefs, attributions, or opinions that may be expressed in identifiable actions such as "utterance, gesture, tone of voice, 'the look,' as well as physical behaviors" (Bornstein, 2002, p. 500).

Regardless of terminology, parent cognition factors interrelate with child factors, situational factors, and quality of parenting to have an impact on child developmental wellbeing (e.g., Coleman & Karraker, 2000). A range of parental beliefs, in particular those related to knowledge about child behaviour, development, and learning, and parenting and guidance practices, are shown to direct parent behaviour and hence the parent-child relationship in significant ways (e.g., Dichtelmiller et al., 1992; Grusec, 2002; Miguel, Valentim, & Carugati Miguel, 2009; Murphey, 1992). Parent beliefs often drive both parenting behaviour—action and reaction—to child behaviour (c.f. Sigel et al., 1992). Therefore, the current study gathered data on several inter-related parent belief factors: beliefs about MSDs for children, knowledge of development, parental self-efficacy, concerns about parenting, and perceived sources of support.

Parent beliefs about MSDs for children. As specific parent beliefs have been found to moderate, mediate, or have no relation to specific parenting practices (Coleman & Karraker, 2000; Hoff et al., 2002; Murphey, 1992), parent beliefs regarding MSDs need to be examined as they relate to infant caregiving practices. Parent beliefs tend to reflect the relevant *zeitgeist,* often moderating parental behaviour (c.f. Murphey, 1992, for review of parent beliefs in relationship to child outcomes). Technology does not materialize on its own in the infant's environment. As noted above, these materials are made available by the people responsible for young children and who believe in their utility. Adult adoption and use of MSDs, as well as their provision to infants, both in adult and child iterations, are influenced by a multitude of factors at all levels of the ecological system. Not unlike previous points of significant technological change in human history, children are socialized into the practical uses and broader sociocultural values these innovations reflect (c.f. Postman, 1994 for an in-depth review of historical and recent views of childhood and approaches to child-rearing practices associated with technological change).

As parent beliefs regarding television media serves as one of the best predictors of child television viewing (Certain & Kahn, 2002; Dalzell, Msall, & High, 2000; Jago, Fox, Page, Brockman, & Thompson, 2010; Rideout & Hamel, 2006), it is likely that parent beliefs would also predict infant consumption of media via new delivery devices. Emerging evidence suggests a highly influential role for parental attitudes regarding screen media on child consumption across multiple media platforms (Cingel & Krcmar, 2013; Lauricella, Wartella, & Rideout, 2015).

Knowledge of development. Knowledge of infant development may be particularly salient to the everyday use of a range of technological devices, including MSDs. For example, if

parents (and other adults) believe the claims of educational benefits made by manufacturers and promoters of mobile devices, programmes, or applications, as many do regarding the educational value of television, videos, or computers (Garrison & Christakis, 2005; Rideout, Vandewater, & Wartella, 2003; Zimmerman, Christakis, & Meltzoff, 2007), then young children are much more likely to be heavy consumers of these materials (as was found for television viewing; Vandewater, Bickham, Lee et al., 2005). As reported in large-scale studies of media use in families with young children (e.g., Gutnick et al., 2011; Rideout, 2011; Rideout et al., 2003), along with beliefs in the educational value of media, is the belief in the ability of these devices to keep a child independently occupied, thereby creating fewer demands on the caregiver's attention and/or social behaviour.

Parental self-efficacy. A large body of literature on self-efficacy supports the notion that the power of one's sense of competence drives behaviour and is a good predictor of success and performance across roles and contexts (e.g., Bandura, 1995; Haidt & Rodin, 1999). For parents, self-efficacy (sense of competence) has been shown to strongly relate to caregiving behaviour with implications for a variety of child development outcomes (e.g., Coleman et al., 2010; Petrie & Holloway, 2006). Measures of parent self-efficacy are commonly used to assess changes in parenting behaviour as a result of parent education programs. For example, one study found that for parents involved in a parenting program, their sense of competency was shown to be the mechanism of change to using more adept discipline practices (Dekovic et al., 2010). Another study found that parents with a higher sense of efficacy reported less parenting stress, even when their child's challenging behaviour was not measurably reduced (Bloomfield & Kendall, 2012). Finally, a recent report looked at parent-reported efficacy for using the Internet to obtain parenting information, with parent age, gender, and geographical address related to

their overall sense of self-efficacy (Dworkin et al., 2012). Although it is not yet known whether there is a relationship between new technologies and parent self-efficacy, it is possible that MSDs, insofar as parents find them helpful in accessing information on child development and parenting practices, or stressful to family life, may relate to factors of parental self-efficacy, with implications for differential parenting behaviour.

Related to parental self-efficacy are the contributions of parenting supports (Chislett & Kenett, 2007; Hoven, 2012; Suzuki, Holloway, Yamamoto, & Mindrich, 2009). Therefore, the current study collected data on a variety of sources of information and/or support that parents identified as important to their sense of themselves in their child-raising roles, and the degree to which they relied upon such sources.

The Current Study

There is little research on typical changes to the functioning of the family unit in the early years of the child's life outside of circumstances that create particular challenges, such as low income (e.g., Stolzer, 2010), ethnic minority status (e.g., Litt et al, 2010), extremely young or old parents (e.g., Cornelius et al., 2009; Shaw & Giles, 2009), or specific health factors of the child (e.g., prematurity— Eiser, Eiser, Mayhew, & Gibson Eiser, 2005; heart disease—Rempel, Ravindran, Rogers, & Magill-Evans, 2013) or parent (e.g., maternal postpartum depression—Milgrom et al., 2011). In the current study, how the addition of MSDs to the family home environment relates to contextual factors such as parent and family factors (demographic, beliefs) to influence infant-toddler access to, and use of, mobile devices within the family environment was explored. The current study was guided by three research questions:

1. How do the presence and use of MSDs relate to factors of the family environment (family size, maternal and paternal characteristics, parent-child interactions, and parent knowledge and beliefs)?
2. Do parent knowledge and beliefs predict the reasons that parents provide their MSDs to their children?
3. Do parent knowledge and beliefs predict how much time a child spends using MSDs?

The answers to the three research questions will begin to address the lack of research in the extant literature regarding the influences of rapidly progressing technologies within primary settings for infant-toddler development.

The purpose of Research Question 1 was to describe, from an ecological framework, the relationship of MSDs to the overall family environment (Family Characteristics, Parent-Child Interactions Around MSDs, and Parent Knowledge and Beliefs). For the current study, family characteristics included factors endemic to the child's most proximal environment, such as child, parent, and family demographics. Parent-child interactions around MSDs included individual and interactional use of MSDs and parenting behaviours such as responsivity, routines, and discipline. Parent knowledge and beliefs included experience with infants and knowledge about child development, parenting self-efficacy, and beliefs about MSDs for children.

For Research Question 2, it was predicted that how parents make MSDs accessible to their child would be influenced by their beliefs regarding MSDs, in addition to other child, parent, or family factors (demographic, parent knowledge, parent self-efficacy). This is consistent with previously reviewed literature where parent knowledge and beliefs has been shown to predict child access to, and use of, television and computer media technology (Parent Psychological Factors—e.g., Rideout & Hamel, 2006).

Finally, for Research Question 3, based on evidence for parents as models of technology use (as reviewed under MSDs in the Context of of Parenting Infants--Bleakley et al., 2013), it was expected that parent MSD use would influence how much time infants and toddlers use MSDs.

CHAPTER 3

METHODOLOGY

The design of this study was a "within-stage mixed model" (Johnson & Onwuegbuzie, 2004, p. 20), which involved two types of data collection. The first method of data collection was a self-report online questionnaire for parents that included both closed-ended (e.g., Likert scales) and open-ended questions (e.g., qualitative). The second method of data collection, which involved a subset of 28 interested parents who completed the questionnaire, was a home visit where the parents were interviewed and observed. Both qualitative and quantitative data was collected via the home visits. Because both qualitative and quantitiatve data were collected for both data collection periods, Figure 2 provides an overview of the relationship between types of data and methods of data collected. This chapter is divided into two sections to describe each of the data collections. Section one provides information about the participants, measures, procedures, and analyses related to the questionnaire data. Section two outlines procedures for sampling, measures, and data analyses for the home visits, which included interview and observational data.

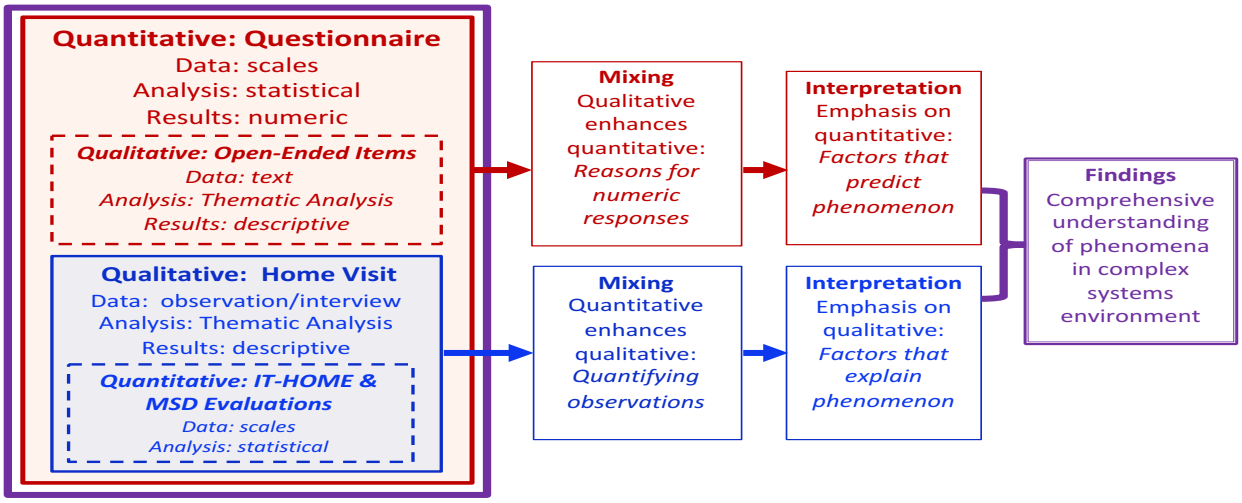

Figure 2. Model of within-stage mixed model research design with dual data collection format.

Methods - Questionnaire Data

Participants

Overview. Parents (or primary caregivers) from British Columbia (B.C.), with at least one child between birth and three years of age, were invited to complete the questionnaire between November 2013 and April 2015. In total, 306 questionnaires were received (303 online and 3 paper). After removal of questionnaires where the child's age was not given, the child was outside the 0-3 year age range, or was substantially not completed, a total of 292 questionnaires formed the final data set. Respondents from B.C. were roughly representative of the distribution of families with children birth to four years old (the most applicable age categorization as per the Ministry of Children and Family's service regions). Although the recruitment process initially targeted families in British Columbia, approximately 25% of responses were received from other Canadian provinces. This was likely attributable to the effects of social media, Internet advertising, and news coverage (radio interviews and quotes in print articles). Analyses of group differences are reported at the beginning of the results chapter. See Table 1 for geographical distribution of participants.

Recruitment. Participants were recruited through several sources, including: a) distributing postcards and putting up posters at B.C. community programs that offer services to families with infants and toddlers (e.g., Health Units, School Districts, Family Places, Early Intervention services, Public Libraries, Community and Recreation Centres, Childcare programs, Strongstart programs); b) social media advertisements (e.g., Facebook); c) participation on news-radio talk shows; d) advertising in an online parenting magazine for two months; and e) by word of mouth. Facebook notices, advertisements, and links to the study's Facebook page accounted for 41% of respondents.

Table 1

Sources of Questionnaire Participants by Geographical Regions in B.C. and Canada

General Region	Local Region	Sample N	Sample %	MCFD%
British Columbia		212	72.6	
	Coast Fraser	139	65.6	60.8
	Interior	35	16.5	16.2
	Vancouver Island	30	14.2	16.7
	Northern	8	3.7	6.3
Rest of Canada		75	25.7	
	Ontario	37		
	Alberta	25		
	Manitoba	2		
	Saskatchewan	2		
	Quebec	2		
	Nova Scotia	2		
Not Classified		5	1.7	

Note. MCFD% = percentage of residents aged 0-4 years by region

Sample Characteristics

The ages of the children for the parent respondents ranged from 1 to 47 months, with a mean age of 19 months. The sample was split by child gender (148 males, 51%). Child ethnicity was reported as 43% North/West European, 41% multiple ethnicity, 4% South, East, or Southeast Asian, 3% South/East European, and the balance dispersed among five other geo-ethnic groups (5 Aboriginal, 3 South American, 5 other and/or unknown, and 12 unclassifiable). Average family size was four persons (range 2-8), with an average of two children (range 1-4).

The vast majority of families included parents who were married or living common law (93%). The majority of parents in the study were between 30-39 years old, and most had bachelor or professional degrees. In general, both parents were employed (mothers 81%, fathers 96%), but fathers were more likely to work full time than mothers, where 28% were on maternity leave (as would be expected of 30% of respondents with a child less than one year of age). The majority of the sample (86%) reported residing in an urban or suburban location, with only 10%

living in a rural area. Infants and toddlers of the parents in this sample were overwhelmingly cared for primarily by their parents, with the majority sharing equally in infant caregiving responsibilities.

Given the self-selected online nature of the sample, it was important to compare the sample characteristics with BC and Canadian census data. This sample was found to be partially representative of the general population of Canadian families who have a child less than three years of age. More specifically, the sample characteristics were found to be comparable for parental age (Cohn, 2013), paternal education, family size, and rural residency (Statistics Canada, 2011). However, this sample had a higher number of dual-parent families, higher maternal education levels, higher parental employment rates, and was more ethnically and linguistically diverse than Canadian averages (Statistics Canada, 2011). As such, it appears that this sample of respondents was slightly more stable and highly functioning than average. This issue is discussed in the limitations section of the discussion.

Procedures

The questionnaire was piloted with three parent volunteers (one mother, one father, and a mother with English as a second language; each of whom had a child less than 3 years old) in order to ascertain the amount of time required, level of ease to complete it, and to gather feedback on any potentially confusing items. Minor edits to wording or presentation of the questionnaire items were made based on feedback from the pilots in preparation for conversion to online format.

The online questionnaire was constructed using the Mediadata™ Survey program and made available on a secure Canadian website that was created for the purposes of this study (www.infanttechstudy.ca). The questionnaire was also available in paper format, upon request. To answer the questionnaire online, participants were directed to a screen that explained the

study and the consent process (see Appendix 6). A hyperlink on the consent page gave participants direct access to the questionnaire. Most of the questionnaire items employed radio buttons (where respondents click to activate their response option), with a few text-boxes for respondents to write in responses to open-ended questions. Once the questionnaire was converted to online format, it was field tested by a parent volunteer familiar with constructing on-line questionnaires to ensure the questionnaire performed without technical problems (e.g., pages advanced correctly, radio buttons were operational, multiple answers were available where appropriate). Minor changes were made to allow for accurate reporting of answer options in the demographics section and subsequently field tested again by the volunteer.

Measures

There were five components to the questionnaire: demographic information, MSD usage and beliefs, parent knowledge of infant development, previous experience with infants, and parent self-efficacy. A copy of the questionnaire can be found in Appendix 10 (unless otherwise indicated, the questionnaire items were developed by the author). As multiple measures were used as variables in the current study, Table 2 organizes the variables by type and their use in associated statistical tests as related to each Research Question, followed by descriptions of each variable's formation.

Table 2

Types of Variables and Statistics Organized by Research Question

Research Question	Variable Type	Statistic Type
RQ1 How do the presence and use of MSDs relate to factors of the family environment (family size, maternal and paternal characteristics, parent-	Descriptive Demographics • Child age • Family size • Family income • Maternal and paternal education • Maternal age and paternal age MSD Factors	Frequencies Distributions Correlations

Research Question	Variable Type	Statistic Type
child interactions, and parent knowledge and beliefs)?	• Parent MSDs • Family MSDs • Parent MSD time • Parent MSD experience • Child MSD time Parent Knowledge and Beliefs • Infant care experience • Child development education • KIDI • PSOC • Positive MSD Beliefs • Negative MSD Beliefs • Appropriate age for child MSD • Sources of parent support	
RQ 2 Do parent knowledge and beliefs predict the reasons that parents provide MSDs to their children?	Covariates • Child age • Child gender • Maternal education • Maternal age • Parent MSDs • KIDI • PSOC • Positive MSD beliefs • Negative MSD beliefs Outcome • Giving child MSD to occupy • Giving child MSD to videochat • Giving child MSD to teach • Giving child MSD to calm	Hierarchical Logistic Regressions
RQ 3 Do parent knowledge and beliefs predict how much time a child spends using MSDs?	Covariates • Child age • Child gender • Maternal education • Maternal age • Family MSDs • Parent MSD time • KIDI • PSOC • Positive MSD beliefs • Negative MSD beliefs Outcome • Child use of MSD • Child MSD time	Hierarchical Logistic and Linear regressions

Demographic measures. Demographic variables for Research Question 1 were generated as follows: Family Size was represented by a count of the number of related and unrelated adults and children with whom the child lives (M = 4.00, SD = 1.16); Family Income was scored from 1 to 5 based on census-derived quintile groups (<$40,000, $40-65,000, $65-90,000, $90-125,000, >$125,000; for those who preferred not to answer, their data was deemed missing). The mean income for this sample was $65-90,000 ($M$ = 3.59, SD = 1.48). Parent education was scored separately for each parent (Paternal Education and Maternal Education). Paternal Education was scored 1 to 5 based on five categories: less than highschool graduation, highschool graduation, post-secondary (e.g., diploma, trade certification), bachelor or professional degree, graduate degree (M = 3.41, SD = 1.12). Maternal Education was collapsed from five categories to four (highschool or less, post-secondary, bachelor degree, graduate degree; scored from 1-4), based on the pattern of responses (M = 2.70, SD = .90). Parent age (Maternal Age, Paternal Age) was scored from 1-3 based on the following age groups: *<30 years, 30-39 years, 40+years* ($M_{Paternal\ Ed}$ = 2.02, SD = .66; $M_{Maternal\ Age}$ = 1.83, SD = .59).

For Research Questions 2 and 3, in addition to Maternal Eduction and Maternal Age, Child Gender and Child Age were used as covariates. For these analyses, Child Age was categorized into two categories (1-23 months, 24-47 months). This was done to maintain sample power, as well as to reflect the age for easing recommendations made by the American Academy of Pediatrics' regarding child screen viewing (AAP, 2001, 2007, 2011).

Reasons for giving child MSDs. The outcomes for Research Question 2 were variables that represented the reasons parents reported for giving their child an MSD. More specifically, parents reported how often (*never, sometimes, often*) they gave their child access to their MSD for eight specified purposes or goals (*occupy, calm, sleep aid, teach,videochat, fine motor skills,*

therapy, or other). Due to the bimodal distribution of the data, for each of the eight purposes, a dummy variable was created to indicate whether a child was ever given their MSD for that purpose or not. As shown in Table 3, only four of the variables were examined due to a lack of variance (Occupy, Videochat, Teach, Calm). These variables were also used in the correlational analyses for Research Question 1 to explore parent-child interactions with MSDs in the home environment.

Table 3

Frequencies for Four Most Commonly Reported Reasons for Providing MSD to Child

Reason to Give Child MSD	N	% of Total N
Occupy	133	46%
Videochat	128	44%
Calm	89	30%
Teach	86	29%

Child MSD use. One outcome variable for Research Question 3 was a binary variable that represented whether or not the child used MSDs. The frequency for users was 175 (60%) and 117 (40%) for non-users. This variable was also included in Research Question 1 as part of the correlational analyses.

Child MSD time. Parents who indicated that their child used any MSDs completed questions about the estimated average amount of time on a typical day (zero, 1-5 minutes, 5-15 minutes, 15-30 minutes, 30-60 minutes, 1-2 hours, >2 hours) that their child engaged with multiple activities on each of five different types of MSDs (smartphone, tablet, electronic-book readers, hand-held gaming devices, and laptop computers). These were scored by averaging each time category (zero, 5 minutes, 10 minutes, 22.5 minutes, 45 minutes, 90 minutes, and 120 minutes), then summing the averages across all categories of devices to create a score for the variable Child MSD Time ($M = 59.52$, $SD = 106.72$). This was used as an MSD-related variable

in relation to the environmental scan for Research Question 1 and as the second outcome variable for Research Question 3. See Table 4 for descriptive statistics.

MSD-Related Measures (Covariates and Correlational Variables)

Parent and family MSDs. Parents reported on the quantity of each of five mobile devices that the reporting parent personally owned, including smartphones, tablets, electronic-book readers, hand-held gaming devices, and laptop computers. Parent MSDs represents the number of devices the parent reports owning (M = 2.99, SD = 1.34) and Family MSDs represents how many devices were present in the family home, including child-owned MSDs (M = 6.11, SD = 3.02). The Family MSD variable was used as part of the environmental scan in Research Question 1, as well as in looking at Child MSD use in Research Question 3. Parent MSDs was used as a covariate in Research Question 2 (it was chosen over Family MSDs because Research Question 2 looks specifically at parent behaviours using their own devices). See Table 3 for descriptive statistics.

Parent MSD time. Similar to Child MSD Time, the average amount of time per day reported engaged with each device (zero [0], <5 minutes [5], 5-15 minutes [10], 16-30 minutes [22.5], 30-60 minutes [45], >60 minutes [60]) in each of several functions or tasks (e.g., work, studies, social networking, shopping, organizing) were summed across devices, then converted to hours, to provide a measure of average daily time for parent use of MSDs (Parent MSD time; M=6.82, SD=3.81). This variable was used as a covariate in Research Question 3, as well as in the correlations assessing the environment for Research Question 1. See Table 4 for descriptive statistics.

MSD experience. Parents reported their experience with any type of MSD: <1 year, 1-3 years, 3-5 years, 5-10 years, >10 years). Responses were converted to a five-point scale (0-4) to

create the variable MSD Experience. This variable was used in Research Question 1 as part of the scan of the environment pertinent to MSDs. Descriptive statistics are presented in Table 4.

Table 4

Descriptive Statistics for MSD-Related Outcome Variables, Covariates, and Correlational Variables From Questionnaire Participants

Variable	N	M	SD	Md	Range
Family MSDs	292	6.11	3.02	6.00	1-24
Parent MSDs	292	3.18	1.38	3.00	0-10
Parent MSD Time (hrs.)	292	6.82	3.81	5.81	0.5-23.3
MSD Experience	283	2.71	1.00	3.00	0-4
Child MSD Time (mins.)	292	59.53	106.72	17.50	0-745

Parent Knowledge and Belief Measures (Predictor and Correlational Variables)

Two variables representing parent knowledge about infants (Child Development Education, Infant Care Experiences), four variables representing parent beliefs (Knowledge of Infant Development, KIDI; Parent Sense of Competence, PSOC; Positive MSD Beliefs, Negative MSD Beliefs), and a parenting context variable (Sources of Support) were included in correlational analyses for Research Question 1. The four parent belief variables were used as predictors for Research Questions 2 and 3. Each of these variables are described below, except the Positive and Negative Beliefs about MSDs, which were derived from open-ended questions and are described in the next section.

Child development education. Parents reported on how many courses they had completed relating to child development and/or parenting young children (Child Development Education). Responses of none, one, or two or more were summed for a total score of 0-2. See Table 12 for descriptive statistics.

Infant care experience. Parents reported on the amount of previous experience (*never, sometimes, often, regular*) they had in caring for infants and toddlers in each of three categories

of experience (*as a babysitter, working in a daycare setting, working in a job that involved regular contact with very young children*). Answers were converted to a 4-point numeric scale (*never=0, sometimes=1, often=2, regular=3*) for each category, then summed for a maximum possible score of 9 for the variable Infant Care Experience. See Table 12 for descriptive statistics.

Knowledge of Infant Development Inventory. Portions of the Knowledge of Infant Development Inventory (KIDI; MacPhee, 1983a, 1983b) were used to assess parental knowledge of child development, including infant milestones and parental practices. The theoretical basis of the KIDI is that parental knowledge of infant development influences parent behaviour and child-rearing practices (e.g., Abelson, 1981; Hunt & Paraskevopoulos, 1980; McGillicuddy-DeLisi, 1980; Miller, White & Delgado, 1980; Ninio, 1979). The KIDI has good to excellent reliability measures (.85-.92) and a variety of studies using the KIDI have provided evidence of generally good validity for utility across diverse parent samples (e.g., multiple SES groups—Bornstein et al., 2010; cross-cultural groups—Huang et al., 2005; Bornstein et al., 2007; between mothers and fathers—de Castro Ribas & Bornstein, 2005; with developmentally delayed children—Dichtelmiller et al., 1992, and multiple combined factors—Seo, 2006).

The full KIDI contains 75 items that, according to the author, "*can* be grouped into four general categories if the user wishes to use subscale scores" (MacPhee, 1983, p. 9). To keep the questionnaire a reasonable length within a broader parent questionnaire, and with permission of the author, a subset of 34 items from the total inventory were selected for the current study. These items retained their original wording. The items selected included the majority of inventory items that related to developmental norms and principles, and parenting practices. The majority of the 11 health and safety items were focused on medical care practices that were

deemed irrelevant to the current study (e.g., vaccination schedules). However, three health and safety items were included as they measured awareness of common infant supervision needs at home.

Response options to the first 30 items were "agree," "disagree," or "not sure." Each item on the inventory was then scored as correct, incorrect, or not sure. This tripartite scheme permits the separation of incorrect information (wrong) from an absence of information or an uncertainty about one's knowledge (not sure). Four items were multiple-choice with five options for response, including "not sure." Regardless of the question format, each correct answer was scored as one point.

The internal reliability scores (Cronbach's alpha) for the entire KIDI ranged from .50 to .82 amongst respondent groups—students, mothers, or professionals (MacPhee, 1983). For the reduced inventory of 34 items used in the current study, the reliability score was $\alpha = .66$. While slightly lower than the traditional threshold for acceptable reliability, it is consistent with studies that used abbreviated versions of the KIDI (e.g., Zolotar et al., 2008) and with scales using a low number of response options (Preston & Colman, 2000; Rattray & Jones, 2005). Moreover, as high alphas have been challenged as to their reliability (Schmitt, 1996) and utility (Sijtsma, 2009) in multidimensional scales, the reliability score for the current study may be considered acceptable for its purpose as a quick gauge of general developmental knowledge within the context of the overall study.

Higher total correct scores on the inventory indicate more accurate knowledge of child development and parenting. The KIDI's normative sample of mothers had an overall accuracy rate of 79.8% (*SD* = 9.6%). For the current sample of parents, on a subset of KIDI items, the accuracy rate was 83% (*SD* = 8%) and is more consistent with the 85.8% accuracy rate as was

recorded for higher SES mothers (MacPhee, 1983, p. 15). KIDI scores correlated significantly only with maternal education ($r = .13$, $p < .05$), with child development education ($r = .27$, $p < .01$), and with media as a frequent source of parenting support ($r = .14$, $p < .05$). See Table 12 for descriptive statistics.

Parenting Sense of Competence Scale. Theoretically rooted in Bandura's (1982) concept of self-efficacy, parenting self-efficacy has been strongly linked to parenting competence and to child development outcomes (Coleman & Karraker, 1998; Jones & Prinz, 2005; Shumow & Lomax, 2002). The Parenting Sense of Competence scale (PSOC; Johnston & Mash, 1989) is a 16-item measure that gauges two important components of self-esteem: satisfaction in the parenting role (e.g., being a parent makes me tense and anxious), and sense of efficacy (e.g., if anyone can find the answer to what is troubling my child, I am the one). The items on the PSOC are answered on a 6-point scale ranging from "strongly disagree" to "strongly agree." A cumulative score is generated for each component of satisfaction (nine items) and efficacy (seven items), and are then summed for a total Parenting Sense of Competence score. Scoring for some items is reversed so that, for all items, higher scores indicate greater parenting self-esteem. While some studies have reported on the use of a 17-item, three-factor PSOC (e.g., Gilmore & Cuskelly, 2009; Rogers & Matthews, 2004) or on the use of a one factor scale of the PSOC (e.g., Coleman & Karraker, 1998) the current study used the original two-factor version as was provided by one of the authors (personal correspondence, Johnston, 2013), and is supported by several studies (e.g., Hayes et al., 2008; Ohan et al., 2000; Ngai et al., 2007; Watkins & Mash, 2009). Johnston and Mash (1989) have reported internal consistencies of .75 for the Satisfaction scale and .76 for the Efficacy scale. The current study similarly demonstrated internal consistencies of .76 for each of the Satisfaction and Efficacy subscales. Johnston and Mash's

study (1989) reported subscale scores separately for mothers and fathers by child gender and by child age groups. For the current study's parent sample, the Satisfaction subscale mean score (M = 39.49, SD = 7.98) was consistent with Johnston and Mash's means (for parents of children 4-6 years) on the Satisfaction factor (M = 37.40 – 39.42, SD 5.44 – 6.60). However, this study's mean Efficacy subscale scores were higher (M = 31.27, SD = 6.34) than Johnston and Mash reported (M = 24.95 – 25.77, SD 4.99 – 5.97). Table 12 includes descriptive statistics for the total PSOC score that was used as a variable to answer all three research questions.

Appropriate age for child to own an MSD. Parents were asked to indicate the appropriate age for their child to have his or her own mobile device. Responses were formatted in a consistent numeric format (child's age in months). If responses were in the form of a numeric range, the midpoint of the range was used (e.g., 10-12 years was recorded as 11). If multiple numeric responses were provided, the midpoint between these ages was used (e.g., 8 years for a handheld gaming device and 13 for a smartphone was recorded as 10.5). This variable was used to describe the family environment for Research Question 1. Table 12 includes descriptive statistics for the variable Appropriate Age for Child MSD.

Sources of information and support. Respondents identified the frequency (*never, sometimes, often, regularly*) with which they obtained information or support on parenting or child development from eight sources (mass media, reading, previous observation of infants, family, friends, comparing their baby with others, professionals, partner). Answers were numerated on a four-point scale (0-3) for each source category. The eight categories were further condensed to four variables as follows: Media was the average of mass media and reading scores; Family and Friends was the average of scores from the categories of family, friends, and partner; Professionals was a single category score; and Own Experience was the

average of scores in the categories of previous observation of infants and current comparison of own infant to others. Descriptive data is summarized in Table 5. The Sources of Support variables were used in the correlational analyses in the environmental scan related to Research Question 1.

Table 5

Descriptive Statistics for Questionnaire Respondents' Sources of Parenting Support

Source of Support	Mean	SD	N
Family and Friends	1.94	.68	286
Media	1.67	.71	285
Professionals	1.51	.82	284
Own Experience	1.21	.64	285

Beliefs about MSDs for children. Four open-ended questions on the questionnaire generated text-based responses related to parent reasons for and against their child's current and future access to, and use of, MSDs. The four open-ended questions that generated text-based responses were: (1) "If your child does not have his/her own MSD, what are the main reasons?" (2) "If your child has his/her own MSD, what are the main reasons?" (3) "If you intend to give your child his or her own MSD, what benefits do you foresee?" (4) "If your child has any child-specific versions of MSDs, what are your main reasons?" First, Thematic Analyses were conducted to examine, reduce, analyze, and synthesize the open-ended responses (Boyatzis, 1998; Braun & Clarke, 2006; Saldaña, 2009). The themes that emerged from the analysis formed part of the environmental scan to answer Research Question 1. Second, in order to form two parent belief predictor variables for statistical tests related to answering Research Questions 2 and 3, the data codes from the process of thematic analysis were subsequently quantified to form the variables of Positive MSD Beliefs and Negative MSD Beliefs (Saldaña, 2009; Srnka & Koeszegi, 2007).

The process of analyzing the data employed the coding practices and nomenclature outlined by Saldaña (2009), consisting of two cycles of coding and followed by "themeing the data" (p. 139). While Braun & Clarke (2006) outlined the analytic process as beginning with codes that are then grouped into themes (with possible sub-themes), Saldaña's process begins with codes that are subsequently grouped into categories (with possible sub-categories), and from which themes emerge. Table 6 provides a summary of the Thematic Analyses for the four questions, followed by descriptions of each step in the analytic process.

Table 6

Summary of Thematic Analyses of Four Open-Ended Questionnaire Items

	Open-ended question	Responses	Codes	Categories
1	If your child does not have his/her own MSD, what are the main reasons?	248	488	Child age Unnecessary Developmental Harm Prefer 3D activities Family organization
2	If your child has his/her own MSD, what are the main reasons?	37	80	Child Development Parent/Family
3	If you intend to give your child his or her own MSD, what benefits do you foresee?	146	224	Child Development Child Learning Parent/Family
4	If your child has any child-specific versions of MSDs, what are your main reasons?	78	90	Child Development Child Learning Parent/Family

First cycle coding. This first step in the analysis involved becoming familiar with the data by reading and re-reading text responses to each of four questions (see Table 6), forming and re-forming codes and categories concurrently. A code is defined as a word or short phrase that "symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (Saldaña, 2009, p. 3). The process of coding is one

in which words or phrases pertaining to the questions are extracted and similar answers identified using the same label (or code), remaining as close to the original data as possible. In this study, the data were automatically organized into an Excel spreadsheet when the online questionnaire was downloaded. Therefore, to code the data, responses that were written into open text boxes were initially read then copied into four Word documents—one document for each question. In each Word document, each response was re-read word-by-word or line-by-line using highlighting and underlining of key words or phrases, then affixing a key word to code each unit of data. Table 7 gives an example of the coding process for a single extract from the data set.

Table 7

Example of Coding and Categorizing a Single Data Extract

Data Extract	Coded for	Categorized for
Research says no screens until age 2, limited use after that. They are bad for brain development and social skills. Children learn from playing. In reality, she sees screens when we are out of the house, but we do not turn the tv on when she is awake and we try to limit our use of screens in her presence. [Case 74, parent of 11-month old]	• Research says • Bad for brain development • Bad for social skills • Learn by playing • Keep tv off • Parents restrict own screen use	1. Developmental harm 2. Preference for 3D experiences 3. Family organization

Each response generated one or more codes. The next step in the coding process involved searching for data from other text boxes within the questionnaire with a view to assessing whether the data was unique or additional data related to one of the four questions and/or whether the other text-boxes on the questionnaire were used for expanded comments related to a particular question. For example, if the response to Question 3 ("If you intend to give your child his or her own MSD, what benefits do you foresee?") contained reasons against the child having an MSD, such responses were re-coded and added to the response to Question 1

("If your child does not have his/her own MSD, what are the main reasons?"). Similarly, if respondents used the general comments section of the questionnaire to provide unique data related to any of these four questions, they were added to the appropriate section and coded (responses that were simple repetitions of previous text data were not coded). The process of forming categories involved "organizing and grouping similarly coded data into categories or 'families' because they share some characteristic" (Saldaña, 2009, p. 8). Therefore, the coded data were grouped into categories (comparable to "themes"—Braun & Clarke, 2006, p. 87). Further refinement of the analysis was achieved with several reviews of the codes and categories, including some "rearrangement and reclassification of coded data into different or even new categories."

Second cycle coding. The primary goal of a second cycle of coding is to "develop a sense of categorical, thematic, conceptual and/or theoretical organization of cycle one codes" (Saldaña, 2006, p. 149). Therefore, codes and categories generated in the first cycle were reorganized to "develop a smaller and more select list of broader categories, themes, and/or concepts (p. 149). The current data was reconfigured to align with concepts of parent beliefs about MSDs for children in a positive-negative binary classification. As the items on the questionnaire were organized *a priori* into "reasons for and against" MSDs for children, the second cycle of coding was simplified. "Focused coding" (p. 155) of responses to open-ended Question 1, including relevant data from other text-based responses, resulted in the formation of "meta-codes" (p. 150), or categories, for conceptual similarity in negative attributions regarding MSDs for children. Focused coding of the coded responses to open-ended Questions 2, 3, and 4, including the addition of relevant data found in other responses, resulted in meta-codes for conceptual

similarity in positive attributions regarding MSDs for children. Table 8 provides an example of second-cycle categorization of codes related to open-ended Question 2.

Table 8

Example of Second Cycle Categorization of First Cycle Codes

Open-ended question 2	
First cycle: codes	Second cycle: categories
Child learning	Child benefit
Specific skill development	
Digital literacy	
Entertainment	
Parent control of access	Parent/family benefit
Parent control of content	
Distract or occupy child	
Device was given as gift	
Family harmony	

Themeing the data. "A theme is an outcome of coding, categorization, and analytic reflection, not something that is, in itself, coded" (Saldaña, 2009, p. 13). It is formed with "a phrase or sentence that identifies what a unit of data is about and/or what it means" (p. 139) and is congruent with Braun & Clarke's fifth step of theme definition and naming (2006, p. 87). The current data generated two themes to capture the positive and negative valences of parent beliefs about MSDs for children. The theme label of Negative MSD Beliefs was given to represent the categories of codes with a negative valence regarding MSDs for children and the theme label of Positive MSD Beliefs was given to represent the categories of codes with a positive valence regarding MSDs for children.

Trustworthiness. The above process was done by hand, without the use of coding software. Solo coding processes may be checked for trustworthiness by checking interpretations with participants, coding during transcription, and maintaining a reflective journal (Ezzy, 2002). With data from an online questionnaire, it is not possible to check interpretations with

participants, however, initial coding was done during transcription of the data from the online questionnaire to a Word document and by keeping reflective memos of ideas generated during the coding process (Saldaña, 2009). Trustworthiness of the data was further established with internal and external audits.

Internal audit. All raw data was analyzed both within responses to open-ended questions and within participants' responses across the data set to "find repeated patterns of meaning" (Braun & Clarke, 2006, p. 86). The coding process used highlighting and underlining of salient words and phrases that were subsequently colour-coded to form categories. The researcher kept a journal of codes and notes that were consulted during the analysis to inform the refinement of coding, categorizing and developing themes.

External audit. Code-checking was conducted on a portion of the data by a volunteer graduate student. For high levels of inter-coder reliability in text-based survey data, interim reliability checks may be conducted, such as with 50% of the data (e.g., Hruschka, Schwarz, St. John, Picone-Decaro, Jenkins, et al., 2004). If sufficient agreement is reached, the remaining data set may be reliably coded using the established code book. For the current study, 92% inter-coder agreement was achieved with 146 responses to open-ended Question 3: "If you intend to give your child his or her own MSD, what benefits do you foresee?" The code-checking process involved two steps: first, the code checker identified 225 coded units (compared to the researcher's 224 codes); second, the code-checker placed the codes into the three categories created by the researcher (child development, child learning, and parent/family). Therefore, the researcher was confident in coding the responses to the remaining open-ended questions using the established coding system.

Coded units of data for open-ended Question 1 were organized into 5 categories: child age, not necessary, developmental harm, preference for 3D activities, and family organization. Table 9 provides exemplars of responses for each category. The category of 'child age' included references to the child's age generally or specifically, as well as to lack of ability. The category of 'not necessary' included responses of direct reference to lack of need. The category of 'developmental harm' included references to negative impacts to physical, mental, or developmental health. The category of 'preference for 3D activities' included statements of preference for non-technology activities. The category of 'family organization' captured references to parent beliefs, choices or rules, perceived lack of benefits, and costs of devices.

Table 9

Examples of Categories and Codes Related to Open-Ended Question 1

Categories of Coded Data	Exemplar Code 1	Exemplar Code 2
Child age	*"she's only 1 year old"*	*"couldn't operate a device yet"*
Unnecessary	*"I can't see why she needs one"*	*"not necessary"*
Developmental harm	*"gets in the way of healthy play"*	*"I don't want a screen addict"*
Prefer 3D activities	*"we prefer books and toys for real play"*	*"they need to play outside"*
Family Organization	*"we don't believe in letting our child watch screens"*	*"too expensive for my child"*

Coded units of data from responses to open-ended Question 2 were placed into two categories based on whether the reasons for the child to have his or her own MSD was primarily indicative of a belief in a benefit to the child or to the parent/family. Table 10 provides exemplar responses for each category. The category of 'child benefit' included references to an MSD assisting with learning, the development of specific skills, digital literacy (including exposure to technology and the development of specific digital skill-building), and entertainment or

enjoyment for the child. The category of 'parent/family' was comprised of references to parent benefits, such as ability to control child access and/or content, relief for the parent by distracting or occupying the child, as an aid in family harmony, or the device received as a gift or by parent passdown.

Table 10

Examples of Categories and Codes Related to Open-Ended Question 2

Question 2 Categories	Exemplar Code 1	Exemplar Code 2
Child benefit	*"learning young how to use relevant technology"*	*"watching movies and playing games"*
Parent/family benefit	*"when we need to get things done without a toddler pestering us"*	*"it was a gift from the grandparents"*

The coded data related to open-ended Questions 3 and 4 formed three categories: child development, child learning, and parent/family. Table 11 provides exemplar responses for each category. The category of 'child development' contained codes related to MSDs assisting in development in domains such as motor (e.g., hand-eye coordination), social (e.g., peer inclusion), personal responsibility, and entertainment. The category of 'child learning' included references to MSDs aiding in general learning, specific academic skills, school-related tasks, access to educational apps, and digital literacy. The category of 'parent/family' included codes related to MSDs as devices to foster family communication, child safety, parent tracking of the child, parental control of access or content, parenting relief by distracting or occupying the child, to eliminate the need to share devices, and for the child to assist with family tasks.

Table 11

Examples of Categories and Codes Related to Open-Ended Questions 3 and 4

Questions 3 and 4 Categories	Exemplar Code 1	Exemplar Code 2
Child development benefit	*"hand-eye coordination"*	*"I don't want him left out of his peer group"*
Child learning benefit	*"there are many educational apps"*	*"school use—research and word-processing"*
Parent/family benefit	*"being able to keep track of where she is"*	*"more mommy alone time"*

Transforming codes into variables for statistical tests. In mixed methods research, qualitative data can be "quantitized" for statistical analysis (Saldaña, 2009, p. 49; Srnka & Koeszegi, 2007). Following coding of text responses, and before forming categories, code frequency counts were conducted for each participant who provided at least one response to any of the four questions above and/or to another question where the data was deemed to fit within one of the four questions above. Code frequency counts are one way to "transfer converted qualitative data into quantitative data analysis programs such as SPSS" (Saldaña, 2009, p. 50). The themes that resulted from the foregoing process of Thematic Analysis generated the variables titled Positive MSD Beliefs and Negative MSD Beliefs. The 488 codes generated from analysis of responses to open-ended Question 1 formed the Negative MSD Beliefs variable. The 394 codes generated from responses to open-ended Questions 2, 3, and 4 formed the Positive MSD Beliefs variable. Negative MSD Beliefs and Positive MSD Beliefs subsequently served as predictor variables in regression tests pertaining to answering Research Questions 2 and 3. Descriptive statistics for these variables are found in Table 12.

Table 12

Descriptive Statistics for Parent Knowledge and Belief Variables

Variable	N	M	SD	Md	Range
Knowledge					
Infant Care Experience	281	2.25	1.98	2	0-9
Child Development Education	280	1.30	.82	2	0-2
Beliefs					
KIDI	286	28.28	2.73	29	19-33
PSOC	281	71.57	10.69	72	25-93
Positive MSD Belief	292	1.53	1.55	1	0-8
Negative MSD Belief	287	1.66	1.14	1	0-5
Appropriate Age for Child MSD (yrs.)	226	10.06	3.33	10	2-18

Methods – Home Visits

Participants

To identify interested families, the questionnaire ended with a section where participants were given the contact information required to volunteer for the home visit phase that involved interviews and observations. Families qualified if they had at least one child aged 12-36 months. No efforts were made to ensure that this sample was representative of the larger sample, however, comparisons between this sample and the larger sample were conducted and are reported in the results section. The data collected was treated separately, and due to the anonymous nature of the questionnaire data, no attempt was made to link home visit participant data with the questionnaire data. Participants were made aware of this.

Over a 15-month period (December 2013 to March 2015), 30 families volunteered for the home visit. Two respondents withdrew their request due to family reasons related to scheduling the home visit. Of the 28 home visits that were completed, 17 were conducted with only mothers present, one was with only a father present, nine were with couples, and one was with a couple plus grandparent. In total 27 mothers and 11 fathers participated in the home visits. The

children of these parents ranged in age from 12.5 to 36 months at the time of the home visit, and consisted of 17 males and 12 females (29 children were represented as the sample consisted of one set of male/female twins). Most children (64%) were first born or an only child, while 35% of children were the youngest of up to four children. Participants consisted of families from 15 communities across BC, including the Lower Mainland and Fraser Valley, as well as the Okanagan, Gulf Islands, and Greater Victoria Area. In total, three of four B.C. Ministry of Children and Families (MCFD) service delivery regions were represented by this sample.

For the sample of families in the home visit phase of the current study, the average child age was 22 months (*SD* = 6.69). The majority of households had only one child (range of 1-4 children). The majority consisted of dual-parent families (22), while three had a sole parent, and three were living in extended families. Of the 28 participant families, 23 had parents with a minimum of post-secondary education and 26 had at least one parent who was engaged in full-time employment. Similar to the larger sample, half the participants (50%) were of European descent and two-thirds (82%) spoke English as the primary language in the home. Parental education was high, with 43% of mothers holding a graduate degree, and 40% of fathers with a bachelor degree. The mean family size was three persons, and families owned an average of five MSDs. Descriptive statistics for the home visit participants may be found in Table 15.

Procedures

A time was arranged with the participant to have a home visit convenient for the family, and questions about expectations for the activities of the home visit were answered. Home visits began with thanking families for their participation in the study and obtaining signed consent forms. Home visits ranged in time from 70-105 minutes, averaging approximately 80 minutes. The overarching goal was for the researcher to minimize intrusion or disruption to the child's experience of their natural home environment and established family activities. The researcher

moved about the home in such a way as to maintain engagement with the parent(s) and child(ren) as they went about their normal activities. Observing and interviewing the parent(s) within the normal routines and activities of the family at home, without evaluation activities beyond the purposes of the research, ensured that the data was obtained from the most natural family environments. The researcher made written notes of observations of the home environment, parent-child interaction, and parent experiences and responses both during the course of the home visit and following the home visit after leaving the family. Interview questions were used as researcher prompts to guide discussion, to introduce new topics, or to probe further into parent questions or responses to clarify meaning. Responses to interview questions were also recorded as written notes. To build rapport, early conversations were often general in nature, whether initiated by the parent(s) or by the researcher's prompt about general concerns regarding raising a child. The topics included in the interview protocol (Appendix 8) were woven into the conversations with parents and were introduced in an unstructured manner, where natural or appropriate to the conversation and activities at that time.

Measures

For the current study, two data collection measures were employed: the IT-HOME scale, and a semi-structured interview. Together, these measures, along with the researcher's field notes, provided the data for this portion of the study. The data were used to answer Research Question 1 by providing a more detailed overview of the home environment. Nine variables were generated from the home visit data (IT-HOME score, Infant Tablet score, Toddler App score, Electronic Toy score, Maternal Education, Paternal Education, Family Size, Family MSDs, and Child Development Knowledge).

Infant & Toddler-Home Observation for Measurement of the Environment. The HOME scale for infants and toddlers (IT-HOME, Caldwell & Bradley, 1984/2003) is an age-

specific version of the HOME Inventory[2] intended to assess "what the child's world is like from his or her perspective—i.e., from where the child stands or sits or moves about and sees, hears, smells, feels, and tastes the world" (Caldwell & Bradley, 2003, p. 8). A version of the HOME Inventory has been used internationally in over 650 studies (Caldwell & Bradley, 2003, note p. 98). The IT-HOME has been used to establish environmental predictors of developmental competency (e.g., Linver et al., 2004; Parks & Bradley, 1991) and to assess effectiveness of intervention practices (e.g., Totsika & Sylva, 2004). While completed with the primary caregiver, most often the mother, it is not primarily an appraisal of the mother's caregiving abilities. Rather, the IT-HOME's theoretical rationale springs from a large body of literature on the interpersonal influences on development articulated through eight principles by which the home environment fosters child development—frequent contact loving adults, a stimulating and responsive social learning environment, need gratification, a positive emotional climate, least-restrictive environment, rich and varied cultural experiences, modulated sensory input, and appropriate play materials (Caldwell & Bradley, 2003, p. 98). The 2003 edition of the IT-HOME, used in the present study, underwent minor revisions to clarify which subscale items were to be obtained by interview, observation, or either (p. iii).

This 45-item measure is structured in the form of six subscales in hierarchical order of more to less variance: I. Responsivity (11 items, e.g., parent spontaneously vocalizes to child at least twice); II. Acceptance (8 items, e.g., parent does not shout at child); III. Organization (6 items, e.g., child's play environment is safe); IV. Learning Materials (9 items, e.g., complex eye-hand coordination toys); V. Involvement (6 items, e.g., parent structures child's play periods);

[2] HOME inventory includes versions for infants-toddlers, early childhood, middle childhood and early adolescence.

and VI. Variety (5 items, e.g., parent reads stories to child at least three times weekly). All items are scored in a binary system—plus or minus. The IT-HOME score is a sum of 'plus' items, with descriptive statistics for this variable found in Table 15.

The IT-HOME maintains acceptable internal reliability (Cronbach's alphas of .80 to .89) and validity when used flexibly (Bradley, 1993; Linver, Martin, & Brooks-Gunn, 2004; Totsika & Silva, 2004). The current study's internal reliability was acceptable, $\alpha = .84$.

Semi-Structured Interview. Beyond the interview items contained in the IT-HOME scale, several topics were introduced during the home visit by way of questions posed to parents as noted in the Interview Guide (Appendix 8). The majority of the interview content was guided by five factors that are reported in the extant literature as cognitions that influence parents' decisions and behaviour: self-identified parental sources of information and support (Zero to Three, 2009), beliefs regarding developmentally supportive practices (e.g., Hoff et al., 2002; Zero to Three, 2009), developmental expectations (e.g., Murphey, 1992), beliefs regarding media and educational programming for infants and toddlers (Rideout et al., 2003; Wong et al., 2008), and acceptance of child-directed media technology product marketing claims (Dorr, Rabin, & Irlen, 2002; Zimmerman et al., 2007). While interview prompts were organized into five organizational sections for ease of recording responses, three topic areas formed the data corpus that was subsequently analysed for the purposes of answering Research Question 1. Described below are the measures for parents' child-raising concerns, parent knowledge of development, and parent evaluation of child-directed MSDs.

Concerns raising children. To assist in building rapport, parents were often asked early in the home visit "what are 2 or 3 things you worry about most when it comes to raising your child?" The responses reflected a variety of concerns related to the child, the parents, the family,

and the community and world outside the home. While the question was open-ended and did not infer concerns related to technology, of the 28 responses, the majority of concerns referenced technology generally or MSDs specifically. A Thematic Analysis of all responses was conducted using Saldaña's (2009) procedure of reading and re-reading, coding, categorizing, and themeing the data, as previously described. The resulting 66 codes were then collated to form 10 categories. Table 13 provides descriptions for each category. The categories were subsequently organized around three themes as presented in the Results chapter.

Table 13

Descriptions of Categories From Coded Interview Data of Parent Child-Raising Concerns

Category Codes	Description
Child health	Matters of current or future child health; matters related to the impact of any family member's health (including mental health) on child's current or future health
Child development	Management of normal toddler development and/or behaviour; challenging child behaviour; developmental delays or disabilities
Responsibility	Parental sense of duty for their child's personality and/or character development
Competence	Parent beliefs, questions about parent competency, parenting responsibilities, fears
Peers	Perceived evaluations, criticism and/or judgment of parent beliefs or practices
Practical	Functional realities of the family situation in immediate terms (e.g., child care, scheduling, finances)
Education	Educational opportunities for the child and anticipated challenges or problems associated with formal schooling
Environment	Concerns related to the natural or sociocultural environment, whether specific, general, or diffused *without references* to the role of media and/or technology (next category)
Technology	References to elements of media or technology generally, to aspects of specific devices, or to human interaction with technological devices

Trustworthiness. Interview data was completed manually, without the use of coding software. Solo coding processes may be checked for trustworthiness by checking interpretations with participants, coding during transcription, and maintaining a reflective journal (Ezzy, 2002). As data was collected via *in vivo* interviews, the researcher checked interpretations with participants throughout the home visit by methods such as follow-up probes, alternative wording, confirmations of meaning, re-visiting topics of discussion, and clarifying questions. Immediately following each home visit, the researcher made personal notes (memos) to contextualize the data as an aid to subsequent review, transcription and interpretation of responses. Initial coding was done during transcription of the data from the researcher's hand-written notes to a Word document and by keeping reflective memos of ideas generated during the coding process (Saldaña, 2009).

The researcher's background qualifications form one set of criteria for establishing credibility of data collection in naturalistic studies (Guba, 1981; Shenton, 2004). In the current study, the researcher's skills in observation, interviewing, and note-taking during home visits are important to obtaining trustworthy data. The researcher has 26 years of experience in home-visiting developmental services that include extensive use of informal and standardized assessment instruments that collect data via direct observation of children, parent-child interaction, and home environments as well as motivational interviewing and reflective practices with parents of infants and toddlers. Trustworthiness of the data was further established with internal and external audits.

Internal audit. Raw data was analyzed both within responses to open-ended questions or topics and within participants' responses across the data set to "find repeated patterns of meaning" (Braun & Clarke, 2006, p. 86). Two coding processes were used. One process used

post-it notes (one note per code) that were repeatedly organized and re-organized to find common meanings, then organized into categories. Another process had codes individually written onto poster boards, then organized by colour-coding those that formed categories to form a mind-map. When transcribed to Word documents, categories were colour-coded and/or underlined and/or highlighted during subsequent review and refinement phases. The researcher kept a journal of codes and notes that were consulted to inform the refinement of coding and categorizing cycles. Finally, categories were organized into conceptual themes.

External audit. In addition to discussions with the research supervisor, check–coding was conducted on two data sets by separate volunteer graduate students. The responses to two interview topics were given to code checkers to determine placement into categories organized by the researcher. For the data set related to parent child-raising concerns, there was an 88% inter-coder agreement rate. For the data set related to reasons for MSD evaluations, the inter-coder agreement rate was 94%.

Child development knowledge. To gauge developmental expectations (e.g., Murphey, 1992), the interview consisted of a set of seven questions that asked parents to estimate the age at which their child attained or was likely to attain each developmental competency. Table 14 summarizes the number (and percentage) of correct responses.

Table 14

Home Visit Participants' Knowledge of Child Development

Item	Expected developmental competency	Correct (%)	
1	Age to experience feelings	17	(61)
2	Age child can be affected by parent's feelings	12	(43)
3	Age child can feel good/bad about self	7	(25)
4	Age child can control emotions	4	(14)
5	Age child can take turns/share	14	(50)
6	Age child follows simple directions	16	(57)
7	Age child is toilet-trained	22	(79)

MSD evaluation. To gauge parent beliefs about infant-toddler media (e.g., Dorr et al., 2002; Zimmerman et al., 2007) and parent acceptance of marketing claims regarding child media products (Rideout et al., 2003; Wong et al., 2008), a portion of the home visit involved parent evaluations of three child-directed mobile devices (an infant tablet, a toddler 'app' for smartphone, and an electronic toy). Although requiring less than ten minutes of the home visit, this measure arguably formed the most structured part of the interview as the researcher was required to activate a laptop computer for parents to evaluate two video advertisements (for the infant tablet and the toddler smartphone app). Evaluations of the electronic toy consisted of parents reading through a reproduced print advertisement containing a photo of the toy and a description of its features and functions. Following each advertisement, parent(s) were asked three questions: (i) "do you believe this is a good product for your child?" (ii) "would you purchase (or obtain) this item for your child?" and (iii) "why or why not?" Responses to the first two questions—whether the product was suitable for their child and whether they would purchase the product—were scored numerically as 1 (no), 2 (neutral/mixed), or 3 (yes). These scores were subsequently summed for a maximum evaluation score of 6 for each product, with higher scores indicative of more positive evaluations. Table 15 includes descriptive statistics for each MSD evaluated.

Table 15

Descriptive Statistics for Variables in Home Visit Sample, N=28

Variable	M	SD	Md	Range
IT-HOME score	38.82	4.69	40.5	23-44
Infant Tablet Score	2.39	1.07	2	2-6
Toddler App Score	2.82	1.49	2	2-6
Electronic Toy Score	3.86	1.78	3	2-6
Maternal Education	3.07	1.02	3	1-4
Paternal Education	2.75	.89	3	1-4
Family Size	3.82	1.18	3	2-7
Family MSDs	5.18	2.11	5	2-10

Thematic analysis. The third question in the MSD evaluation task generated general responses to an open-ended question ("why or why not?") and were noted by the researcher. Thematic analysis was conducted on these responses, utilizing the reading-coding-categorizing-themeing process previously described (Saldaña, 2009). Responses generated 117 codes that were organized into six categories, summarized in Table 16.

The Child Age category contained codes that referenced the child's age and/or skill level. Responses that were coded as comparing child-directed devices to corresponding adult versions of MSDs were categorized as Compared to Real. Codes that referred to evaluations of child MSDs in relation to any aspect of child development or health, whether as a benefit or a detractor, were categorized as Development/Health. The category of Play Value contained codes referring to the effects of the products on child play. The category of Parent Appeal included codes that reflected the parents' like or dislike towards the device or any feature thereof. Finally, codes that reflected statements of parent decision or already established family rules regarding technology for children were placed in the Family Policy category.

Categories were further analysed for dimensions of positive, negative, or neutral valence that led to three broad themes as presented, with exemplars, in the Results chapter.

Table 16

Summary of Code Categories and Valence Dimension Related to Evaluations of Child MSDs

Codes	Categories	Valence	MSDs referenced
Too early	Child age	Negative	tablet, app, toy
Not yet capable to use			
Prefer adult MSD	Compared to 'real' MSD	Negative	tablet, app
Limited apps			
Quickly outgrow			
Harmful to development	Development/Health	Negative	Tablet
Risk to health		Positive	tablet, app, toy
Fear of dependency		Neutral	tablet
Interferes with learning			
Learning aide			
Digital literacy development			
No effect			
Prefer non-tech activities	Play value	Negative	tablet, app, toy
Prefer parent-child interactions		Positive	app, toy
Child disinterested		Neutral	tablet, app
Enhanced			
Limited			
Reduced			
Annoying	Parent appeal	Negative	tablet, app, toy
Fun/entertaining		Positive	tablet, app
Okay		Neutral	toy
Appealing features			
Violates rules	Family policy	Negative	tablet, app
Against family values			

CHAPTER 4

RESULTS

The results are organized according to the research questions that guided this study. The first section involved preliminary analyses to determine comparability of the sample for participants who were from outside of B.C., as well as for participants who were in the subsample versus the larger sample. The research questions that organize the rest of the chapter's sections are:

1. How do the presence and use of MSDs relate to factors of the family environment (Family Size, Maternal and Paternal Parent Characteristics, Parent-Child Interactions, and Parent Knowledge and Beliefs)?
2. Do parent knowledge and beliefs predict the reasons that parents provide MSDs to their children?
3. Do parent knowledge and beliefs predict how much time a child spends using MSDs?

Preliminary Analyses – Group Comparisons

Geographical Comparisons. In order to make a determination about inclusion of non-B.C. data, comparisons were made between participants from B.C. (N=217) and participants from the rest of Canada (RoC, N=75). Following inspections of histograms for assumptions, sixteen t-tests were conducted on demographic variables of interest (Income, Maternal Age, Paternal Age, Maternal Education, Paternal Education, Parent MSDs, Family MSDs, Parent MSD Time, Child Age, Child MSD Time), and parent experience, knowledge, and belief variables (Child Development Education, Infant Care Experience, KIDI, PSOC, and Positive and Negative MSD beliefs).

With a Bonferroni correction to reduce the chance of Type I errors associated with multiple tests (Pallant, 2007), only parental age met the criteria for the revised level of significance at $p = .003$ (.05/16 tests). Mothers were older in B.C. ($M_{Maternal\ Age\ BC} = 2.95$, $SD = .56$;) than in the rest of Canada ($M_{Maternal\ Age\ RoC} = 2.41$, $SD = .62$), $t(122.31) = -6.93$, $p < .001$, as were fathers ($M_{Paternal\ Age\ BC} = 3.17$, $SD = .71$; $M_{Paternal\ Age\ RoC} = 2.68$, $SD = .86$), $t(107.27) = -4.24$, $p < .001$. As group differences associated with parental age were small, and likely reflect differences in recruitment notice formats, the entire data set was retained.

A series of parametric tests was also conducted to assess for group differences between rural and non-rural (combined urban and suburban) questionnaire respondents. The results of 15 t-tests to compare Family MSDs, Parent MSD Time, Child MSD time, Child Age, Maternal Age, Paternal Age, Maternal Education, Paternal Education and seven parent experience, knowledge and belief measures (Knowledge of Development, Parenting Sense of Competence, Infant Care Experience, Caregiving Activities, Positive and Negative MSD beliefs, and Parent Reasons for giving their MSD to their child) failed to reach significance criteria of $p = .003$ (with Bonferroni correction). Therefore, rural residency status was not considered a concern, and all participants were grouped for all further analyses.

Comparison of Questionnaire vs Home Visit Sample. Although the home visit participants were drawn from questionnaire participants, as noted above, no efforts were made to link interviewees' data to the questionnaire data. However, as summarized in Table 17, there was overlap in five variables, which allowed comparisons to be made between the groups. In general, child age and parent education were marginally higher in the home visit group. Differences are probably attributable to the self-initiated, voluntary nature of participant recruitment process for the home visit interviews.

Table 17

Descriptive Statistics for Comparison of Data Sources (Questionnaire and Home Visit)

Variable	Data Source	M	SD	Md	Range
Child Age (months)	Questionnaire	19.11	11.40	19.0	1-47
	Home Visit	22.00	6.69	20.5	13-36
Family MSDs	Questionnaire	6.11	3.02	6	1-24
	Home Visit	5.18	2.11	5	2-10
Family Size	Questionnaire	4.00	1.16	4	2-8
	Home Visit	3.82	1.19	3	2-7
Maternal Education	Questionnaire	3.66	.99	4	1-5
	Home Visit	4.04	1.11	4	1-5
Paternal Education	Questionnaire	3.41	1.12	3	1-5
	Home Visit	3.75	.89	4	2-5

Note. Questionnaire group (N=292); Home Visit group (N=28)

Research Question 1: How MSDs Relate to Factors of the Family Environment

Data from the questionnaire and home visit participants were analyzed to answer the first research question: "How do MSDs relate to factors of the family and home environment?" First, correlational analyses were done with data from the questionnaire to assess the relationship between MSDs (Family MSDs, Parent MSD Time, MSD Experience, Child MSD Use) and three aspects of the family environment: 1) Family and Parent Characteristics (Maternal Education, Paternal Education, Maternal Age, Paternal Age, Family Size, Income); 2) Parent-Child Interactions (the variables representing why parents give MSDs to their child; to Occupy, to Videochat, to Calm, or to Teach); and 3) Parent Knowledge (Child Development Education, Infant Care Experience) and Beliefs (KIDI, PSOC, as well as Positive and Negative MSD Beliefs). Second, a correlational analysis was conducted to examine the relationships between Sources of Support and Parent Knowledge (Child Development Education, Infant Care Experience) and Beliefs (KIDI, PSOC, Positive and Negative MSD Beliefs).

To provide further infomation about the family environment with respect to MSDs, an analysis of the open-ended responses parents provided for giving their child an MSD are

presented. Finally, observation and interview data from the home visit provided further, more detailed and specific information about the family environment as it relates to MSDs, first by conducting a correlational analysis of Maternal and Paternal Education, Family Size, Family MSDs, Parent Evaluations of MSD products (infant tablet, toddler smartphone app, electronic toy) and the IT-HOME scores, and second, by analyzing data from the semi-structured interview pertaining to their worries about technology and evaluations of MSD products.

Correlational Analysis of Questionnaire Data. The availability and parent use of MSDs in the context of the family home were examined for their relationship to Family and Parent Characteristics, Parent-Child Interactions, and Parent Knowledge and Beliefs, and are reported in Tables 18, 19, and 20.

For Family and Parent Characteristics, Family MSDs was significantly positively related to demographic factors of Income and Family Size. Parent MSDs was significantly positively related to only Income. There was significant inverse correlation between MSD Experience and Maternal Age. Parent MSD Time was not correlated with any of the sociodemographic factors, while Child MSD Time was significantly positively related only to Paternal Age.

For Parent-Child Interactions, Family and Parent MSDs, and Parent and Child MSD Time were significantly positively related to the four most common reasons for which parents reported giving their child an MSD (Occupy, Videochat, Teach, Calm). MSD Experience was not related to the reasons parents gave their children MSDs.

For Parent Knowledge and Beliefs, Family and Parent MSDs were significantly positively correlated with Positive MSD Beliefs, and inversely correlated to Appropriate Age for Child MSD. MSD Experience was significantly positively associated with Positive MSD Beliefs. Parent MSD Time was significantly positively correlated with Positive MSD Beliefs

and negatively correlated with both Parenting Sense of Competence (PSOC) and with Appropriate Age for Child MSD. Child MSD Time was significantly positively correlated with Positive MSD Belief and inversely correlated with Appropriate Age for Child MSD.

Table 18

Correlations Between Factors of MSDs and Family Sociodemographics

Variable	Family MSDs	Parent MSDs	MSD Experience[a]	Parent MSD Time	Child MSD Time
Family Size[a]	.12*	-.05	-.02	-.05	.11
Income[a]	.12*	.12*	.00	.03	.11
Maternal Education[a]	.05	-.00	.01	.02	-.01
Paternal Education[a]	.00	-.01	-.04	.10	.05
Maternal Age[a]	.10	-.02	-.13*	-.11	.08
Paternal Age[a]	.11	.01	-.06	-.10	.14*

[a] *Spearman's rho* *$p \leq .05$ **$p \leq .01$

Table 19

Correlations Between Factors of MSDs and Parent Reasons for Providing MSDs to Child

Variable	Family MSDs	Parent MSDs	MSD Experience[a]	Parent MSD Time	Child MSD Time
Give child MSD to Occupy[a]	.32**	.38**	-.10	.25**	.83**
Give child MSD to Videochat[a]	.28**	.32**	-.08	.25**	.73**
Give child MSD to Calm[a]	.29**	.35**	-.11	.32**	.69**
Give child MSD to Teach[a]	.31**	.32**	-.07	.31**	.64**

[a] *Spearman's rho* *$p \leq .05$ **$p \leq .01$

Table 20

Correlations Between Factors of MSDs and Parent Experience, Knowledge and Beliefs

Variable	Family MSDs	Parent MSDs	MSD Experience[a]	Parent MSD Time	Child MSD Time
Parenting Sense of Competence	-.03	-.01	.07	-.13*	-.16**
Knowledge of Infant Development	.04	.08	-.06	-.02	-.08
Child Development Education[a]	.02	.08	-.08	.08	.04
Infant Care Experience[a]	-.06	.08	-.03	.08	.10
Positive MSD Belief	.26**	.30**	.15**	.14*	.17**
Negative MSD Belief	-.01	-.00	.06	-.00	.02
Appropriate Age for Child MSD	-.26**	-.25**	-.06	-.23**	-.09

[a] *Spearman's rho* *$p \leq .05$ **$p \leq .01$

The relationship between four Sources of Support and Parent Knowledge and Beliefs is summarized in Table 21 below. Media as a frequent Source of Support was significantly positively related to Knowledge of Infant Development (KIDI) scores, while Professionals as a frequent Source of Support was significantly positively related to Child Development Education and to Infant Care Experience. As expected, parents' own experience as a frequent source of support was significantly positively related to Infant Care Experience.

Table 21

Correlations Between Parenting Sources of Support and Parent Knowledge and Belief Variables

Variable	Source of Support			
	Family and Friends	Media	Professionals	Own Experience
PSOC	-.03	.06	-.04	.03
KIDI	.06	.21**	.04	.11
Child Development Education[a]	.03	.04	.15*	.07
Infant Care Experience[a]	.08	-.05	.12*	.32**
Positive MSD Belief	-.02	-.02	.05	-.01
Negative MSD Belief	.04	-.11	.06	-.00
Appropriate Age for Child MSD	.09	-.05	-.03	.10

[a] *Spearman's rho* *$p \leq .05$ **$p \leq .01$

Results of Questionnaire Open Ended Data. Four open-ended questions on the questionnaire allowed parents to give their reasons for and against their child owning an MSD. In total, 509 responses were included in the analysis, with only 18% of respondents providing both positive and negative reasons. The process of Thematic Analysis, as described in Methods, led to two broad themes. The Negative MSD Beliefs theme emerged following analysis of 248 responses to one item that generated 488 codes organized into six categories, reflective of a negative attitude to child use of MSDs. The Positive MSD Beliefs theme emerged following analysis of 261 responses collated from three items that generated 394 codes organized into five categories, reflective of a positive attitude toward child use of MSDs.

The following excerpts of responses serve as exemplars of the analysis that generated the Negative MSD Beliefs theme.

Exemplar 1: "I want my daughter to learn to interact with the physical world first. She will have the rest of her life to be involved in the digital world" (parent of 11-month infant; case 118). It serves as an exemplar of responses where parents expressed preference for their child having extensive interactions with the animate and inanimate world instead of digital or screen experiences (category: Prefer 3D Experiences).

Exemplar 2: "We are worried about the effect it would have on a young child's developing brain and how it would affect learning. Want him to enjoy childhood and not be addicted to technology" (parent of 12-month infant, case 216). This extract served as an exemplar of the range of parent concerns regarding the negative impacts or actual harm to their child's health or development they believe to be attributable to early MSD use (category: Developmental Harm).

Exemplar 3: "I have followed the advice of the APA on limiting screen time—including no screen time before 2 years of age" (parent of 27-month toddler, case 57). This response was representative of those that cited policies or rules adopted and/or established by the family to explain their restrictions placed on their child's use of MSDs (category: Family Policy).

The following response are exemplars of the Positive MSD Beliefs theme.

Exemplar 1: "There are some educational games available, but I find the biggest benefit is having the children stay in one place entertaining themselves when I need to focus my attention elsewhere. Like when I'm cooking dinner" (parent of a 23-month toddler; case 85). This example represents a range of responses where the utility of child MSD use rendered some benefit to the parent or family (Category: Parent/Family Benefit).

Exemplar 2: "Technology is a reality of our time…I feel that denying him the ability to know how to use it is doing him a disservice. I don't want him left out of his peer groups because he doesn't know how, it's hard enough being a kid" (parent of 25-month toddler, case 112). This example reflected parents' anticipation of their child's social and identity development anticipated for the development of satisfying peer relationships. (Category: Child Development).

Exemplar 3: "Increased fine motor skills, comfort learning from and adapting to new technology as it becomes available, faster acquisition of basic reading and math skills" (parent of 22-month toddler, case 24). A range of responses identified general or specific benefits to child learning or school-related aides, as this extract represents (Category: Child Learning).

Exemplar 4: "Eventually…she will have a cell phone so she can call 911 and call home for safety reasons" (parent of 22-month toddler, case 88). This response reflects parents' intention of providing their child with an MSD for the benefits of communication as the child becomes more independent (Category: Parent/Family Benefit).

Exemplar 5: "Keeping up on the use of technology and engage with peers and prepare for the workforce when ready to work" (parent of 5-month infant; case 128). This response represents a long-range, future-oriented view of the benefits of the child becoming digitally literate by using MSDs (Category: Child Learning).

Correlations of Home-visit Data. To provide further understanding of the relationship between factors of the home environment and MSDs, a correlational analysis was conducted on the relationship between factors of the family (IT-HOME scores, Family MSDs, Family Size, Maternal and Paternal Education, and Child Development Knowledge—which were the variables available that were similar as for the correlations with the questionnaire data) with MSD product evaluation scores. As summarized in Table 22, there were significant inverse

associations between IT-HOME scores and evaluations of the Infant Tablet and Toddler App, between Maternal Education with evaluations of the Infant Tablet and Electronic Toy, and a significant positive correlation between Family Size and evaluation of the Electronic Toy. Higher maternal education and higher scores on the IT-HOME scale were associated with negative evaluations of child-directed MSDs and parents of larger families more positively evaluated the electronic toy.

Table 22

Correlations Between Parents and Family Factors and Child MSD Evaluations

Variable	Infant Tablet	Toddler App	Electronic Toy
IT-HOME score	-.45*	-.43**	-.03
Maternal Education	-.54 **	-.29	-.43*
Paternal Education	-.21	-.12	-.26
Family MSDs	-.16	-.01	-.21
Family Size	.15	-.04	.51*
Child Development Knowledge	.09	.18	-.13

*$p \leq .05$ **$p \leq .01$

Analysis of Home-visit Interview. Parent thoughts and opinions regarding MSDs were obtained from two components of the interview. A general question, "What 2 or 3 things do you worry about most when it comes to raising your child?" generated responses with multiple references to technology. In addition, a specific question asked parents to give their reasons for their MSD product evaluations as described in Methods. A thematic analysis was conducted on each set of responses to these two questions separately to provide further insight into parent beliefs related to MSDs.

Concerns raising children. Three themes emerged that reflected parent child-raising concerns as more or less proximal to the child at the time of the Home Visit.

The Child Theme contained categories of codes that represented parent concerns most proximal to the child. Exemplar: "We are really concerned about her tantrums when we remove

the iPad …doesn't seem normal" (mother of 20-month infant). This example was considered to reflect a present concern regarding the child's behaviour with MSDs (Category: Child Development).

The Parent/Family Theme contained categories slightly removed from the child but still within the child's microsystem (family). Exemplar: "I worry about them developing a character of instant gratification and life that's 'all about me" (mother of a 13-month infant with older siblings). This response was considered reflective of parental sense of responsibility in how parents might structure the home environment to restrict and/or control their child's access to, and use of, new technologies (Category: Responsibility).

The Community Theme contained three categories of responses that reflected concerns of the world beyond the family microsystem, whether presently or anticipated in the future. Taken together, the analysis demonstrated that whether the concerns that parents have about child-raising result from direct experiences with new technologies or are attributed to the broader society, they are thinking about them in the present as they organize their family and parenting practices. Therefore, these concerns form part of the child's most proximal environment.

Exemplar of a present concern: "We worry about the impact of technology and media on play at this age" (parents of 18-month toddler, Category: General Technology).

Exemplar of future childhood concern: "What will he be exposed to? For example social media, or cyberbullying" (parents of 25-month toddler, Category: Online Safety).

Exemplar of future societal concern: "The kids are screwed! ...They're all getting stupider, we're all getting stupid *en masse*. And it's all so superficial" (father of 20-month toddler, Category: Humanity/Citizenship).

MSD product evaluations. Following Thematic Analysis, the valence of the coded data within each category for parent reasons for their evaluations of child MSDs lent themselves rather well to three themes: Negative MSD Evaluations, Positive MSD Evaluations, and Neutral MSD Evaluations. Exemplars for each theme are reported in rough proportion to the responses received.

The Negative MSD Evaluation theme included responses in all six categories (child age, comparison to 'real' MSD, development/health, play value, parent appeal, family policy) and to all three child-directed mobile devices (infant tablet, toddler smartphone app, electronic toy). Respondents were overwhelming negative in their ratings of the infant tablet and the toddler smartphone app. Some examples include: "I don't want my child plugged into one device—I don't want a screen addict" (father of 22-month toddler, referring to the infant tablet, Category: Development/Health); "We don't use apps for him or let him use our devices (mother of 28-month toddler, referring to the smartphone app, Category: Family Policy); and "I dislike plastic [and] it has irritating tech sounds and very limited child control" (mother of 18-month toddler, referring to the electronic toy, Category: Parent Appeal).

The Positive MSD Evaluation theme included significantly fewer responses overall and generally were attributed to the electronic toy. Responses were from only three categories (development/health, play value, parent appeal) and for all three child-directed mobile devices. Examples include: "It's easy to use on the go" (mother of 13-month infant, referring to the infant tablet, Code: Parenting Aide, Category: Parent Appeal); "The music is catchy and upbeat" (mother of 18-month toddler, referring to the smartphone app, Code: Fun/Entertainment, Category: Parent Appeal); and "It offers early concepts—colours, cause and effect, turn-taking"

(parents of 20-month toddler, referring to electronic toy, Code: Learning Aide, Category: Development/Health).

The Neutral MSD Evaluation theme included a few responses where the reasons reported for MSD evaluations were non-committal or gave both positive and negative reasons for the answers related to these devices as good for the child and/or the decision to purchase the product. Examples relate to three categories (development/health, play value, parent appeal) and for all three child-directed devices: "It increases access and reliance on tech versus non-tech…influences attention span and sedentary effects. On the other hand, they will need to use tech in school so may develop some competency (father of 32-month toddler, referring to the infant tablet, Code: No/Cancelled Effect, Category: Development/Health); "It's similar to what we have" (mother of 20-month toddler, referring to the smartphone app, Code: Okay, Category: Parent Appeal); and "There's no harm, no benefit. I probably wouldn't buy it but it would be OK as a gift" (mother of 21-month toddler, referring to the electronic toy, Code: No/cancelled effect, Category: Development/Health).

Research Question 2: How Parent Knowledge and Beliefs Relate to Provision of MSDs to Children

To answer Research Question 2, questionnaire data was used. Hierarchical logistic regressions were conducted separately for four of the reasons parents gave for giving MSDs to their children (to occupy them, for videochat, to teach them, to calm them). As noted above, only these four outcome variables (out of eight) were examined due to the small number of parents indicating that they gave their children devices for the other reasons (to develop fine motor skills, to help them sleep, for therapeutic reasons). For each logistic regression, in Block 1 child age (over versus under 2 years of age) and gender were entered as covariates. In Block 2, parent

socio-demographics were entered as covariates (Maternal Education, Maternal Age, Parent MSDs[1]). In Block 3, parent cognition variables were entered: Parenting Sense of Competency (PSOC), Knowledge of Development (KIDI), and positive and negative attitudes towards children using MSDs (Positive MSD Belief, Negative MSD Belief). In Block 4, the interactions of Child Age, Parent MSDs, and Maternal Education with each of the parenting belief variables were explored (11 variables in total), however only three interaction effects were explored at a time (all the Child Age interactions, then the Parent MSD interactions, and finally, the Maternal Education interactions). Interaction effects are reported in the tables that follow only where significant.

For the first outcome, to occupy the child, as can be seen in Block 1, Table 23, parents were 4.77 times more likely to report giving a child an MSD to occupy them if the child was two years old or more (Wald test = 33.35, $p < .001$; overall model significance: $X^2(2) = 36.01$, $p < .001$). In Block 2, the higher the Maternal Education and the more Parent MSDs, the more likely parents were to report giving an MSD to Occupy their child, 1.39 and 1.61 times more likely, respectively (Wald tests 4.37, $p = .04$ and 18.64, $p < .001$, respectively; overall model significance: $X^2(5) = 63.75$, $p < .001$). In Block 3, the only significant parent belief variable was Parenting Sense of Competence (PSOC), which was inversely related to the outcome, indicating that parents who had a higher sense of competency were less likely to give an MSD to a child to Occupy them (odds ratio = .96; Wald test = 7.67, $p = .01$; overall model significance: $X^2(9) = 77.89$, $p < .001$). In Block 4, the interactions of the three parent cognitive variables with each of Child Age, Parent MSDs, and Maternal Education were explored in separate models. One

[1] Note that Parent MSD Time was not included in these analyses because it was confounded with Parent MSDs

interaction effect was found where the effect of Parent MSDs depended on the level of Positive MSD Beliefs because in interaction, these variables predicted whether or not an MSD was given to the child to Occupy (odds ratio = .86; Wald test=4.53, p=.03; overall model significance: $X^2(13) = 87.05$, $p < .001$). The interaction is presented in Figure 3.

Table 23

Hierarchical Logistic Regression Predicting Provision of Parent MSD to Occupy Child

Variable	*B*	*SE*	*Wald*	*OR*	*95% C.I.*	R^2	ΔR^2
Block 1 Covariates						.17	.17***
(Constant)	-.89	.22	16.97***	.41			
Child age >=23 months	1.56	.27	33.35***	4.77	2.81-8.10		
Female child	.09	.26	.12	1.10	.66-1.84		
Block 2 Parent Factors						.28	.11***
(Constant)	-3.86	.75	26.79***	.02			
Child ge >=24 months	1.67	.29	32.90***	5.30	3.00-9.38		
Female child	.09	.28	.11	1.10	.64-1.89		
Maternal education	.33	.16	4.37*	1.39	1.02-1.89		
Maternal age	.28	.25	1.29	1.32	.82-2.14		
Parent MSDs	.48	.11	18.64***	1.61	1.30-2.00		
Block 3 Parent Beliefs						.34	.04**
(Constant)	-3.42	1.91	3.21	.03			
Child age >=24 months	1.64	.30	29.67***	5.15	2.86-9.29		
Female child	.18	.29	.38	1.20	.68-2.11		
Maternal education	.29	.16	3.25	1.34	.98-1.85		
Maternal age	.24	.26	.89	1.27	.77-2.10		
ParentMSDs	.41	.11	13.47***	1.51	1.21-1.88		
PSOC	-.04	.01	7.67**	.96	.94-.99		
KIDI	.07	.05	1.90	1.08	.97-1.20		
Positive MSD belief	.18	.10	3.37	1.20	.99-1.46		
Negative MSD belief	.17	.13	1.80	1.19	.92-1.53		
Block 4 Interactions						.37	.03
(Constant)	-8.50	5.62	2.28	.00			
Child age >=24 months	1.78	.31	32.00***	5.91	3.20-10.95		
Female child	.23	.30	.60	1.26	.70-2.26		
Maternal education	.36	.17	4.49*	1.43	1.03-1.98		
Maternal age	.20	.26	.57	1.22	.73-2.04		
Parent MSDs	2.11	1.63	1.67	8.22	.34-200.87		
PSOC	.03	.04	.68	1.04	.95-1.12		

Variable	*B*	*SE*	*Wald*	*OR*	*95% C.I.*	R^2	ΔR^2
KIDI	.01	.14	.01	1.01	.76-1.34		
Positive MSD belief	.68	.26	6.85**	1.97	1.19-3.28		
Negative MSD belief	.37	.35	1.26	1.47	.75-2.89		
Parent MSDs x PSOC	-.02	.01	3.53	.98	.95-1.00		
Parent MSDs x KIDI	.02	.04	.21	1.02	.94-1.10		
Parent MSDs x Positive MSD belief	-.15	.07	4.53*	.86	.75-.99		
Parent MSDs x Negative MSD belief	-.08	.10	.64	.92	.76-1.12		

Note. PSOC = Parenting Sense of Competence Scale
Note. KIDI = Knowledge of Infant Development Inventory
Model $X^2(13)=85.39$, $p<.001$*$p \leq .05$; **$p \leq .01$; ***$p \leq .001$

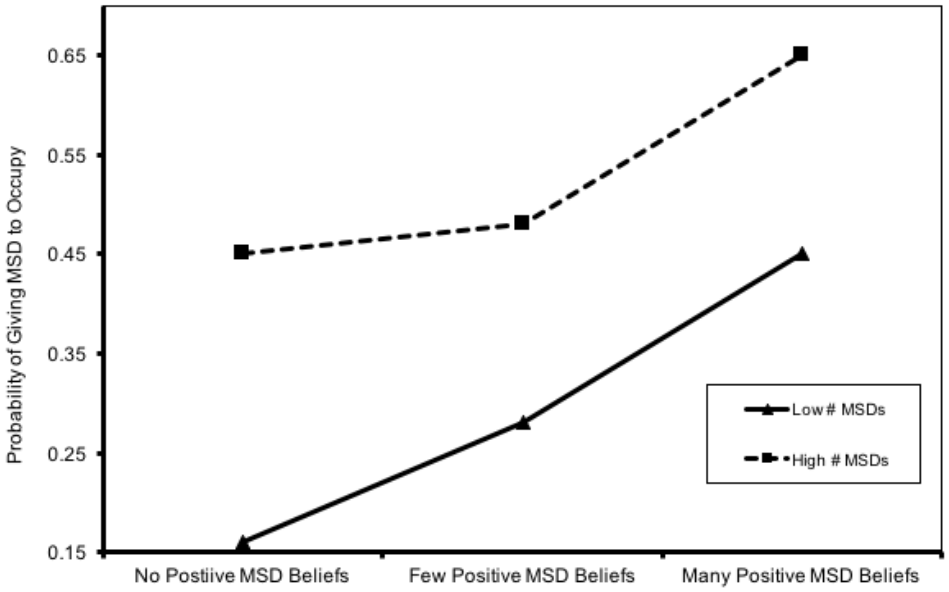

Figure 3. Probability of giving child an MSD to Occupy as a factor of interaction between number of Parent MSDs and three levels of Positive MSD Beliefs.

For the second reason that parents gave for supplying an MSD to a child, to videochat, the results are presented in Table 24. As can be seen in the Block 1, parents were 3.58 times more likely to report giving a child their MSD for Videochat purposes if the child was two years old or older (Wald test = 23.32, $p < .001$; overall model significance: $X^2(2) = 24.63$, $p < .001$). In Block 2, the parent was 1.57 times more likely to report giving an MSD to their

child for Videochat purposes for each additional device owned (Wald test = 18.56, p <.001; overall model significance: $X^2(5) = 46.15$, p <.001). In Block 3, none of the Parent Belief variables were significant predictors of the outcome, nor were there any significant interaction effects between the Parent Belief variables and Child Age, Parent MSDs, or Maternal Education

Table 24

Hierarchical Logistic Regression Predicting Provision of Parent MSD to Child for Videochat

Variable	*B*	*SE*	*Wald*	*OR*	*95% C.I.*	R^2	ΔR^2
Block 1 Covariates						.12	.12***
(Constant)	-.88	.12	16.86***	.42			
Child age >23 months	1.27	.26	23.32***	3.58	2.13-6.00		
Female child	.13	.26	.25	1.14	.69-1.89		
Block 2 Parent Factors						.28	.16***
(Constant)	-2.50	.68	13.64***	.08			
Child age >=24 months	1.32	.28	22.59***	3.73	2.17-6.43		
Female child	.13	.27	.22	1.14	.67-1.93		
Maternal education	-.03	.15	.04	.97	.72-1.30		
Maternal age	.13	.24	.27	1.13	.71-1.81		
Parent MSDs	.45	.11	18.56***	1.57	1.28-1.93		
Block 3 Parent Beliefs						.30	.02
(Constant)	-3.12	1.80	3.01	.04			
Child age >=24 months	1.26	.28	19.95***	3.51	2.02-6.08		
Female child	.20	.28	.52	1.22	.71-2.09		
Maternal education	-.05	.15	.11	.95	.70-1.29		
Maternal age	.10	.24	.17	1.10	.69-1.77		
Parent MSDs	.40	.11	13.59***	1.48	1.20-1.83		
PSOC	-.01	.01	.69	.99	.97-1.02		
KIDI	.05	.05	.87	1.05	.95-1.16		
Positive MSD belief	.17	.09	3.08	1.18	.98-1.42		
Negative MSD belief	.03	.12	.06	1.03	.81-1.30		

Note. PSOC = Parenting Sense of Competence Scale
Note. KIDI = Knowledge of Infant Development Inventory
*Model $X^2(9)=64.08$, $p<.001$; *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$*

For the third reason that parents gave for supplying their MSD to a child, for Teaching purposes, the results are presented in Table 25. As can be seen in Block 1, parents were 3.88

times more likely to report giving a child their MSD to Teach if the child was two years old or more (Wald test = 22.77, p <.001; overall model significance: $X^2(2) = 24.08$, p <.001). As can be seen in Block 2, parents were 1.86 times more likely to report giving their child their MSD to Teach for each additional device owned (Wald test = 26.13, p <.001; overall model significance: $X^2(5) = 58.01$, p <.001). In Block 3, none of the parent belief variables were significant predictors of the outcome. To explore interaction effects while maintaining power, the covariates of Child Gender, Maternal Age, and Negative MSD Belief were removed at this point. Then, three sets of interaction effects (9 variables) were conducted (first the Parent Beliefs with Parent MSDs, then with Maternal Education, then with Child Age). As can be seen in Block 4, the effect of the Parenting Sense of Competence (PSOC) score depended on the level of Maternal Education because in interaction, these variables predicted the likelihood of giving a child an MSD for teaching (odds ratio = 1.04, Wald test = 4.22, p = .04; overall model significance *Model $X^2(9)= 67.76$, p <.001.*). The interaction is presented in Figure 4.

Table 25

Hierarchical Logistic Regression Predicting Parent Provision of MSD to Teach Child

Variable	*B*	*SE*	*Wald*	*OR*	*95% C.I.*	R^2	ΔR^2
(Constant)	-1.63	.25	41.69***	.20			
Child age >=24 months	1.36	.28	22.77***	3.88	2.22-6.76		
Female child	.18	.28	.40	1.20	.69-2.09		
Block 2 Parent Factors						.28	.16***
(Constant)	-4.65	.83	31.32***	.01			
Child age >=24 months	1.44	.31	21.65***	4.21	2.30-7.72		
Female child	.25	.31	.65	1.28	.70-2.34		
Maternal education	.14	.17	.69	1.16	.82-1.62		
Maternal age	.29	.27	1.13	1.34	.78-2.29		
Parent MSDs	.60	.18	26.13***	1.86	1.44-2.28		

Variable	*B*	*SE*	*Wald*	*OR*	*95% C.I.*	R^2	ΔR^2
Block 3 Parent Beliefs						.30	.02
(Constant)	-1.90	1.97	.94	.15			
Child age >=24 months	1.43	.32	20.38***	4.20	2.25-7.82		
Female child	.27	.32	.74	1.31	.71-2.43		
Maternal education	.13	.18	.54	1.14	.81-1.61		
Maternal age	.31	.28	1.21	1.36	.79-2.34		
Parent MSDs	.54	.12	19.90***	1.72	1.36-2.18		
PSOC	-.03	.02	2.80	.98	.95-1.00		
KIDI	-.04	.06	.48	.96	.86-1.08		
Positive MSD belief	.17	.10	2.72	1.19	.97-1.45		
Negative MSD belief	.01	.14	.01	1.01	.78-1.32		
Block 4 Maternal Education Interactions							
(Constant)	9.15	6.54	1.96	9441.51			
Child age ≥24 months	1.49	.32	21.76***	4.45	2.38-8.33		
Maternal education	-3.43	2.21	2.41	.03	.00-2.46		
Parent MSDs	.55	.12	19.70***	1.73	1.36-2.20		
PSOC	-.14	.06	5.73*	.87	.79-.98		
KIDI	-.14	.19	.59	.87	.60-1.25		
Positive MSD belief	.40	.31	1.72	1.49	.82-2.72		
Maternal education x PSOC	.04	.02	4.22*	1.04	1.00-1.08		
Maternal education x KIDI	.04	.06	.33	1.04	.92-1.17		
Maternal education x Positive MSD belief	-.09	.10	.71	.92	.75-1.12		

Note. PSOC = Parenting Sense of Competence Scale
Note. KIDI = Knowledge of Infant Development Inventory
*Model $X^2(9)=67.76$, $p<.001$; *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$*

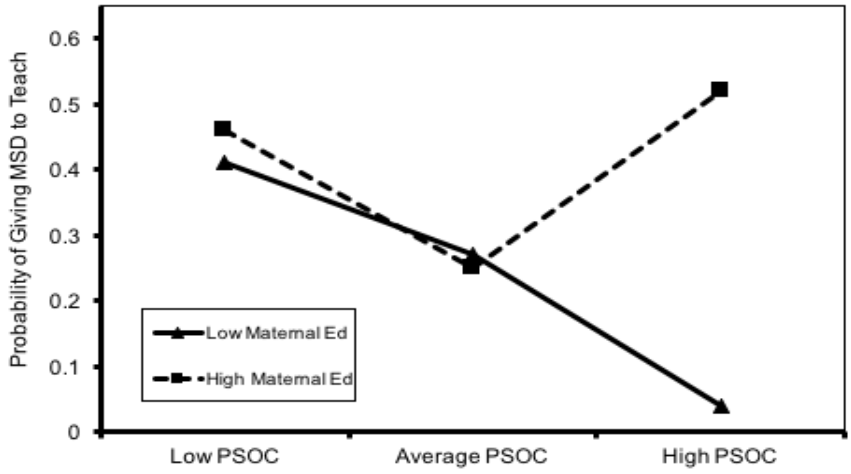

Figure 4. Probability of giving child an MSD to Teach as a factor of interaction between two levels of maternal education and three levels of Parenting Sense of Competence scores.

For the fourth reason that parents gave for supplying their MSD to a child, to Calm the child, the results are presented in Table 26. As can be seen in the Block 1, parents were 2.39 times more likely to report giving a child their MSD to Calm if the child was two years old or more (Wald test = 10.40, p <.001; overall model significance: $X^2(2) = 10.46$, p <.001). As can be seen in Block 2, parents were 1.84 times more likely to report giving their MSD to their child for calming purposes with every additional device they owned (Wald test = 28.33, p <.001; overall model significance: $X^2(5) = 46.81$, p <.001). In Block 3, the only significant parent belief variable was Parenting Sense of Competence (PSOC), which was inversely related to the outcome, indicating that parents who had a higher sense of competency were less likely to give their MSD to calm their child (odds ratio = .97; Wald test 5.95, p = .02; overall model significance: $X^2(9) = 55.70$, p <.001). In Block 4, the interactions of the three Parent Belief variables with each of Child Age, Parent MSDs, and Maternal Education were explored in three separate models (9 variables). Child Gender, Maternal Age, and Negative MSD Beliefs were

removed from the model at this point to maintain power. There was one significant interaction where the effect of the number of Parent MSDs depended on the level of Positive MSD Beliefs because in interaction, these variables predicted the likelihood of giving a child an MSD to calm (odds ratio = .84; Wald test = 6.93, p <.01; overall model significance: $X^2(9) = 62.01$, p <.001). The interaction is presented in Figure 5.

Table 26

Hierarchical Logistic Regression Predicting Parent Provision of MSD to Calm Child

Variable	*B*	*SE*	*Wald*	*OR*	*95% C.I.*	R^2	ΔR^2
Block 1						.05	.05**
(Constant)	-1.31	.22	25.22***	.32			
Child age >=24 months	.87	.27	10.40	2.39	1.41-4.07		
Female child	-.09	.22	.11	.91	.54-1.55		
Block 2						.23	.18***
(Constant)	-3.97	.77	26.57***	.02			
Child age >=24 months	.90	.29	9.37**	2.46	1.38-4.38		
Female child	-.08	.29	.08	.92	.52-1.63		
Maternal education	.20	.17	1.46	1.22	.88-1.69		
Maternal age	.12	.26	.23	1.13	.68-1.88		
Parent MSDs	.61	.12	28.33***	1.84	1.47-2.31		
Block 3						.26	.03
(Constant)	-1.52	1.92	.63	.22			
Child age >=24 months	.90	.30	8.77**	2.46	1.36-4.46		
Female child	-.09	.30	.09	.91	.51-1.64		
Maternal education	.18	.17	1.18	1.20	.86-1.67		
Maternal age	.11	.27	.18	1.12	.66-1.88		
Parent MSDs	.60	.12	24.32***	1.80	1.43-2.28		
PSOC	-.04	.01	5.95*	.97	.94-.99		
KIDI	-.01	.06	.03	.99	.89-1.10		
Positive MSD belief	.04	.10	.14	1.04	.86-1.26		
Negative MSD belief	.22	.13	2.77	1.24	.96-1.61		

*Model $X^2(9)=55.70$, $p<.001$; *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$*

Variable	*B*	*SE*	*Wald*	*OR*	*95% C.I.*	R^2	ΔR^2
Block 4 Parent MSD Interactions							
(Constant)	-2.00	5.76	.12	.14			
Child age >=24 months	.98	.31	10.18***	2.67	1.46-4.89		
Maternal education	.23	.17	1.85	1.26	.90-1.74		
Parent MSDs	.89	1.58	.31	2.43	.11-53.75		
PSOC	.00	.04	.01	1.00	.92-1.09		
KIDI	-.13	.15	.71	.88	.66-1.18		
Positive MSD belief	.69	.27	6.48*	2.00	1.17-3.40		
Parent MSDs x PSOC	-.01	.01	.94	.99	.97-1.01		
Parent MSDs x KIDI	.03	.04	.77	1.03	.96-1.17		
Parent MSDs x Positive MSD belief	-.18	.07	6.93**	.84	.73-.96		

Note. PSOC = Parenting Sense of Competence Scale
Note. KIDI = Knowledge of Infant Development Inventory
*Model $X^2(9)=62.01$, $p<.001$; *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$*

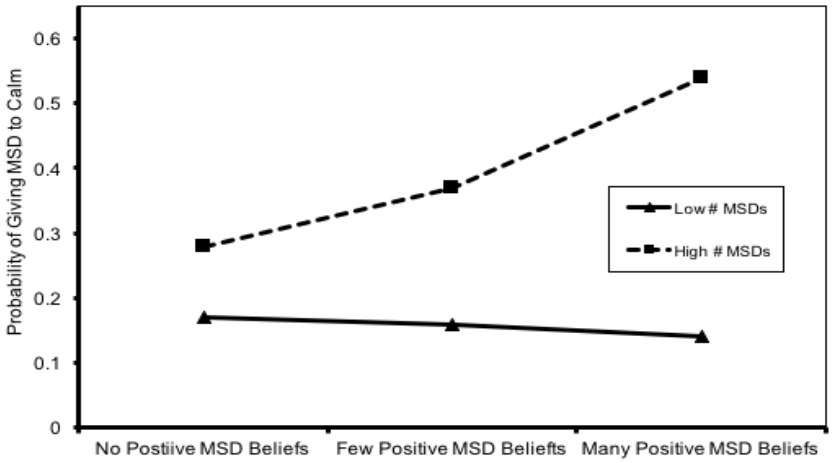

Figure 5. Probability of giving child an MSD to Calm as a factor of interaction between number of Parent MSDs and three levels of Positive MSD Beliefs.

Research Question 3: How Parent Knowledge and Beliefs Relate to Infant-Toddler Use of MSDs

Questionnaire data were used to answer Research Question 3. Two hierarchical regressions—one logistic and one linear--were conducted to predict child use of MSDs. The first

(logistic) regression used a binomial variable representing whether the child used MSDs or not. For the second (linear) regression, for children who spent time using MSDs, the outcome was the parent-reported daily average number of minutes the child spent on MSDs. As there was strong collinearity between the Family MSDs and Parent MSD Time, the covariates were placed in separate blocks to allow for the examination of the effects of Parent MSD Time (a parent factor) after controlling for the effects of Family MSDs (a factor of the home environment). For each of the two regressions, in Block 1, Child Age, Child Gender, and Family MSDs were entered as covariates. In Block 2, parent socio-demographics were entered as covariates (Maternal Education, Maternal Age, Parent MSD Time). In Block 3, Parent Belief variables were entered: Parenting Sense of Competence (PSOC), Knowledge of Development (KIDI), and positive attitude towards child MSD use (Positive MSD Belief). For each regression, interaction effects between the Parent Belief variables and each of Child Age, Maternal Education, and Family MSDs were explored in Block 4, but none were significant and are therefore not reported.

Child MSD Use. The results of the logistic regression exploring the factors that predict whether the child was an MSD user (versus non-user) is presented in Table 27. In Block 1, children were 5.95 times more likely to use MSDs when they were two years of age or older (Wald test = 32.62, $p<.001$) and 1.26 times more likely to use an MSD for each additional MSD present in the home (Wald test = 14.96, p <.001; overall model significance: $X^2(3) = 53.27$, $p <.001$). In Block 2, none of the covariates were significant (overall model significance: $X^2(6) = 57.52$, $p <.001$). In Block 3, for each additional point on the Positive MSD Belief scale, the child was 1.20 times more likely to use an MSD (Wald test = 3.02, $p = .05$; overall model significance: $X^2(10) = 63.64$, $p <.001$). As noted above, interaction effects were explored by way of separate analyses for each set of interaction terms between Parent Belief variables (PSOC, KIDI, Positive

MSD Beliefs, Negative MSD Beliefs) and demographic factors (Child Age, Maternal Education, Parent MSD Time, and Family MSDs), with none being significant.

Table 27

Hierarchical Logistic Regression Predicting Infant-Toddler MSD Use

Variable	*B*	*SE*	*Wald*	*OR*	*95% C.I.*	R^2	ΔR^2
Block 1 Covariates						.25	.25***
(Constant)	-1.66	.43	14.96	.19			
Child age ≥24 months	1.78	.28	32.02***	5.95	3.21-11.03		
Female child	.20	.28	.50	1.22	.71-2.10		
Family MSDs	.23	.43	14.96***	1.26	1.12-1.42		
Block 2 Parent Factors						.26	.01
(Constant)	-2.49	.72	11.93***	.08			
Child age ≥24 months	1.80	.32	31.82***	6.06	3.24-11.33		
Female child	.12	.28	.19	1.13	.65-1.97		
Family MSDs	.18	.07	7.86**	1.20	1.06-1.37		
Maternal education	-.01	.16	.00	1.00	.73-1.36		
Maternal age	.37	.25	2.14	1.44	.88-2.35		
Parent MSD time	.00	.00	2.79	1.00	1.00-1.00		
Block 3 Parent Beliefs						.29	.01
(Constant)	-3.09	1.89	2.68	.05			
Child Age ≥24 months	1.75	.33	28.93***	5.77	3.05-10.93		
Female Child	.17	.29	.35	1.19	.67-2.09		
Family MSDs	.16	.07	5.57*	1.17	1.03-1.34		
Maternal Education	-.01	.16	.00	.99	.72-1.36		
Maternal Age	.35	.26	1.90	1.42	.86-2.35		
Parent MSD Time	.00	.00	2.32	1.00	1.00-1.00		
PSOC	-.01	.01	.97	.99	.96-1.01		
KIDI	.05	.05	.70	1.05	.94-1.16		
Positive MSD Belief	.18	.10	3.02*	1.20	1.00-1.47		
Negative MSD Belief	.15	.13	1.31	1.16	.90-1.49		

Note. PSOC = Parenting Sense of Competence Scale
Note. KIDI = Knowledge of Infant Development Inventory
*Model $X^2(10)=63.64$, $p<.001$; *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$*

Child MSD Time. The results of the hierarchical linear regression exploring the factors that predict the amount of time a child uses an MSD are presented in Table 28. Note that this analysis only included children who were reported to spend time using MSDs (N=175). The data

was first checked for assumptions of linearity, outliers, collinearity and homoscedasticity, with all conditions being met. As can be seen in Block 1, Family MSDs was a significant positive predictor of Child MSD Time (Beta = .18, $t(3) = 2.27$, $p = .03$); overall model significance was $F(3, 150) = 2.93$, $p < .05$. In Block 2, Maternal Education was a significant negative predictor of Child MSD Time (Beta = -.18, $t(6) = -2.42$, $p = .02$) and Parent MSD Time was a significant positive predictor of Child MSD Time (Beta = .36, $t(6) = 4.66$, $p < .001$). Overall model significance was $F(6, 147) = 6.17$, $p < .001$. In Block 3, Parent Knowledge of Development (KIDI) was a significant inverse predictor of Child MSD Time, in that more accurate developmental knowledge predicted less Child MSD Time (Beta = -.15, $t(10) = -2.00$, $p = .05$; overall model significance $F(10, 143) = 4.54$, $p < .001$). Interaction effects between each of Family MSDs, Parent MSD Time, and Maternal Education with each of PSOC, KIDI, and Positive MSD Beliefs were explored, but none were significant.

Table 28

Hierarchical Linear Regression Predicting Child Time Using MSDs Amongst Child MSD Users

Variables	B	SE B	β	R^2	ΔR^2
Block 1 Covariates				.06	.06*
(Constant)	16.31	30.70			
Child age (months)	1.22	.89	.11		
Female child	20.82	19.59	.08		
Family MSDs	6.79	3.00	.18*		
Block 2 Parent Factors				.20	.15***
(Constant)	-2.08	49.50			
Child age (months)	1.46	.84	.13		
Female child	24.52	18.23	.10		
Family MSDs	3.08	2.92	.08		
Maternal education	-26.32	10.87	-.18*		
Maternal age	2.48	16.50	.01		
Parent MSD time	2.01	.43	.36***		

Variables	B	SE B	β	R^2	ΔR^2
Block 3 Parent Beliefs				.24	.04***
(Constant)	277.19	116.67			
Child age (months)	1.67	.85	.15*		
Female child	21.50	18.08	.09		
Family MSDs	2.69	2.95	.07		
Maternal education	-25.92	10.92	-.18*		
Maternal age	3.30	16.41	.02		
Parent MSD time	1.91	.43	.34***		
PSOC	-1.15	.84	-.10		
KIDI	-6.89	3.44	-.15*		
Positive MSD belief	3.07	5.69	.04		
Negative MSD belief	-2.79	7.70	-.03		

Note. PSOC = Parenting Sense of Competence Scale
Note. KIDI = Knowledge of Infant Development Inventory
*$p \leq .05$, **$p \leq .01$, ***$p \leq .00$

Chapter Summary

Utilizing a mixed methods approach to analyze data obtained from an online parent questionnaire (primarily numerical, limited text) and from observations and interviews with families during Home Visits (primarily text, limited numerical), the results of statistical and thematic analyses may be summarized as follows.

Results showed that the home environments for infants and toddlers in this sample were replete with MSDs—the average home reported six mobile devices and parents used these devices for an average of just under seven hours per day. Infants and toddlers did not necessarily directly use MSDs as 40% of respondents reported no child time engaged with mobile devices. The primary method by which children accessed MSDs was through parent provision of their device, which was done for several reasons, most commonly to occupy or distract a child while the parent attended to other matters, followed by to videochat, to calm a child, and for teaching purposes.

Results further showed that likelihood of parents providing their MSD to their child for each of four purposes was predicted by different combinations of factors of the child (age), home environment (number of parent MSDs), parent demographic factors (maternal education), and parent knowledge and beliefs (positive beliefs in MSDs for children). Whether a child used MSDs or not was predicted by factors of the child (age), the home environment (number of family MSDs), and parent knowledge and beliefs (positive beliefs in MSDs for children). Amongst children reported to spend time using MSDs, the amount of time (above or below the mean) was predicted by factors of the home environment (number of of family MSDs), parent behaviour (parent MSD time), parent demographics (maternal education), and parent knowledge and beliefs (knowledge of development as per KIDI scores).

Lastly, results showed that the families with infants and toddlers that participated in this study held more negative than positive views about the impact of new technologies on their child's development, their family, and the world in which they are to raise their children. These results are discussed in detail in the Discussion chapter that follows.

CHAPTER 5

DISCUSSION

The primary objective of this study was to gain an understanding of the impact of mobile screen devices (MSDs) in the family context as the first developmental environment for infants and toddlers. There were four inter-related findings. First, even when accounting for child and parent factors, parent knowledge and beliefs (positive beliefs in MSDs for children, parenting sense of competence, knowledge of development) predicted the reasons for which parents provided MSDs to their child, whether the child used MSDs, and if so, how much time a child spent using MSDs. Second, infants and toddlers gained access to MSDs primarily to the extent that parents made their mobile devices available to them, and the data on child use of MSDs was bimodal (60% of children used MSDs and 40% did not). Third, select child and parent sociodemographic factors (child age, maternal education, number of parent and family MSDs) and parent behaviour (parent MSD time) also predicted child access to and use of MSDs. Finally, parents reflected on how rapid technological change has placed new demands upon them as they raise their child(ren) born into the Digital era. The four components of the child's microsystem environment that were outlined in Chapter 1 are now used to roughly organize the discussion of findings that follow, however, they are presented in reverse order, from most to least proximal within the infant's microsystem of the family. A fifth component discusses contextual influences that arguably may emanate from beyond the child's microsystem but may also form the climate in the immediate developmental environment in relation to their effects on infant caregivers.

MSDs in Psychological Environment (Parent Knowledge and Beliefs)

Parent knowledge and beliefs influence infant-toddler MSD use. Various dimensions under the broad umbrella of parent knowledge and beliefs were found to have direct influences on infant-toddler access to and use of MSDs. While only modest links have been found between parental attitudes and general childrearing practices (Holden & Buck, 2002), there is stronger evidence for congruence between parenting behaviours and in the areas of socialization practices with young children (e.g., Grusec, 2002; Miguel et al., 2009; Murphey, 1992), including specifically with respect to media and educational technology (Garrison & Christakis, 2005; Gutnick et al., 2011; Lauricella et al, 2015; Postman, 1994; Rideout, 2011; Rideout et al., 2003; Schlembach & Johnson, 2014; Vandewater et al., 2007, 2005).

Positive MSD Beliefs. The responses to the open-ended questions about parents' perceptions of the positive aspects of their child's use of MSDs were combined to provide a construct of positive MSD beliefs. The link between parental positive beliefs in early technology use and actual child access to MSDs was demonstrated where positive beliefs in MSDs increased the probability of a child using MSDs at all. Positive MSD beliefs also predicted a likelihood for parents with more than three MSDs to use their device to occupy, distract, or calm their child. This finding suggests that, with positive beliefs in MSDs for young children, owning several devices may facilitate the generation of short periods of time where the child is engaged with a device while the parent attends to other tasks. Consistent with emerging research, keeping a child occupied with an MSD in order to do something else is the most commonly reported reason for parents to give their mobile device to their child (AAP, 2015). An example of how multiple devices *de facto* occupy or calm a child was reported by the parent of a 33-month old in explaining the reasons for making devices available to the child: "…to keep her from being

bored, and to keep her from getting into everything and destroying the house" (case 209). The contribution of positive beliefs in MSDs to differential access and use of MSDs by infants and toddlers is consistent with existing literature on parent provision of materials and activities considered age-appropriate for the child (Bradley, 2009; Duncan et al., 1994; Neuman & Celano, 2001; Sigel, 1992; Smith et al.,1997), including provision of traditional and mobile screen devices (Lauricella et al., 2015).

Negative MSD Beliefs. Text-based responses on the questionnaire also gauged parents' negative perceptions attributed to their child's use of MSDs, and were combined to create a construct of negative MSD beliefs. However, negative MSD beliefs held no significant predictive power in terms of the likelihood of a child using MSDs or of a parent providing their MSD to their child for any specific purpose. Within the home visit subsample, negative MSD beliefs were expressed in parents' negative evaluations of the infant tablet (71%) and the toddler Smartphone 'app' (57%), despite advertising claims. In fact, of the 28 families in the Home Visit group, 22 specifically referred to the superiority of parent-child interaction and children's real-world experiences to the products' promised benefits for development or learning. One mother of two stated: "these are just designed to sell and get dollars—everything can be done directly with the child" (case 103). Another mother of two stated: "it's a cop-out—everything we can do ourselves. It's too directive, too constrained" (case 123).

While positive beliefs in MSDs predicted child use of MSDs, it was somewhat surprising that the reverse effect was not found. Most of the sample (85%) had a score on the Negative MSD Beliefs scale, yet only 40% of children were reported to not use MSDs at all. Given the strong relationship between parent provision of their MSD and reported child use of MSDs, it would seem that some of the children in this sample were accessing MSDs in other ways than by

direct parent provision. Less direct forms of child MSD access and use may be accounted for by children who had their own dedicated MSD and/or who accessed siblings' or other family members' devices. Therefore, negative MSD beliefs alone may be sufficient to restrict parents' direct provision of their MSD to their child but may be insufficient to restrict child access to and use of devices in more indirect ways. This pattern of influence might also be explained by the need to be motivated (through belief in the value of MSDs as a toy or learning material) to make devices available to the child or to bring into the home toy versions of MSDs (Bradley et al., 1989; Duncan et al., 1994; Neuman & Celano, 2001; Smith et al., 1997). Negative beliefs in MSDs may counteract the motivation required to produce parent behaviour that directly provides a young child with an MSD through parent-child interaction but does not necessarily preclude child use of MSDs via other means.

Knowledge of development. As an important element of general parenting quality (NICHD, 2006), parent knowledge of early development is known to shape the types of experiences to which young children have access, the quality of the home environment, and expectations of child capacities (e.g., Bornstein et al., 2010). More accurate developmental knowledge has been related to a higher level of parenting skills (e.g., Benasich & Brooks-Gunn, 1996; Oldershaw, 2002; Reich, 2005) that includes providing young children with a wider variety of developmentally appropriate activities (e.g., Huang et al., 2005; Zolotar et al., 2008). Yet, an Invest in Kids' national survey of Canadian parents of young children found that a large majority of parents knew very little about how children grow and develop, with the weakest knowledge in the domain of social and emotional development of young children (Oldershaw, 2002).

In the current study, parent knowledge of development was measured in two ways. In this study, a reduced portion of the The Knowledge of Infant Development Index (KIDI) was used to gauge the developmental knowledge of questionnaire respondents. The Home Visit participants estimated the correct age for the development of seven child capacities (toilet-training, understanding simple instructions, sharing and turn-taking, controlling emotions, feeling good or bad about oneself, being affected by parent feelings).

Among questionnaire respondents, parent knowledge of development, as measured by the KIDI, was shown to be a significant inverse predictor of the amount of time children spent using MSDs among the 60% of children using MSDs. More specifically, in families where child use of MSDs was reported, children spent more daily time using MSDs when parent knowledge of development was less accurate (low KIDI scores). There are at least two possible explanations for this relationship between more accurate parent knowledge of development and lower child MSD time. First, as accuracy of developmental knowledge increases, parents tend to provide more developmentally-appropriate activities, play with their children in more responsive ways, interact with children in ways that advance development, and have better overall parenting skills (Hess, Teti, & Hussey-Gardner, 2004; Huang et al., 2005; Sanders, & Morawska, 2005, 2014; Sigel, 1992; Tamis-LeMonda, Damast, & Bornstein, 1994), with improved developmental outcomes for high-risk infants (e.g., Dichtelmiller et al., 1992). In an era of mobile devices, parents with more accurate developmental knowledge may emphasize a broader range of manipulative or interactive off-screen experiences, and in so doing, consciously limit the amount of access to and use of MSDs. In fact, many of the reasons parents in the current study offered as negative MSD beliefs cited specific preference for 'real' play activities. Second, parents with more accurate developmental knowledge may minimize risk or otherwise create safety

procedures for what they perceive to be hazards to their child's development, as was shown in a U.S. study regarding improving household toddler safety by improving parent knowledge of development (Zolotar et al., 2008). In the current study, many parents articulated concerns about the risks of technology to their child's developmental wellbeing, with a comprehensive offering from the father of a three-year-old and a newborn infant:

> My wife and I are in the software business, so we are educated, technical people. We recognize that mobile devices are important. However…there is no hurry to introduce them. We actively hide our device usage from our kids. … We also believe that early childhood is better spent exploring and learning about real things through direct experience, not via abstractions on a glowing screen. …[When] we introduced cartoons to our 3-year-old…his behaviour became obsessive, his play became listless and he was whiny. Now he gets 30 minutes every few days as a treat, and he's back to normal….We hope to raise kids free of the obsessive-compulsive behaviour we have observed in ourselves and our peers when it comes to these devices. (Case 129)

Among Home Visit participants, parents were mostly accurate in their knowledge of physical (toilet-training) and cognitive (understanding simple instructions) milestones of development and were mostly inaccurate in their knowledge of social (sharing and turn-taking) and emotional (controlling emotions, feeling good or bad about self, being affected by parent feelings) development. While parent knowledge of development was not significantly correlated with any other measures in the Home Visit group, the data do echo the Invest in Kids survey where accuracy of developmental knowledge was higher with regard to child physical and/or cognitive development and lower for social or emotional capacities (Oldershaw, 2002).

Parenting sense of competence. This study demonstrated that parenting sense of competence (as measured by the PSOC) was negatively related to two of the reasons for which parents reported giving their child their MSD—to teach and to calm. For the purpose of calming a child, increasing scores on the Parenting Sense of Competence scale was associated with decreasing likelihood of providing an MSD to calm a child. For the purpose of teaching, however, high sense of competence (high PSOC scores) had a positive predictive value on the likelihood of a parent providing their MSD only for the most highly educated mothers. For parents with low or average PSOC scores, the likelihood of giving their MSD to their child to teach decreased with rising maternal education status. This means that a child was more likely than not to be given an MSD for teaching purposes only by highly educated mothers with a high sense of parenting competence (combined self-efficacy and parenting satisfaction). Therefore, the effect of parenting sense of competence had different effects on predicting parent provision of MSDs to the child depending on the purpose or the activity for providing the device.

These results are consistent with existing evidence for a synergistic relationship between maternal education and self-efficacy (e.g., Azmoude, Jafarnejade, & Mazlom, 2015; Coleman & Karraker, 2003). As parents with a strong sense of efficacy tend to be more directly engaged in stimulating activities with their children (e.g., Mash & Johnston, 1983; Sanders & Woolley, 2005), and higher maternal education is positively associated with parents providing educational activities (e.g., Hofferth, 2006; Raley, 2007; Shonkoff & Phillips, 2000), the results of the current study may be interpreted as highly educated mothers with a strong sense of parenting self-efficacy consider mobile devices more as interactive tools beneficial for specific teaching goals (Hart & Risley, 1995; Landry, Smith, & Swank, 2006; Rogoff, 1990) and less as mobile television viewing screens (Laureau, 2003).

To further understand the complex role of parenting sense of competence in shaping the family context for infant and toddler development, some researchers have examined the link between parent self-efficacy (a component of the PSOC measure) and sources of social support, whether formal, such as professional service providers or support groups, or informal, such as family members or peers (Chislett & Kenett, 2007; Hoven, 2012; Jackson, 2009; Suzuki et al., 2009). Parent-identified sources of support may be proximal (persons they interact with) or more distal (online or print media). In the present study, parents identified how often they turned to a variety of supports. Consistent with previous research (e.g., Elliott, 2007; Guralnick et al., 2008; Leahy Warren, 2005), Canadian parents in this study consider their partners, family (especially elders), and friends to be their most frequently accessed supports (54% accessed often), although online sources of support (mass media) were gaining in popularity (33% accessed often). Inconsistent with previous research, however, this study did not find a significant relationship between sources of support and parenting sense of competency, however, significant correlations were found between sources of support and parent knowledge of development. Frequent use of Media as a Source of Support was positively associated with parent Knowledge of Development (as measured by the KIDI) and frequent use of Professionals as a Source of Support was associated with the number of Child Development Education courses completed (as distinct from parent education level).

Parent comments from Home Visits provided a more nuanced understanding of how different sources of information and support provide parents with different forms of support. This subset of parents indicated that they tended to rely on their family and peers for emotional support in parenting (both in person and via social media) and turned to mass media (books and specific websites) and professionals (45% accessed often) more for information regarding child

health or development. One father of a 28-month old toddler exemplified how different sources were supportive for different purposes: "Other parents are reassuring. The doctor is only useful for medical issues. I also like specific website for information, such as WebMD, BC Public Health, and government and educational facilities' sites" (case 128). Given the links between parent perceived sources of information and support and parenting knowledge, beliefs, and practice, further research is indicated to better tease apart how parents perceive their support systems in an era of social media and blurred distinctions between online and offline expertise. To date, one of the only studies completed to explore the effects of social media (Facebook) support found that adjusting to parenthood could be either facilitated or hindered depending on who was part of the new parents' social network and how frequently new parents engaged with their online network (Bartholomew et al., 2012).

Intentions. Parent beliefs were also examined from the perspective of prospective thinking about child use of MSDs. The average age that parents in this study believed to be suitable for their child to have his or her own MSD was 10 years. The range was from 2 to 18 years as the question did not specify the type of MSD. Some respondents, such as the parent of a 32-month-old, reported different ages as appropriate for different devices, exemplifying the complexity of the topic under consideration for today's parents:

> "When they can afford them themselves (phones), when they need them for school (laptop) university?, game player—when they're old enough to play video games, hmmm maybe intermediate grades—5 or 6?, tablet—use the family one." (Case 245)

A general trend was observed in the parent comments regarding the appropriate age for their child to have their own mobile device. Cellphones were considered most appropriate for teenagers, laptops were seen as most suitable when required for school work, and tablets and

gaming devices were more likely to be considered acceptable at younger ages. As articulated by the parent of a 26-month old: "…depends on the device…1st [sic] device will be an e-reader/tablet around age 4/5" (case 170). Indeed, infants and toddlers who already owned their own MSDs were more likely to own tablets (in child or adult versions) and child versions of cellphones or handheld gaming devices. Parent reasoning for the benefits of young children having dedicated MSDs was exemplified by a parent of an 18-month-old with three child versions of MSDs (smartphone, tablet, laptop): "…learning, i.e. shapes color etc…learning about technology build skills for 'real' devices" (case 117).

MSDs in Context of Parenting Behaviour

Infant-toddler access to MSDs. A primary finding of this study was that infant-toddler use of MSDs was mostly predicated upon parental provision of devices to the child. This study found that 60% of Canadian families reported their young child used a mobile device, whether passively (e.g., to listen to music), actively (e.g., to engage with an app game), or interactively (e.g., to videochat with an absent family member). Although some MSD use for children in this age group has been the result of MSDs being placed in spaces dedicated to them (e.g., a tablet placed in a crib) or in the broader home environment (e.g., access to an older siblings's device), in this study most infant-toddler use of MSDs was the result of parents directly giving a device to their child for a purpose.

The four most common reasons given for parents making their devices available for child use were to occupy or distract the child while attending to another task, to communicate with absent family members (videochat), to teach the child (educational apps), and to calm a fussy or upset child. Less commonly reported reasons for giving a young child an MSD included to help the child sleep, to develop fine motor skills, and as part of a therapeutic protocol. These

common purposes for parent provision of MSDs to very young children corresponded to often emotionally-charged anecdotal reports, news media reports, and social media dialogue regarding modern parenting (e.g., Cowan, 2015; Knapton, 2015; Tsavliris, 2013). However, in this study, the probability of children being provided with their parent's MSD varied with unique combinations of predictive factors, as already discussed.

MSDs in Relation to Sociodemographic Factors

Child age. The factor that was demonstrated to have the most consistent influence on infant-toddler MSD use was the child's age. Parent provision of MSDs to children for the four purposes examined ranged from almost three times to almost six times more likely for children two years of age or older. Two-year-old children were also over six times more likely to be spending time using MSDs than younger children. These findings suggest that many parents may be acting on the recommendations of the AAP and/or want to delay a child's direct experience with MSDs until later in childhood. Indeed, the reasons given for restricting early MSD engagement included developmental concerns (including mental health concerns) and considerations of the social implications during this formative period of socialization. Another possibility is that children at two years of age are more physically and cognitively capable of using and benefitting from handheld devices. Newly emerging research and anticipated revisions to the AAP's recommendations in light of interactive touchscreen functions tentatively support the conditional use of MSDs with toddlers (Brito, Barr, McIntyre, & Simcock, 2012; Brown et al., 2015; Christakis, 2014; Dayanim & Namy, 2015; Eagle, 2012).

Maternal education. The only parent sociodemographic factor that had a predictive effect on infant-toddler access to and use of MSDs was maternal education. However, this effect

was limited to one reason for parent provision of their MSD to their child and was observed only for highly educated mothers who also had high parenting sense of competence.

Parent time using MSDs. The extent to which parents use their MSDs had a significantly positive predictive effect only on the amount of time the child uses MSDs amongst the 60% of children where use of MSDs was reported. Parent time using MSDs accounted for 14% of the variance in child time using MSDs. That infants and toddlers spend more time using MSDs where parents spend more time using MSDs reinforces the power of parent modeling of behaviour. For example, the parent of an 8-month-old explained her child had an infant tablet to "pretend to be an adult like make believe like I did as a kid" (case 167). This is consistent with the literature regarding other technology, such as television viewing (Bleakley et al., 2013; Sigman, 2012a), and with theories of adults as primary models of behavioural learning (Anderson et al., 1996; Derrick, 2013; Leung, 2007; Meltzoff, 1999). As noted by the parent of a 13-month-old: "My son is interested in my phone and tablet so I figured I'd get an educational version of each that he could play with" (case 179).

Number of MSDs in family homes. The number of parent-owned MSDs was a significant predictor of parents providing their MSD to a child: 50% more likely for videochat, 60% more likely to occupy a child, 70% more likely for purposes of teaching, and 80% more likely to calm a child. However, the number of parent MSDs was a main predictor only for videochat and teaching purposes. As noted above, for purposes of occupying or calming a child, the effect of more devices was only seen in interaction with high positive MSD beliefs. For these two purposes, the number of parent-owned MSDs did not increase the likelihood of parents giving their child an MSD if they reported few or no positive beliefs in MSDs for young children.

The number of MSDs in the home was a significant predictor of child MSD use. For every additional MSD in the home, there was a 20% rise in the likelihood of an infant or toddler using any device. Multiple MSDs in the home may allow young children greater access either as devices are installed in ways that children may easily use them (e.g., a screen device attached to an infant's crib), more devices in the homes of larger families (e.g., access to an older sibling's MSD), or as devices are increasingly passed down when adults upgrade to new ones. A survey by PBS KIDS Lab (2011) found that 25% of parents surveyed reported their intention to pass down their mobile devices to their children. In the present study, several participants identified the reason for the child having their own MSD was as the result of a 'pass-down: "We gave the kids an old iPad that we disable the Internet" (parent of 11-month-old, case 185); "We had an extra smartphone so we let her use it as hers" (parent of a 2-year-old, case 83); "My husband bought a new one, and gave his old one to her" (mother of a 13-month-old, case 214); and "We have a very old, otherwise unused laptop. We let our child use it for digital drawing, writing, and watching videos" (parents of a 34-month old, case 152).

First with television (Bleakley, 2012; Sigman, 2012a), then with computer technology (Gentile & Walsh, 2002), it has become accepted practice to understand children's differential access to, and use of, media and technology as based on a cluster of socio-demographic factors—most notably, family income and/or parent (mostly maternal) education and/or ethnic minority status (more common in U.S. studies). In many studies with older children, gender has also been a factor in the types of activities or content that children engage in on computers or with television (e.g., Sigman, 2012a, 2012b). While such studies have considered parent media behaviour, or the technological devices available in the home, very few have considered the role of parent thinking or beliefs regarding child use of technology at different stages of development.

In this work, we found that apart from child age, few socio-demographic factors played a significant role in predicting infant-toddler use of mobile devices. For example, income, as a traditional sociodemographic measure, was only indirectly related to child use of MSDs. While there was a significant correlation between income and number of MSDs in the home, only the number of MSDs predicted child access to and use of devices. While child access to computer technology has, to date, been more or less determined by family SES (e.g., Carroll et al., 2005; Thomas, Heinlich, Kühnlein & Radon, 2010), there is now evidence of increased use of mobile devices across all sociodemographic levels (Barseghian, 2013; Crawford, 2013; Zickuhr & Smith, 2012). This study provides further evidence for this in that income was correlated with the number of MSDs in the home and the number of MSDs in the home, in turn, predicted parent provision of MSDs to the child as well as the amount of child MSD use. Given the bi-modality of the data for infant-toddler use of MSDs, it would appear that parent knowledge and beliefs are primary determinants of early use of new technologies.

New Demands on Parenting: Beyond the Microsystem?

Today's parents are navigating child-rearing in a climate of confusion and contradictory information about the developmental impact of rapidly-changing technology for their children, with possible effects on parenting stress and/or confidence (e.g., Dworkin, 2012). The confusion and contradictions parents experience on a daily basis were captured in questionnaire participants' responses that formed the category of Family Policy under the Negative MSD Beliefs theme. As an example, the parent of a 6-month-old infant illustrated the conflict between the AAP's repeated recommendation to restrict screens for children less than two years while concurrently exposed to a barrage of MSD products that are marketed as beneficial to infant

learning (e.g., music and videos) and/or to assist with early parenting (e.g., to relieve the parent momentarily):

> "Our community health nurse advised us not to do screen time before age 2. But we've already allowed our [child] since [our child] was only a few weeks old to play on our phones. [Our child] figured out how to swipe through [child's] flashcards by 4 months." (Case 192)

Furthermore, as exemplified by the parent of an 11-month-old infant, parents are faced with the daily reality that their child is exposed to screen media despite their best efforts to restrict early access:

> "Research says no screens until age 2, limited use after that. They are bad for brain development and social skills. Children learn from playing. In reality, [my child] sees screens when we are out of the house, but we do not turn the TV on when she is awake and try to limit our use of screens in her presence." (Case 74)

Parenting stress. Parents in the home visit portion of the current study shared their concerns about raising a child in the current time, with most of their comments referring to the influence of technology presently or anticipated in their child's future. Most of these comments expressed a level of concern that would not be construed as a source of parenting stress. However, for a few parents, their concerns were expressed as fears which arguably may be interpreted as stressful, particularly in combination with other parenting stresses.

As active users of mass media and social media, today's parents have unprecedented access to largely unfiltered information about early development, learning, and parenting practices. Contradictory and confusing information that parents obtain from mass media has been noted as one of four weaknesses in mass media's role in parenting education and support

(Simpson, 1997). In addition, today's parents feel increasingly that they are parenting "in public" that brings with it peer critique regardless of a family's values, decisions, or practices. For example, from a home visit interview, the parent of a 25-month-old toddler stated: "I don't buy some people's concern that my [child] won't know to use technology because I don't let [my child] play with an iPad at this age" (case 16). While parents more regularly relied on their families, their partners, and their peers for information and support in parenting, the effect of mass media (newsfeeds, websites, blogs, and online forums) was reported as contributing to their parenting stress. One home visit participant, a single mother of two children, shared how she disengaged from several online forums and parent blogs and became more discerning of her social media practices in light of the pervasive negativity and peer judgment she experienced, while simultaneously, as a 'digital native,' (Prensky, 2001) attempting to manage an active online social life.

Parenting confidence. Parent confidence may be eroded, or at least frequently tested, in a climate of contradictory information and public judgment. Parent confidence constitutes a component of parenting self-efficacy and parenting sense of competency measures (e.g., Johnston & Mash, 1989; Sanders & Woolley, 2005). In the current study, the IT-HOME instrument measured the quality of the environment of Home Visit participants that included items to assess parenting competency, with lower scores on parenting competency as indicative of lower parenting self-efficacy (Bradley & Caldwell, 1984). Results showed that a stronger sense of competency was related to greater disagreement with the purported benefits associated with the promotion of child-directed MSD products during the evaluation exercise in the home visit subsample. Stated another way, parents with a higher sense of competency had confidence in their ability to evaluate and make choices about child media products that countered the

claims of product promoters. A number of questionnaire participants offered contradictory positive and negative beliefs of the benefits and risks associated with child MSD use. This may affect parent confidence and sense of competence by increasing or decreasing parent assuredness in their knowledge of development and/or parenting practices congruent with one's family and cultural values.

Summary of Findings

Taken together, the findings of this study answered the research questions in the following ways:

Research Question 1: How do the presence and use of MSDs relate to factors of the family environment (family size, maternal and paternal characteristics, parent-child interactions, and parent knowledge and beliefs)? MSDs contribute to shaping all levels of the first developmental environment—the physical, the social, and the psychological context of the family. Today's parents use multiple mobile devices for almost seven hours per day in their caregiving capacities, and make decisions for their child's use of MSDs from birth (or before). Their knowledge of child development, their confidence in their parenting abilities, their beliefs in the value of technology, and the sources of information and support upon which they rely, together guide their structuring of the home environment, the materials and experiential opportunities they provide to their children, the timing, manner and purposes for introducing their child to technological tools, and their intentions for preparing their child to adapt to the rapid changes that accompany technological changes in the Digital Age.

Research Question 2: *Do parent knowledge and beliefs predict the reasons that parents provide MSDs to their children?* Parents are the gatekeepers to infant-toddler use of MSDs and they are divided on allowing their young child any access to mobile devices. Parents who do

provide MSDs to infants and toddlers do so for multiple reasons. In addition to factors of child (age), the physical environment (number of parent MSDs), and parent (maternal education) serving as significant predictors for the reasons parents provided their MSD to their child, positive beliefs in MSDs for children and parenting sense of competence were significant predictors for three of these reasons (to occupy, to teach, to calm).

Research Question 3: *Do parent knowledge and beliefs predict how much time a child spends using MSDs?* Child MSD use may be predicted by two factors of the physical environment (child age, number of MSDs available), by two parent factors (maternal education, parent MSD time), and by three parent knowledge and belief factors (positive MSD beliefs, parenting sense of competence, and knowledge of infant development).

The bioecological model of development invites a focus on differentiating between "features of the environment that foster versus interfere with the development of proximal processes" with particular significance given to "the growing hecticness, instability, and chaos in the principal settings in which human competence and character are shaped—in the family…" (Bronfenbrenner & Morris, 1998, p. 995). Therefore, within a bioecological systems framework, this work sought to examine the influence of MSDs on the developing person at the 'centre of the circles', by honouring the unique sensitivities of the relationships amongst factors of the child's first developmental environment.

Bronfenbrenner's concept of 'ecological niches' as unique combinations of socio-demographic factors (2005) is evidenced in the findings of this study. Specifically, Canadian infants and toddlers may be experiencing unique ecological niches as formed by mobile technologies in the home and family context. Although the average home has several MSDs and parents use mobile devices for several hours per day, approximately 40% of infants and toddlers

have no direct engagement with MSDs. Children in this niche experience mobile devices indirectly—as devices become a normal element of the home landscape and as children observe their parents and caregivers use these devices in daily activities. Almost 60% of infants and toddlers are provided with access to MSDs for a variety of purposes. Children in these families experience the technological environment via direct pathways to engagement with MSDs. At least two general ecological niches may represent the child MSD user group—those who use MSDs extensively (several hours per day) and those who use MSDs moderately (less than one hour per day). While not disaggregated in the current study, *how* children use MSDs—whether primarily independently, jointly with family members, or combinations thereof—may form additional ecological niches.

Figure 6 depicts the four broad, interrelated findings from this study: parents make MSDs available to children, parent beliefs influence child access to and use of MSDs, socio-demographic factors influence child MSD use, and the surrounding climate includes new demands on parents associated with new, mobile technologies. It is important to remember that all children are now born into a world shaped by rapid technological change. Their experiences of technology and how devices are used will vary to the extent to which they both observe the use of MSDs and have access to devices for direct engagement. As infants and toddlers are neither born with or able to independently obtain MSDs, primary caregivers serve as key socializers of children to the Digital Age in the first few years of life. Therefore, the technological world of the infant or toddler may be conceptualized as shaped by factors across levels of the microsystem—factors of the child, the parent, the family, and the home—and further shaped by factors of the exosystem and macrosystem associated with community, institutional, and global technological change as forming climates of caregiving. These factors

have been shown to combine in unique ways to create ecological niches for infant-toddler development and is consistent with the call for complex models of research that include a broader range of psychosocial factors in examining how families, with media technology, form cultural niches within the broader societies in which they are situated (e.g., Anand & Krosnick, 2005; Bradley, 1999; Bronfenbrenner, 2005).

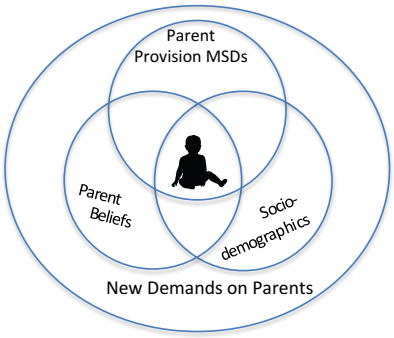

Figure 6. Depiction of relationship among four key findings in microsystem environment.

Limitations and Strengths

One limitation was that there was a paucity of instruments available to adequately measure the ecology for early development in today's technological reality. As such, the questionnaire was assembled using components from a variety of tools that were unable to provide a comprehensive assessment of the technological aspects of the child's environment. For example, the IT-HOME, a validated and current instrument specific to infants and toddlers, did not include media technology devices as a regular feature in the home environment. Given that all homes in the current sample had multiple non-mobile and mobile screen devices, as well as a large screen televisions (which are increasingly "smart" TVs or internet-enabled), this is an important aspect that is missing from this measure. Similarly, the observations about toys in the home failed to take into account the increasing electronic features that direct their utility and use. For example, in the Learning and Materials domain of the IT-HOME scale, two items look for

the presence of simple and complex eye-hand coordination toys. Although an electronically embedded toy might seem to fit these criteria, according to the IT-HOME manual's described criteria[3] (Caldwell & Bradley, 2003), electronic toys, which rely on pushing buttons or swiping screens, mostly fail to meet these criteria for the manipulative features that make toys either simple or complex. In fact, for the current study, it was only through discussions with parents that a sense of the child's engagement with traditional (manipulative) learning materials *vis a vis* their engagement with media technology (on any device) was discernable. In light of the ubiquitous presence of screen technologies in the infant-toddler home environment, observers must take into consideration the qualitative changes in the daily experiences afforded to infants and toddlers in an increasingly technological landscape.

A second limitation of this study was the challenges associated with recruiting participants. Recruiting parents of very young children is inherently challenging because the children are not yet universally connected to any particular institution (e.g., schools). As such, the ability to distribute information about the study to large groups was limited, forcing recruitment to be targeted at individuals, primarily online and through signs at community centres. Related to this, given that the primary tool for recruitment was via Facebook, it is likely that this sample of participants are active social media users, which may have biased the sample to people who have a positive attitude towards technology. Given that there was a large percentage of families who did not directly provide devices to their children, it was felt that this did not impact the outcomes of the study, however, future replication work is needed to confirm this.

A third limitation was the restriction to examining mobile screen devices which, while deliberate at the outset, resulted in only a partial examination of the child's engagement with

technology. Television is still the primary screen technology for infants and toddlers, with home environments typically containing ever-larger, higher definition, Internet-connected, and centrally-located units. Mobile screen devices are rapidly being added to the television viewing context, serving to increase the overall access to screens by all family members. As such, although this study clearly identifies factors that are related to children's experiences with mobile devices, it does not provide any insight about the additive effects of MSDs on top of television viewing. It is possible that the 40% of parents who did not let their infants and toddlers have access to MSDs may have given the child access to television, whether modest or extensive. Future work that explores all screen technology in a child's home environment, as well as in alternative care environments (e.g., daycare) will be able to unpack the patterns of MSD use across infant-toddler environments.

A fourth limitation was the self-selected nature of the sample. It is likely that parents who were interested or concerned about their children's use of MSDs were more likely to volunteer for the study. Although our sample was roughly representative on many demographic factors (e.g., parent age, paternal education, family size, income, and rural residency) when compared to 2011 Canadian census figures, mothers in ths study tended to be more highly educated, there were more two-parent families, and participants were more ethnically and linguistically diverse. Given this, caution must be exercised in generalizing results. For example, higher maternal education may explain higher mean scores on the Knowledge of Infant Development Inventory that in turn, may be related to the amount of time infants and toddlers use MSDs. A higher proportion of two-parent families implies more devices in the home, and therefore, potentially increases access to MSDs by infants and toddlers and, in turn, how much time infants engage with MSDs.

A fifth limitation related to some families not represented in this study, possibly due to barriers such as access to learning about the study (e.g., unconnected to community services or social media), accessing and/or completing the study itself (e.g., literacy, English competency, computer access and ability), and/or reasons of personal choice (e.g., non-custodial parents, too busy, change of family circumstances).

A final limitation related to the research design where data was collected from home visit participants simultaneously with the online questionnaire participants. While doing so ensured timely data collection from participants who indicated their interest, the simultaneous process precluded the ability to build the home visits around questionnaire findings.

Although there were several limitations to this study, there were also several strengths, including the fact that this is the first study to look comprehensively at how MSDs are present in the environments of very young children. In addition to the novelty of this study, the mixed methods approach was a strength of this study's design. Furthermore, the online questionnaire consisted largely of established and validated measures, such as the Parenting Sense of Competence scale, revised Knowledge of Infant Development Index, and elements of the Catalogue of Previous Experience with Infants. The questionnaire also included open-ended questions that allowed participants the opportunity to express ideas and beliefs that could not be well captured with bounded and pre-set answer options. This element facilitated the gauging of parent beliefs that are typically not a component addressed when assessing developmental environments and predictors of children's experiences. In fact, wherever there were open-text elements, many respondents capitalized on the opportunity to provide rich data beyond that typically obtained in a survey format. In addition to this, the home-based observations and interviews conducted with a subset of participants bolstered the overall findings by providing a

richer view into the realities of the infant's first developmental environment. Another strength of this study was gathering data from two sources that cross-validated parent reports. The researcher's qualifications and ability to conduct home visits and complete both an established observational measure (IT-HOME) and a semi-structured interview in the least intrusive manner facilitated obtaining more authentic data with high fidelity for interpretation.

Implications

There are several implications for this work. The broadest implication is in the potential contribution of this work to our understanding of the daily experiences of Canadian parents who are creating the ecologies of technology in which their infants and toddlers are developing. Specifically, how parents think about technology and what they believe to be the risks or benefits for their child's use of technology needs to be understood as related to how children are socialized in a Digital Age. Another implication is the reaffirmation that human development is a function of factors emanating from all levels of a bioecological system, with foundations for healthy development and future citizenship the responsibility of parents *and* the broader communities and sociopolitical contexts in which families must perform their roles. It is necessary, but insufficient, to assess developmental environments without attending to parental beliefs and reasoning as critical components of the child's total environment. A third implication is that it provides a Canadian data set on the actual use of MSDs by parents in their caregiving role, as well as the use of MSDs by infants and toddlers. A fourth implication is enhanced understanding of the range of motivations, meanings, and practicalities that drive the adoption and use patterns of both current MSDs and emerging digital innovations. Parents are not a monolithic group—they embrace a wide range of beliefs and practices regarding child access to and use of MSDs, which in turn are informed by a wide range of socio-demographic, cultural,

and family values. As there was not one ideal way to do the job of parenting in the past, there is also not one ideal approach to parenting in the Digital Age.

A final implication of this work is that it contributes to the development of guidelines for managing new technologies in infant environments in ways that are realistic and relevant to modern family life. This work can be seen to support Dorr and colleagues' (2002) recommendations: 1) Parents make sure their own interactions with media and technology exemplify the best they might hope ever to see in their children; 2) Parents organize the household and children's daily lives to emphasize and de-emphasize, according to parental values, children's engagement with media and technology (e.g., emphasize reading and de-emphasize video games or television viewing); and 3) Parents be vigilant socializers of their children. Children with well-established, socially valued skills, knowledge, beliefs, attitudes, and behavioural patterns are more likely to stick to what they know rather than adopt alternative perspectives that media and technology may present, and are more likely to use what they know to interact with media and make sense of the content.

Directions for Future Research

In the study of any ecological system, a lack of adequate instruments often leads to the investigation of selected aspects of the system, sometimes in isolation from the whole, and to the examination of systems as highly complex as the human ecology, where both the researcher and the subjects of study reside. In the study of early child development, examination of caregiver cognitions— knowledge, beliefs, and self-awareness—are often treated as either "unknowable" or as stable factors in the child's world. The latter has historically relied on demographic markers that are treated as fixed factors. Therefore, future research may want to consider an enhanced focus on refining and validating existing measures and/or developing new measures

that can be flexibly employed to measure factors that are both amorphous by nature and yet powerful in influence—parent beliefs. Current instruments that measure child environments in effect measure the application of parent beliefs and, therefore, could be expanded to include items that probe a variety of parental cognitions, including their beliefs about what their child needs for healthy development and how it is to be provided. A second area of assessment for future research would be to design further studies to examine the links between parent beliefs, parenting behaviour, and child development, as was done by Coleman and colleagues in 2010. For example, do the children who use MSDs in the first three years have experiences that significantly alter the development of school readiness skills? How do parents conceptualize the skills that young children will require when technology is constantly changing? And how might parenting practices both inform and be informed by their child's earliest experiences in a technological world? Will school readiness skills require re-defining as new technologies alter the educational landscape? The ecological niches created by parent beliefs and practices with new technologies effectively mimic randomized, natural groupings for prospective and/or retrospective comparative analysis in longitudinal research designs. In all cases, future researchers would do well to build their study designs using mixed models and mixed methods from inception.

Another direction for future research is to examine the technological environment comprehensively. This study was limited to examining MSDs as a recent phenomenon in the lives of infants and toddlers. The next step would be to investigate new technologies as added to existing technologies, in particular as these innovations 'hybridize' and operate across platforms and modalities. While the devices and programs associated with technology may be treated as static factors, at least for a brief time pending the latest editions, their applications and uses are

constantly in flux. Also, technologies considered to be on the horizon today will tomorrow seem normal to everyday life. For example, there are rapidly-growing innovations in 'wearable' technologies, including those for children, as well as implant technology (such as tracking devices already used for pets). Therefore, it will become increasingly vital to understand the possible effects on health, development, and social-cultural relationships with more comprehensive monitoring and tracking by technologies embedded in children's clothing or as body implants.

A third consideration for future research involves the challenges and opportunities that mobile devices bring to recruitment efforts. Those who intend to recruit parents and caregivers will need to keep current as to how the intended participants use media. As parents increasingly rely on a variety of devices to accomplish daily tasks, and as they have access to massive amounts of information about child development or parenting, it is incumbent upon future investigators to learn directly from parents and caregivers how they participate in, and use, social media, parenting blogs, online magazines, and virtual parent groups. These will be the primary vehicles to both recruit participants and quite possibly, to collect data. For example, the current study used a web-based questionnaire that was most conducive to computers. Some participants commented on the limitations of completing the questionnaire on a mobile device for which the online questionnaire was not specifically adapted. Future participants may *expect* to be able to use any mobile device to accomplish daily tasks, including requests to participate in research. It is quite possible that the concept of an online questionnaire, seemingly new now, will become obsolete in the near future, perhaps to be replaced with questionnaires in the form of an app for cross-platform use or data collection by text or instant messaging. Therefore, future researchers

will need to keep current with new developments in technology, but even more so with how technology itself is forming a complex ecological system for behavioural research.

Concluding Statement

In a 1998 lecture, humanist author, media theorist, and cultural critic Neil Postman posited five concepts critical to our understanding of technological change. There is no implied order to these inter-related points. First, we always pay a price for technology: the greater the technology, the greater the price. Second, that there are always winners and losers, and the winners always try to persuade the losers that they are really winners. Third, there is embedded in every great technology an epistemological, political, or social prejudice: sometimes greatly to our advantage, sometimes not. Fourth, technological change is not additive; it is ecological, which means, it changes everything. Fifth, technology tends to become mythic; that is, perceived as part of the natural order of things, and therefore tends to control more of our lives than is good for us.

This study's findings fit with several of Postman's five points. First, and consistent with the fourth point—that technological change is ecological—the impact of MSDs was found in the physical, relational, and parent beliefs aspects of the infant's first environment, the family. MSDs can no longer be considered simply tools that only have an effect when they are utilized for a specific function. By their very presence in the family environment, MSDs influence how parents interact with their children, as they model behaviour with technology for their own needs and as they provide MSDs for the perceived needs of their child. Thoughts and concerns related to technology inform the psychological climate of the family as parents manoeuver their way through conflicting information that may collide with personal values while they fulfill their roles as their child's primary socializing agents in preparation for an unknown future with

technology. Second, and consistent with Postman's fifth point—that technological change becomes mythic—it was found that the presence of multiple MSDs is ubiquitous in these families' environments and they are extensively used across multiple activities of daily family life. That current MSDs and unknown future technologies are now seen as part of the natural environment was reflected in the current study by several comments parents made that were related to the inevitable need for their child's digital literacy (which in turn, related to their beliefs about when and how to introduce their child to these devices). Postman's third point—that social prejudice is embedded in every technology—was highlighted in the current study by the polarity of parent practices and beliefs regarding their infants' or toddlers' direct access to MSDs. Over 40% of families in this study completely restrict their child's use of mobile devices in the early years, which echoes the negative bias to technology that is present in anecdotal reports and observations of both professionals and laypersons, as well as in the often highly-charged discourse on social media platforms and parenting forums. Yet another form of social prejudice can be found in professional recommendations made for the restriction of MSD use by children less than two years of age (in the American context; less than three years of age in European contexts), without directions about how to practically manage it. This form of embedded social bias, while having greater scientific evidence behind it, has led to misinterpretation and over-application of the recommendations such that some parents may be unduly stressed about their inability to shield their young child from omnipresent screen technology. The promised forthcoming amendments to the AAP recommendations regarding children and media is a positive sign that experts in child development are willing to consider the real-life realities and practicalities of raising children in a digital world as they craft future policy statements.

As for Postman's first two points, perhaps only time and further research will tell whether children will be winners or losers in the Digital Age and whether the ultimate price paid for the current era's massive and continuing technological change is childhood itself.

> "You can't connect the dots looking forward; you can only connect them looking backwards. So you have to trust that the dots will somehow connect in your future."
>
> —Steve Jobs, 2005

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APPENDICES

Appendix 1: Questionnaire Section 1 (Mobile Screen Devices)

In this section, we want to learn about how parents and very young children use of a variety of mobile screen devices in daily life.

A. Parent Use of Mobile Screen Devices

This part focuses on how you, the parent, uses mobile screen devices.

I. Overall Usage

		Smart Phones (internet-enabled)	Tablets (e.g. iPad, Galaxy)	E-Reader (e.g. Kindle, Kobo)	Handheld Game Players (e.g. PSP, iPod touch)	Laptop/ Notebook Computers
1	How many of each device do you personally own?					
2	How many of each device does your family own?					
3	For how long have you owned each device?					
4	On average, how long per day are you engaged with each device? (hours, minutes)					
5	Do you intend to purchase any of these devices in the next year?					
6	Proportion of time each device is used for work or business purposes? (percentage)					
7	Proportion of time each device is used for personal or social purposes? (percentage)					

II. Smartphones *(internet-connected, e.g. iPhone, Blackberry, Android)*

I use my smartphone to do the following activities on average each day:

		< 5 mins	5-15 mins	16-30 mins	30-60 mins	> 60 mins
a	Voice calls					
b	Text messages					
c	Email					
d	Internet browsing					
e	Photography/videos					
f	Watch movies/tv					
g	Reading (news, magazines)					
h	Consumer purchases (online shopping)					
i	Stock trading					
j	Games					
k	Scheduling/reminders/notes					
l	Social media					
m	Video chat (e.g. Skype, FaceTime)					
n	Other: _____					

III. Tablets *(e.g. iPad, Galaxy)*

I use my tablet for the following activities on average each day:

		< 5 mins	5-15 mins	16-30 mins	30-60 mins	> 60 mins.
a	Text messages					
b	Email					
c	Internet browsing					
d	Photography/videos					
e	Watch movies/tv					
F	Reading (news, mags)					
g	Consumer purchases (e-shop)					
h	Stock trading					
I	Games					
J	Scheduling/reminders/notes					
k	Social media					
L	Video chat					
m	Other					

IV. E-readers *(e.g. Kindle, Kobo, Nook, iPad mini)*

I use my e-reader for the following activities on average each day:

		< 5 mins	5-15 mins	16-30 mins	30-60 mins	> 60 mins
A	Reading (books, news, mags)					
B	Watch movies/tv					
C	Internet browsing					
D	Email					
E	Consumer purchases (online shop)					
F	Stock trading					
G	Games					
H	Social media					
I	Other					

V. Handheld Game Devices *(e.g. Nintendo 3DS, PSP, Xperia, iPod touch)*

I use my handheld game device for the following activities on average each day:

		< 5 mins	5-15 mins	16-30 mins	30-60 mins	> 60 mins
A	Games					
B	Photography/videos					
C	Watch movies/tv					
D	Music					
E	Internet browsing					
F	Social media					
G	Other					

VI. Laptop Computers *(including Notebooks)*

I use my laptop or notebook computer for the following activities on average each day:

		< 5 mins	5-15 mins	16-30 mins	30-60 mins	> 60 mins
a	Email					
b	Word processing/database					
c	Internet browsing					
d	Voice calls (internet phone)					
e	Photography/videos					
f	Watch movies/tv					
g	Reading (news, mags)					
h	Consumer purchases (e-shop)					
i	Stock trading					
j	Games					
k	Scheduling/reminders					
l	Social media					
m	Video chat (e.g. Skype, FaceTime)					
n	Other: _____					

B. Child Use of Mobile Screen Devices

*This part focuses on how **your child** uses mobile screen devices.*

I. Overall Usage

		Smart Phones (internet-enabled)	Tablets (iPad, Galaxy)	E-Reader (Kindle, Kobo)	Handheld Gamers (PSP, Nintendo, iPod touch)	Laptop/ Notebook Computer
1	How many of each device does your child have? *[If answer if "none", skip to item #8]*					
2	For how long has your child owned the device?					
3	On average, how long per day is your child engaged with each device? (hours, minutes)					
4	Do you intend to purchase any of these devices for your child in the next year?					
5	Does your child use ***your*** device?					
6	On an average day, how long does your child use ***your*** device? (hours, minutes)					
7	Do you have infant-specific programs or apps on ***your*** device?					
8	If no on #1, what is the right age for your child to have his/her own device?					

9. a. If your child has his/her own mobile screen device, what are the main reasons?

_____

_____

b. If you intend to give your child his/own mobile screen device, what benefits do you foresee? _____

_____

c. If your child does NOT have his/her own mobile screen device, what are the main reasons? _____

_____

II. Smartphones *(internet-connected)*

1. On an average day, my child uses any ***smartphone*** for the following activities (includes parent's or child's phone):

		0	1-5 mins	5-15 mins.	15-30 mins.	30-60 mins.	1-2 hours	> 2 hours
A	Voice talk / video chat							
B	Child-specific apps/games							
C	Watch videos/tv							
D	Listen to music							
E	Explore/keep busy							
F	Therapy goals							

2. I give my child ***my*** smartphone for the following purposes:

		Never	sometimes	often
G	To distract my child while I get something else done			
H	To calm him/her when upset			
I	To help my child sleep			
J	To teach my child			
K	To keep in touch with relatives			
L	To develop fine motor skills (hands & fingers)			
M	For therapeutic purposes			
N	Other: _____			

III. Tablets *(e.g. iPad, Galaxy)*

1. On an average day, my child uses any ***tablet device*** for the following activities (includes parent's or child's tablet):

		0	< 5 mins	5-15 mins	15-30 mins	30-60 mins	1-2 hours	> 2 hours
A	Video chat							
B	Child-specific apps/games							
C	Watch videos/tv							
D	Listen to music							
E	Explore/keep busy							
F	Therapy goals							

2. I give ***my tablet*** to my child for the following purposes:

		never	sometimes	often
g	To distract my child while I get something else done			
h	To calm him/her when upset			
i	To help my child sleep			
j	To teach my child			
k	To keep in touch with relatives			
l	To develop fine motor skills (hands & fingers)			
m	For therapeutic purposes			
n	Other: _____			

IV. E-readers *(e.g. Kindle, Kobo, Nook, iPad mini)*

1. On an average day, my child uses an ***e-reader*** for the following activities (includes parent's or child's e-reader):

		0	< 5 mins	5-15 mins	15-30 mins	30-60 mins	1-2 hours	> 2 hours
A	Read/look at books/literacy							
B	Child-specific apps/games							
C	Watch videos/tv							
D	Listen to music							
E	Explore/keep busy							
F	Therapy goals							

2. I give ***my e-reader*** to my child for the following purposes:

		never	sometimes	often
G	To distract my child while I get something else done			
H	To calm him/her when upset			
I	To help my child sleep			
J	To teach my child			
K	To keep in touch with relatives			
L	To develop fine motor skills (hands & fingers)			
M	For therapeutic purposes			
N	Other: _____			

V. Handheld Game Players *(e.g. Nintendo 3DS, PSP, Xperia, iPod touch)*

1. On an average day, my child uses a **game player** for the following activities (includes parent's or child's game player):

		0	< 5 mins	5-15 mins	15-30 mins	30-60 mins	1-2 hours	> 2 hours
a	Child-specific apps/games							
b	Watch videos/tv							
c	Listen to music							
d	Explore/keep busy							
e	Therapy goals							

2. I give my child ***my game player*** for the following purposes:

		never	sometimes	Often
f	To distract my child while I get something else done			
g	To calm him/her when upset			
h	To help my child sleep			
i	To teach my child			
j	To develop fine motor skills (hands & fingers)			
k	For therapeutic purposes			
l	Other: _____			

VI. Laptop Computers *(including Notebooks)*

1. On an average day, my child uses any **laptop computer** (or notebook) for the following activities (includes parent's or child's computer):

		0	< 5 mins	5-15 mins	15-30 mins	30-60 mins	1-2 hours	> 2 hours
A	Video chat							
B	Child-specific apps/games							
C	Watch videos/tv							
D	Listen to music							
E	Explore/keep busy							
F	Education							
G	Therapy goals							

2. I give ***MY laptop computer*** to my child for the following purposes:

		Never	sometimes	often
h.	To distract my child while I get something else done			
i.	To calm him/her when upset			
j.	To help my child sleep			
k.	To teach my child			
l.	To keep in touch with relatives			
m.	To develop fine motor skills (hands & fingers)			
n.	For therapeutic purposes			
o.	Other: _____			

VII. Child Versions of Mobile Screen Devices

This part focuses on mobile screen devices made specifically for young children, to be distinguished from adult devices with child-directed apps/software.

Does your child have any of the following child-specific versions of mobile screen devices?

	yes	no
Smartphone (e.g. V-Tech Slide & Talk; iPlay My First Mobile Phone; Fisher-Price Smartphone iPhone; Rc2 First Years LC23115 My Phone, Babies Grow My First Smartphone; Kidz Delight Smooth Touch SmartPhone)		
Tablet (e.g. LeapFrog LeapPad2; Kurio Kids Tablet with Android 4.0; V-Tech Innotab 2S or 3; MEEP!; Lexibook; Kyros Capacitive Tablet; Tabeo)		
E-reader (e.g. V-Tech V. Reader; Fisher-Price iXL)		
Hand-held Gaming Device (e.g. LeapFrog Leapster Explorer; V-Tech MobiGo)		
Laptop (e.g. V-Tech Baby's Learning Laptop; V-Tech Brilliant Creations Notebook; Fisher-Price SmartScreen Laptop; LeapFrog My Own Laptop; Winton Elite Plus Laptop)		

Which, if any, child-specific devices do you intend to buy of acquire in the next year?

_____

_____

What are your main reasons for providing child-specific mobile screen devices?

_____

_____

Appendix 2: Questionnaire Section 2 (Knowledge of Infant Development)

(Reduced version, with permission, from KIDI, MacPhee, 1981)

Please mark for each of the following whether:

		Agree	Disagree	Not Sure
1	A parent just needs to feed, clean and clothe a baby for it to turn out fine.			
2	A 2-year-old who is two or three months behind other 2-year-olds is "delayed" or "slow"			
3	Children will often keep using the wrong word for a while, even when they are told the right way to say it (like "feet," not "footses")			
4	The baby should not be held when fed because this will make him/her want to be held all the time			
5	Babies do some things just to make trouble for the parent(s) (like crying a long time or soiling their diapers)			
6	The same thing may make an infant cry one time and laugh another time (like a large dog or playing "I'm gonna getcha")			
7	You must stay in the bathroom when your child is in the bathtub			
8	Babies understand only words they can say			
9	If a baby is shy or fussy in new situations, it usually means there is an emotional problem			
10	Talking to the baby about things he/she is doing helps the baby's development and later competence			
11	A 2-year-old who says "no" to everything and tries to boss you around means it and is just trying to get you upset			
12	The way an infant is brought up will have little effect on its intelligence			
13	All infants need the same amount of sleep			
14	The infant has little effect on how the parent cares for and plays with him/her, at least until the baby gets older			
15	Taking care of a baby can leave the parent feeling tired, frustrated or overwhelmed			
16	Putting a soft pillow in the crib is a good, safe way to help the baby sleep better			
17	The newborn can see a face 6 feet away as well as an adult can			
18	The 2-year-old's sense of time is different from an adult's			
19	One's IQ (intelligence) score stays the same from infancy through childhood			
20	The baby's personality (individuality) is set by 6 months of age			
21	A child is using rules of speech when he/she says words and sentences in an unusual way (like "I goed to town" or "what the dolly have?")			
22	Some mothers do not really get involved with their infants until the baby starts to smile and look at them.			
23	The way the parent(s) responds to the baby in the first few months of life determines whether the child will grow up to be happy and well-adjusted or moody and a misfit			
24	Children learn their language by copying what they have heard adults say			
25	An infant may stop paying attention to what is going on around him/her if there is too much noise or too many things to look at			
26	Some normal babies do not enjoy being cuddled			
27	The more you comfort your baby by talking to him/her, the more you spoil him/her			
28	A frequent cause of accidents for 1-year-olds is pulling something like a frying pan, or tablecloth, or a lamp down on top of them			
29	A good way to teach your child not to hit is to hit back			
30	Some days you need to discipline your baby; other days you can ignore the same thing. It all depends on the mood you're in that day			

For the following, please check the best single answer:

1. The best way to deal with a 1-year-old who keeps playing with breakable things in the living room is to:

___ a. keep him/her in a playpen and out of everything
___ b. slap the baby's hand whenever he/she touches something
___ c. tell the child "No!" and expect him/her to obey you
___ d. put the things out of reach until the child is older
___ e. not sure

2. Select the most appropriate game for a one-year-old:

___ a. string small beads
___ b. cutting out shapes with scissors
___ c. rolling a ball back and forth with an adult
___ d. sorting things by shape and colour
___ e. not sure

3. If a 2-year-old doesn't get his/her way and has a temper tantrum, which of the following would be the best way to avoid future problems with tantrums?

___ a. give the child a new toy
___ b. ignore the temper tantrum
___ c. spank the child's bottom
___ d. let the child have his/her own way
___ e. not sure

4. An 8-month-old is most likely to be scared by:

___ a. dreams
___ b. large animals
___ c. being alone in the dark
___ d. an unfamiliar person wearing a mask
___ e. not sure

Appendix 3: Questionnaire Section 3 (Baby Care Experience)

(Reduced version, with permission, from COPE, MacPhee, 1981)

These questions ask about your experience with babies. Please check the answer that best describes how much you know or have learned about infants (birth to 2 years of age).

1. Before becoming a parent, I have had experience with infants:

	Never have	Sometimes / Infrequent	Often / Part-time	Regularly / Full-time
Caring for an infant (e.g. sibling, casual babysitter)				
Worked in a daycare centre or nursery school				
Worked in a profession involving contact with infants (e.g. public health, social work, medicine, psychology)				

2. How many classes or courses in infant care, child development, or child psychology have you taken? (includes high school, parent education, childbirth preparation, college)

None		One		Two or more	

3. With your own baby, how often do you do the following baby care activities

	Never	Sometimes	Often	Almost daily
Give the baby baths				
Change diapers				
Dress or undress the baby				
Feed the baby				
Play with my baby				
Put the baby to bed				
Read or sing to my baby				

4. How much have you learned about infants from the following sources?

	never	sometimes	fairly often	regularly
Mass media (radio, magazines, movies, tv, newspapers, internet)				
Reading magazine articles or books on infants and toddlers				
Watching infants and parents when I was younger				
Talking to own family (e.g. mother, father, sister, grandparent)				
Talking to friends or other adults with babies				
Comparing your baby to others whom you see or know				
Talking to doctors or nurses before or after your baby was born				
Talking to your spouse or partner				
Other: _____				

Appendix 4: Questionnaire Section 4 (Parenting Sense of Competence Scale)

(Johnson et al., 1989)

Please rate the extent to which you agree or disagree with each of the following statements.

Strongly Disagree	Somewhat Disagree	Disagree	Agree	Somewhat Agree	Strongly Agree
1	2	3	4	5	6

1.	The problems of taking care of a child are easy to solve once you know how your actions affect your child, an understanding I have acquired.	1 2 3 4 5 6
2.	Even though being a parent could be rewarding, I am frustrated now while my child is at his/her present age.	1 2 3 4 5 6
3.	I go to bed the same way I wake up in the morning, feeling I have not accomplished a whole lot.	1 2 3 4 5 6
4.	I do not know why it is, but sometimes when I'm supposed to be in control, I feel more like the one being manipulated.	1 2 3 4 5 6
5.	My mother/father was better prepared to be a good mother/father than I am.	1 2 3 4 5 6
6.	I would make a fine model for a new mother/father to follow in order to learn what she/he would need to know in order to be a good parent.	1 2 3 4 5 6
7.	Being a parent is manageable, and any problems are easily solved.	1 2 3 4 5 6
8.	A difficult problem in being a parent is not knowing whether you're doing a good job or a bad one.	1 2 3 4 5 6
9.	Sometimes I feel like I'm not getting anything done.	1 2 3 4 5 6
10.	I meet by own personal expectations for expertise in caring for my child.	1 2 3 4 5 6
11.	If anyone can find the answer to what is troubling my child, I am the one.	1 2 3 4 5 6
12.	My talents and interests are in other areas, not being a parent.	1 2 3 4 5 6
13.	Considering how long I've been a parent, I feel thoroughly familiar with this role.	1 2 3 4 5 6
14.	If being a mother/father of a child were only more interesting, I would be motivated to do a better job as a parent.	1 2 3 4 5 6
15.	I honestly believe I have all the skills necessary to be a good parent to my child.	1 2 3 4 5 6
16.	Being a parent makes me tense and anxious.	1 2 3 4 5 6

Appendix 5: Questionnaire Section 5 (About Your Family)

1. CHILD INFORMATION:

Your child's **age** (years, months): _____ Male _____ Female _____

CHILD'S Ethnic Background	Check all that apply
Northern and Western European origins (e.g., British, Scottish, German, Swedish, Danish, Norwegian, Dutch)	
Eastern and Southern European origins (e.g., Polish, Russian, Ukranian, Italian, Greek, Spanish)	
Aboriginal origins (e.g., First Nations, Inuit, Metis)	
South Asian origins (e.g., East Indian, Punjabi, Pakistani)	
East Asian origins (e.g., Chinese, Japanese, Korean)	
Southeast Asian origins	
Middle East/West Asian origins (e.g. Persian)	
African origins (e.g. South African, Rwandan, Kenyan, Somali)	
Caribbean/Central American origins (e.g. Haitian, Jamaican, Trinidadian)	
South American origins (e.g. Columbian, Peruvian, Chilean, Brazilian)	
I don't know	
Other (please list):	

2. PARENT INFORMATION:

AGE	< 20 yrs.	20-29 yrs.	30-39 yrs.	40-49 yrs.	50-59 yrs.	> 59 yrs.
Mother						
Father						

Marital Status	Married / Common Law	Separated/Divorced & Co-parenting	Sole Parent

Ethnic Background	Mother	Father
Northern and Western European origins (e.g., British, Scottish, German, Swedish, Danish, Norwegian, Dutch)		
Eastern and Southern European origins (e.g., Polish, Russian, Ukranian, Italian, Greek, Spanish)		
Aboriginal origins (e.g., First Nations, Inuit, Metis)		
South Asian origins (e.g., East Indian, Punjabi, Pakistani)		
East Asian origins (e.g., Chinese, Japanese, Korean)		
Southeast Asian origins		
Middle East/West Asian origins (e.g. Persian)		
African origins (e.g. South African, Rwandan, Kenyan, Somali)		
Caribbean/Central American origins (e.g. Haitian, Jamaican, Trinidadian)		
South American origins (e.g. Columbian, Peruvian, Chilean, Brazilian)		
I don't know		
Other (please list):		

Education	Mother	Father
Less than high school graduation		
High school graduate		
Some post-secondary/college/diploma		
Bachelor Degree/Professional Designation		
Graduate Degree (Masters, Doctorate)		

Employment Status	Mother	Father
Not employed		
On leave (e.g. maternity, medical)		
Part-time		
Full-time		
Student		

3. FAMILY INFORMATION:

Languages spoken in the home: 1. _____
2. _____
3. _____

SIBLINGS	Male / Brother	Female / Sister		**Non-Related Children**	Male	Female
Age				Age		
Age				Age		
Age				Age		
Age				Age		
Age				Age		
Age				Age		

Other ADULTS in Home	Male	Female
Related adults		
Non-related adults		

CHILD CAREGIVERS (in-home or out-of-home)	Primary or only	Equal Shared responsibility	Sometimes/ Regularly	Occasional/ Rarely
Mother				
Father				
Grandparent				
Other relative				
Child Care Professional (e.g. daycare)				
Nanny				
Babysitter or Friend				
Other: _____				

ANNUAL FAMILY li INCOME	< $40,000	$40,000-65,000	$65,000-90,000	$90,000-125,000	> $125,000	Prefer Not to Answer

HOUSING	Own	Rent
Single family detached house		
Attached duplex or townhouse		
Apartment or Condominium		
Other: _____		

4. COMMUNITY INFORMATION:

I/WE LIVE IN….	Large city (>100,000)	Medium city (50,000-100,000)	Small City (25,000-50,000)	Town (<25,000)
Urban core				
Suburban region				
Rural area				

Survey Complete

THANK YOU!

INFORMATION ON FURTHER RESEARCH PARTICIPATION:

A second study involved in this research project is recruiting families with a child (or children) under three years of age to learn more about the opportunities and challenges that parents face regarding mobile screen devices. This study will involve having the researcher conduct an interview and observation the family's home environment.

If you would like further information about this study, please contact XXX

Appendix 6: Consent Forms

THE UNIVERSITY OF BRITISH COLUMBIA

Department of Educational and Counselling Psychology, and Special Education
The University of British Columbia
Faculty of Education
2125 Main Mall
Vancouver BC Canada V6T 1Z4
Tel 604-822-0242 Fax 604-822-3302
www.ecps.educ.ubc.ca

Parental Consent Form

An Ecology of Technology: Infants, Toddlers and Mobile Screen Devices

Principal Investigator:

Dr. Jenna Shapka, Assistant Professor, Department of Educational and Counselling Psychology, and Special Education, University of British Columbia. Tel: XXX Email: XXX

Co-principal Investigator:

Michaela Wooldridge, PhD. Candidate; Department of Educational and Counselling Psychology, and Special Education, University of British Columbia. Tel: XXX Email: XXX

Background:

Infants are born into a digital world. Today's parents/caregivers often use mobile screen devices (e.g., smartphones, tablets) to carry out daily infant caregiving activities. In addition, the large growth in programs and devices made specifically for very young children means that infants and toddlers have easier and earlier access to screen media.

Purpose:

In this study, we want to learn how infants and toddlers (birth to 3 years of age) and their parents/caregivers use mobile screen devices in their lives. The purpose of this study is to better understand how parents report using these devices in their caregiving role, and how, when, and why they are used by their very young children.

We hope that this study will help us better understand the first years of development in the modern world and allow us to better understand the ways in which mobile screens influence the child's environment.

We are asking parents with at least one child between birth and 3 years of age to take part in this research because they can help us learn more about early child development in families using mobile screen devices.

Study Procedure:

This study involves completing an online questionnaire on a secure website. It is expected that the questionnaire will take about 20-30 minutes. A paper questionnaire is available upon request.

There are no known risks to this study. You may withdraw from the study at any time.

Confidentiality

All answers or comments to the questionnaire will be kept confidential. The online questionnaire will only be identified by a code number and will be kept in a locked cabinet or container. Neither you nor your child will be identified by name in any of the reports of the completed study.

In accordance with section 26(c) of the *Freedom of Information and Protection of Privacy Act* (FIPPA), your personal information is collected and stored by a Canadian web host. This information relates directly to the research activity and will be used to analyse grouped responses. The security and privacy policy for the websurvey company can be found at the following link:
http://www.canadianwebhosting.com/company/privacy_policy.asp

Contact for Concerns about the Rights of Research Subjects:

If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line at the UBC Office of Research Services at 604-822-8598 or if long distance email to RSIL@ors.ubc.ca. You may also contact the Chair, Interior Health Research Ethics Board at 250-870-4602 or by email to researchethics@interiorhealth.ca.

Consent:

By completing and submitting this questionnaire, either online or by return mail (paper option), you have consented to participate in this study.

Parental Consent Form (Home Visit)

THE UNIVERSITY OF BRITISH COLUMBIA

Department of Educational and Counselling Psychology, and Special Education
The University of British Columbia
Faculty of Education
2125 Main Mall
Vancouver BC Canada V6T 1Z4
Tel 604-822-0242 Fax 604-822-3302
www.ecps.educ.ubc.ca

Parental Consent Form (HOME VISIT)

An Ecology of Technology: Mobile Screen Devices and Infant and Toddler Development

Principal Investigator:
Dr. Jenna Shapka, Assistant Professor, Department of Educational and Counselling Psychology, and Special Education, University of British Columbia. Tel: XXX Email: XXX

Co-principal Investigator:
Michaela Wooldridge, PhD. Candidate; Department of Educational and Counselling Psychology, and Special Education, University of British Columbia. Tel: XXX Email: XXX

Background: Infants are born into a digital world. Today's parents/caregivers often use mobile screen devices (e.g., smartphones, tablets) to carry out daily infant caregiving activities. In addition, the large growth in programs and devices made specifically for very young children means that infants and toddlers have easier and earlier access to screen media.

Purpose: In this study, we want to learn how infants and toddlers (birth to 3 years of age) and their parents/caregivers use mobile screen devices in their lives. The purpose of this study is to better understand how parents use these devices in their daily home lives, and how, when, and why they are used by their very young children.

We hope that this study will help us better understand the first years of development in the modern world and allow us to better understand the ways in which mobile screens influence the child's environment.

We are asking parents with at least one child between 12 and 30 months (1 to 2 ½ years) of age to take part in this research because they can help us learn more about young children's development in families using mobile screen devices.

Study Procedure:

This study involves the researcher visiting your home. We will do our visit at a time that works best for your family. It will take about 60 to 90 minutes and will involve two activities.

Activity 1: Observation – the researcher will spend about 20 to 30 minutes observing your family activities. Notes will be made on parent-child interactions, play activities, and materials in the home.

Activity 2: Interview – the researcher and you will spend 20 to 30 minutes talking about your thoughts and beliefs related to mobile devices in your daily life. The researcher will ask questions and make written notes when we talk. You do not need to answer any questions you do not wish to speak to.

Confidentiality: Every effort will be made to ensure your confidentiality. The information we collect will be coded and combined with the information from others. No names will be used in any reports. Only the researchers will have access to your names or contact information.

Contact for information about the study: If you have any questions or would like more information about this study, contact Michaela Wooldridge at XXX

Contact for concerns about the rights of research subjects: If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598.

Consent:
Taking part in this study is up to you, and you may refuse to take part any part of this study, or withdraw from the study at any point.

Your signature below means that you have received a copy of this consent form for your records and that you consent to take part in this study

☐ I consent to the researcher conducting a home visit as described above, to be arranged at at time that works well for me .

Your Name (please print): _____

_____

Your Signature Date

Your Contact Information (so we can arrage a time for our visit):

Phone number(s):_____

Email: _____

Future Research
(To be completed during the home visit)

In the event the researcher conducts a follow-up study at a future date, I consent to being contacted. I understand that I will have the option to accept or decline participation in future research at the time I am contacted.

_____

Signature Date

Appendix 7: IT-HOME Inventory

Infant/Toddler HOME Record Form

Place a plus (+) or minus (-) in the box alongside each item depending on whether the behavior is observed during the visit, or if the parent reports that the conditions or events are characteristic of the home environment. Enter the subtotals and the total on the Summary Sheet. **Observation (O), Either (E), or Interview (I) is indicated for each item.**

I. RESPONSIVITY		24. Child has a special place for toys and treasures. **E**	
1. Parent permits child to engage in "messy" play. **I**		25. Child's play environment is safe. **O**	
2. Parent spontaneously vocalizes to child at least twice. **O**		**IV. LEARNING MATERIALS**	
3. Parent responds verbally to child's vocalizations or verbalizations. **O**		26. Muscle activity toys or equipment. **E**	
4. Parent tells child name of object or person during visit. **O**		27. Push or pull toy. **E**	
5. Parent's speech is distinct, clear, and audible. **O**		28. Stroller or walker, kiddie car, scooter, or tricycle. **E**	
6. Parent initiates verbal interchanges with Visitor. **O**		29. Cuddly toy or role-playing toys. **E**	
7. Parent converses freely and easily. **O**		30. Learning facilitators—mobile, table and chair, high chair, play pen. **E**	
8. Parent spontaneously praises child at least twice. **O**		31. Simple eye-hand coordination toys. **E**	
9. Parent's voice conveys positive feelings toward child. **O**		32. Complex eye-hand coordination toys. **E**	
10. Parent caresses or kisses child at least once. **O**		33. Toys for literature and music. **E**	
11. Parent responds positively to praise of child offered by Visitor. **O**		34. Parent provides toys for child to play with during visit. **O**	
II. ACCEPTANCE		**V. INVOLVEMENT**	
12. No more than 1 instance of physical punishment during past week. **I**		35. Parent talks to child while doing household work. **I**	
13. Family has a pet. **E**		36. Parent consciously encourages developmental advance. **I**	
14. Parent does not shout at child. **O**		37. Parent invests maturing toys with value via personal attention. **I**	
15. Parent does not express overt annoyance with or hostility to child. **O**		38. Parent structures child's play periods. **I**	
16. Parent neither slaps nor spanks child during visit. **O**		39. Parent provides toys that challenge child to develop new skills. **I**	
17. Parent does not scold or criticize child during visit. **O**		40. Parent keeps child in visual range, looks at often. **O**	
18. Parent does not interfere with or restrict child more than 3 times during visit. **O**		**VI. VARIETY**	
19. At least 10 books are present and visible. **E**		41. Father provides some care daily. **I**	
III. ORGANIZATION		42. Parent reads stories to child at least 3 times weekly. **I**	
20. Child care, if used, is provided by one of 3 regular substitutes. **I**		43. Child eats at least one meal a day with mother and father. **I**	
21. Child is taken to grocery store at least once a week. **I**		44. Family visits relatives or receives visits once a month or so. **I**	
22. Child gets out of house at least 4 times a week. **I**		45. Child has 3 or more books of his/her own. **E**	
23. Child is taken regularly to doctor's office or clinic. **I**			
TOTALS I_____ II_____ III_____ IV_____ V_____ VI_____ **TOTAL** _____			

Caldwell & Bradley, 1984/2003

Appendix 8: Semi-Structured Interview

Topics and Possible Prompts

Parent Concerns and Challenges

2 or 3 things you worry about most about raising your child

Anything challenging about child's behaviour?

Types of childcare arrangements

- workplace flexibility or employer supports for family obligations?

Sources for Information on Parenting & Child Development

Who you usually turn to for information about child development and parenting

- How often do you rely on these sources?

The greatest influence on approach to parenting

Fostering Child Development

Factors believed to most support child's social and emotional development

Factors believe to most support child's learning

School readiness skills

Parents' Expectations of Development

Age child can experience feelings, like sadness and fear

Age child senses parent's feelings (anger and sadness) and be affected

Age child feels good or bad about himself or herself

Age child can control his or her emotions (if needed, e.g. having a tantrum when frustrated)

Age child can share and/or take turns with other children

Age child follows your instructions or directions (if needed, e.g. “go pick up your shoes”)

Age child can be toilet-trained

1 or 2 skills most important for child to be ready for school

Influences of Media

A video advertisement for a new electronic tablet for infants.

Video link here

1. Do you believe this is a good product for your child?
2. Would you purchase this item for your child?
3. Why or why not?

A video advertisement for a toddler smartphone app.

Video link here

1. Do you believe this is a good app for your child?
2. Would you purchase this app for your child?
3. Why or why not?

A print advertisement for a new electronic toy.

1. Do you believe this is a good toy for your child?
2. Would you purchase this toy for your child?
3. Why or why not?